



thermo scientific

Thermo Scientific

TriPlus RSH SMART

User Guide

Robotic Sample Handling

MI-317000-0041 Revision A September 2021

ThermoFisher
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Release history:

First edition, released September 2021 *“Original Instructions”*

General Lab Equipment. Not for Clinical, Patient, or Diagnostic Use.

TriPlus RSH SMART User Guide, P/N MI-317000-0041, First Edition

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The manual is well organized.	1	2	3	4	5
The manual is clearly written.	1	2	3	4	5
The manual contains all the information I need.	1	2	3	4	5
The instructions are easy to follow.	1	2	3	4	5
The instructions are complete.	1	2	3	4	5
The technical information is easy to understand.	1	2	3	4	5
Examples of operation are clear and useful.	1	2	3	4	5
The figures are helpful.	1	2	3	4	5
I was able to operate the system using this manual.	1	2	3	4	5

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- installation
- re-calibration
- changes and repairs

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- the local installation complies with local law regulations
- the instrument is used according to the instructions provided and if its operation is only entrusted to qualified trained personnel

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- EMC Directive:2014/30/EU
- Machinery Directive: 2006/42/EU
- RoHS Directive 2011/65/EU, including amending Delegate Directive 2015/863/EU

... and conforms with the following product standards:

Safety

This device complies with:

- IEC 61010-1:2010, EN 61010-1:2010,
- IEC 61010-2-010:2014, EN 61010-2-010:2014
- IEC 61010-2-051:2015, EN 61010-2-051:2015
- IEC 61010-2-081:2015, EN 61010-2-081:2015
- UL 61010-1:2012, CSA C22.2 No. 61010-1:2012

Electromagnetic Compatibility

This device complies with:

- IEC 61326-1:2012, EN 61326-1:2013
- EN 55011:2016+A1:2017, CISPR 11:2015+A1:2016
- FCC part 15, Subpart B, §15.107(a) and §15.109(a)

Laser Class 1

The selected Class 1 Laser for the TriPlus RSH module Barcode Reader complies with the following regulations:

- 21 CFR1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated July 26, 2001
- EN60825-1:2014
- IEC60825-1:2014

FCC Compliance Statement

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRE OPERATION.



CAUTION Read and understand the various precautionary notes, signs, and symbols contained inside this manual pertaining to the safe use and operation of this product before using the device.

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Notice on the Proper Use of Thermo Scientific Instruments

In compliance with international regulations: Use of this instrument in a manner not specified by Thermo Fisher Scientific could impair any protection provided by the instrument.

Notice on the Susceptibility to Electromagnetic Transmissions

Do not use radio frequency transmitters, such as mobile phones, in close proximity to the instrument.

WEEE Directive 2012/19/EU



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- Number of product pieces, and the estimated total weight and volume
- Pick-up address and contact person (include contact information)
- Appropriate pick-up time
- Declaration of decontamination, stating that all hazardous fluids or material have been removed from the product

For additional information about the Restriction on Hazardous Substances (RoHS) Directive for the European Union, search for RoHS on the Thermo Fisher Scientific European language websites.

IMPORTANT This recycling program is **not** for biological hazard products or for products that have been medically contaminated. You must treat these types of products as biohazard waste and dispose of them in accordance with your local regulations.

Directive DEEE

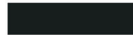
2012/19/EU



Thermo Fisher Scientific s'est associé avec une ou plusieurs sociétés de recyclage dans chaque état membre de l'Union Européenne et ce produit devrait être collecté ou recyclé par celle(s)-ci. Pour davantage d'informations, rendez-vous sur la page www.thermoscientific.fr/rohs.

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Preface

This manual describes the features and the components of the Thermo Scientific™ TriPlus RSH (Robotic Sample Handling) SMART integrated sampling system. Inside, you find all of the information necessary for the routine operations of your sampling system. This includes operating procedures, sample injection techniques, diagrams, and the description of the major components.

This User Guide is intended for frequent or new TriPlus RSH SMART users who are experienced at using automated systems to run existing analytical methods.

Note The TriPlus RSH SMART must be installed and set up properly before this document can be used.

This manual is organized as follows:

- [Chapter 1, “Getting Started with Your TriPlus RSH SMART,”](#) provides information to familiarize with the TriPlus RSH.
- [Chapter 2, “TriPlus RSH SMART Overview,”](#) provides basic information to start the TriPlus RSH, and for using the Handheld Controller.
- [Chapter 3, “Setup Menu,”](#) describes the options of the **Setup Menu** operated either with the Virtual Handheld Controller, or directly using the installed Handheld Controller.
- [Chapter 4, “Maintenance Menu,”](#) describes the options of the **Maintenance Menu** operated either with the Virtual Handheld Controller, or directly using the installed Handheld Controller.
- [Chapter 5, “Service Menu,”](#) describes the options of the **Service Menu** operated either with the Virtual Handheld Controller or directly using the installed Handheld Controller.
- [Chapter 6, “Analytical Troubleshooting,”](#) gives a quick overview of possible causes and recommended actions which can be taken to eliminate an erratic behavior.
- [Appendix A, “Multi Headspace Extraction \(MHE\).”](#) describes the principles and the use of the Multi Headspace Extraction (MHE).

About Your System

Thermo Fisher Scientific systems operate safely and reliably under carefully controlled environmental conditions. If the equipment is used in a manner not specified by the manufacturer, the protections provided by the equipment might be impaired. If you maintain a system outside the specifications listed in this guide, failures of many types, including personal injury or death, might occur. The repair of instrument failures caused by operation in a manner not specified by the manufacturer is specifically excluded from the Standard Warranty and service contract coverage.

Power Rating

TriPlus RSH

- 100/240 Vac +/-10%; 50/60 Hz; 5 A max; 200 VA (400 VA when two power modules are required).

Detailed instrument specifications are in the Product Specification or Product Brochure.

Contacting Us

There are several ways to contact Thermo Fisher Scientific for the information you need.

❖ To find out more about our products

Go to www.thermofisher.com for information about our products.

❖ To get local contact information for sales or service

Go to gcgcms.freshdesk.com/support/home.

❖ To suggest changes to documentation or to Help

Send an e-mail message to the Technical Publications Editor at techpubs-austin@thermofisher.com.

Related Documentation

In addition to this guide, Thermo Scientific™ provides the following documents for the TriPlus RSH.

- *TriPlus RSH Safety Guide*, PN 31709600
- *TriPlus RSH SMART Preinstallation Requirements Guide*, PN MI-317000-0043
- *TriPlus RSH SMART User Guide*, PN MI-317000-0041
- *TriPlus RSH SMART Hardware Manual*, PN MI-317000-0040

To suggest ways we can improve the documentation, follow this link to complete our [Reader's Survey](#).

Safety Alerts and Important Information

Make sure you follow the precautionary notices presented in this manual. The safety and other special notices appear in boxes.

Special Notices

Notices includes the following:






IMPORTANT Highlights information necessary to prevent damage to software, loss of data, or invalid test results; or might contain information that is critical for optimal performance of the system.

Note Emphasizes important information about a task.



Tip Helpful information that can make a task easier.

Safety Symbols and Signal Words

All safety symbols are followed by **WARNING** or **CAUTION**, which indicates the degree of risk for personal injury, instrument damage, or both. Cautions and warnings are following by a descriptor, such as **BURN HAZARD**. A **WARNING** is intended to prevent improper actions that could cause personal injury. Whereas, a **CAUTION** is intended to prevent improper actions that might cause personal injury, instrument damage, or both. You can find the following safety symbols on your instrument, or in this guide:

Symbol	Descriptor
	BIOHAZARD: Indicates that a biohazard <i>will, could, or might</i> occur.
	BURN HAZARD: Alerts you to the presence of a hot surface that <i>could</i> or <i>might</i> cause burn injuries.
	ELECTRICAL SHOCK HAZARD: Indicates that an electrical shock <i>could</i> or <i>might</i> occur.
	FIRE HAZARD: Indicates a risk of fire or flammability <i>could</i> or <i>might</i> occur.
	EXPLOSION HAZARD. Indicates an explosion hazard. This symbol indicates this risk <i>could</i> or <i>might</i> cause physical injury.

	FLAMMABLE GAS HAZARD. Alerts you to gases that are compressed, liquefied or dissolved under pressure and can ignite on contact with an ignition source. This symbol indicates this risk <i>could</i> or <i>might</i> cause physical injury.
	GLOVES REQUIRED: Indicates that you must wear gloves when performing a task or physical injury <i>could</i> or <i>might</i> occur.
	CLOTHING REQUIRED. Indicates that you should wear a work clothing when performing a task or else physical injury <i>could</i> or <i>might</i> occur.
	BOOTS REQUIRED. Indicates that you must wear boots when performing a task or else physical injury <i>could</i> or <i>might</i> occur.
	MATERIAL AND EYE HAZARD. Indicates you must wear eye protection when performing a task.
	HAND AND CHEMICAL HAZARD: Indicates that chemical damage or physical injury <i>could</i> or <i>might</i> occur.
	HARMFUL. Indicates that the presence of harmful material <i>will</i> , <i>could</i> , or <i>might</i> occur.
	INSTRUMENT DAMAGE: Indicates that damage to the instrument or component <i>might</i> occur. This damage might not be covered under the standard warranty.
	LIFTING HAZARD. Indicates that a physical injury <i>could</i> or <i>might</i> occur if two or more people do not lift an object.
	MATERIAL AND EYE HAZARD: Indicates that eye damage <i>could</i> or <i>might</i> occur.
	READ MANUAL: Alerts you to carefully read your instrument's documentation to ensure your safety and the instrument's operational ability. Failing to carefully read the documentation <i>could</i> or <i>might</i> put you at risk for a physical injury.
	TOXIC SUBSTANCES HAZARD: Indicates that exposure to a toxic substance could occur and that exposure <i>could</i> or <i>might</i> cause personal injury or death.
	LASER HAZARD. Indicates that exposure to a laser beam <i>will</i> , <i>could</i> , or <i>might</i> cause personal injury.

	RADIOACTIVE HAZARD. Indicates that the presence of radioactive material <i>could or might</i> occur.
	For the prevention of personal injury, this general warning symbol precedes the WARNING safety alert word and meets the ISO 3864-2 standard. In the vocabulary of ANSI Z535 signs, this symbol indicates a possible personal injury hazard exists if the instrument is improperly used or if unsafe actions occur. This symbol and another appropriate safety symbol alerts you to an imminent or potential hazard that <i>could cause personal injury</i> .

Instrument Markings and Symbols

Table 1 explains the symbols used on Thermo Fisher Scientific instruments. Only a few of them are used on the TriPlus RSH, which are annotated with an asterisk below.

Table 1. Instrument Marking and Symbols (Sheet 1 of 2)



















Symbol	Description
	Direct Current
* 	Alternating Current
	Both direct and alternating current
3 	Three-phase alternating current
	Earth (ground) terminal
	Protective conductor terminal
	Frame or chassis terminal
	Equipotentiality
* 	On (Supply)
* 	Off (Supply)
	Equipment protected throughout by DOUBLE INSULATION or REINFORCED INSULATION (Equivalent to Class II of IEC 536)
	Fuse
* 	Instruction manual symbol affixed to product. Indicates that the you must refer to the manual for specific WARNING or CAUTION information to avoid personal injury or damage to the product.

Table 1. Instrument Marking and Symbols (Sheet 2 of 2)

Symbol	Description
	Caution, risk of electric shock
* 	Caution, hot surface
* 	Caution, biohazard
* 	Caution, Laser beam
* 	Symbol in compliance to the Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE) placed on the European market after August, 13, 2005.

Safety Information and Warnings

This safety guide raises awareness of potential safety issues and general points for consideration for Thermo Fisher Scientific representatives during installation, and repair of the TriPlus RSH, or parts of it (following the life cycle principle), as well as for the end user TriPlus RSH in the lab during the learning phase, and in routine work.



IMPORTANT Read this section first before operating the TriPlus RSH.

General Considerations

- Before a unit is put to use, consult the TriPlus RSH User Guide and related documents under all circumstances.
- Changes or modifications to this unit not expressly approved by the party responsible for compliance, could void your's authority to operate the equipment.
- Be aware that if the equipment is used in a manner not specified by the manufacturer, the protective and safety features of the equipment might be impaired.
- The repair of instrument failures caused by operation in a manner not specified by the manufacturer is expressly excluded from the standard warranty and service contract coverage.

- When for technical reasons it is necessary to work on instrument parts which might involve a potential hazard (moving parts, components under voltage, and so on.) contact the Thermo Fisher Scientific authorized representative. In general, this type of situation arises when access to the parts is only possible using a tool. When you perform a maintenance operation, you must have received proper training to carry out that specific task.

Electrical Hazards



Every analytical instrument has specific hazards. Be sure to read and comply with the following pre-cautions. They ensure the safe and long-term use of your TriPlus RSH.

The installation over-voltage category is Level II. The Level II category pertains to equipment receiving its electrical power from the local level, such as an electrical wall outlet.

Connect the TriPlus RSH only to instruments complying with IEC 61010 safety regulations.

The power line and the connections between the TriPlus RSH and other instruments, used in the configuration setup of the total analytical system, must maintain good electrical grounding. Poor grounding represents a danger for the operator, and might seriously affect the performance of the instrument.

Do not connect the TriPlus RSH to power lines that supply devices of a heavy duty nature, such as motors, refrigerators and other devices that can generate electrical disturbances.



Use only fuses of the type and current rating specified. Do not use repaired fuses, and do not short-circuit the fuse holder. The supplied power cord must be inserted into a power outlet with a protective earth (ground) contact. When using an extension cord, make sure that the cord also has an earth contact.

If the supplied power cord does not fit the local electrical socket and a replacement or adapter has to be purchased locally, make sure that only a certified power cord is used. Any power cord used must be certified by the appropriate local authorities.

Pay attention not to leave any cable connecting the TriPlus RSH and the chromatographic system, or the power cord close to heated zone, such as the injector or detector heating blocks, or the GC hot air vents.

Always replace any cable showing signs of damage with another one provided by the manufacturer. Safety regulations must be respected.



Do not change the external or internal grounding connections. Tampering with or disconnecting these connections could endanger you and damage the TriPlus RSH. The instrument is properly grounded in accordance with these regulations when shipped. To ensure safe operation, you do not must make any changes to the electrical connections or the instrument's chassis.



Do not turn the instrument on if you suspect that it has incurred any type of electrical damage. Instead, disconnect the power cord and contact a Thermo Fisher Scientific representative for a product evaluation. Do not attempt to use the instrument until it has been evaluated. Electrical damage might have occurred if the TriPlus RSH shows visible signs of damage, exposure to any liquids or has been transported under severe stress.



Damage can also result if the instrument is stored for prolonged periods under unfavorable conditions: for example, subjected to heat, moisture, and so on. Ensure that the power supply/controller unit is always placed in a clean and dry position. Avoid any liquid spills in the vicinity.



Before attempting any type of maintenance work, always disconnect the power cords from the power supply(ies) if optional devices are installed. Capacitors inside the instrument might still be charged also if the instrument is turned off.

To avoid damaging electrical parts, do not disconnect an electrical assembly while power is applied to the TriPlus RSH. After the power is turned off, wait approximately 30 seconds before you disconnect an assembly.



The instrument includes a number of integrated circuits. These circuits might be damaged if exposed to excessive line voltage fluctuations, power surges or electrostatic charges, or both.



Never try to repair or replace any components of the instrument without the assistance of a Thermo Fisher Scientific representative. There are no operator-serviceable or replaceable parts inside the power supply(ies) or in the TriPlus RSH. If a power supply is not functioning, contact a Thermo Fisher Scientific representative.



The power supplies for the TriPlus RSH, the Temperature Controlled Drawer have the symbols **I/O** on the label for the power switch to indicate ON/OFF. If a Temperature Controlled Drawer is installed in combination with a TriPlus RSH, a second power supply is active in the complete system. Turning OFF the two power supplies, or pulling the two power cords in an emergency, stop the entire TriPlus RSH.

It is important that the power supply(ies) is in a location where the power ON/OFF switch is accessible and easy to operate, and where it is possible to unplug the AC power cord from the power supply/wall outlet in case of emergency.

Laser Safety Information



Safety Warning for Laser Class 1 Product.

CLASS 1 LASER PRODUCT
LASER KLASSE 1
APPAREIL À LASER DE CLASSE 1



WARNING The installed Laser device is a Class 1 Laser Product. Class 1 Laser devices are not considered to be hazardous when used for their intended purpose. The following statement is required to comply with US and international regulations.

CAUTION Use of controls, adjustments or performance of procedures other than those specified herein might result in hazardous laser light exposures.

The selected Class 1 Laser for the TriPlus RSH module Barcode Reader complies with the following regulations:

- 21 CFR1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated July 26, 2001
- EN60825-1:2014
- IEC60825-1:2014

The software contains a built-in safety time limit such that the laser scanning mechanism cannot be operated in AIM mode for more than 5 continuous seconds.

Other Hazards



To avoid injury and possible infection through contamination during TriPlus RSH operation, keep your hands away from the syringe.



Do not operate the TriPlus RSH without the safety guard. The safety guard must be installed for safe operation. Do not place any objects inside the area of the safety guard. Keep away from the area around the safety guard during operation of the TriPlus RSH.



Danger of crushing to fingers and hands. To avoid injury keep your hands away from moving parts during operation. Turn off the power to the TriPlus RSH if you must reach inside a mechanically powered system with moving parts.



To avoid injury, observe safe laboratory practice when handling solvents, changing tubing, or operating the TriPlus RSH. Know the physical and chemical properties of the solvents you use. See the MSDS (Material Safety Data Sheets) from the manufacturer of the solvents being used.

When using the TriPlus RSH, follow the generally accepted procedures for quality control and method development.

When using the TriPlus RSH in the field of chromatographic analysis, if a change is observed in the retention of a particular compound, in the resolution between two compounds, or in the peak shape, immediately determine the reasons for the changes. Do not rely on the separation results until you determine the cause of a change.

Do not operate on the instrument components that form part of the work area of the TriPlus RSH when it is in motion.



Use caution when working with any polymer tubing under pressure:

- Always wear eye protection when near pressurized polymer tubing.
- Do not use polymer tubing that has been severely stressed or kinked.
- Do not use polymer tubing, in particular no PEEK or Tefzel tubing when using tetrahydrofuran (THF), dimethylsulfoxide (DMSO), chlorinated organic solvents, concentrated mineral acids such as nitric, phosphoric or sulfuric acids, or any related compounds.



Do not use vials without a sealing cap, or microtiter or deepwell plates without a plate seal. Vapor phase from organic solvents can be hazardous and flammable. Acidic vapor phase can cause corrosion to critical mechanical parts.



When sample vials have to undergo heating and agitation, it is important to consider the glass quality. Use high quality glass only. Remember that depending on the application conditions, high pressure can build up in the vial. Whenever a temperature greater than 60 °C is applied, consider the vapor pressure of the solvent used to ensure that no excessive pressure builds up. This is important when using a temperature above 100°C and especially at the maximum temperature of 200 °C. Be aware that solid materials can also contain volatile compounds such as water (humidity) which could cause build-up of excess vapor pressure.

Do not reuse headspace vials. During the process of washing the vial, micro-cracks can form which will weaken the glass wall and increase the chances of the vial breaking.



In case of a single fault situation where the temperature control of the Agitator fails, there is the potential danger that the device will heat up in an uncontrolled manner until it reaches the cut-off temperature of the over temperature fuse, in this case, 240 °C. Based on this single fault scenario, when working with flammable solvents, ensure that the solvent used has a flash point which is 25 °C higher than the maximum potential temperature (240 °C) of the Agitator.



When filling-up a standard reservoir or replacing a solvent such as a washing solvent, remove the solvent reservoir bottle from the system to avoid a possible spill over the instrument. Depending on the physical, chemical or hazardous properties of the solvent, use the appropriate protective measures for handling.

Working with Toxic or other Harmful Compounds



WARNING Before using hazardous substances (toxic, harmful, and so on), please read the hazard indications and information reported in the applicable Material Safety Data Sheet (MSDS). Use personal protective equipment according to the safety requirements.

Before using dangerous substances (toxic, harmful, and so on) read the hazard indications and information reported in the Material Safety Data Sheet (MSDS) supplied by the manufacturer, referring to the relevant CAS (Chemical Abstract Service) number. The TriPlus RSH requires the use of several chemical products with different hazard characteristics, which are present in vials and syringes. Before using these substances or replacing the syringe, please read the hazard indications and information reported in the MSDS supplied by the manufacturer referring to the relevant CAS number.

When preparing the samples, please refer to local regulations for the ventilation conditions of the work room.

All waste materials must be collected and eliminated in compliance with the local regulations and directives in the country where the instrument is used.

Biological Hazards



In laboratories where samples with potential biological hazards are handled, you must label any equipment or parts thereof which might become contaminated with biohazardous material. The appropriate warning labels are included with the shipment of the instrument. It is your responsibility to label the relevant parts of the instrument.

When working with biohazardous materials, it is your responsibility to fulfill the following mandatory requirements:

- Instructions on how to safely handle biohazardous material must be provided.
- Operators must be trained and made aware of the potential dangers.
- Personal protective equipment must be provided.
- Instructions must be provided on what to do in case the operators are exposed to aerosols or vapors during normal operation (within the intended use of the equipment) or in case of single fault situations such as a broken vial. The protective measures must consider potential contact with the skin, mouth, nose (respiratory organs), and eyes.
- Instructions for decontamination and safe disposal of the relevant parts must be provided.

It is your responsibility to handle hazardous chemicals or biological compounds (including, but not limited to, bacterial or viral samples and the associated waste), safely and in accordance with international and local regulations.

Maintenance

Any external cleaning or maintenance must be performed with the TriPlus RSH turned off and the power cord disconnected. Avoid using solvents and spraying on electrical parts. For the removal of potentially dangerous substances (toxic, harmful, and so on) read the hazard indications and information reported in the MSDS (Material Safety Data Sheet) supplied by the manufacturer referring to the relevant CAS (Chemical Abstract Service) number. Use proper protective gloves.

When working with hazardous materials such as radioactive, biologically hazardous material, and so on, it is important to train all operators how to respond in case of spills or contamination.

Depending on the class of hazardous material, the appropriate measures have to be taken immediately. Therefore, the chemicals or solvents needed for decontamination have to be on hand.

Any parts of the equipment which can potentially be contaminated, such as the sample vial rack, syringe tool, wash module, and so on, must be cleaned regularly. The waste solvent from cleaning and any hardware which requires to be disposed of has to be properly eliminated with all the necessary precautions, abiding by national and international regulations.

When preparing for decontamination, ensure that the solvent or chemical to be used will not damage or react with the surface, dye (color) of the instrument, table or other nearby objects. If in doubt, please contact your Thermo Fisher Scientific representative to verify the compatibility of the type or composition of solvents with the TriPlus RSH.

Disposal



Do not dispose of this equipment or parts thereof unsorted in municipal waste. Follow local municipal waste regulations for proper disposal provisions to reduce the environmental impact of waste electrical and electronic equipment (WEEE).

European Union customers: Call your local customer service representative responsible for the TriPlus RSH for complimentary equipment pick-up and recycling.



WARNING The customer has to ensure that the TriPlus RSH has not been contaminated by any hazardous chemical or biological compounds including (but not limited to) bacteria or viruses.

Any part which had direct contact with the analytical sample must be identified and must undergo an appropriate decontamination procedure prior to shipping for disposal. Potentially dangerous components are: Syringes, Vials and Well Plates. Any critical parts sent for disposal must be handled according to national laws for hazardous compounds. The customer and the service engineer are fully responsible for enforcing these requirements. Thermo Fisher Scientific will hold the representative, customer responsible, or both, if these regulations are not observed.

Getting Started with Your TriPlus RSH SMART

This chapter provides information to familiarize with the TriPlus RSH SMART.

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- [Instrument Basics](#)
- [Definition of Terms, Naming Conventions, and Start Screen Icons](#)
- [Definitions of Active and Passive Hardware Modules](#)
- [The TriPlus RSH SMART System](#)
- [Crossrails](#)
- [Head](#)
- [Control Interface](#)
- [TriPlus RSH SMART Tools](#)
- [TriPlus RSH SMART Tool Stations](#)
- [TriPlus RSH SMART Tray Holders](#)
- [TriPlus RSH SMART Washing Stations](#)
- [Heating/Shaking Modules and Stations](#)
- [TriPlus RSH SMART Optional Modules](#)

Instrument Basics

The TriPlus RSH SMART, offers you great flexibility in various applications. A unique automated Tool changer is provided, increasing throughput and allowing sample preparation steps before the injection cycle.

The new versatility and seminal technical aspects are highlighted. The TriPlus RSH SMART has several advantages for use and provides greater flexibility and security for routine and research applications, including:

- System Setup using the Virtual Handheld Controller software (or optional Handheld Controller).
- Guided teaching wizards for Tools and Modules.
- The future-oriented **Servo motor** — a new control concept for motors with a high intelligence, providing high security on X-, Y-, and Z-positioning at any time.
- The communication Bus increases the flexibility for adding so-called **Active modules** and controlling these modules in a bidirectional manner. A self-detection mode simplifies the addition of a module to the TriPlus RSH SMART configuration.

The bidirectional communication allows control of the module at any given time or position. Data stored in a log file not only gives you a high degree of security but also facilitates the tractability of cycle performance, providing easy access to essential information which might be requested by inspection authorities.

- A unique ATC Station allows an automated change of Tools (syringes with different volumes or different Tool Types) for advanced sampling preparation, liquid handling (dilutions), derivatization steps or any other time-consuming repetitive step. This added versatility alongside the increase in throughput are significant benefits for you.
- New optional hardware modules, for example the Vortexer, for efficient phase mixing, expands the range of applications and adds to the system versatility.
- A large range of syringe volumes is available for liquid or gaseous sample injection for different GC-injector types (split/splitless, on-column, and so on.) and GC-columns (from micro capillary to packed columns) enhancing the available options for you.
- A large range of vial sizes or microtiter plates which can be used in various tray holders.
- Vial bottom sensing allows aspiration of the very last drop in a vial.
- Barcode reader with dual scan module for barcode identification in any position.
- A wide range of predefined cycles for advanced liquid handling.

The TriPlus RSH SMART can be set up and configured using either the Handheld Controller or the Virtual Handheld Controller (PC software).

The options and parameters are identical, but the handling differs between the Handheld Controller (Scroll Wheel and **Enter** button) and the normal control within the software. The setup procedure is described in the sections “[Service Menu](#)” on [page 221](#).

Definition of Terms, Naming Conventions, and Start Screen Icons

This section details the definition of the terms, the naming conventions used in this manual, and the Start Screen icons visualized on the Handheld Controller.

See the related topics:

- [“Definition of Terms” on page 3](#)
- [“Naming Conventions” on page 6](#)
- [“Start Screen Icons” on page 7](#)

Definition of Terms

- **TriPlus RSH SMART System** — The brand name for the entire System product family. The product family includes not only the TriPlus RSH SMART instruments but also the various optional modules.
- **TriPlus RSH SMART** — A generic term referring to the TriPlus RSH SMART system. TriPlus RSH SMART is more used in combination with the basic unit with X- and Y-axes, Head (Z-axis), and Power installed.
- **Module** — A generic term used to refer to both active and passive modules.
- **Active Module** — A module which is controlled by the BUS connector via active control. An active module requires a device firmware which is part of the TriPlus RSH SMART Firmware. An active module is recognized when connected to the BUS, it can be deactivated but not deleted.
- **Passive Module** — A static module, e.g. a non-temperature programmable tray holder, does not require any control or checks through the BUS. A passive module requires an object template which is part of the TriPlus RSH SMART Firmware. A specific device firmware is not required. A passive module cannot be deactivated but it can be deleted.
- **Composite Module** — An active module consisting of one or more devices which also communicate with the BUS, but in slave functionality. A typical example is the TriPlus RSH SMART Head (Z-axis).
- **Device** — A single active module communicating with the BUS but in slave functionality. Each device requires a device firmware which is part of the TriPlus RSH SMART Firmware.
- **Motor** — Generic term for the new generation of motors used for the axes. The motor uses the logic of a servo-motor with electronic and software control. The various motors are specified with the suffix of where the motor is applied, such as motor-X, or motor-Z.
- **Base** — The combination of the X- and Y-Axes, with or without the electronics installed.

- **Head** — Consist of Z-axis, the Needle Guide Motor, and the Plunger Motor. The cover is part of the entire unit as well.
- **Tool** — Generic term for the holder of a syringe or SPME fiber. Different Tools are used:
A Tool consists of the lower and upper needle guides, the electronic identification, heating and purge gas connections if required, and the coupling pivots for the Tool itself. A Tool is designed for a specific syringe type tailored for the application (Liquid, Headspace, SPME, SPME Arrow or ITEX DHS), with a specific glass barrel outer diameter and needle length.
- **Control Software** — The entire software package of the operating system, application software, configuration, and various device firmware. The file extension is ***.pack**.
- **TriPlus RSH SMART Firmware** — Starting with software version 2.0 the **Control Software** is renamed to **Firmware**. The definition is identical as described above with **Control Software**
- **Device Firmware** — The software for an active module. The device firmware is part of the **RSH Firmware**.
- **Activity** — The lowest level of command available with the RSH Firmware. Activities depend on the Application Software version, and are downloaded to the program from the TriPlus RSH when the initial connection is made, and updated during the run time on a regular basis.

Activities are grouped in classes:

- **Public:** Activities available to build a custom specific script.
- **Private:** Activities not available to build a script. They are necessary for internal control, and for the integration of the TriPlus RSH SMART into another Chromatography Data System (CDS).

A Script is built by linking **Activities** together in a sequence.

- **Script** — Created by building a sequence of TriPlus RSH SMART operations, which are linked by a series of Activities. A Script can be a Method depending on the functionality built-into the script.
- **Cycle** — Consists of the specific operations necessary to process one sample. The cycle operations are repeated for each sample within a job (sequence). Cycles are designed for specific applications.
- **Method** — A Method is an executable procedure defined by the Sample Control software. For the operator, certain parameters can be modified in order to define how the samples are processed.
- **Method Parameters** — Associated with the cycle operations. User-assigned parameter values define how a processing operation is performed. A zero parameter value will disable a cycle operation. Cycle parameters are application-specific.

- **Objects** — Data structures describing the properties of physical modules, such as Tray Holder, Agitator, Motors, and so on.
- **Module Type** — Unique identification of a module, defines the machine object description of the combining device.
- **Module ID** — Unique identification of a module.
- **Tray Holder** — Holds one or more trays. Each tray holder has a reference position (X-, Y-, Z-coordinates), that defines its location. A tray holder is a passive module.
- **Slot** — The physical place where a Tray can be positioned in the Tray Holder.
- **Sample Tray** — Generic term. A tray can be a **rack** for holding vials, or a well plate for deepwell plates, or microtiter plates. A tray holds multiple samples. Trays are defined by designating the tray type, and the Tray Holder. Tray names are used to identify the sample source within a Job.
- **Well Plate** — A generic term used for all types of well plates. The most common well Plates are deepwell plates, or microtiter plates. The well plates have a standardized footprint. The tray holder drawers are designed to accept well plates. Passive tray holders for the TriPlus RSH SMART have three slots, each one designed with the footprint dimensions of a Well Plate.
- **Tray Type** — Generic term. A Tray Type can be a Tray for vials or a plate for well plates. A Tray Type defines the pattern and sampling sequence of sample locations within a Tray.
- **Vial Type** — The physical dimensions of a Vial and parameters required for automation, such as Needle Penetration Depth or Penetration Speed, are described by the various item parameters of the Vial Type.
- **Cap Type** — Describes the material of the vial cap, which in turn determines whether or not a vial can be transported.
- **Needle Guide Type** — Selectable parameter in the software class **Tools**. Selects the required Tool that is mounted to the Lower Needle Guide of the Tool. For example, you can select the large magnetic ring for transporting 10/20 mL vials or the Foil Cutter for use with sealed Well Plate.
- **Temperature Controlled Drawer** — An active Tray Holder with drawer system. It is temperature controllable.
- **Liquid Cooled Tray Holder** — A passive module controlled through external liquid circulation bath.

Naming Conventions

This section provides the standard naming convention for TriPlus RSH SMART Trays and Tray Types. Following these conventions will allow the TriPlus RSH SMART to be pre-configured for certain applications, will simplify software backups and application development, and will improve technical support and training.

An example of naming convention is detailed in [Table 1](#).

Table 1. Example of Tray Types Naming Convention

Tray Type	Tray Description
Vial Tray 15 (VT15)	Tray with same footprint as Well Plate; 15 positions (3 x 5). Pattern: Regular for 10 and 20 mL vials with OD 22.5 mm and height 46/76 mm.
Vial Tray 54 (VT54)	Tray with same footprint as Well Plate; 54 positions (6 x 9). Pattern: Regular for 2 mL vials with OD 12 mm and height 32 mm.
Vial Tray 70 (VT70)	Tray with same footprint as Well Plate; 70 positions (7 x 10). Pattern: Regular for 0.7-0.8 mL vials with OD 7.5 mm and height 40 mm. Viewing window in position 68 for needle penetration check.
Vial Tray 60 (R60)	Tray with footprint for entire Tray Holder (passive Tray Holder with 3 Slots). 60 positions (6 x 10). Pattern: Staggered+ for 10 and 20 mL vials with OD 23, and height 46/76 mm. Viewing window in position 60 (for needle penetration check).
Vial Tray 32 (R32)	Tray with footprint for Liquid Cooled Tray Holder; 32 positions (4 x 8). Pattern: Regular for 20 mL vials with OD 22.5 and height 76 mm.
DWP96	Well Plate Type. Deep Well Plate DW96. 96 positions (8 x 12). Pattern: Regular. Plate Height: 43.0 mm; Well Cavity Depth: 39.0 mm; Well Cavity Diameter: 7.0 mm.
MTP96	Well Plate Type. Microtiter Plate MT96. 96 positions (8 x 12). Pattern: Regular. Plate Height: 14.6 mm; Well Cavity Depth: 10.9 mm; Well Cavity Diameter: 7.0 mm.
MTP384	Well Plate Type. Microtiter Plate MT384. 384 positions (24 x 16). Pattern: Regular. Plate Height: 14.4 mm; Well Cavity Depth: 11.5 mm; Well Cavity Diameter: 3.7 mm.

Start Screen Icons

Table 2 lists the Start Screen icons visualized on the Handheld Controller according to the Tools, modules and stations installed on the TriPlus RSH SMART.

Table 2. Start Screen Icons (Sheet 1 of 3)















Icon	Description
Tool and Tool Change Station	
	LS Tool, Syringe tool for liquid Injections
	HS Tool; Headspace Tool
	SPME Fiber Tool; Tool for SPME Fiber Holder
	SPME Arrow Tool; Tool for SPME Arrow Holder
	ITEX DHS Tool
	Dilutor Tool
	ATC Station; Active module for automated Tool change.
	TR Station
Active Module	
	Agitator
	Vortexer
	Heatex Stirrer
	SPME Fiber Conditioning Station / SPME Arrow Conditioning Station
	Barcode Reader
	Temperature Controller Drawer

Table 2. Start Screen Icons (Sheet 2 of 3)





















Icon	Description
	OC Injector (On-column Injector)
	Fast Wash Module
	Dilutor Syringe Module
Passive Module	
	Tray Holder (rectangular)
	Liquid Cooled Tray Holder
	Standard Wash Station (5x10 mL Vials)
	Large Solvent Wash Station (2 x 100 mL bottles and 1 Waste Position)
	Solvent Station (Solvent reservoir station for 3 x 100 mL bottles)
	Tray, rectangular (Tray to hold vials with volume from 1 to 40 mL)
	Vials, set of vials
	Vial, single vial (Vial Type CV)
	Solvent Reservoir Bottle (Vial Type SR)
	Injector (GC Injector)
	MHE Station
Synchronization and Signals	
	Input and Output Signals
	Input Signal

Table 2. Start Screen Icons (Sheet 3 of 3)

Icon	Description
	Output Signal
	Chromatographic System. Specifies synchronization of Input and Output Signals, Cryo Trap, and Delay Time for a Fake Injection for an analytical system.
General Icons	
	TriPlus RSH SMART System
	Head (Injection unit)

Definitions of Active and Passive Hardware Modules

This section details the definitions of the hardware modules.

Active Versus Passive Module

An **Active module** is defined as a module that sends or receives specific commands and checks. The control communication is done via the **BUS** serial protocol for all active devices.

A typical example is the motor for the X-Axis which has to be accelerated to a certain speed and stopped after a defined travel distance. The motor records the position at every point of its trajectory and is reported back to the processor via the BUS using the X-motor (Servo motor X-axis).

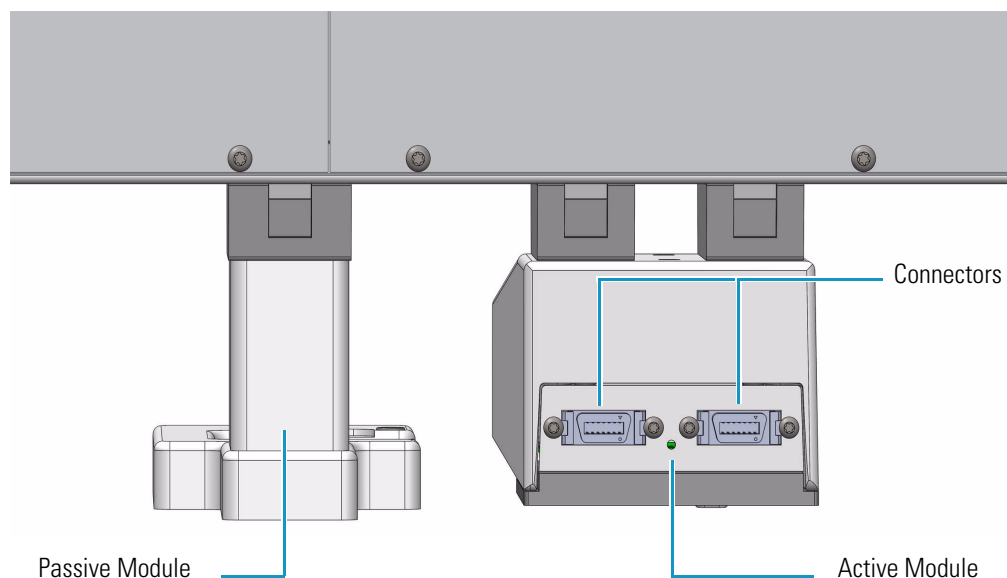
Another example is an Agitator/Incubator where the temperature and motor for sample agitation have to be controlled and monitored.

A **Passive** module is a static device. Typical examples are non-temperature programmable Tray Holders, a TR Station, or a Standard Wash Station.

You can easily distinguish the difference between **active** and **passive** devices by checking for any serial connectors at the device.

See the example in [Figure 1](#), which shows the passive module **TR Station** on the left, and the active module **ATC Station** for three **Tools** on the right. Every Active Module has two connectors for daisy chaining to the next module.

Figure 1. Example of Passive and Active Modules



At the level of the TriPlus RSH SMART Firmware, it is important to understand other differences between the two classes of modules:

- **Active module** — The device firmware is always included in (or is part of) the basic TriPlus RSH SMART Firmware. When the module is connected to the BUS, the device is recognized and made available for use via serial control. A module **ID#** is automatically provided and stored. Loading or activating a specific firmware object is not necessary.

An active device can be de-activated but not deleted. A deactivation is done by disconnecting the serial cable. The device **ID#** is stored. If the device is re-activated later, the same device **ID#** will be re-assigned.

Note It is possible to delete an active device in the **Service** access level.

- **Passive module** — The template of a passive module is included in (or part of) the basic TriPlus RSH SMART Firmware. Using the Handheld Controller, add the module by selecting **Options > Setup > Modules**.

A dialog guides you through the screens to define the various Attributes and Parameters. After the newly-defined module is stored, it is available for further setup definitions such as teaching the positions.

A module **ID#** is automatically provided and stored as long as the device is in operation. Loading or activating a specific device firmware is not possible for a Passive module.

A passive module cannot be deactivated but it can be deleted. The module **ID#** will not be stored. If the same device is re-activated later, another module **ID#** will be randomly provided.

Active Versus Composite Module

The term **Active module** is used for a module which communicates with the BUS. An Active module can consist of one or more devices which also communicate with the **Active** versus **Composite module**.

The term **Active module** is used for a module which communicates with BUS. An Active module can consist of one or more devices which also communicate with the BUS but in slave functionality. A typical example is the **TriPlus RSH SMART Head** (Z-axis) which contains three different motors, each of them connected to the BUS.

A **Composite module**, such as the TriPlus RSH SMART, is composed of several devices.

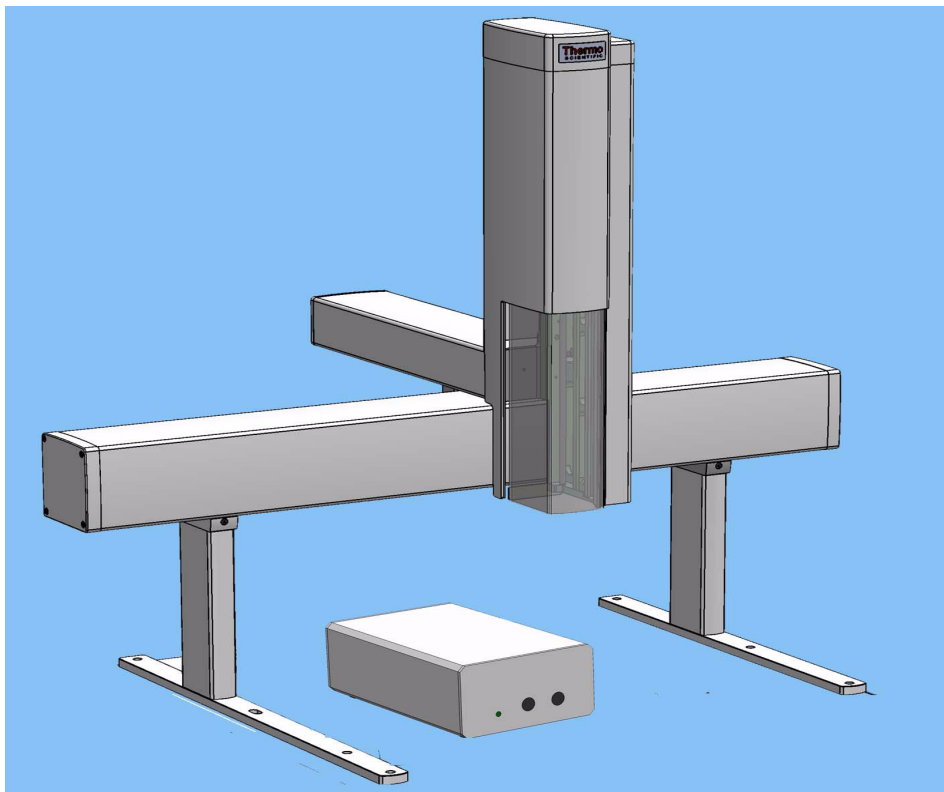


Note This differentiation is not important for the routine use of the TriPlus RSH SMART. You must understand this difference when a device must be replaced, for example a motor-Z as part of the TriPlus RSH SMART Head.

The TriPlus RSH SMART System

The TriPlus RSH SMART is an integrated sampling system based on three axes X,Y and Z, constituted by a basic body on which a series of components are installed. See [Figure 2](#).

Figure 2. TriPlus RSH SMART Schematic View



The components are chosen by the operator according to their own analytical demands.

Choosing the appropriate components, TriPlus RSH SMART sampler may be configured for Liquids **LS**, Headspace **HS**, or **SPME** and **SPME Arrow** Solid Phase Micro Extraction, or **ITEX DHS** In-tube/Dynamic Headspace Extraction.

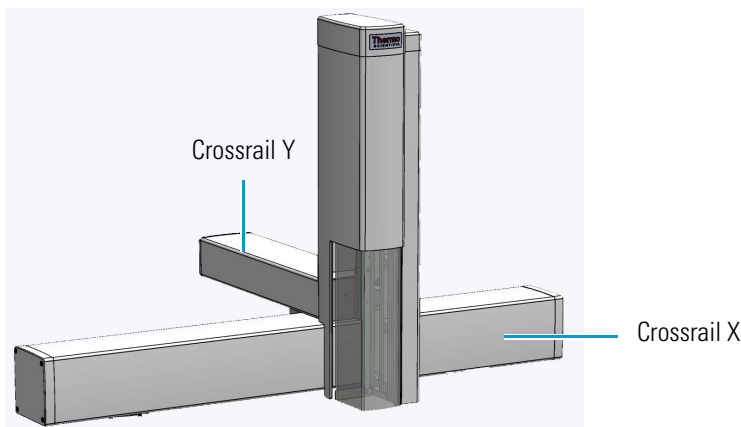
Besides, TriPlus RSH SMART can perform sampling preparation by using the optional single or multi **Dilutor Module**.

Crossrails

The crossrails constitute the primary structure up on which the sampling unit components are installed according to the configuration of the sampler.

The two sliding crossrails constitute the X and Y axes of the sampler. See [Figure 3](#). They are connected to one another through a mechanism that manages the movements of the system by both a motorized truck and a tray located in every crossrail.

Figure 3. Crossrails X and Y



Crossrail X

It represents the X-axis of the system and is the structure bearing the sampling units components. It consists of the following sections:

- **Front-upper section** — The part of the crossrail on which the crossrail Y slides.
- **Lower section** — Includes the slots to connect the sampler support and the components.
- **Back section** — Includes the Control Interface for the connection of the sampling unit to the power module, the GC, and the components installed. See the section “[Control Interface](#)” on [page 14](#). It includes the inlet port for the connection of the syringe flushing gas.

- **Internal section** — Contains the main low voltage electronics boards. It also manages the movement along the crossrail X.

Two different lengths of the X-axis are available: **850 mm** (Standard) and **1200 mm** (Extended).

Crossrail Y

It represents the Y-axis of the system. It is connected to the crossrail X through the motorized truck. Crossrail Y motors carry out the movements of the Head (Z-axis).

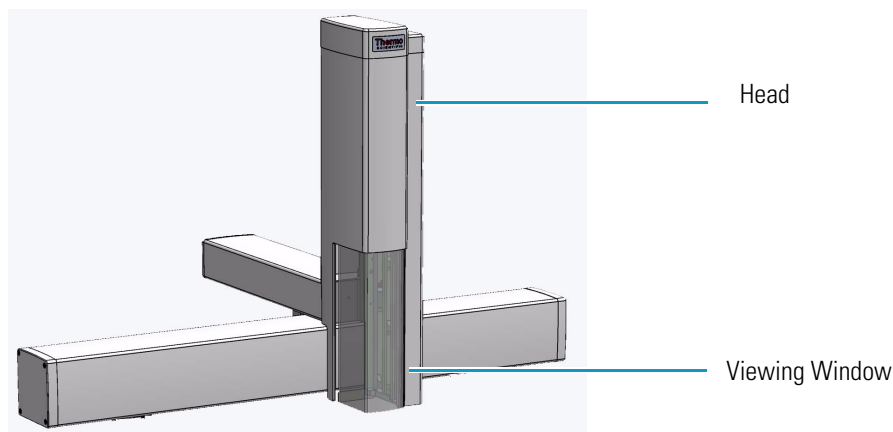
It consists of the following sections.

- **Front section** — Includes the guides and the electric connections for the Head installation.
- **Lower section** — The part that slides along the crossrail X.

Head

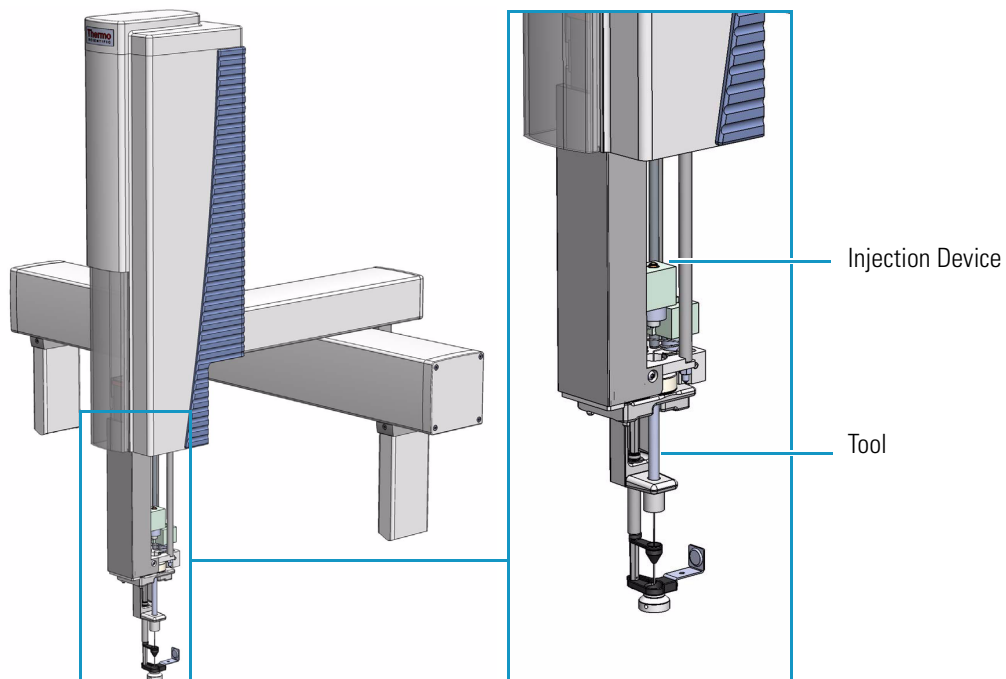
It represents the Z-axis of the system. It consists of a vertical structure fixed on the crossrail Y which guides the movements along the X and Y axes. See [Figure 4](#).

Figure 4. Head



A viewing window is provided on the front side for allowing access to the injection device. See [Figure 5](#).

Figure 5. Injection Device

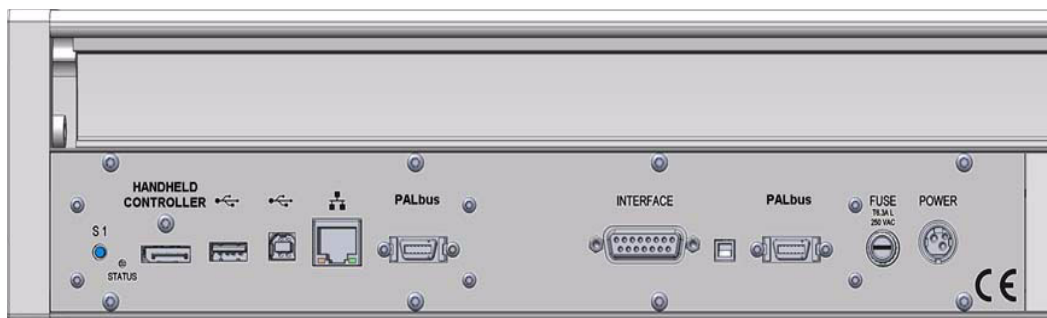


The injection device includes an active needle guide and a coupling plate to couple/uncouple the RSH SMART Tools.

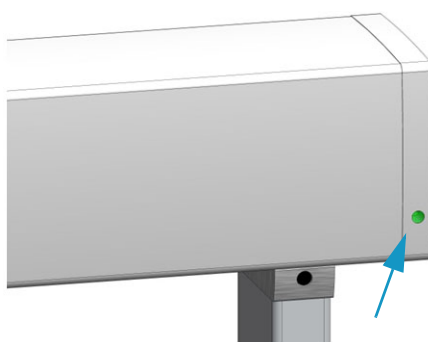
Control Interface

The back part of the crossrail X includes the following components as shown in [Figure 6](#).

Figure 6. Control Interface







- **Status** — This LED (*Light Emission Diode*) provides indications on the instrument operating conditions showing a solid or blinking light.



The LED light on the right side cover of the X-axis shows the identical status as the Status Light displayed on the Handheld Controller. See [Table 3](#).

See also the section “[Menu Screen Status Bar Symbols](#)” on [page 74](#), and to the section **System Status LED at Status Bar or at X-Axis Side Cover** in the chapter **Troubleshooting** of the *TriPlus RSH SMART Hardware Manual*.

Table 3. Status LED Lights

Symbols	Description
	<p>Green status light, blinking: TriPlus RSH SMART is working (moving). Execution mode. The Handheld Controller is partially blocked to specific actions.</p> <p>Green status light, steady on: TriPlus RSH SMART is ready in Standby. Idle Mode.</p>
	<p>Yellow status light, blinking: Firmware is booting.</p> <p>Yellow status light, steady on: A problem has been detected which cannot be resolved by the robotic system.</p> <p><i>Examples:</i> Bent needle (mechanical problem), missing Tool, and so on. detected at the moment of sample execution. A software run-time error can also cause a status light change to steady-on yellow.</p>
	<p>Blue status light, blinking: The TriPlus RSH SMART is in the process of software Update or Backup. (For the processes Copy Backup and Restore the Status light remains green).</p> <p>Blue status light, permanent: TriPlus RSH SMART is in a safe state (power reduced to a minimum) and requires manually moving the Head to the Teach Point.</p> <p>Note: If an error is detected at the same time that an action is required according to the Blue Status Light, then by default the yellow status light will dominate.</p>
<ul style="list-style-type: none"> • S1 — Reset button to restore the factory default settings without knowing the IP Address. • HANDHELD CONTROLLER — A 20-pin port connector for the connection between the TriPlus RSH SMART and the Handheld Controller. • USB Host  — USB Type A connector for the connection of the USB Stick only for service purposes. 	



- **USB Device/Client**  — USB Type connector for the connection to an USB device or USB client.
- **Ethernet**  — RJ45 Ethernet cable connects the TriPlus RSH SMART directly to a computer, and a LAN (Local Area Network) for the network connection of the TriPlus LAN sampler.
- **BUS** — Two Mini Delta Ribbon 14-pin connectors for the connection to the CPU board and the components installed on the sampler.
- **INTERFACE** — DSB 15-pin female connector for the connection between the sampler and the GC.
- **FUSE** — Housing for the fuse T6.3; 250 VDC. See [Table 4](#).

Table 4. Fuse Parameters

Parameter	Value
Rated Current	6.3 A
Rated Voltage	250 VAC
Fuse Dimensions	5 x 20 mm

- **POWER** — KYon KPJX-3S-S connector receives 36 V from the Power Module.

TriPlus RSH SMART Tools

The TriPlus RSH SMART requires more information and intelligence on the level of Tools than just the syringe identification numbers as used with common samplers. The capability to use a Tool for one task, store the Tool away and select a second Tool for the next task in the cycle sequence necessitates knowledge of the geometry of the syringe and holder. The location of the syringe holder is tracked at any point in time with a unique number.

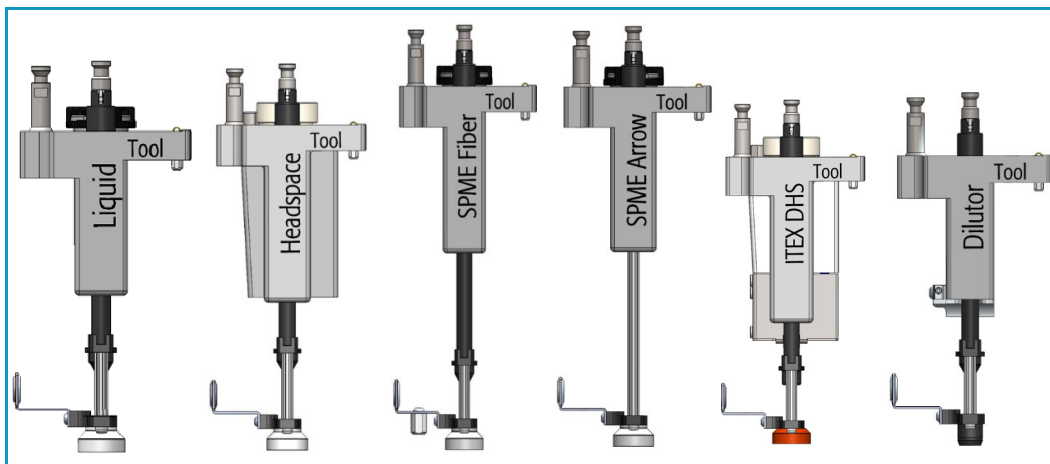
Specific Tools are:

- **LS Tool** — Used for liquid injection with a metallic plunger typically used for GC technique or with a polymer plunger used for syringes with a larger volume than 10 µL or for gaseous samples. The syringe is in the Tool holder, and the entire assembly is called LS Tool. See the section “[LS Tool](#)” on [page 17](#).
- **HS Tool** — Used for headspace injection. The entire assembly consists of a gas-tight syringe with a side hole for purging, the syringe heater and the syringe holder. See the section “[HS Tool](#)” on [page 22](#).
- **SPME Fiber Tool** — Automates the SPME Fiber holder. See the section “[SPME Fiber Tool](#)” on [page 24](#).
- **SPME Arrow Tool** — Automates the SPME Arrow Fiber holder. See the section “[SPME Arrow Tool](#)” on [page 26](#).
- **ITEX DHS Tool** — Used for In-tube/Dynamic Headspace extraction technique. See the section “[ITEX DHS Tool](#)” on [page 28](#).

- **Dilutor Tool** — Used exclusively with the Dilutor Module.
See the section “[Dilutor Tool](#)” on [page 31](#)

[Figure 7](#) shows the available Tools, which are clearly labeled.

Figure 7. Example Tools Identification



LS Tool

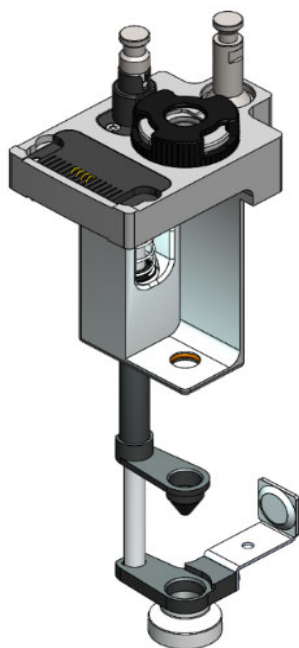
The LS Tool is used for liquid sample injection.

The LS Tool includes:

- A LED to show if the Tool is correctly placed on the Tool Station and to illuminate the syringe to easier show the scale or air bubbles
- A cover on the back helps with reading the syringe scale
- A bayonet coupling makes syringe changes faster - Improved guidance of the lower needle guide

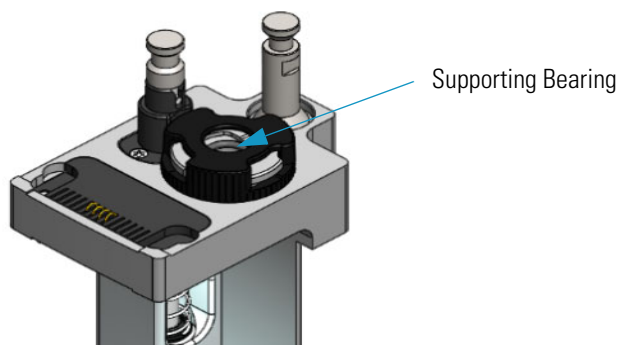
The LS Tool is a single block, easy to use to install a syringe. See [Figure 8](#).

Figure 8. LS Tool



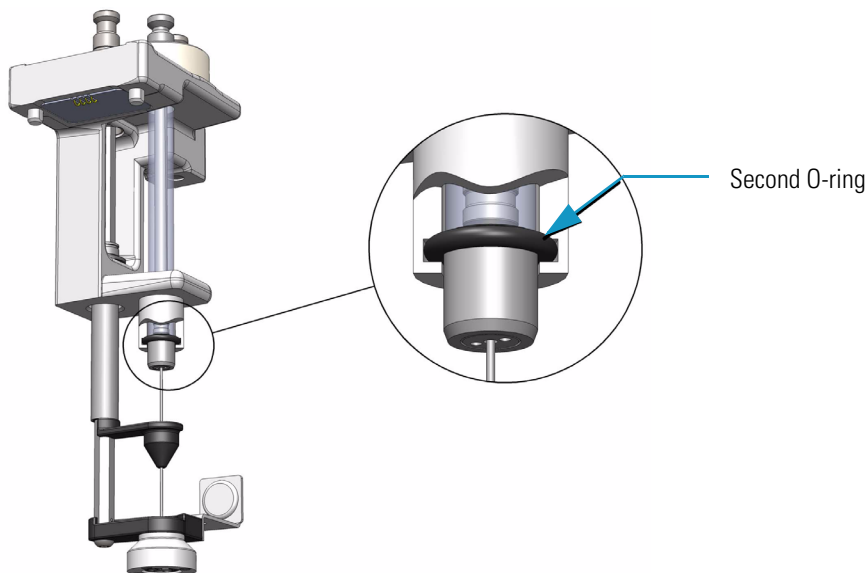
The syringe flange is supported by an O-ring (support bearing). See the example of [Figure 9](#).

Figure 9. Support Bearing



At the lower part of the block a second O-ring is installed which guides the syringe glass barrel and prevents direct metal contact. See the example in [Figure 10](#).

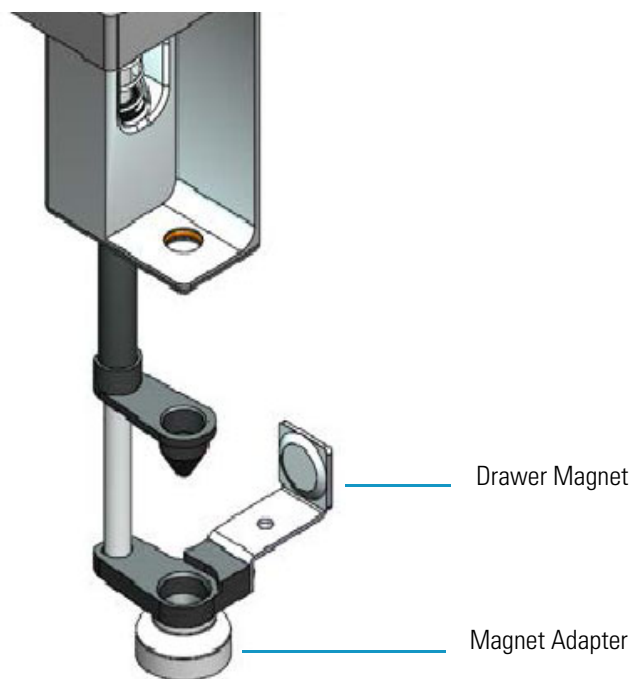
Figure 10. O-Ring



The Magnet Adapter Ring is used to transport 10-20 mL vials for example from a Tray to the Agitator/Incubator.

The lower needle guide has the Drawer Magnet installed, fixed with two screws. The magnet is required to open and close the Temperature Controlled Drawer. See the example of [Figure 11](#).

Figure 11. LS Tool - Magnets





ATTENTION If 2 mL vials with a magnetic cap are used, the Magnet Adapter ring must be removed. The 2 mL vials will be transported by the four magnets on the bottom of the Tool.

Three LS Tools are available. The LS Tools must be selected according to the required syringe as detailed in [Table 5](#).

Table 5. List of Syringes for LS Tools

LS Tool	Syringes Type	Syringe Volume
D7/57	7 mm diameter syringe barrel with 57 mm needle length.	0.5 µL, 1.0 µL, 5.0 µL, 10 µL, 25 µL, 50 µL, 100 µL
D7/85	7 mm diameter syringe barrel with 85 mm needle length	0.5 µL, 1.0 µL, 5.0 µL, 10 µL, 25 µL, 50 µL, 100 µL volumes
D8/57	8 mm diameter syringe barrel with 57 mm needle length	250 µL, 500 µL, 1000 µL volumes
D8/85	8 mm diameter syringe barrel with 85 mm needle length	250 µL, 500 µL, 1000 µL volumes
D18/57	18 mm diameter syringe barrel with 57 mm needle length	10000 µL volume

The syringe plunger can be metallic or polymeric.

- Syringes with a metallic plunger are used typically for the gas chromatographic technique where ideally organic solvents, such as alkanes, ketones, esters or alcohols, are used.
- Syringes with a polymeric plunger are used for gaseous sampling.

Note The metallic plunger type is not recommended for sample solutions which contain matrix particles, or a solvent which does not form a solvent film in between the syringe plunger and the glass barrel surface.

The metal can bite into the glass which will destroy the plunger. Examples of critical solvents to watch out for are mixtures of water and an organic solvent as water and ethanol, or DMSO (dimethyl sulfoxide). For such applications, we recommend using a syringe with a polymer plunger.

Liquid Syringe (LS) Tools are full compatibility with Thermo Injector technology. See [Table 6](#).

Table 6. LS Tool - Injector Compatibility

Injector

TRACE GC Ultra SSL Injector and TRACE 1300 Series GC TSI Injector

- Splitless injection — 85 mm needle length LS Tool
- Split injection — 57 mm needle length LS Tool
- Large Volume splitless — 57 mm needle length LS Tool

TRACE 1300 Series GC SSL Injector

- SSL injector — 57 mm needle length LS Tool

OC injector

- Conventional injection — 85 mm needle length LS Tool
- Large volume injection — 85 mm needle length LS Tool

PTV injector

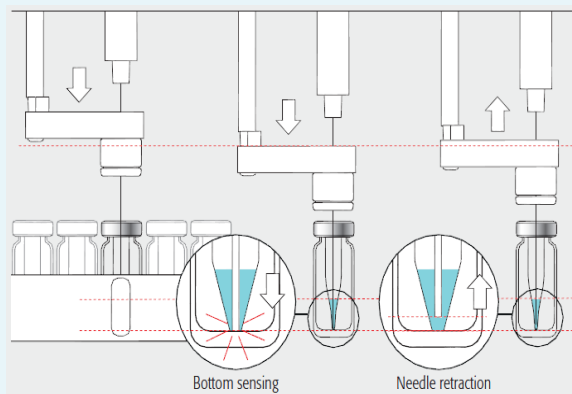
- Conventional injection — 57 mm needle length LS Tool
- Large volume injection — 57 mm needle length LS Tool
- Large volume with programmable depth — 85 mm needle length LS Tool

PKD injector

PKD injector — 57 mm needle length LS Tool

ATTENTION Syringe needles length of 85 mm and bevel tip needle are not suggested for automated **Bottom Sensing**, because of the high risk of needle bending.

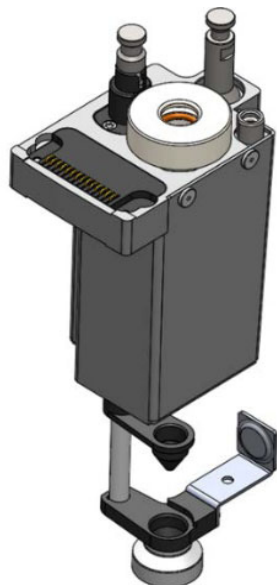
Bottom sensing makes sure that small volumes can be injected out of few μL of sample (for example 1 μL out of 5 μL)



HS Tool

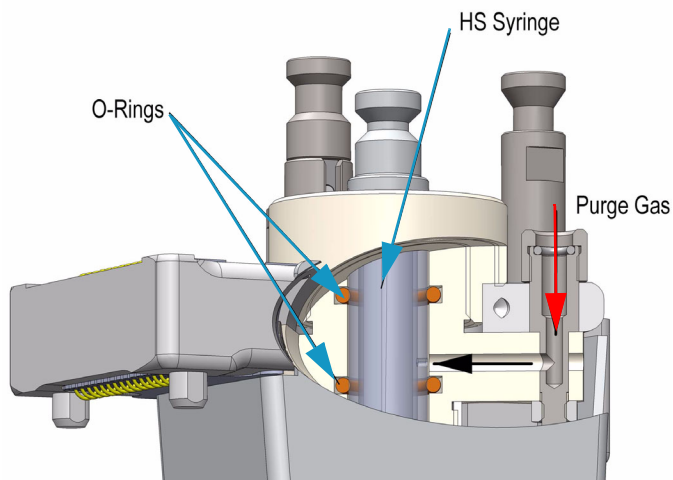
The Headspace Tool (HS Tool) is used for headspace injections. The HS Tool is provided as a single block, easy to use to install a syringe and the purge gas line. See [Figure 12](#).

Figure 12. HS Tool



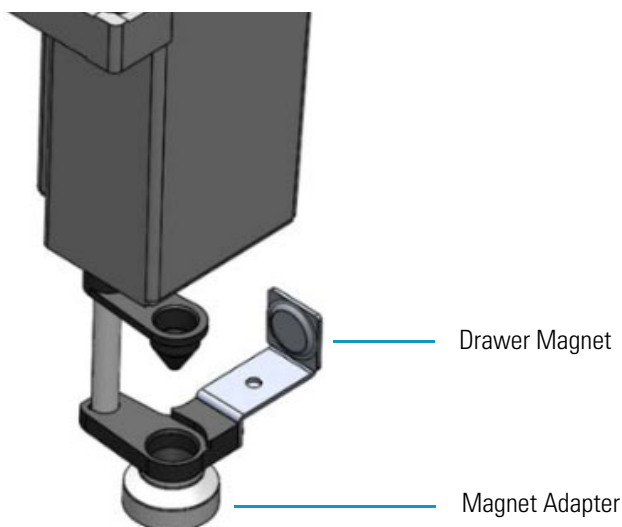
The syringe temperature is controlled from 40 °C to 150 °C, in 1 °C steps. The syringe is flushed with inert gas flow through X-Y-Z-axis. Besides the coupling pivots for the needle guide and the Tool, the purge gas connector is directly installed on the cover plate of the Tool. The syringe flange is supported by the polymer counterpart to the retaining nut. In the heating cylinder there are two O-rings which seal the gas flow to enable a syringe purge. It is recommended to replace these O-rings during preventative maintenance. [Figure 13](#) shows the cut-out of the HS Tool visualizing the Purge Gas Flow and the Sealing O-ring.

Figure 13. HS Tool Cut-out



The Magnet Adapter Ring is used to transport 10-20 mL vials, for example from a Tray to the Agitator/Incubator. The lower needle guide has the Drawer Magnet installed, and fixed with two screws. The magnet is required to open and close a Temperature Controlled Drawer. See [Figure 14](#).

Figure 14. HS Tool - Magnets



Three different HS Tools are available according to the headspace syringe volume See [Table 7](#).

Table 7. List of Syringes for HS Tool

HS Tool	Syringe
Headspace Syringe Tool for 1.0 mL Syringe	1.0 gas tight headspace syringe 23 gauge, 65 mm length needle
Headspace Syringe Tool for 2.5 mL Syringe	2.5 gas tight headspace syringe 23 gauge, 65 mm length needle
Headspace Syringe Tool for 5.0 mL Syringe	5.0 gas tight headspace syringe 23 gauge, 65 mm length needle

SPME Fiber Tool

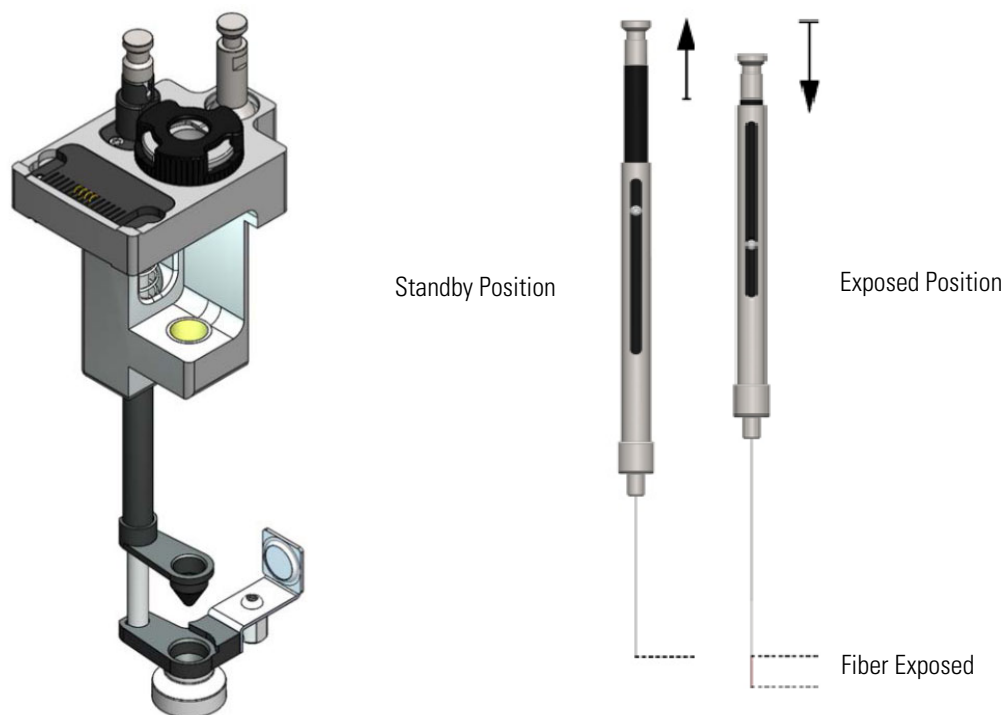
The **SPME Fiber Tool** for Solid Phase Micro Extraction are a dedicated devices adapted for the SPME Fiber Holder. Currently, there are two different fiber lengths commercially available: **10 mm** and **20 mm**. Both types can be adapted with the SPME Tool. The TriPlus RSH SMART System software allows setting the fiber extension length to the necessary distance.



CAUTION The SPME Fiber Conditioning Module **cannot be** used with the SPME Arrow Tool.

Figure 15 shows the SPME Fiber Tool with the holder mounted and a SPME Fiber holder with the fiber installed in the positions **Standby** and **Exposed**.

Figure 15. SPME Fiber Tool

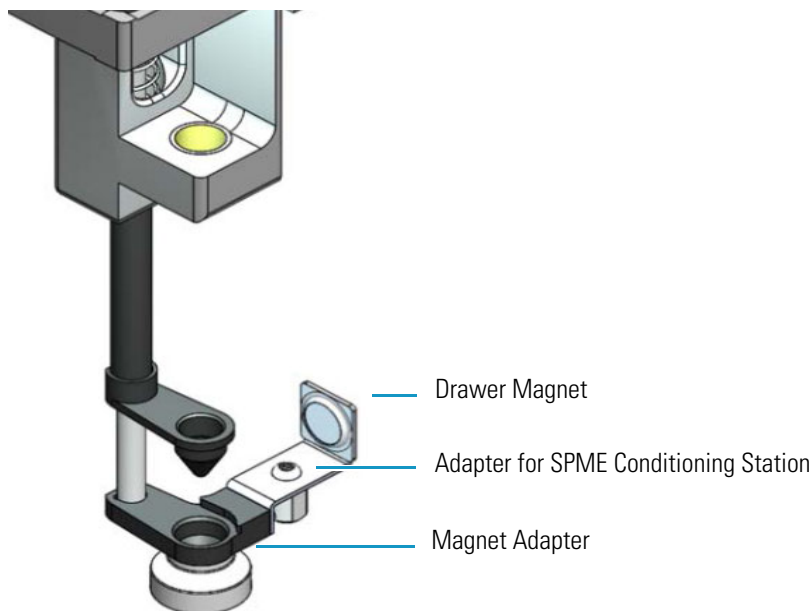


The SPME Fiber Tool includes:

- A LED to shows if the Tool is correctly placed on the Tool Station
- A bayonet coupling makes syringe changes faster - Improved guidance of the lower needle guide

The holder is fixed in position by the SPME Fiber Tool adapter and the retaining nut. No O-rings are necessary to fix or protect the SPME Fiber holder. A dedicated magnet is required for the SPME Fiber Tool. See [Figure 16](#).

Figure 16. SPME Fiber Tool - Magnet



The Magnet Adapter Ring is used to transport 1020 mL vials for example from a Tray to the Agitator/Incubator.

An adapter is present to automatically activate the gas flow on the SPME Conditioning Station.

The lower needle guide has the Drawer Magnet installed and fixed with two screws. The magnet is required to open and close a Temperature Controlled Drawer.

SPME Arrow Tool

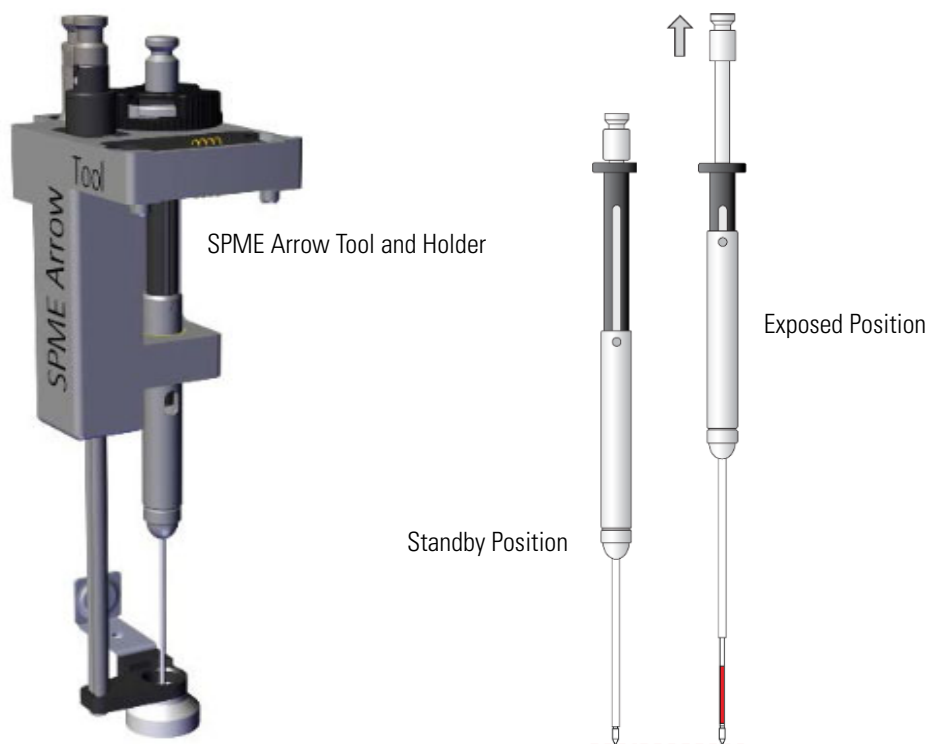
The SPME Arrow Tool is a dedicated Tool adapted for the SPME Arrow Fiber Holder.

IMPORTANT The use of the **Agitator/Incubator** and the **Heatex Stirrer** with the SPME Arrow is essential. The use of the SPME Arrow Conditioning Station is strongly suggested.

Note The SPME Arrow Conditioning Station can also be used with the SPME Fiber Tool

Figure 17 shows the SPME Arrow Tool with the holder mounted and a SPME Arrow holder with the fiber installed in the positions **Standby** and **Exposed**.

Figure 17. SPME Arrow Tool



The SPME Arrow Tool includes:

- A LED to show if the Tool is correctly placed on the Tool Station
- A bayonet coupling makes syringe changes faster and improves the guidance of the lower needle guide

The holder is fixed in position by the retaining nut. No O-rings are necessary to fix or protect the SPME Arrow holder.

A Check-Window on the SPME Arrow fiber holder allows a fast and easy identification of the type of the SPME Arrow fiber installed. See Figure 18.

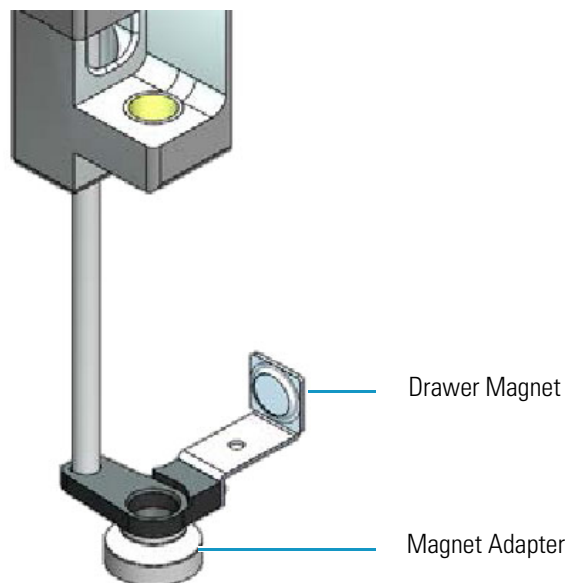
Figure 18. SPME Arrow Holder



Fiber types are color coded, while fiber thickness is distinguished by the number of the notches on the threaded joint.

The Magnet Adapter Ring is used to transport vials for example from a Tray to the Heatex Stirrer. The lower needle guide has the Drawer Magnet installed, fixed with two screws. The magnet is required to open and close a Temperature Controlled Drawer. See [Figure 19](#).

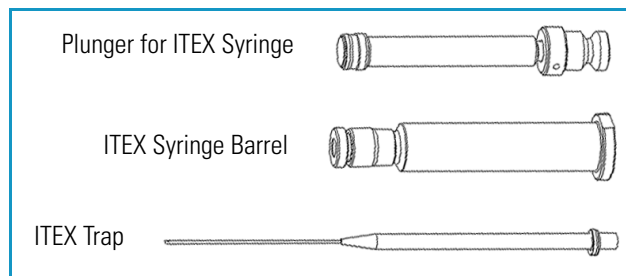
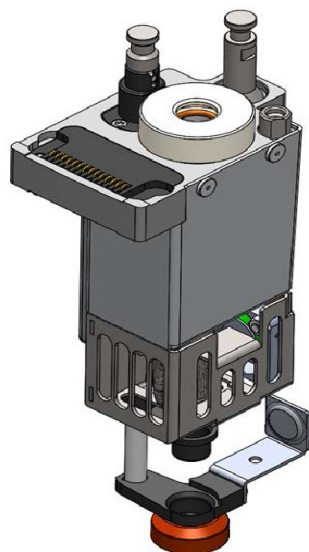
Figure 19. Magnet Adapter Ring



ITEX DHS Tool

The ITEX DHS Tool consists of a dedicated gas-tight syringe with an adapter for a replaceable side-hole needle, a heated syringe cartridge, a trap desorber heater and a trap cooling fan. See [Figure 20](#).

Figure 20. ITEX Tool



WARNING - BURN HAZARD The ITEX DHS Tool can operate at a maximum temperature of 200 °C.

Operating at this temperature, its outer surface will reach about 70 °C. Do not touch the outside of the ITEX DHS Tool. Always let the ITEX DHS Tool cool down before you touch it, or before you remove the Syringe.

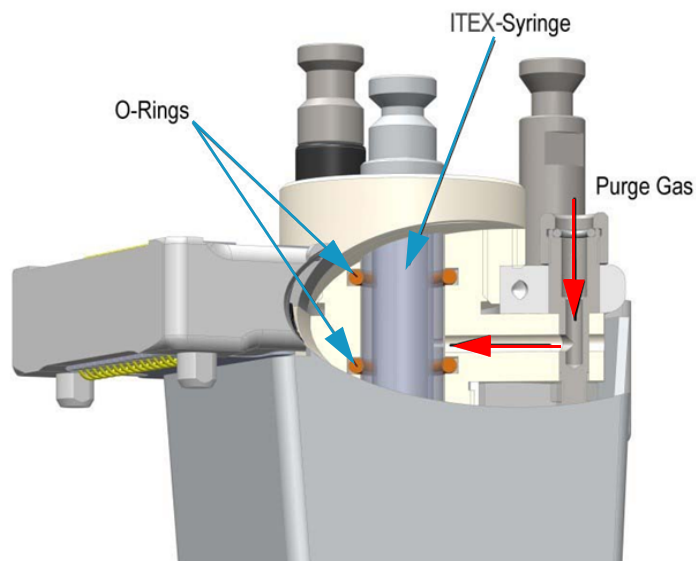
Besides the coupling pivots for the needle guide and the Tool, the purge gas connector is directly installed on the cover plate of the Tool.

The syringe flange is supported by the polymer counterpart to the retaining nut.

In the heating cylinder there are two O-rings which seal the gas flow to enable a syringe purge. It is recommended to replace these O-rings during preventative maintenance.

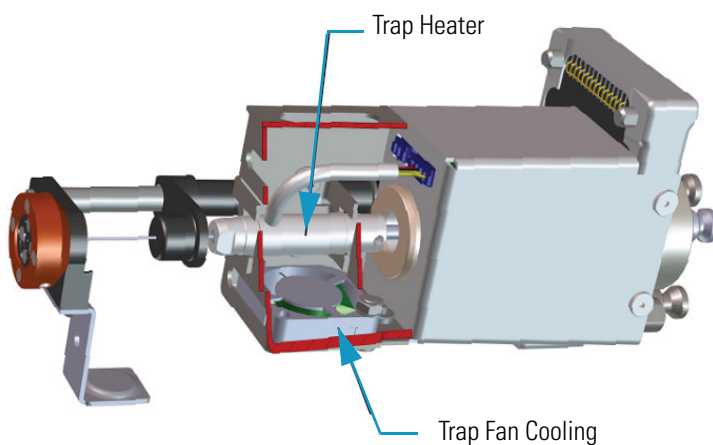
[Figure 21](#) shows the cut-out of the ITEX DHS Tool visualizing the Purge Gas Flow and the Sealing O-ring.

Figure 21. ITEX DSH Tool Cut-out (1)



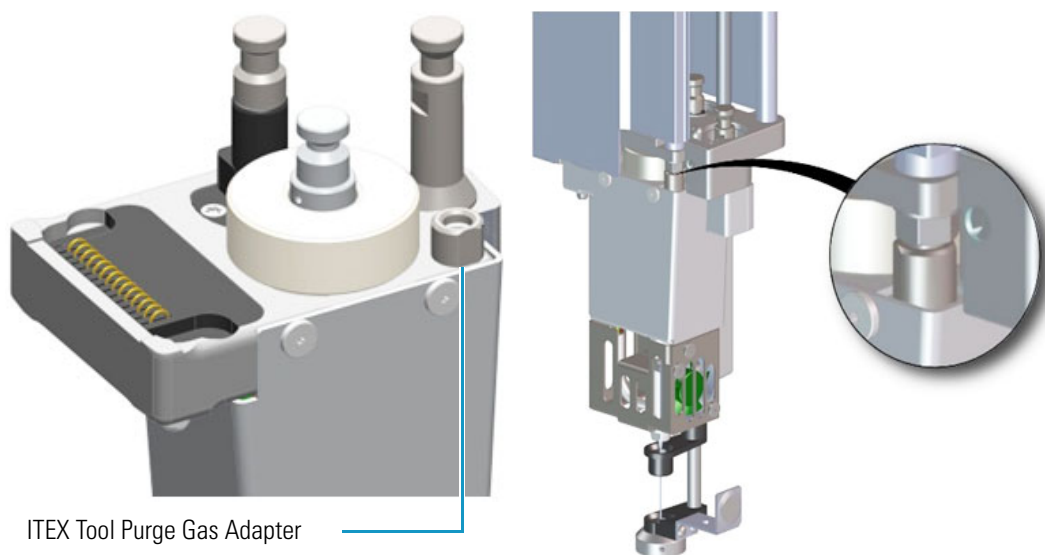
The heating and cooling functionality for the Trap is integrated in the lower part of the Tool. See [Figure 22](#).

Figure 22. ITEX DHS Tool Cut-out (2)



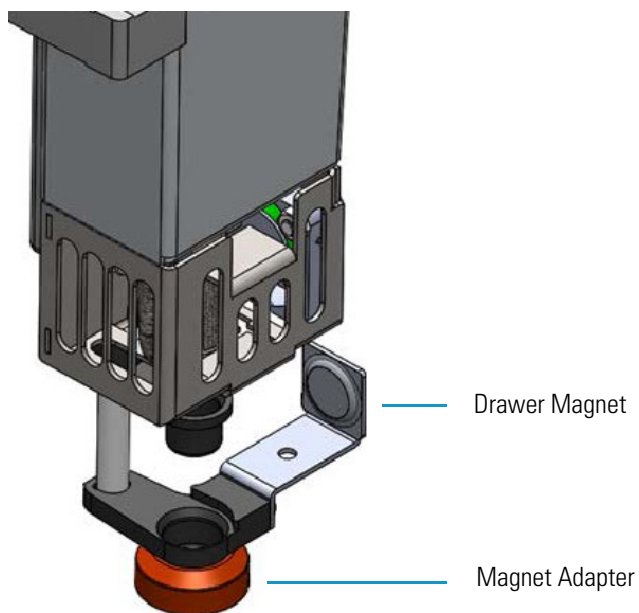
The purge gas adapter mounted on the ITEX DHS Tool couples with the adapter from the Head. The coupling is sealed with an O-ring installed in the ITEX DHS Tool Purge Gas Adapter. See [Figure 23](#).

Figure 23. ITEX Tool Purge Gas Adapter



The Magnet Adapter Ring is used to transport vials, for example from a Tray to the Agitator/Incubator. The lower needle guide has the Drawer Magnet installed, and fixed with two screws. The magnet is required to open and close a Temperature Controlled Drawer. See [Figure 24](#).

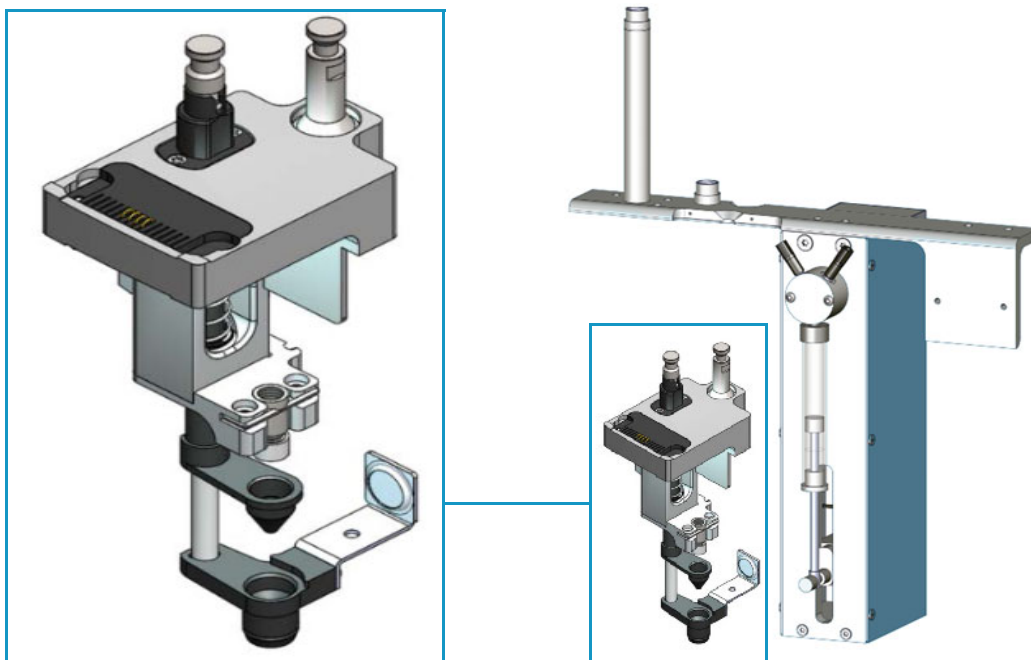
Figure 24. ITEX Tool - Magnets



Dilutor Tool

The Dilutor Tool is part of the Dilutor Module. See [Figure 25](#).

Figure 25. Dilutor Tool



The Dilutor Tool allow an efficient and precise addition of solvent and reagents. Carryover is minimized since the sample does not get in contact with the syringe and the sample tubing can be washed in backflush mode.

The Dilutor Module is described in the section “[Dilutor Module](#)” on [page 71](#).

TriPlus RSH SMART Tool Stations

This section provides a description of the following Tool Stations:

- “TR Station” on [page 32](#)
- “ATC Station” on [page 33](#)

TR Station

This passive module contains a single slot for an injection Tool. See [Figure 26](#) and [Figure 27](#).

Figure 26. TR Station

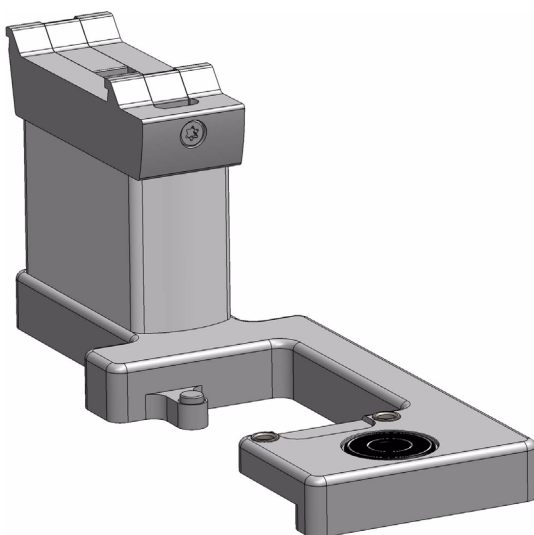
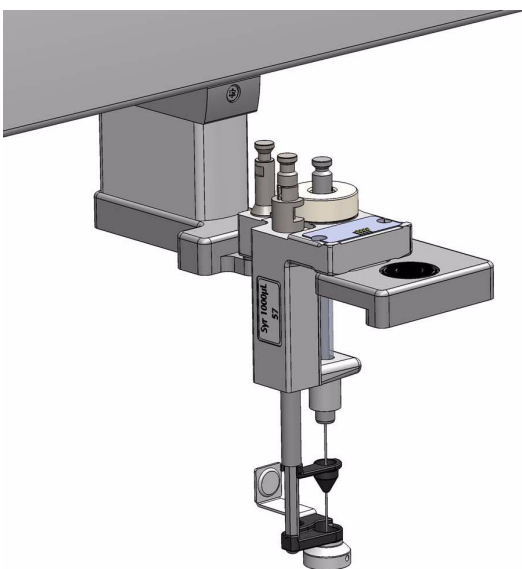


Figure 27. TR Station with a Tool



ATC Station

This active module containing three slots for Tools allows you to change an injection Tool automatically for specific needs. See [Figure 28](#) and [Figure 29](#).

Figure 28. ATC Station

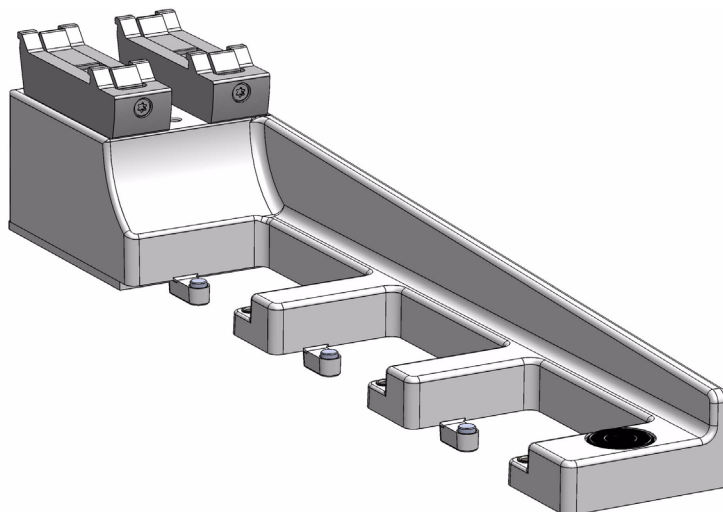
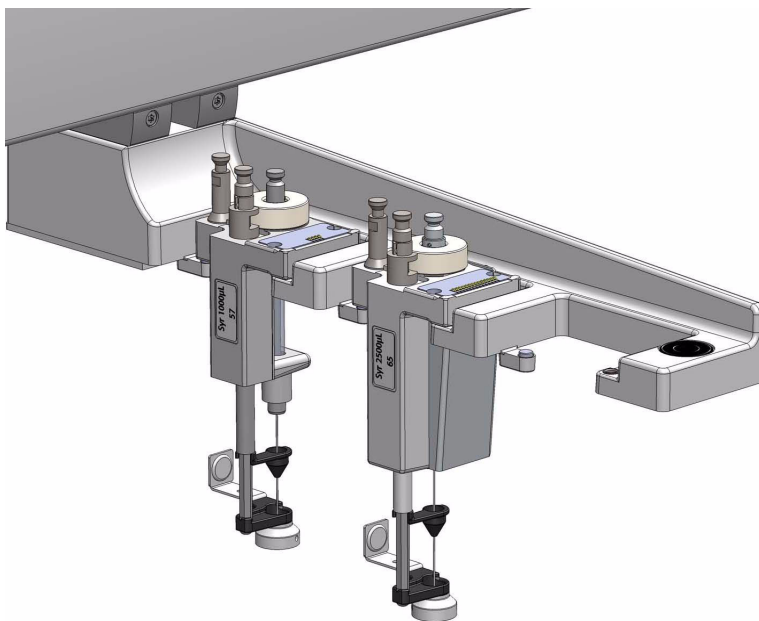


Figure 29. ATC Station with Tools



TriPlus RSH SMART Tray Holders

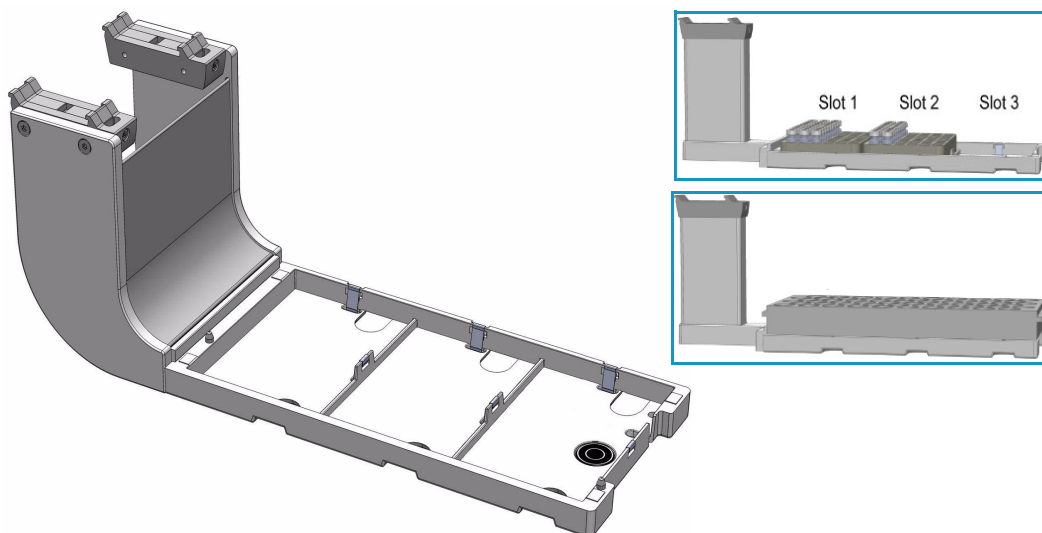
This section provides a description of the following Tray Holders:

- “Standard Tray Holder” on [page 34](#)
- “Liquid Cooled Tray Holder” on [page 35](#)
- “Temperature Controlled Drawer” on [page 36](#)

Standard Tray Holder

The Standard Tray Holder can accommodate up to three VT15, VT54 or VT70 sample trays, one in each slot positions, or a sample tray R60 which spreads over the three slot positions. See [Figure 30](#).

Figure 30. Standard Tray Holder



Up to four Standard Tray Holders can be simultaneously installed on the standard X-axis (850 mm length), and up to six on the extended X-axis (1200 mm length).

The Standard Tray Holder specifications are:

- **Sample Capacity** — 162 x 2 mL vial or 60 x 10-20 mL vial or 210 x 0.5-0.7 mL vial
- **Vial Size** — 0.3, 0.5, 0.7, 2.0, 2.5, 10, and 20 mL and micro volume non-standard vials
- **Electrical Connectors** — None

The Standard Tray Holder is also compatible to accommodate 96-position Deep Well Plates (DW 96), 96-position Microtiter Plates (MT 96), and 384-position Microtiter Plates (MT 384)

The Standard Tray Holder dimensions and mass are detailed in [Table 8](#).

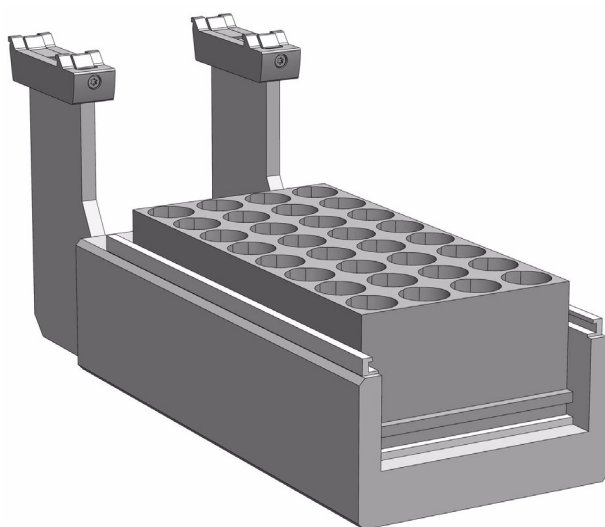
Table 8. Standard Tray Holder - Dimensions and Mass

Length	Dimension in mm (in.)
Width	134 (5.28)
Depth	375 (14.76)
Height	103 (4.06)
Compartment Width/Depth/Height	110/220/46 (4.33/8.66/1.81)
Mass	Dimension in kg (lbs)
Standard Tray Holder	2.50 (5.51)

Liquid Cooled Tray Holder

The Liquid Cooled Tray Holder is a passive module for an external re-circulating bath. See [Figure 31](#).

Figure 31. Liquid Cooled Tray Holder



In the bottom section of the Tray Holder, there is an open tube. The $\frac{1}{4}$ -in. hose connections for this tube can be seen at the back of the unit. Liquid from an external bath is circulated into the Tray Cooler through this tube; the liquid can be either heated or cooled.



CAUTION The Liquid Cooled Tray Holder operates within a temperature range from +4 °C to 70 °C.

The Liquid Cooled Tray Holder specifications are:

- **Sample Capacity** — Holds one tray for 32 vials capacity of 10 mL and 20 mL vials.

- **Temperature Control** — Through an external liquid circulation bath, not provided.
- **Connection Tube Dimensions** — Stainless steel tube, OD 8 mm (0.3-in.), and ID 6 mm (0.24-in.) open tube for hose connection.
- **Electrical Connectors** — None

The Liquid Cooled Tray Holder dimensions, mass, operating and environmental requirements are detailed in [Table 9](#) and [Table 10](#).

Table 9. Liquid Cooled Tray Holder - Dimensions and Mass

Length	Dimension in mm (in.)
Width	134 (5.28)
Depth	375 (14.76)
Height	103 (4.06)
Compartment Width / Depth / Height	110 / 220 / 46 (4.33 / 8.66 / 1.81)
Mass	Dimension in kg (lbs)
Liquid Cooled Tray Holder	2.50 (5.51)

Table 10. Liquid Cooled Tray Holder - Operating Environmental Requirements

Parameter	Requirements
Maximum relative humidity	80%, non-condensing
Vibration	Negligible
Static electricity	Negligible

Temperature Controlled Drawer

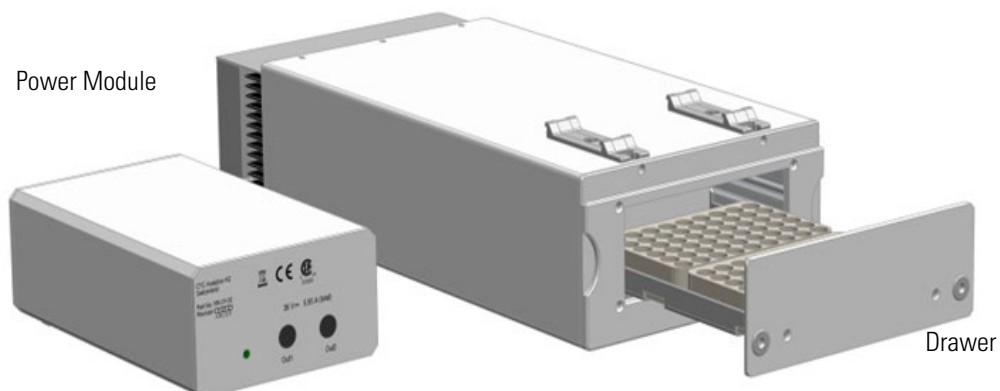
The Temperature Controlled Drawer is a temperature controlled sample tray that keeps the analytical sample below or above the ambient temperature. See [Figure 32](#).

It is an active module with a single drawer containing two slots for positioning Vial Trays or Well Plates. The module is equipped with a Peltier element which allows it to be heated to 40 °C or cooled to +4 °C. A separated power supply is also included.



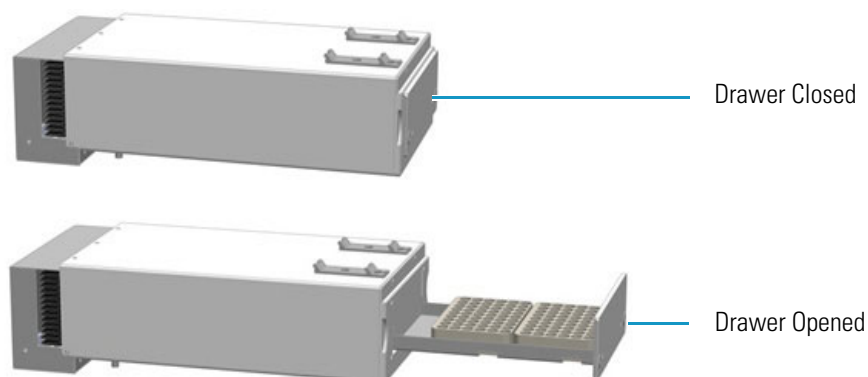
WARNING It is mandatory to use a second Power Module. Do not use the same power supply as used for the TriPlus RSH SMART. See the chapter **Installation of the TriPlus RSH SMART System** in the *TriPlus RSH SMART Hardware Manual* for details.

Figure 32. Temperature Controlled Drawer



The position of the drawer is recognized by a sensor, and translated from the software in the following descriptions. See [Figure 33](#).

Figure 33. Two Positions of Temperature Controlled Drawer



Note An **Opening** drawer status indicates an undefined status, or could also signal a defective PCB or sensor. Check whether the status changes after manually opening and closing the drawer.



CAUTION This module can adapt to sample tray made for different vial sizes. When the different racks are used, consider the different vial heights and ensure that the Drawer Magnet, attached to the lower needle guide, does not catch at the front row of vials from behind the tray.

The Temperature Controlled Drawer specifications are:

- **Sample Capacity** — Accommodate two different sample trays.
Compatible VT70, VT54, and VT 15 (10 mL vials only).
- **Total vial height** — 47 mm (including cap)
- **Temperature Control** — From 4 °C – 40 °C in 0.1 °C increments.

- **Temperature Cooling** — The specification for the Temperature Controlled Drawer temperature cooling is defined as:

Cooling time = 60 minutes to obtain a 14.0 °C ΔT

where ΔT = Room temperature – Drawer temperature

- **Electrical Connectors** — Two BUS connectors for daisy chaining and a connector for external power supply.

The Temperature Controlled Drawer dimensions, mass, operating and environmental requirements are detailed in [Table 11](#) and [Table 12](#).

Table 11. Temperature Controlled Drawer - Dimensions and Mass

Length	Dimension in mm (in.)
Temperature Controlled Drawer	
Width	197 (7.78)
Depth	425 (16.73) including cable connector
Height	103 (4.06)
Power Supply	
Width	135 (5.31)
Depth	215 (8.46)
Height	75 (2.95)
Mass	Dimension in kg (lbs)
Temperature Controlled Drawer	3.57 (7.87)
Power Supply	1.30 (2.87)
Associated cables (3 pieces)	0.50 (1.10)

Table 12. Temperature Controlled Drawer - Operating Environmental Requirements

Parameter	Requirements
Operating temperature range	4 to 40 °C
Maximum relative humidity	80%, non-condensing
Bench space	At least 50 mm (2-in.) at the back space for air circulation. Access to power switch(es) and power cords.
Vibration	Negligible
Static electricity	Negligible
Altitude limitations	3000 meters above sea level

Temperature Control

The cooling/heating capacity of a temperature control device based on the Peltier technique is always relative to room temperature. The maximum temperature difference that can be reached between the device and ambient temperature is limited. The Temperature Controlled Drawer can attain a minimum of 14 °C (ΔT) below ambient temperature or better.

The displayed temperature represents the temperature in the compartment and not necessarily the sample temperature. To verify the temperature independently, insert a temperature probe at the front of the compartment by removing one plastic screw from the front cover. Position the probe in the middle of the drawer where the Tray separator projects upwards.

Tape the probe to the metal plate of the drawer.

To maintain the efficiency of the Peltier element overtime, it is suggested to set a standby temperature close to ambient temperature when the control drawer is not used for prolonged time.

If the drawer is set for working at low temperature, it is suggested to cool the sample tray first in a refrigerator before placing it into the Temperature Controlled Drawer. This shortens the cool-down time and avoids temperature fluctuation.

Temperature Alarm

A fuse to prevent overheating is built in for unattended automated runs. The Peltier element will turn off automatically at $+72\text{ °C} \pm 5\text{ °C}$.

Temperature Stability

It is recommended observing the following guidelines:

- Switch on the Temperature Controlled Drawer at least 30 minutes before an analytical operation at $+10\text{ °C}$ or 75 minutes before an operation at $+4\text{ °C}$.
- For high-throughput analyses – at a typical cycle time of 60 seconds or less per analysis – leave the drawers open between the injections.
- For longer cycle times, it is recommended to use the **System** option to close the drawer after each sampling.

The function for closing the drawer after each sampling, or closing it only after a sequence is completed, is selectable under the **Activities** used for a cycle.

Condensation Build-up

Condensation build-up is directly related to the ambient temperature and humidity (dew point). Long-term tests have shown very little condensation build-up in an environment with relative humidity up to 60% and ambient temperatures of $22 \pm 2\text{ °C}$.

Condensation at the bottom of the compartments will be channeled to the drain outlet labeled **Condensation Drain**. The outlet is plugged with a paper filter. This helps to evaporate the collected water in the drain line using the excess heat from the Peltier element.

A drain line from the outlet to a reservoir bottle is not necessary under normal conditions.

In case of a laboratory environment with high temperature and humidity, a flow of clean and dry oil-free air or nitrogen could be used to dry the compartment. For the purpose connect the corresponding gas line to the Swagelok® fitting (1/8-in.) at the back of the **Temperature Controlled Drawer** labeled **Purge Gas**. A flow of about 300-400 mL/min is required to keep the compartments moisture-free.

Note If a purge gas is used, make sure that a two-stage safety pressure regulating device is installed between the gas supply and the Temperature Controlled Drawer.



WARNING Do not use any flammable or explosive gas such as hydrogen.

If using an application that produces an acidic vapor phase, use the same gas line connection to flush a stream of inert gas, such as nitrogen or helium, into the compartments. A stream of a few mL/min can help to avoid corrosion of the rolls. Checking the lines regularly for condensation build-up is recommended.

It is good practice to clean the inside of the Temperature Controlled Drawer when changing analytical samples. Dry out the Temperature Controlled Drawer at ambient temperature at regular intervals. Open the drawers from 1 to 5 cm to allow air circulation. The compartment drying frequency depends greatly on the ambient conditions.

TriPlus RSH SMART Washing Stations

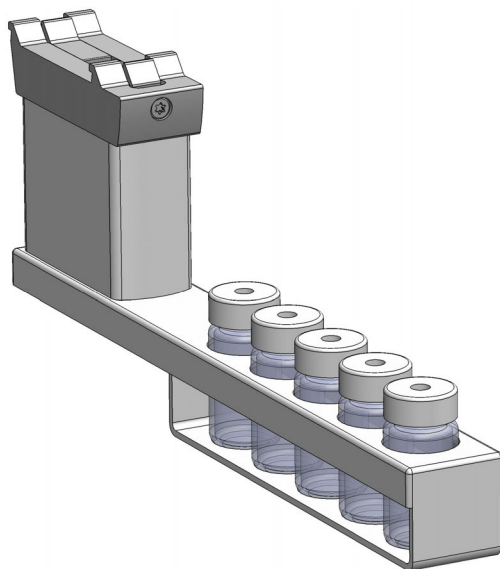
This section provides a description of the following Washing Stations:

- “Standard Wash Station” on [page 40](#)
- “Large Volume Wash Station” on [page 42](#)
- “Large Solvent Station” on [page 42](#)
- “Fast Wash Station” on [page 43](#)

Standard Wash Station

The Standard Wash Station is shown in [Figure 34](#).

Figure 34. Standard Wash Station



Contains five 10 mL vials;

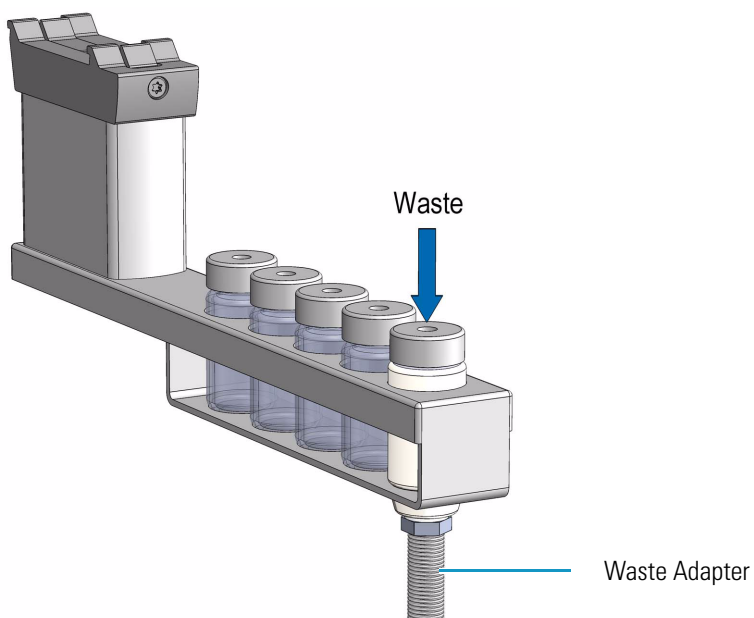
- 4 x Wash Vials and 1 x Waste Vial.

The configuration within the Standard Wash Station can be flexible; for example

- 2 x Wash Vials and 2 x Wash Vials dedicated for Internal Standard, Reagent, and so on, and a Waste Vial.

When the size of the Waste Vial is too small in size to accept 4 x 20 mL wash solvent, replace the Vial in the waste position with a waste adapter. See [Figure 35](#).

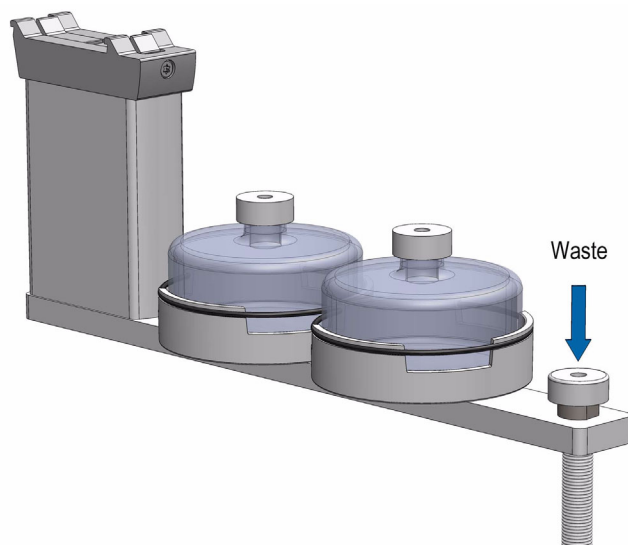
Figure 35. Standard Wash Station with Waste Adapter



Large Volume Wash Station

The Large Volume Wash Station is shown in [Figure 36](#).

Figure 36. Large Volume Wash Station

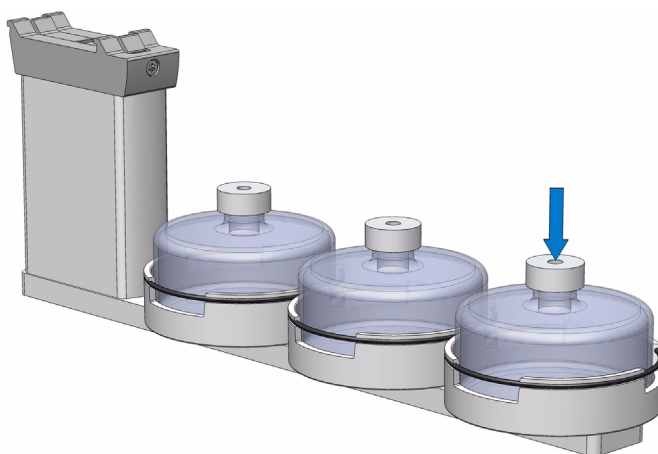


Contains two 100 mL bottles and one vial for waste port for diverting waste to large reservoir.

Large Solvent Station

The Large Solvent Station is shown in [Figure 37](#).

Figure 37. Solvents Station

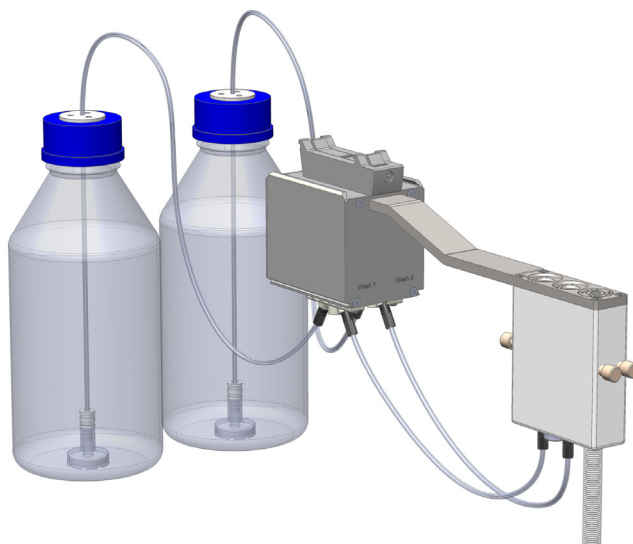


Contains three 100 mL bottles.

Fast Wash Station

The Fast Wash Station is shown in [Figure 38](#).

Figure 38. Fast Wash Station



The Fast Wash Station is an active module. Communication and control of the station is provided through the BUS from the system. Two Micro Pumps actively deliver the required flow of two different wash solvents.

The syringe is washed by inserting the needle into a glass liner; the provided wash solution is aspirated and dispensed. The needle is washed outside during this process.

The dispensed solvent passes from the overfilled liner into an internal flow channel to the waste outlet. This wash process can be repeated.

The wash solvent can also be changed by moving the syringe to the second wash port and starting the wash process over again. The advantage of this station is that the head does not need to move to the waste position to eject the wash solvent.

The Fast Wash Station dimensions, mass, operating, and environmental requirements are detailed in [Table 13](#) and [Table 14](#).

Table 13. Fast Wash Station - Dimensions and Mass (Sheet 1 of 2)

Length	Dimension in mm (in.)
Width	60 (2.36)
Depth	315 (16.73) Including cable connectors [380 (15.0)]
Height	135 (5.3) Including cable connectors [185 (7.3)]

Table 13. Fast Wash Station - Dimensions and Mass (Sheet 2 of 2)

Length	Dimension in mm (in.)
Associated Cables (two pieces)	0.15 (0.33)
Mass	Dimension in kg (lbs)
Fast Wash Station	0.750 (1.65)
Solvent reservoir kit	1.30 (2.87) Including two 1000 mL bottles

Table 14. Operating Environmental Requirements

Parameter	Requirements
Operating temperature range	4 to 40 °C
Maximum relative humidity	80%, non-condensing
Bench space	Consider bench space for the two 1000 mL bottles, or by your request.
Altitude limitations	3000 m above sea level

Heating/Shaking Modules and Stations

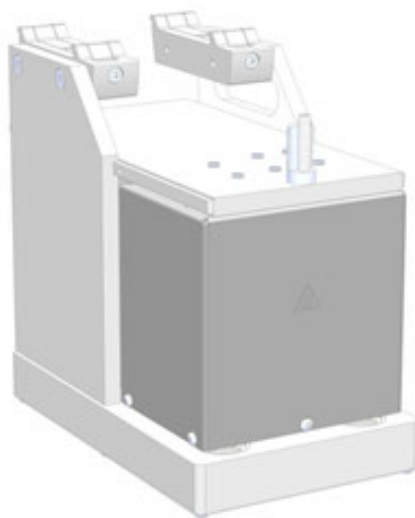
This section provides a description of the following Heating/Shaking Modules and Stations:

- “Agitator/Incubator Module” on page 45
- “Vortexer Module” on page 47
- “Heatex Stirrer Module” on page 49
- “SPME Conditioning Station” on page 51
- “SPME Arrow Conditioning Station” on page 53

Agitator/Incubator Module

The Agitator/Incubator is an active module used for heating and shaking the sample. See Figure 39.

Figure 39. Agitator/Incubator Module with Perforated Cover



The Agitator/Incubator specifications are:

- **Sample Capacity** — Six heated vial positions for 2 mL, 10 mL, and 20 mL vials. Magnetic caps are required.
 - Adapters for 2 mL vials and 10 mL vials are available.
- **Temperature Control** — From 30 °C to 200 °C in 1 °C increments.
- **Agitation** — Orbital interval shaking, speed selectable from 250 to 750 rpm.
- **Electrical Connectors** — Two BUS connectors for daisy chaining.

Note The non-perforated Agitator cover is compatible with TriPlus RSH SMART Advanced, but not compatible with TriPlus RSH SMART Standard.

The Agitator dimensions, mass, operating and environmental requirements are detailed in [Table 15](#) and [Table 16](#).

Table 15. Agitator /Incubator - Dimensions and Mass

Length	Dimension in mm (inches)
Width	114 (4.45)
Depth	180 (7.09)
Height	176 (6.93)
Mass	Dimension in kg (pounds)
Agitator (with cable and 6x10 mL vial spacers)	2.38 (5.25)

Table 16. Agitator - Operating Environmental Requirements

Parameter	Requirements
Operating temperature range	4 to 40°C
Maximum relative humidity	80%, non-condensing
Vibration	Negligible
Static electricity	Negligible

The main function of the Agitator/Incubator is to speed up the formation of the equilibrium between two phases which can be used for applications such as static headspace, or SPME/APME Arrow (*Solid Phase Micro Extraction*), or ITEX DHS (*In-tube/Dinamic Headspace Extraction*). The Agitator/Incubator can also be used for chemical derivatization reactions, liquid/liquid extractions, and so on. Temperature and shaking parameters can be individually controlled.



WARNING -BURN HAZARD The Agitator/Incubator can operate at a maximum temperature of 200 °C. Operating at this temperature, its outer surface will reach approximately 70 °C. When the Agitator is heated, do not touch the outside surface, do not reach into it; do not try to remove vials manually from it. The vials will be at the selected operating temperature, and there is a danger of burns.

Use only high quality vials compatible with the operating temperature. Consider the high pressure that can build up in the vial and the vapor pressure of the solvent when a temperature greater 60 °C is applied. Do not reuse headspace vials.

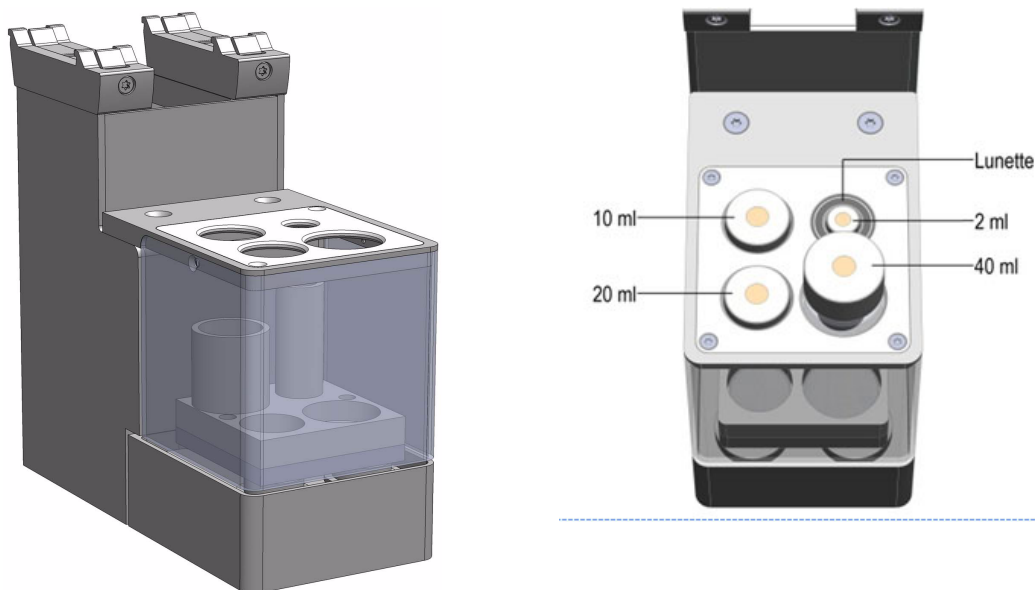


CAUTION We suggest the use of vials furnished by Thermo Fisher Scientific. If vials of other suppliers are used, it is your responsibility to verify their compatibility with the applications.

Vortexer Module

The Vortexer is an active module which used for intensive shaking (orbital interval shaking) at ambient temperature. See [Figure 40](#). Its main application is the automated liquid/liquid extraction of two immiscible solvent phases. An emulsion is temporarily formed which will break after the shaking stops. Only one vial at time can be treated. Shaking speed can be selected. The temperature control of the module is not possible.

Figure 40. Vortexer Module



The Vortexer specifications are:

- **Agitation** — Orbital interval shaking, speed selectable from 250 to 2000 rpm.
- **Sample Vial Dimensions** — 2, 10, 20, and 40 mL. Magnetic caps are required.
- **Sample Capacity** — 1 vial treated at once
- **Electrical Connectors** — Two BUS connectors for daisy chaining

The Vortexer dimensions, mass, operating, and environmental requirements are detailed in [Table 17](#) and [Table 18](#).

Table 17. Vortexer - Dimensions and Mass

Length	Dimension in mm (in.)
Width	82 (3.23)
Depth	180 (7.09)
Height	177 (7.0)
Mass	Dimension in kg (lbs)
Vortexer (with cable)	2.10 (4.63)

Table 18. Operating Environmental Requirements

Parameter	Requirements
Operating temperature range	Ambient, no control
Maximum relative humidity	80%, non-condensing
Vibration	To be tested
Static electricity	Negligible

Use quality glass vials suitable for the applications. Use only one vial at time for mixing and do not reuse headspace vials



CAUTION We suggest the use of vials furnished by Thermo Fisher Scientific. If of other suppliers are used, it is your responsibility to verify their compatibility with the applications. Do not wash and recycle used vials;



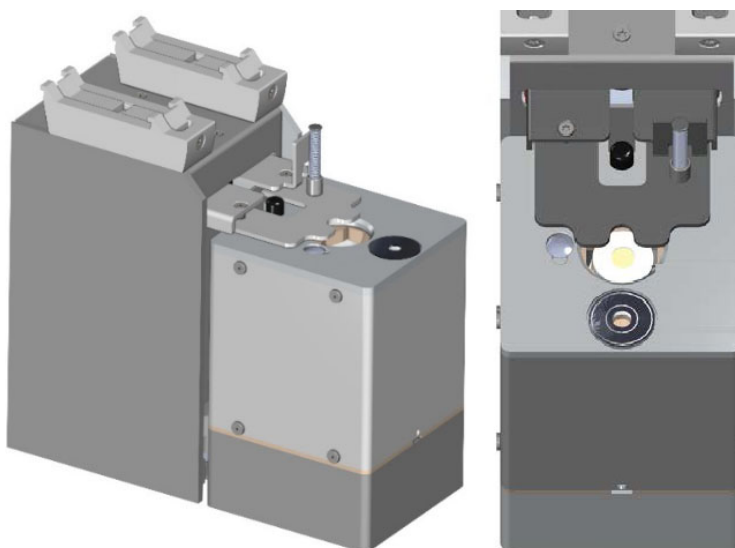
WARNING It is mandatory using the mixer with the installed protective cover. During the mixing step it is important to keep the TriPlus RSH SMART Head always above the vial to avoid an uplift of the vial caused by the spin.

The recommended application for the Vortexer is liquid/liquid extraction. If a solid material is mixed with a liquid at high speeds, this will likely cause cracking of the vial.

Heatex Stirrer Module

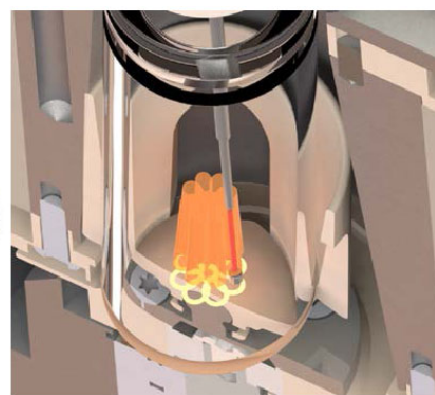
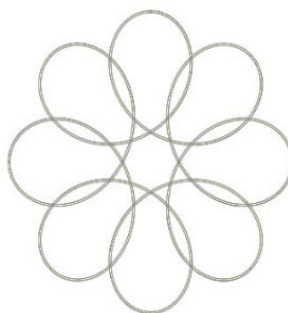
The Heatex Stirrer is an active module which mixes samples rapidly applying a cycloid shaped mixing pattern without the need for stir bars. See [Figure 41](#).

Figure 41. Heatex Stirrer Module



Motion of a liquid (orange) when applying a cycloidal mixing pattern (yellow). The entire volume of the liquid is mixed efficiently. The integrity of the SPME Arrow fiber (red) is not compromised.

Cycloidal Mixing



For SPME headspace and immersion sampling, the special design ensures that the delicate fiber is not damaged. The temperature can be set in the range of 40 to 150 °C.

The Heatex Stirrer specifications are:

- **Agitation** — Cycloid shaped mixing, speed selectable from 0 to 1600 rpm (0 to 200 cycloidal loops).
- **Sample Vial Dimensions** — 20 mL Vial diameter 23 ± 0.5 mm, height 78 mm including magnetic cap (2 mL and 10 mL Vials can be used with adapter inset)
- **Sample Capacity** — 1 vial
- **Electrical Connectors** — Two Bus connectors for daisy chaining

- **Firmware** — Version 2.4 or higher

The Heatex Stirrer dimensions, mass, operating and environmental requirements are detailed in [Table 19](#) and [Table 20](#).

Table 19. Heatex Stirrer - Dimensions and Mass

Length	Dimension in mm (inches)
Width	85 (3.35)
Depth	188 (7.40)
Height	177 (7.0)
Mass	Dimension in kg (pounds)
Heatex Stirrer (with cable)	2.60 (5.73)

Table 20. Heatex Stirrer - Operating Environmental Requirements

Parameter	Requirements
Operating temperature range	4 to 40 °C
Maximum relative humidity	80%, non-condensing
Static electricity	Negligible

Use quality glass vials suitable for the applications. Use only one vial at time for mixing and do not reuse headspace vials.

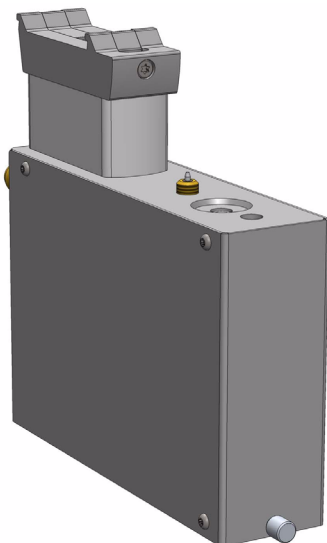


CAUTION We suggest the use of vials furnished by Thermo Fisher Scientific. If of other suppliers are used, it is your responsibility to verify their compatibility with the applications. Do not wash and recycle used vials;

SPME Conditioning Station

The SPME Conditioning Station is an optional device used for the SPME (Solid Phase Micro Extraction) technique. It conditions or cleans a fiber between chromatographic runs. See [Figure 42](#).

Figure 42. SPME Conditioning Station



The SPME Conditioning Station specifications are:

- **Temperature Control** — From 30 °C to 350 °C selectable in 1°C increments.
- **Electrical Connectors** — Two BUS connectors for daisy chaining.

The SPME Conditioning Station dimensions, mass, operating and environmental requirements are detailed in [Table 21](#) and [Table 22](#).

Table 21. SPME Conditioning Station - Dimensions and Mass

Length	Dimension in mm (in.)
Width	44 (1.73)
Depth	190 (7.48)
Height	160 (6.30)
Mass	Dimension in kg (lbs)
SPME Conditioning Station (with Cable)	1.08 (2.38)

Table 22. SPME Conditioning Station - Operating Environmental Requirements (Sheet 1 of 2)

Parameter	Requirements
Operating temperature range	4 to 40 °C
Maximum relative humidity	80%, non-condensing

Table 22. SPME Conditioning Station - Operating Environmental Requirements (Sheet 2 of 2)

Parameter	Requirements
Vibration	Negligible
Static electricity	Negligible

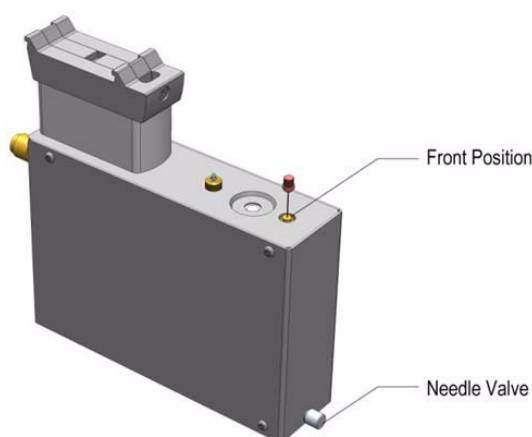


WARNING The SPME Conditioning Station operates at a maximum temperature of 350 °C. Operating at this temperature, the outer surface will reach approximately 70 °C. Do not touch the outside of the SPME Conditioning Station.

A flow of inert gas protects the fiber from degradation when it is exposed to elevated temperatures. The temperature for conditioning or cleaning can be selected.

A spare fiber can be conditioned in the front well to ensure that a spare fiber is always ready for use. The front position is designed to condition a spare SPME Fiber. See [Figure 43](#).

Figure 43. Spare Fiber Inserted in Front Position



The fiber is manually placed into the hole, and brought to the exposed position. If this second position is used, open the needle valve for gas flow in the second channel (front). The needle valve is the metallic knob in front of the conditioning module. After the spare fiber has been removed from the front position, close the needle valve in front of the conditioning station (metallic knob).

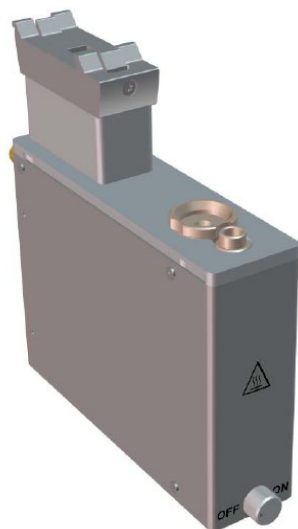
Note Saving gas, letting gas flow unrestricted through this open, second channel reduces the gas flow in the channel for the automated conditioning. This could result in damage to the fiber, as it will not be protected by inert gas.

It is not only a matter of saving gas, but letting gas flow unrestricted through this open, second channel would reduce the gas flow in the channel for the automated conditioning. This could result in damage to the fiber, as it is not be protected by inert gas.

SPME Arrow Conditioning Station

The SPME Arrow Conditioning Module is an optional device used for the SPME (Solid Phase Micro Extraction) technique in combination with the SPME Arrows. Its purpose is to condition a SPME Arrow or clean an Arrow between chromatographic runs. See [Figure 44](#).

Figure 44. SPME Arrow Conditioning Station



The SPME Arrow Conditioning Station specifications are:



WARNING The SPME Arrow Conditioning Module can be operated at maximum temperature of 350 °C. When operated at this temperature, the outer surface will reach approx. 70 °C. Do not touch the outside of the SPME Arrow Conditioning Module.

- **Temperature Control** — From 30 °C to 350 °C selectable in 1°C increments.
- **Electrical Connectors** — Two BUS connectors for daisy chaining.
- **Firmware** — Version 2.4 or higher

The SPME Arrow Conditioning Station dimensions, mass, operating and environmental requirements are detailed in [Table 23](#) and [Table 24](#).

Table 23. SPME Conditioning Station - Dimensions and Mass

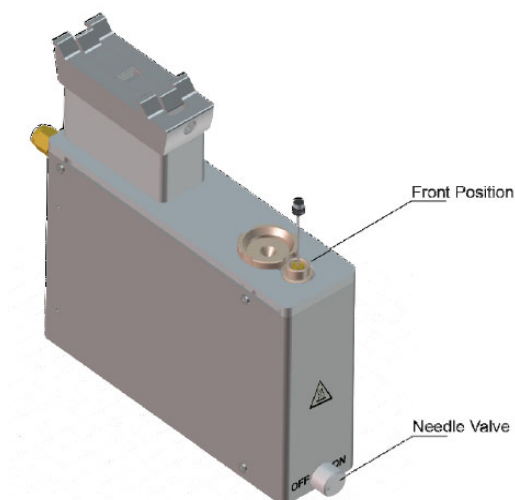
Length	Dimension in mm (in.)
Width	44 (1.73)
Depth	190 (7.48)
Height	166 (6.54)
Mass	Dimension in kg (lbs)
SPME Arrow Conditioning Station (with Cable)	1.20 (2.65)

Table 24. SPME Conditioning Station - Operating Environmental Requirements

Parameter	Requirements
Operating temperature range	4 to 40 °C
Maximum relative humidity	80%, non-condensing
Vibration	Negligible
Static electricity	Negligible

A flow of inert gas protects the Arrow from degradation when it is exposed to elevated temperatures. The temperature for conditioning or cleaning can be selected. A spare Arrow can be conditioned in the front well to ensure that a spare Arrow is always ready for use. See [Figure 45](#).

Figure 45. Spare Fiber Inserted in front Position



TriPlus RSH SMART Optional Modules

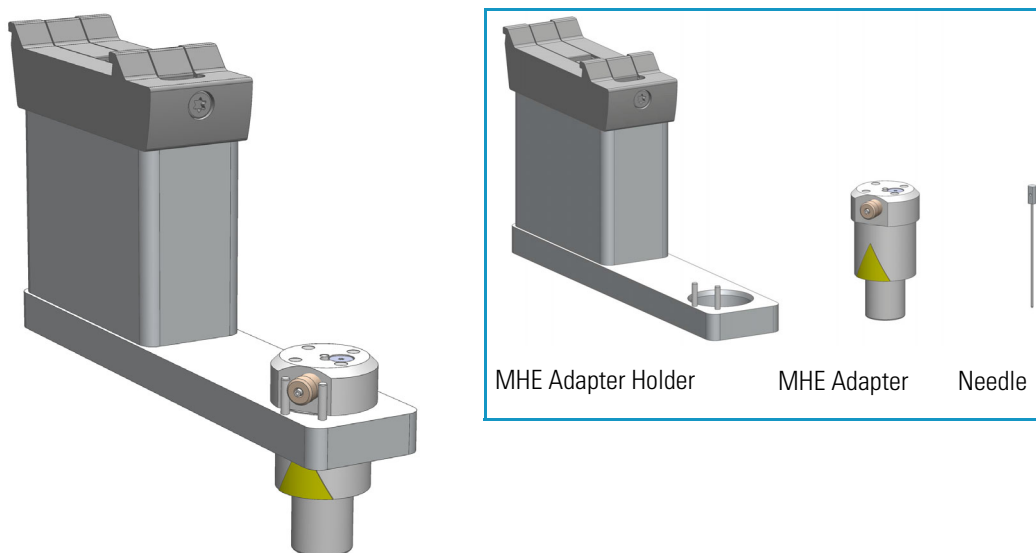
This section provides a description of the following Optional Modules:

- “MHE Station” on [page 55](#)
- “Centrifuge Module” on [page 57](#)
- “Flow Cell Module” on [page 62](#)
- “Barcode Reader ” on [page 66](#)
- “Electronic Box for OC Injector Actuator” on [page 70](#)
- “Dilutor Module” on [page 71](#)
- “Handheld Controller” on [page 73](#)

MHE Station

The MHE (Multiple Headspace Extraction) Station is an add-on passive module to extend the range of headspace applications. It consists of a venting Tool (MHE Adapter) combined with a MHE Adapter Holder. See [Figure 46](#).

Figure 46. MHE Station



The MHE adapter and MHE Adapter Holder dimensions, mass, operating, and environmental requirements are detailed in [Table 25](#), [Table 26](#) and [Table 27](#).

Table 25. MHE Adapter - Dimensions and Mass

Length	Dimension in mm (in.)
Width	25 (1.0)
Height	51 (2.0)
Mass	Dimension in kg (lbs)
MHE Adapter	0.027 (0.06) without vent tubing

Table 26. MHE Adapter Holder - Dimensions and Mass

Length	Dimension in mm (in.)
Width	35 (1.4)
Depth	150 (5.9)
Height	110 (4.3) with MHE Adapter inserted
Mass	Dimension in kg (lbs)
MHE Adapter Holder	0.285 (0.63) without vent tubing

Table 27. Operating Environmental Requirements

Parameter	Requirements
Operating temperature range	4 to 40 °C
Maximum relative humidity	80%, non-condensing
Latitude limitations	3000 meters above sea level

Naming Convention

MHE Adapter — The MHE Adapter, equipped with a built-in needle, is used as the Tool to release the pressure from the vial.

The MHE Adapter is also equipped with a vent outlet connector for connecting a vent line. In cases toxic gases are released from the vial, the venting line can be positioned into a neutralizing agent or to a fume hood to protect the operator and the environment.

MHE Needle — The MHE Needle is a dedicated needle used for the MHE Adapter only. Length: 46 mm, Gauge 22, Point style 5 (side hole needle tip).

MHE Adapter Holder — Parks the MHE Adapter in between the cycles, or in standby position.

CAUTION The MHE Venting Adapter contains a spring-loaded white insert to protect the needle. Use caution when handling the white insert; the needle can pierce skin.



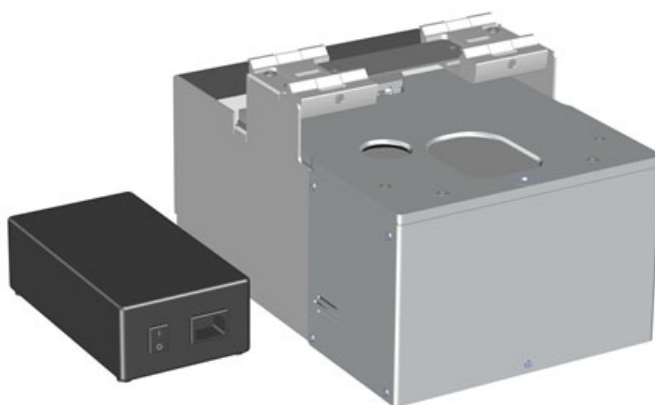
Note The MHE Adapter has a threaded gas vent outlet, allowing an optional OD 1/16.in waste tube to be attached. This optional gas venting tube can be used for applications requiring hazardous or toxic gases. The pressure setting for the MHE technique is 1.0 to 1.5 bar (about 15 psi). If your system was previously used for static headspace applications, you may need to adjust your pressure regulator.

Note For details about the **Multi Headspace Extraction**, see the [Appendix A, “Multi Headspace Extraction \(MHE\).”](#)

Centrifuge Module

The Centrifuge Module is an active, optional module which can be used for centrifugation of samples or other compounds in vials. The Centrifuge Module supports the centrifugation of either up to four, 2 mL vials, two 10 mL vials, or two 20 mL vials. The maximum RCF is 2000 x g.

Figure 47. Centrifuge Module



Specifications

The Centrifuge specifications are:

- **Electrical Connectors** — Two BUS connectors for daisy chaining.
- **Sample Capacity**— 2 mL, 10 mL, and 20 mL.
 - 4 vial positions for 2 mL vials (magnetic cap only).
 - 2 vial positions for 10 mL vials (magnetic cap only).
 - 2 vial positions for 20 mL vials (magnetic cap only)

- **Power Supply** — 36V DC, 200 W

The Centrifuge dimensions, mass, operating and environmental requirements are detailed in [Table 31](#).

Table 28. Centrifuge - Dimensions and Mass

Length	Dimension in mm (in.)
Width	222.6 (87.64)
Height	185.0 (72.83)
Depth	326.2 (128.43) 380 (149.61) including module cables
Mass	Dimension in kg (lbs)
Weight	10.5 (23.2)

Table 29. Relation between RPM and RCF

RPM	RCF (x g)
500	22
1000	87
1500	195
2000	347
2500	543
3000	781
3500	1063
4000	1389
4500	1758
4800	2000

The Centrifuge Module must not be used for microbiological samples (bacteriological cultures, cell cultures) or flammable or explosive substances or mixtures other than the following: acetone, ac-etionitrile, ethyl acetate, methyl tert-butyl ether (MTBE), methanol, ethanol, isopropanol, n-pentane, n-hexane, cyclohexane in a total amount of 20 mL (2x10 mL). The vials have to be closed with septum and cap.

Loading the Rotor

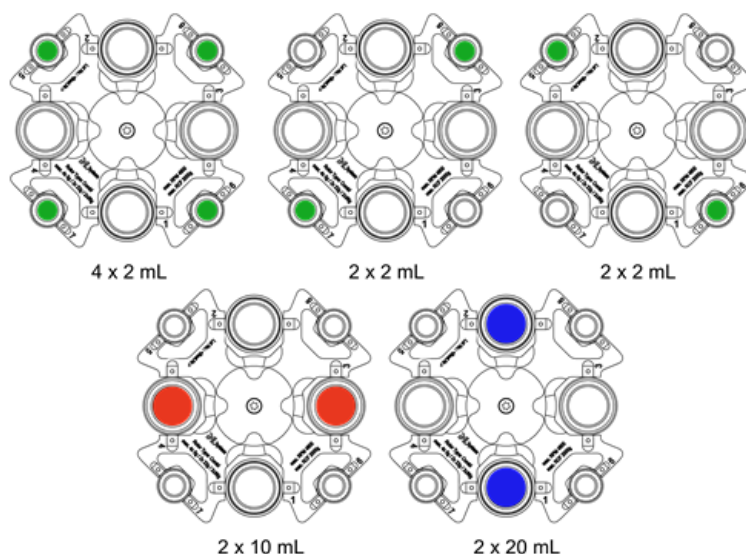
The rotor is loaded automatically using a software script. Each slot is numbered. The slot numbers can be found engraved on the rotor to the right of each vial slot.

The weight of each vial slot is limited to a total of 5 g (2 mL vial slot), 22 g (10 mL vial slot) and 36 g (20 mL vial slot). This includes the vial, the cap, the content of the vial, and, the adapter (if used).

The actual weight of the dosed volume for each vial may vary by $\pm 5\%$ (± 0.1 g for a 2 mL vial, ± 0.5 g for a 10 mL vial, ± 1 g for a 20 mL vial. Based on a reference density of 1 g/cm^3).

To prevent imbalance, the rotor must always be loaded symmetrically. Only even numbers of vials (2 or 4) are allowed for loading the rotor. If an uneven number of vials has to be centrifuged, a dummy vial of the same weight has to be used as counterweight for the unpaired vial. The following figure shows possible options for loading the rotor, all other options are prohibited.

Figure 48. Rotor Loading Options (Positions Marked Green for 2 mL, Red for 10 mL and Blue for 20 mL)



Emergency Shutdown

The Centrifuge Module triggers an emergency shutdown if an imbalance of the rotor (caused by an irregular loading of the rotor) is detected. If an emergency shutdown has been performed, a pending message is generated, preventing the Centrifuge Module from being started again. A restart of the Centrifuge Module is only possible, if the cause for the emergency shutdown has been remedied and the emergency shutdown has been reset in extended user mode via the corresponding command in the **Options** menu of the Centrifuge Module.

Check all vial slots for broken vials or glass parts after an emergency shutdown.

Cleaning if a Vial Breaks or Leaks

If a vial breaks or leaks in the Centrifuge Module, the rotor with the vials and the accessible interior of the Centrifuge Module housing have to be cleaned thoroughly. All glass parts have to be removed from the vial compartments as remaining glass parts will cause further breakage of vials.

❖ To clean the rotor and the interior of the Centrifuge Module beneath it

1. Clean the rotor and interior with a soft lint-free cloth dampened with 70% ethanol.
2. Dry the surface immediately after cleaning.

After cleaning the rotor and the interior of the Centrifuge Module the rotor and the housing must be checked from all sides for damage like corrosion or cracks.

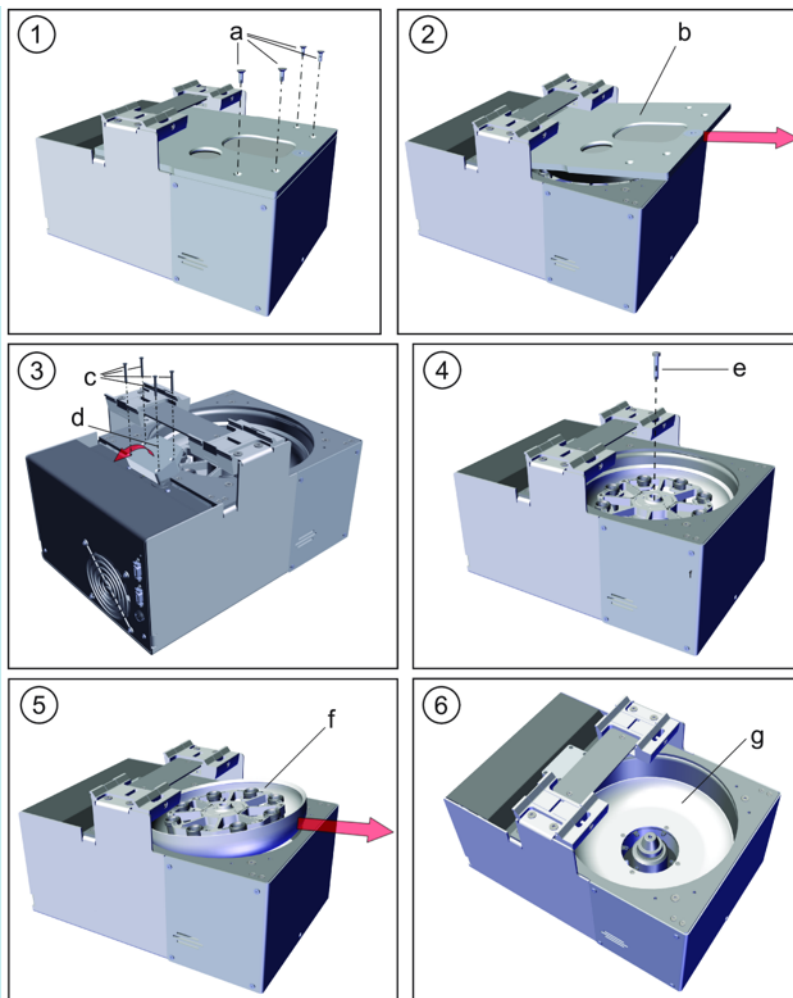
Removing the Rotor

There are different reasons for removal of the rotor from the Centrifuge Module housing:

- Checking the rotor and the rotor chamber for damages.
- Cleaning the rotor and the rotor chamber for regularly maintenance.
- Cleaning the rotor and the rotor chamber in case of a broken vial.

The procedure in all cases is the same. Complete the following instructions to remove the rotor from the Centrifuge Module housing.

Figure 49. Removing the Rotor from the Centrifuge Module



❖ **To remove the rotor from the module housing**

1. Turn off the Centrifuge Module and disconnect the Centrifuge Module power cord.
2. Turn off the TriPlus RSH SMART system.
3. Loosen and remove the four screws (Torx 20) (a).
4. To remove the lid (b), slightly raise it on the front side and slide it out (see (2)).
5. Loosen the 4 screws (c) and carefully swivel and lift the block (d) slightly - just so far that the rotor can be taken away without colliding.

The block can't be removed because it is connected to a cable.
6. The rotor is fixed in the rotor chamber with a centric screw (Torx 25) (e). Loosen and remove the screw (e).
7. To remove the rotor (f), slightly raise it on the front side and slide it out (see (5)).

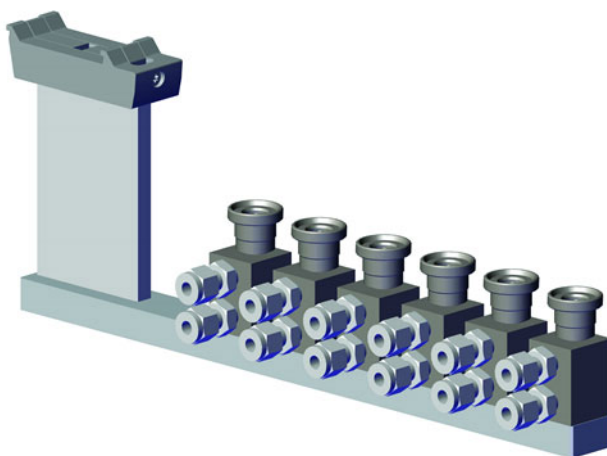
It might be necessary to turn the rotor slightly to remove it. Do not disassemble the rotor any further.

8. The rotor (f), as well as the rotor chamber (g), can be cleaned and/or checked for damage.
9. To reassemble the Centrifuge Module proceed in reverse order. All screws have to be tightened hand-tight.
10. Check the rotor for smooth and proper running.
11. Check all screws for tightness and proper seating.

Flow Cell Module

The Flow Cell Module is an optional device used for flow-through sampling applications.

Figure 50. Flow Cell Module



The concept is that the medium which has to be monitored (or analyzed) is pumped through the cell. The system can take a sample aliquot from the cell according to a given time interval, such as sampling every five minutes for analysis.

Some common applications are:

- Waste water analysis
- Surface water analysis
- Drinking water analysis
- Exhaust gas analysis
- Chemical Reaction, process analysis
- Fermenter online analysis

The media flowing through the cell can be in gaseous or liquid form. The Flow Cell Holder comes with one Flow Cell, but can be enhanced to carry up to six Flow Cells.

Specifications

The Flow Cell Module dimensions and mass are detailed in [Table 30](#).

Table 30. Flow Cell Module- Dimensions and Mass

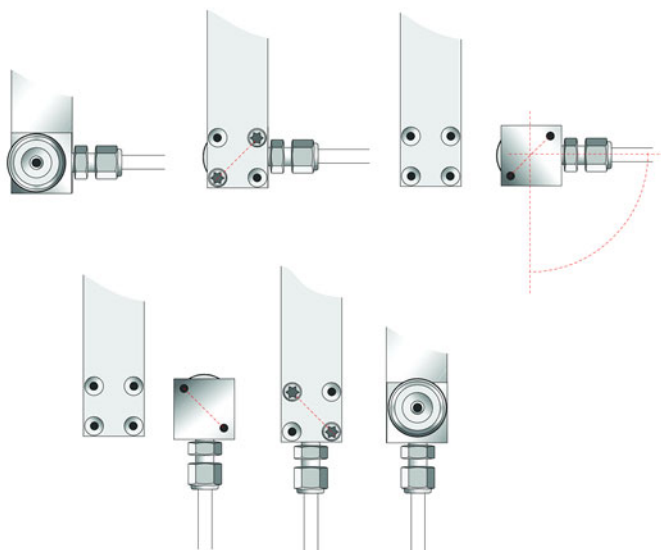
Length	Dimension in mm (in.)
Width	52 (2.05)
Height	327 (12.87)
Depth	112 (4.41)
Mass	Dimension in kg (lbs)
Weight	0.72 (1.59)

Single Flow Cell Installation

The Flow Cell can be installed with the connections pointing to the front or turned by 90° and pointing to the side. This flexibility allows you to adapt a set-up according to how the supply lines can be guided to the instrument without interference.

The Flow Cell is mounted to the holder with two screws. Open the screws from the bottom side and rotate the cell body in the desired position. Retighten the screws. For screw locations refer to the following figure.

Figure 51. Flow Cell Installation

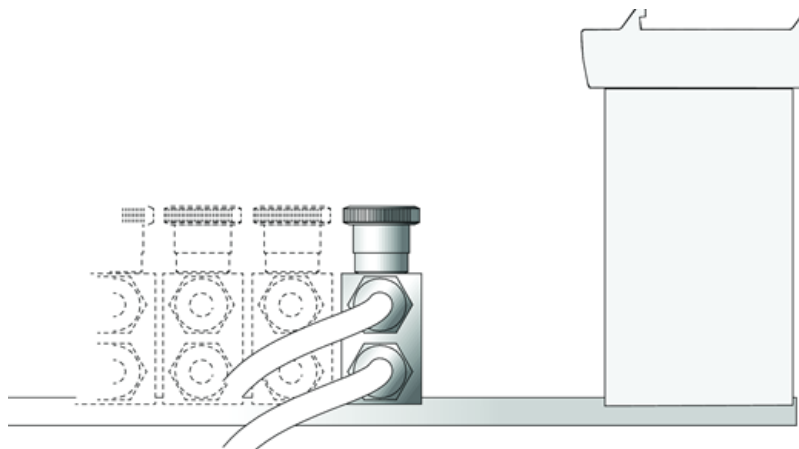


Multiple Flow Cell Installation

The standard Flow Cell Module is shipped with a single Flow Cell installed.

If more than one Flow Cell is required, it is possible to install them on a single module as shown in the following figure. In such a situation, the possibility of re-orienting the direction of the cell connections is important.

Figure 52. Multiple Flow Cell Installation



Supply Line Connections

Connect the supply lines to the Flow Cell using the provided 6 mm (0.236 in) Swagelok connections. The inlet line has to be attached to the lower connection port as shown in the following figure.

Temperature Control of Flow Cell

The Flow Cells do not contain a built-in heating feature. If an application requires a temperature higher than ambient temperature, the first step will be to heat the supply lines. The temperature of the heated line will be partially transferred to the cell body. If this is not sufficient, use additional insulating material to retain heat or an independent heating device with external temperature control.

Flow Control of Media

The flow of the media passing through the cell has to be controlled to avoid turbulence within the cell. Consider the internal volume of the cell (approx. 0.5 mL) alongside the expected flow-through time of the media within the cell. If a high sampling rate is expected, the media should be exchanged within a short time. The residence time in the cell should be a fraction of the sampling rate to ensure that the aliquot taken for the next analysis has been refreshed.

Note The higher the flow is set, the higher the risk of turbulence in the cell.

There are several ways to restrict flow. Examples for a liquid medium are:

- Bypass from the main pipe controlled by a needle valve
- Pump installed on the outlet line after the cell

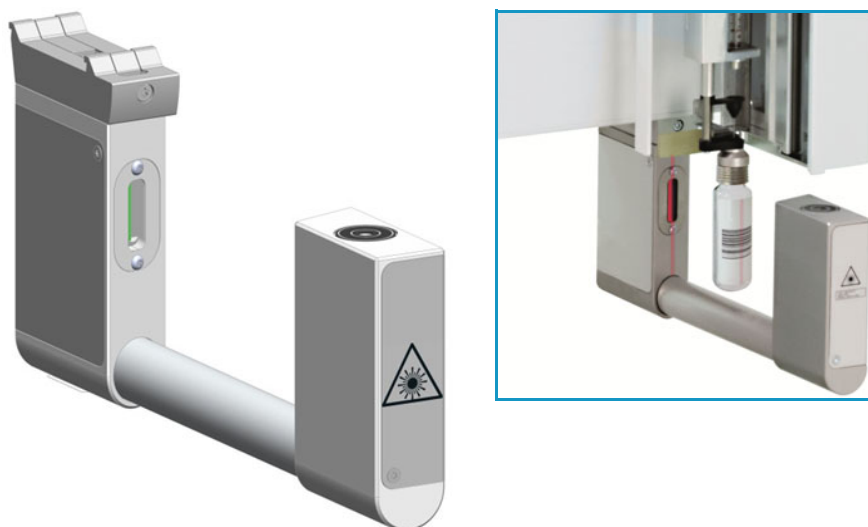
Also, consider filtering the liquid if applicable (to avoid blockages in the cell or at the point of restriction caused by particles).

For gas sample analysis, the most convenient way to adjust the flow is by using a flow controller or a pressure regulator.

Barcode Reader

The Barcode Reader is an active module used to decode and read codes applied in horizontal bars on vials of 1 to 20 mL volume. See [Figure 53](#).

Figure 53. Barcode Reader



The Barcode Reader specifications are:

- **Vial Sizes** — 2 mL, 10 mL, and 20 mL
- **Electrical Connectors** — Two BUS connectors for daisy chaining.

The Barcode Reader dimensions, mass, operating and environmental requirements are detailed in [Table 31](#) and [Table 32](#).

Table 31. Barcode Reader - Dimensions and Mass

Length	Dimension in mm (in.)
Width	30 (1.18)
Depth	273 (10.75)
Height	128 (5.04)
Mass	Dimension in kg (lbs)
Barcode Reader Module (with cable)	0.83 (1.83)

Table 32. Barcode Reader - Operating Environmental Requirements

Parameter	Requirements
Maximum relative humidity	80%, non-condensing
Vibration	Negligible
Static electricity	Negligible

The Barcode Reader consists of two scanners. The vial with the barcode label is positioned in the middle. The distance between the two scanners is optimized by the scan angle. The two scanners are activated one after another.

- If the first scanner can read and decode the barcode symbols, the second scanner is not activated.
- If the first one fails, the second scanner is activated, and if the barcode is positively interpreted the process is ended.

When both scanners cannot read the barcode, an error exception is run. The error handling itself is part of the CDS software and in most cases you can select one of the following options:

- Continue with sample handling but stamp the field **Sample ID** with an error comment **BC not readable**.
- Stop the process of data handling, stop the entire **Sample List**.

This approach of using two scanners confers the advantage that the vial with the barcode label does not require to be oriented directly towards the scanner. Respecting the minimum length of 18 mm for the barcode allows the vial be positioned randomly in the vial tray and the barcode label will be successfully interpreted.

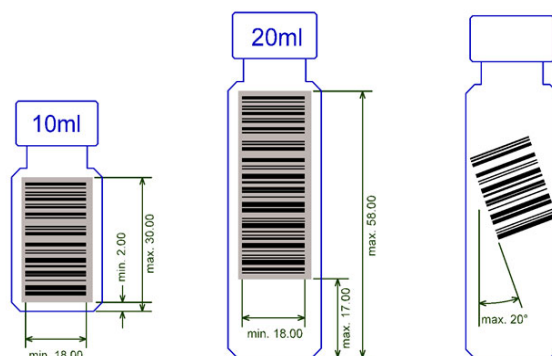
Barcode Labels

The Barcode labels should be made of polyester and not paper. Polyester can withstand high temperatures and the barcode lines will be printed clearly.

- **Label Width** — The minimum length of the barcode is 18 mm if used with a 20 mL vial. This dimension refers to the actual barcode length and not the label itself. Adapt the label accordingly. When possible use larger dimensions for reliable processing of the barcodes.
- **Maximum tilt of the barcode label:** $\pm 20^\circ$.
- **Minimal barcode density (minimal width of a bare or a space):** 5 mil (0.005") / 0.127 mm.

Place the barcode label on the vial such that the barcode bars are horizontally positioned. The allowed area for the placing of the label is given in [Figure 54](#).

Figure 54. Examples of Barcode Label Positioning and Label Size



The Barcode Reader reads a barcode label from an individual vial, but it is not able to scan and treat multiple units of information, as would typically be received from a Multiple Well Plate.

Supported Types of Barcode Symbols

The following barcode types can be decoded. See [Table 33](#).




Prerequisites are:

- Horizontal scan line
- 1D scanner

Table 33. Barcode Symbolologies (Sheet 1 of 2)

Barcode Type	Description	Min Length	Max Length	Barcode Symbology
Key for Barcode Symbolologies				 <p>Bar Code Data Start-/Stopcharacter Checkdigit</p>
UPC-A	Universal Product Code, 12 numerical digits. 11 usable digits +1 check digit.	12	12	<p>UPC Version A</p> 
UPC-E	Universal Product Code, Zero-compressed UPC code, 7 numerical digits. 6 usable digits + 1 check digit.	6	6	<p>UPC Version E</p> 
EAN-8	Derived from the longer European Article Number (EAN-13), 8 numerical digits. 7 usable digits + 1 check digit.	7	7	<p>EAN8</p> 
EAN-13	European (International) Article Number, 13 numerical digits. 12 usable digits + 1 check digit.	12	12	<p>EAN13</p> 
Code-128	High density barcode for alphanumerical codes, supporting all 128 ASCII characters.	1	Unlimited	<p>Code 128</p> 

Table 33. Barcode Symbolologies (Sheet 2 of 2)

Barcode Type	Description	Min Length	Max Length	Barcode Symbology
EAN-128/GS10128	Alpha-numerical codes, supporting all 128 ASCII characters.	1	48	 <p>EAN128 / GS1-128 EAN128</p>
Code 39 (3 of 9)	Alphanumeric code, consisting of uppercase letters (A-Z), numeric digits (0-9) and some special characters (-, ., \$, /, +, %, and space).	1	Unlimited	 <p>3 of 9 (Code 39) TEC-IT</p>
2 of 5 Interleaved	Numerical characters.	1	Unlimited	 <p>2 of 5 Interleaved 012345</p>
ISBT 128	Used for labeling of human blood.	1	Unlimited	Application specific barcodes

Safety Information

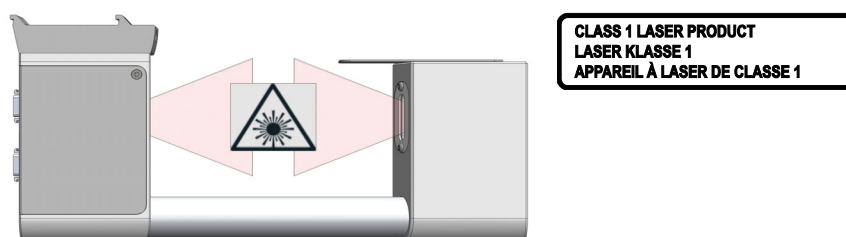
The installed laser device is a Class 1 Laser Product.



WARNING Class 1 laser devices are not considered to be hazardous when used for their intended purpose. The following statement is required to comply with international regulations: Use of controls, adjustments or performance of procedures other than those specified herein might result in hazardous laser light exposures.

Figure 55 shows the laser warning label and the location of the laser aperture.

Figure 55. Laser Warning Label and Laser Aperture



The selected Laser Class 1 for the module Barcode Reader complies with the following regulations:

- 21 CFR1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated July 26, 2001.
- EN60825-1:1994 + A1:2002 + A2:2001
- IEC60825-1:1993 + A1:1997 + A2:2001

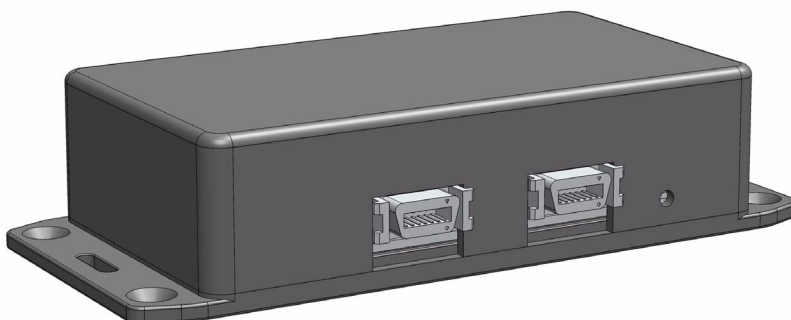
The software contains a built-in safety time limit such that the laser scanning mechanism cannot be operated in AIM mode for more than 5 continuous seconds.

Electronic Box for OC Injector Actuator

The OC Injector Actuator, not provided with the TriPlus RSH SMART, is a combination of the On-column Injector and the Actuator to open and close the rotary valve of the On-Column injector. The device consists of an electronic box and the BUS daisy chain cable. See [Figure 56](#).

The OC Injector is an active module where the OC Electronic Box is connected to the BUS connector while the cable from the GC Injector is connected to the Box.

Figure 56. OC Electronic Box



The electronic module is laid out to activate the OC Actuator. A specification is not applicable. The Electronic Box for OC Injector Actuator - dimensions, mass, operating and environmental requirements are detailed in [Table 34](#) and [Table 35](#).

Table 34. Electronic Box for OC Injector Actuator - Dimensions and Mass

Length	Dimension in mm (in.)
Width	44 (1.73)
Depth	190 (7.48)
Height	160 (6.30)
Mass	Dimension in kg (lbs)
OC Electronic Box (with cable)	1.08 (2.38)

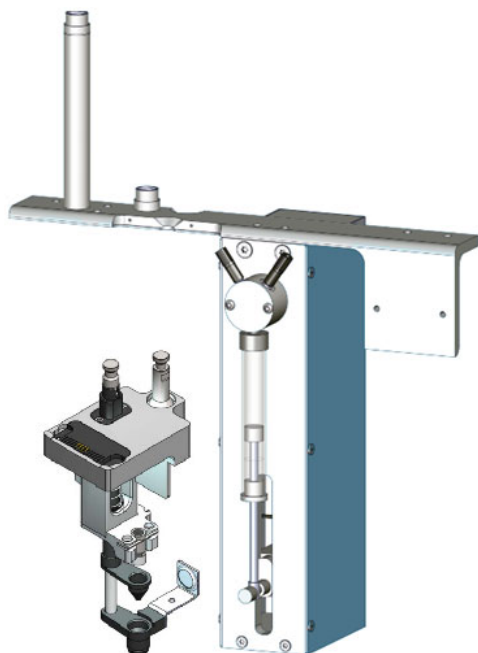
Table 35. Electronic Box for OC Injector Actuator - Operating Environmental Requirements

Parameter	Requirements
Maximum relative humidity	80%, non-condensing
Vibration	Negligible
Static electricity	Negligible

Dilutor Module

The Dilutor Module is an optional device for the TriPlus RSH SMART System. Its main purpose is typically solvent handling, such as adding a solvent for dilution, a reagent for derivatization, spiking with an internal standard, and so on. Another widely used application is sampling an exact volume of an aliquot and pipetting it into another vessel for further processing. See [Figure 57](#).

Figure 57. Dilutor Module



Two versions are available:

Single Dilutor
With a Single Solvent valve for 1/4-in.-28 fittings

Multi Dilutor
With a Multi Solvent ceramic valve for 1/4-in.-28 fittings

Naming Conventions

Naming conventions for the Dilutor Module and its parts are listed below:

- **Dilutor Module** — Describes the entire assembly of the Module.
- **Dilutor Syringe Module** — Active module carrying the Dilutor Syringe and the Dilutor Valve.
- **Dilutor Tool** — Describes the Tool itself as part of the Dilutor Module.
- **Dilutor Valve** — It is placed on the Dilutor Syringe Module and one of its ports is connected to the Dilutor Syringe. Two types are available:
 - Single Solvent PTFE Valve
 - Multi Solvent Ceramic Valve
- **Mounting Bracket** — Fixes the Dilutor Module to the X-Axis of the TriPlus RSH SMART. Contains two holders for the Guiding Wire.
- **Solvent Reservoir Kit** — Consists of one reservoir bottle (1 L) with tubing (PFA) and one glass frit with a pore size of 40 μm .

- **Transfer Tubing Kit** — Connects the Dilutor Module and Dilutor Tool. Consists of the PFA Tubing, the Guiding Wire and connection fittings.
- **Guiding Wire** — The Wire integrated into the Transfer Tubing.

Specifications

The specifications of the Dilutor Module are:

- **Dilutor Module** — Single Dilutor or Multi Dilutor
- **Dilutor Valve** — Single Solvent valve for ¼-in.-28 fittings for Single Dilutor; 7-port (6+) Ceramic (Alumina) valve for ¼-in.-28 fittings for Multi Dilutor
- **Maximum Permissible Pressure** — 3 bar (300 kPa; 43.5 psig)
- **Dilutor Syringe** — 1 mL, Scale 60 mm; Optional 0.1 mL, 5 mL, 10 mL
- **Transfer Tubing** — PFA tubing ID 0.787 mm (1/32”) / OD 1.58 mm (1/16”) Including Connection Fittings and Guiding Wire Length of transfer tubing: 1530 mm
- **Needle** — Gauge 22, Pst 3, Length 51 mm; Optional Gauge 23, Pst AS, Length 51 mm
- **Solvent Reservoir Kit** (1 piece for Single Dilutor; 5 pieces for Multi Dilutor) — 1000 mL borosilicate glass including:
 - Glass Filter, 40 µm pore size (1000-SV)
 - Aspiration Tubing (PFA)
- **Wetted Parts** — Tubing from Reservoir Bottle to Dilutor Syringe Module.

Tubing: PFA

Frit: Glass Filter

Dilutor Syringe Module: Syringe: Borosilicate Glass

Valve 3-port: PTFE / Kel-F

Valve 7-port: Ceramic (Alumina)

Transfer tubing from Pump to LCP Tool: Tubing: PFA

- **Electrical Connectors** — Two BUS connectors for daisy chaining; M12, 4 position, male, reserved for future use.
- **Firmware** — Version 2.1.0 or higher

The Dilutor Module dimensions, weights, operating and environmental requirements are detailed in [Table 36](#) and [Table 37](#).

Table 36. Dilutor - Dimensions and Mass

Length	Dimension in mm (inches)
Width	115 (4.52); 175 (6.89) including cable connectors
Depth	260 (10.24)
Height	430 (16.93) 550 (21.65) including transfer tubing
Mass	Dimension in kg (lbs)
Dilutor Syringe Module	1.31 (2.89)
Mounting Bracket	0.220 (0.49)
Associated Cable	0.15 (0.33)
Solvent Reservoir Kit	Aspiration Kit: 0.06 (0.13) Reservoir Bottle 1000 mL: 0.58 (1.28)
Total Weight of Single Dilutor	2.32 (5.11)
Total Weight of Multi Dilutor	4.88 (10.76)

Table 37. Dilutor - Operating Environmental Requirements

Length	Dimension in mm (inches)
Operating Temperature Range	4 to 40 °C
Maximum Relative Humidity	80%, non-condensing
Bench Space	Consider bench space for the Wash Solvent reservoir bottles, size 1000 mL (or as required by customer)
Altitude Limitations	3000 meters above sea level

Handheld Controller

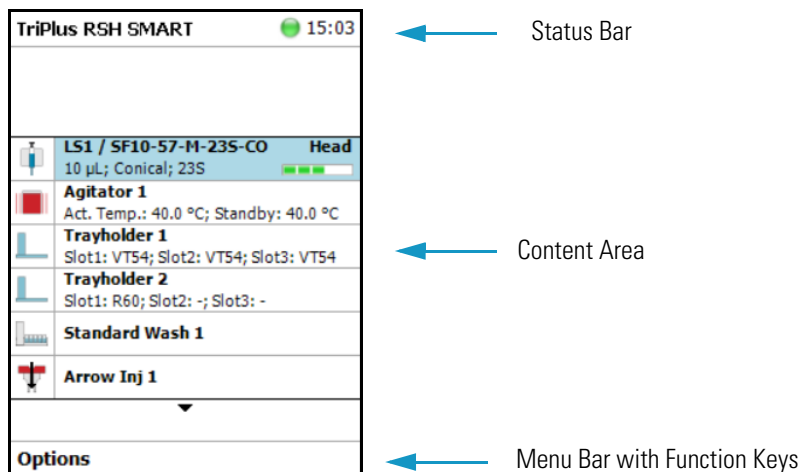
This section provides a description of the Handheld Controller.

Menu Screen

Different menu screens are displayed, depending on the TriPlus RSH SMART operating state and the particular function being accessed by the operator. All menu screens have the same basic format. The uppermost line is the **Status bar** where the selected section, the status and time are displayed.

The **Content Area** shows the list of selected items. The **Function Keys** are located in the **Menu Bar**. See [Figure 58](#).

Figure 58. Main Screen



Note The Start Screen displays the installed Tools, the Active Modules and the Passive Modules.

Menu Screen Status Bar Symbols

The following symbols can be displayed in the Menu Screen Status Bar. See [Table 38](#).

Table 38. Menu Screen Status Bar Symbols (Sheet 1 of 2)








Symbols	Description
	Green status light, blinking: TriPlus RSH SMART is working (moving). Execution mode. The Terminal is partially blocked to specific actions.
	Green status light, steady on: TriPlus RSH SMART is ready in Standby. Idle Mode.
	Yellow status light, blinking: Firmware is booting.
	Yellow status light, steady on: A problem has been detected which cannot be resolved by the robotic system. <i>Examples:</i> Bent needle (mechanical problem), missing Tool, and so on. detected at the moment of sample execution. A software run-time error can also cause a status light change to steady-on yellow .

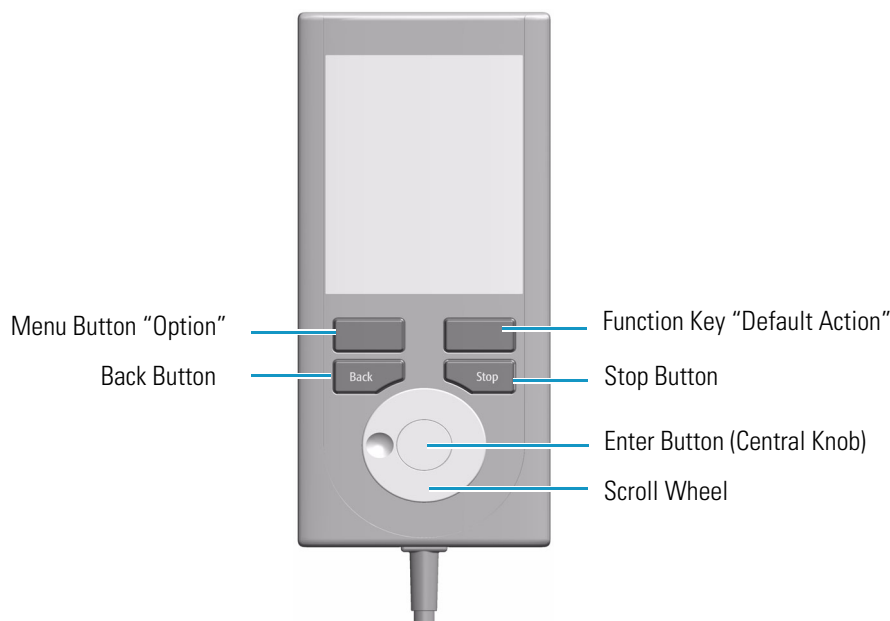
Table 38. Menu Screen Status Bar Symbols (Sheet 2 of 2)

Symbols	Description
	<p>Blue status light, blinking: The TriPlus RSH SMART is in the process of software Update or Backup. (For the processes Copy Backup and Restore the Status light remains green.)</p> <p>Blue status light, permanent: TriPlus RSH SMART is in a safe state (power reduced to a minimum) and requires manually moving the Head to the Teach Point.</p> <p>Note: If an error is detected at the same time that an action is required according to the Blue Status Light, then by default the yellow status light will dominate.</p>
	<p>USB Symbol: A USB device is connected to control.</p>
	<p>Message (Envelope): A system message is pending.</p> <p><i>Example:</i> Error message after software upgrade or after a device has been disconnected. In User Access Level the message symbol is displayed only. To view and process the system message(-s) the operator has to change the access level to Extended User.</p>
	<p>Key is the indicator for the access level Extended User.</p>
	<p>Flat Wrench is the indicator for the access level Service User.</p>

Function Keys and Buttons

Options for a particular menu are assigned to the corresponding function key on the left side. See [Figure 59](#).

Figure 59. Handheld Controller Buttons



- The Menu Button **Option** on the left side opens a pull-up menu, and is a dynamic allocatable key.
- The Function Key on the right side is reserved for **Default Actions**, such as **Ok**, **Next**, and so on.
- Pressing the **Back** button returns to the previous menu. If the Back button is pressed continuously, the cursor will jump back to the home screen (Start Page).
- Pressing the **Stop** button stops the ongoing activity at the first possibility. The behavior is closer to stop the run, but the stop itself occurs after an activity has completed its tasks, for example the filling of a syringe.

Note The term **Stop** usually relates to the controlled end of a process, for example finishing a sample from the sample list. The automated run is paused and the user has the possibility to interfere with, make corrections to, continue with or stop the run completely. The **Stop** button used with the TriPlus RSH SMART can terminate the process during the run.

Scroll Wheel and Enter Button

Rotate the outer knob to scroll through items in a menu. To select a highlighted item, press the **Enter** button (central knob). Use the outer knob to scroll through the available options for that item or to change a numeric value. Press the inner knob again to enter the displayed option.

The inner knob is also used for other operations that require an Enter function to continue or complete an operation.

Handheld Controller Versus the Virtual Handheld Controller

With every TriPlus RSH SMART, a Virtual Handheld Controller Software is provided. This software replaces the actual hardware, the Handheld Controller. However, the Handheld Controller is still available as an option. See [Figure 60](#).

Figure 60. Handheld Controller and Virtual Handheld Controller



The functionality of both the hardware **Handheld Controller** and the **Virtual Handheld Controller** software are basically the same. Menus, selection of modules, definition of attributes, or feeding parameter values are identical. The only difference is the handling.

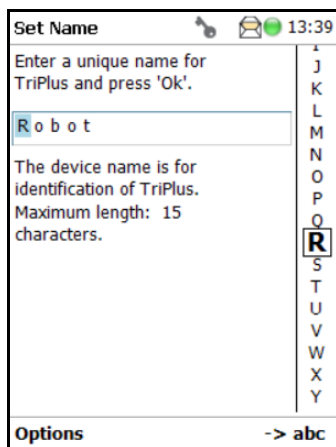
When using the Handheld Controller, use the Scroll Wheel, Enter button, Menu Buttons, and so on. If the software Virtual Handheld Controller is running, the keyboard functions are used.

For example: when the position of a module is defined as the X-, Y-, Z-, the values are changed by moving the arrow key up and down.

To open a pull-up menu, use the **Enter** key and the menu items, where for example a name has to be given. You receive the same context menu to enter a number or character.

Use the mouse cursor to select the name. Do not use the standard keyboard keys to select the name. See [Figure 61](#).

Figure 61. Example Context Menu to Enter a Password



SMART Consumables

Beginning with Firmware 3.1 and the TriPlus RSH SMART, Smart Consumables have been introduced and are mandatory for using the TriPlus RSH SMART. The Smart Consumables (syringes, SPME Fibers, and SPME Arrows) are high-performance consumables whose functionality and properties are precisely tailored to successful use in the system. This results in the best measuring results with maximum compatibility and the longest lifetime of the consumables.

The SMART name indicates intelligent data management of extensive data that is generated in connection with the use of the consumables within the TriPlus RSH SMART system. This data can be read and written via a special interface in the head of the TriPlus RSH SMART system.

A chip is integrated in the coupling head of each smart consumable, and stores data in the form of various parameters. With the help of the stored data, it is now possible to uniquely identify each smart consumable and assign it to its usage history. It is possible to know the condition of the consumables at any time and estimate their expected remaining service life.

Most parameters are read-only (for the user). In addition to usage data, all specifications of the consumables are also stored on the chip. The unique ID enables the recognition of a consumable as soon as it is coupled in the head of the TriPlus RSH SMART system.

There are two parameters that determine when a smart consumable should be replaced:

- **Expiry Duration** – In days, which can be set by the user. This makes it possible to define a **Maximum Expiry Duration** (in days) for each consumable.

The **Expiry Duration** is added to the date of the first use, resulting in an end date for the consumable, when it should be replaced at the latest. A bar on the home screen, displays a green, yellow, or orange status. If the end of the lifetime is near, the color of the bar changes to yellow, after the end of the lifetime is reached it changes to orange.

- **Max. Strokes Count.** – This parameter specifies the maximum number of strokes that can be used to estimate the lifetime of a Smart Consumable. You can set the value based on experience for the previous **Strokes/Sample** values.

Basically, all strokes are counted. For the conversion into samples, the following applies: For each sample batch coming from the CDS, the value **Strokes/Sample** is calculated. (Total number of strokes over the whole batch divided by the number of samples in the batch). Only values greater than or equal to 5 are considered - all batches with values below 5 are ignored for the sample-count (but the strokes are nevertheless counted). The last 3 **Strokes/Sample** values (which were greater than or equal to 5) are averaged and the average value obtained is used for the dynamic calculation of the remaining samples.

This value is stored in the parameter **Avg. Strokes/Sample**. The strokes are converted into samples and - just as with the remaining life in days - the number of remaining samples is displayed as a status bar on the home screen. It is the user's responsibility to pay attention to the display of the bars for **Remaining Days** and **Remaining Samples** and to exchange the consumable for a new one shortly before or at their expiration.

Note The service life of consumables also depends on regular maintenance and care. The consumables should only be used and handled as described in their user documentation.

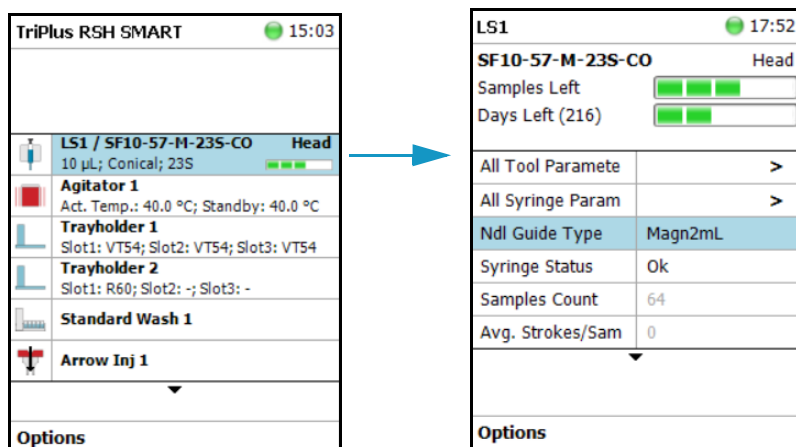
The Smart Consumables are backward compatible and can be used with older firmware. The smart-functionality is not available when used with older firmware. Smart Consumables can be used the same as their previous non-smart predecessors.

The parameters of the Smart Syringes and of the Smart Fibers and Smart Arrows are shown in the following tables. Most parameters are read only.

Status Display

When you set the **Expiry Duration** and **Max Stroke Count** parameters, the status is shown in the form of colored bars on the Home screen together with the tool (1 bar) or on the Tool screen (2 bars).

Figure 62. SMART Consumable Status Display

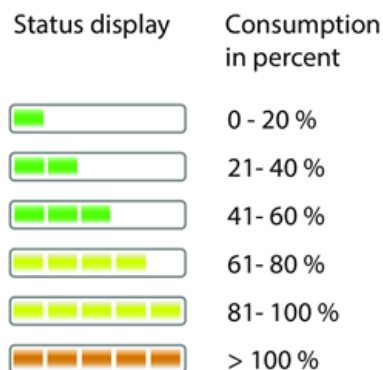


The two status bars each represent a parameter that determines the remaining lifetime of the consumable:

- **Samples Left** – Calculated based on the **Strokes Count** parameter.
- **Days Left** – Calculated based on the **Expiry Duration** parameter.

The progress indicator of the bar represents the percentage of use in each case, which is shown in the following graphic. See [Figure 63](#)

Figure 63. SMART Consumable Usage Indicator



If **Expiry Duration** and **Max. Strokes Count** parameters are not set, the home screen displays one green square (0-20% consumption) and will not change during life of the consumable. If one of the parameters is set and the other not, only the corresponding status display for the set parameter will be shown on the home screen and on the tool screen.

Setting Up the Status Display

To activate the status display, it is necessary to specify values for the **Expiry Duration** and **Max. Strokes Count** parameters.

The values depend on how often and under which conditions (chemistry, temperature, etc.) the consumables are used, it is recommended to initially enter conservative values and then gradually approach more realistic values via gained experience.

SMART Syringe Parameters

The following table lists the SMART Syringe parameters.

Table 39. SMART Syringes Parameters (Sheet 1 of 5)

Parameter	Description
Syringe Type	The type of the syringe e.g. SF-10000-57-T-19-CO.
Data Revision	Revision of the actual stored data set.
Lot	Number of the manufacturing lot.
Replacement Plunger	Number 0 indicates original plunger, number 1 indicates first replacement plunger, number n indicates the nth replacement plunger.
User Description 1	Free editable.
User Description 2	Free editable.
Syringe Volume	The volume of the syringe in [µL].
Plunger Type	The material of the plunger tip. Possible values are: NotSpecified PTFE (T) Metal (M) PlgInNeedle (B) Polyethylene (PE)

Table 39. SMART Syringes Parameters (Sheet 2 of 5)

Parameter	Description
Body Type	<p>The body type of the installed syringe. Possible values are:</p> <p>NotSpecified = Body type of the syringe is not provided</p> <p>LiqFixNdl = Liquid syringe with fixed needle</p> <p>LiqXchnaNdl = Liquid syringe with exchangeable needle</p> <p>HsFixNdl = Headspace syringe with fixed needle</p> <p>XchnAHsNdl = Headspace syringe with exchangeable needle</p> <p>XchnAItnNdl = ITEX syringe with exchangeable needle</p> <p>XchnLCMSNdl = LCMS syringe with exchangeable needle</p> <p>FixSidePortInGlas = Glass syringe with side-port and fixed needle</p> <p>XchnSidePortInGlas = Glas syringe with side-port and exchangeable needle</p> <p>GstLiqFixNdl = Gastight Liquid syringe with fixed needle</p> <p>GstLiqXchnaNdl = Gastight Liquid syringe with exchangeable needle</p> <p>(The list of types will be continuously enhanced with upcoming types.)</p>
Needle Gauge	The needle gauge.
Needle Length	See Firmware
Point Style	<p>The point style of the needle. Possible values are:</p> <p>NotSpecified</p> <p>Conical (CO)</p> <p>Flat (FL)</p> <p>SidePort (SP)</p> <p>StepNeedle (ST)</p>
Scale Length	The scale length. [mm]

Table 39. SMART Syringes Parameters (Sheet 3 of 5)

Parameter	Description
Needle Fixation	<p>The type of the needle fixation. Possible values are:</p> <p>NotSpecified NIP_0 NIP_1 F_5 F_10 F_25 F_1000 HS_1000 F_10000 Glue XTypeGlue CrimpGlue GlueFree ToolFlange</p> <p>(The list of types will be continuously enhanced with upcoming types.)</p>
Needle Coating	<p>The type of the needle-coating. Possible values are:</p> <p>NotSpecified NoCoating Hydrophilic Hydrophobic</p> <p>(The list of types will be continuously enhanced with upcoming types.)</p>
Needle Out Dia	The outer diameter of the needle. [μm]
Needle Inner Dia	The inner diameter of the needle. [μm]
Max Pen Depth	The maximum penetration depth. [mm]
Max Pen Velocity	The maximum velocity for penetration. [mm/s]
Def Pen Velocity	The default penetration velocity. If no velocity is specified for penetration, this value will be used. [mm/s]
Bottom Sense	Check Box, showing if Bottom Sensing is used.
Max Aspirate Flow	The maximum aspirate flow rate. [μL/s]
Def Aspirate Flow	The default aspirate flow rate. [μL/s] (Fill Speed)
Def Aspirate Delay	The default aspirate delay. [s] (activated at end of aspiration; Pullup Delay)
Max Dispense Flow	The maximum dispense flow rate. [μL/s]

Table 39. SMART Syringes Parameters (Sheet 4 of 5)

Parameter	Description
Def Dispense Flow	The default dispense flow rate. [μL/s] (Inject Speed)
Def Dispense Delay	The default dispense delay time. [s] (after the end of dispense, Pst Inj Del)
Def Fill Strokes Count	The default fill strokes count. (Fill Strokes)
Def Fill Strokes Volume	The default fill strokes volume. [μL]
Gas Inlet Pos	The gas inlet position. [mm]
Bottom Sense Count	Total number of performed bottom senses.
Syringe Status	Status for the syringe. Possible values are Ok , SuspectOrExpired , or Defective . User Lever Access are only allowed to change the parameter from OK to SuspectOrExpired or from SuspectOrExpired to Defective . Extended User Access can change the value arbitrary. Will be set to SuspectOrExpired if Expiry Duration (Days) or Max. Strokes Count is reached.
Strokes Count	Counted total number of plunger-strokes.
Max. Strokes Count	The number of strokes, after which the syringe shall be replaced. 0 means unlimited strokes. A warning will be displayed on the virtual terminal once the number of strokes is reached and Syringe Status will be set to SuspectOrExpired .
Remaining Strokes	This parameter is only visible, if the parameter Max. Strokes Count has been set to a value different from 0 . It displays the number of remaining strokes till the syringe shall be replaced.
Strokes above Max.	This parameter is only visible, if the parameter Max. Strokes Count has been set to a value different from 0 . It displays the number of strokes above the specified limit.
First Usage	Date of first usage.
Expiry Duration (Days)	Number of days after which the syringe shall be replaced. 0 means unlimited days. A warning will be displayed on the virtual terminal once the number of days is reached.
Days Left	This parameter is only visible, if the parameter Expiry Duration (Days) has been set to a value different from 0 . It displays the number of remaining days till the syringe shall be replaced.

Table 39. SMART Syringes Parameters (Sheet 5 of 5)

Parameter	Description
Days Expired	This parameter is only visible, if the parameter Expiry Duration (Days) has been set to a value different from 0 . It displays the number of usage days above the specified limit.
Last Usage	Date of last usage.
Dur. < 50°C	Total number of seconds, the syringe was exposed to temperatures below 50 °C. [s].
Dur. ≥ 50°C < 100°C	Total number of seconds, the syringe was exposed to temperatures between 50 °C and 99.9 °C. [s].
Dur. ≥ 100°C < 150°C	Total number of seconds, the syringe was exposed to temperatures between 100 °C and 149.9 °C. [s].
Dur. ≥ 150°C	Total number of seconds, the syringe was exposed to temperatures equal and above of 150 °C. [s].
Branding Ident.	Number of the Branding/Data-set.
Syringe Serial No.	Unique identifier of the Smart Syringe.
Samples Count	The total number of Samples - calculated as StrokesCount / Avg. Strokes/Sample .
Avg. Strokes/Sample	The average value (strokes/sample) over the last three sample batches.
% Remaining Days	Remaining Days divided by Expiry Duration, displayed in 5% steps. If the Expiry Duration parameter has not been set, 100% will be displayed and 0%, if it is already expired.
% Remaining Samples	Calculated in 5% steps as $1 - (\text{StrokesCount} / \text{Max. Strokes Count})$. Numbers outside [0, 100] are displayed as 0% and 100% respectively. If Maximum Strokes is 0 , --- is displayed.
Samples Left	Calculated as $(\text{Max. Strokes Count} - \text{StrokesCount}) / \text{Avg. Strokes/Sample}$. Negative numbers are displayed as 0. If Avg. Strokes/Samples is not present or Maximum Strokes is 0 , --- is displayed.

SMART SPME Arrow and SMART SPME Fiber Parameters

The following table lists the SMART SPME Arrow and SMART SPME Fiber parameters.

Table 40. SMART SPME Arrow and SMART SPME Fiber Parameters (Sheet 1 of 4)

Parameter	Description
SPME Status	Status for SPME fibers or SPME Arrows. Possible values are Ok , SuspectOrExpired , or Defective . User Lever Access are only allowed to change the parameter from OK to SuspectOrExpired or from SuspectOrExpired to Defective . Extended User Access can change the value arbitrary. Will be set to SuspectOrExpired if Expiry Duration (Days) or Max. Strokes Count is reached.
Lot	Number of the lot.
Data Revision	Revision of the actual stored data set.
Outer Phase	The material of the outer phase.
Thickness Outer Phase	The thickness of the outer phase.
Surface Outer Phase	The surface of the outer phase.
Volume Outer Phase	The volume of the outer phase.
Fiber Core Type	The type of the fiber core.
Phase length	Length of the SPME fiber/arrow phase.
Needle Gauge	Gauge of the mantle.
Needle Out Dia.	Outer diameter of the mantle.
Needle Length	See Firmware
Max Pen Depth	See Firmware
Def Pen Velocity	See Firmware
Max Pen Velocity	See Firmware
Minimum Cond. Temp.	The minimum conditioning temperature.
Maximum Cond. Temp.	The maximum conditioning temperature.
Recom. Cond. Temp	The recommended conditioning temperature [°C].
Above Max Temp	If the Fiber/Arrow was exposed to temperatures above the specified maximum temperature the check box is checked.

Table 40. SMART SPME Arrow and SMART SPME Fiber Parameters (Sheet 2 of 4)

Parameter	Description
Temp above Max.	If the SPME fiber/arrow has been exposed to temperatures above the specified maximum temperature, the delta between the highest temperature the fiber/arrow has been exposed to and the maximum temperature will be displayed.
Duration above Max.	The cumulated total time, the fiber/arrow has been exposed to temperatures above the specified maximum temperature.
Injection Duration	The cumulated total time, the fiber/arrow has been exposed in the injector.
Inj. Cond. Duration	The cumulated total time, the fiber/arrow has been conditioned in the injector.
Dur. < 250°C	Total number of seconds, the fiber/arrow was exposed to temperatures below 250 °C. [s]
Dur. ≥ 250°C < 265°C	Total number of seconds, the fiber/arrow was exposed to temperatures between 250 °C and 264.9 °C. [s]
Dur. ≥ 265°C < 280°C	Total number of seconds, the fiber/arrow was exposed to temperatures between 265 °C and 279.9 °C. [s]
Dur. ≥ 280°C < 295°C	Total number of seconds, the fiber/arrow was exposed to temperatures between 280 °C and 294.9 °C. [s]
Dur. ≥ 295°C < 310°C	Total number of seconds, the fiber/arrow was exposed to temperatures between 295 °C and 309.9 °C. [s]
Dur. ≥ 310°C < 325°C	Total number of seconds, the fiber/arrow was exposed to temperatures between 310 °C and 324.9 °C. [s]
Dur. ≥ 325°C	Total number of seconds, the fiber/arrow was exposed to temperatures above of or equal to 325 °C. [s]
Total Cond. Duration	The cumulated total time, the fiber/arrow has been conditioned in the conditioning module.
Strokes Count	Number of times, the fiber or arrow has been exposed.
Max. Strokes Count	The number of strokes, after which the fiber or arrow shall be replaced. 0 means unlimited strokes. A warning will be displayed on the virtual terminal once the number of strokes is reached and SPME Status will be set to SuspectOrExpired .
First Usage	Date of first usage.
Last Usage	Date of last usage.

Table 40. SMART SPME Arrow and SMART SPME Fiber Parameters (Sheet 3 of 4)

Parameter	Description
Expiry Duration (Days)	Number of days after which the SPME Fiber/Arrow shall be replaced. 0 means unlimited days. A warning will be displayed on the virtual terminal once the number of days is reached.
Imm. Extraction Count	The cumulated total time, the fiber/arrow has been used for immersion extraction.
User Description 1	Free editable.
User Description 2	Free editable.
Branding Ident	Number of the Branding/Data-set.
SPME Fiber Serial No.	Unique identifier of the Smart SPME Arrow or Fiber
Samples Count	The total number of Samples - calculated as StrokesCount/Avg. Strokes/Sample .
Avg. Strokes/Sample	The average value (strokes/sample) over the last three sample batches.
% Remaining Days	Remaining Days divided by Expiry Duration , displayed in 5% steps. If the Expiry Duration parameter has not been set, 100% will be displayed and 0%, if it is already expired.
% Remaining Samples	Calculated in 5% steps as $1 - (\text{StrokesCount} / \text{Max. Strokes Count})$. Numbers outside [0, 100] are displayed as 0% and 100% respectively. If Maximum Strokes is 0 , --- is displayed.
Samples Left	Calculated as $(\text{Max. Strokes Count} - \text{StrokesCount}) / \text{Avg. Strokes/Sample}$. Negative numbers are displayed as 0 . If Avg. Strokes/Samples is not present or Maximum Strokes is 0 , --- is displayed.
Inner Phase	Type of the inner phase. Only visible for two phase fibers or arrows.
Thickness Inner Phase	Thickness of the inner phase. [m] Only visible for two phase fibers or arrows.
Volume Inner Phase	Volume of the inner phase. [mL] Only visible for two phase fibers or arrows.
Surface Inner Phase	Surface of the inner phase. [mm ²] Only visible for two phase fibers or arrows.

Table 40. SMART SPME Arrow and SMART SPME Fiber Parameters (Sheet 4 of 4)

Parameter	Description
Middle Phase	Type of the middle phase. Only visible for three phase fibers or arrows.
Thickness Middle Phase	Thickness of the middle phase. [m] Only visible for three phase fibers or arrows.
Volume Middle Phase	Volume of the middle phase. [mL] Only visible for three phase fibers or arrows.
Surface Middle Phase	Surface of the middle phase. [mm ²] Only visible for three phase fibers or arrows.
Total Phases Volume	The total volume of all phases. Only visible for three phase fibers or arrows.
Remaining Strokes	This parameter is only visible, if the parameter Max. Strokes Count has been set to a value different from 0 . It displays the number of remaining strokes till the SPME fiber/arrow shall be replaced.
Strokes above Max.	This parameter is only visible, if the parameter Max. Strokes Count has been set to a value different from 0 . It displays the number of strokes above the specified limit.
Days Left	This parameter is only visible, if the parameter Expiry Duration (Days) has been set to a value different from 0 . It displays the number of remaining days till the SPME fiber/arrow shall be replaced.
Days Expired	This parameter is only visible, if the parameter Expiry Duration (Days) has been set to a value different from 0 . It displays the number of usage days above the specified limit.

TriPlus RSH SMART Overview

This chapter contains information about the different **Access Levels** on the TriPlus RSH SMART, using the Handheld Controller, and an overview of menu times.

Using the Handheld Controller is similar to using Virtual Handheld Controller, and the PC software-based Handheld Controller.

Contents

- Starting the TriPlus RSH SMART
- User, Extended, and Service Access Levels
- Local Scripts
- Setup, Installation, and Maintenance Menu Items
- Help Menu Item
- About Menu Item
- Shutdown Menu Item
- Operation of the TriPlus System in Combination with Other Chromatography Data Systems

Starting the TriPlus RSH SMART

This section describes how to start the TriPlus RSH SMART.



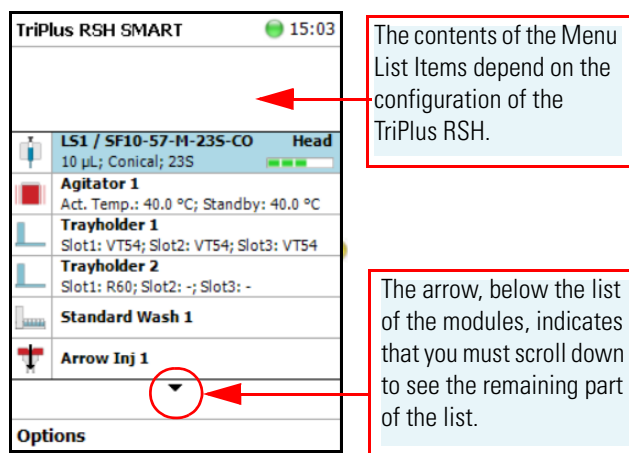
IMPORTANT Before starting the TriPlus RSH SMART, make sure that the sampler and all the modules are properly already installed.

A syringe of the appropriate type, or several syringes (Tools), named using the appropriate Method, must be installed in the TR Station or ATC Station, and positioned in the slot.

How to Start the TriPlus RSH SMART

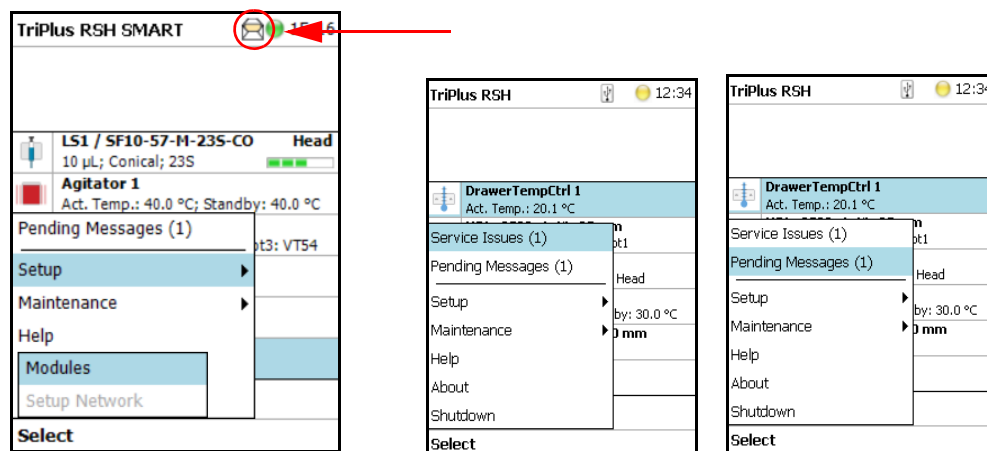
1. Turn on the power and observe the software loading process. The following Start Screen appears. See the example of [Figure 64](#).

Figure 64. Example of Start Screen



If any error occurs during the start-up process, the Start Screen shows a blinking **Envelope** in the **Status Line** as an indicator of a Pending Message, a Service Issue, or both. See [Figure 65](#).

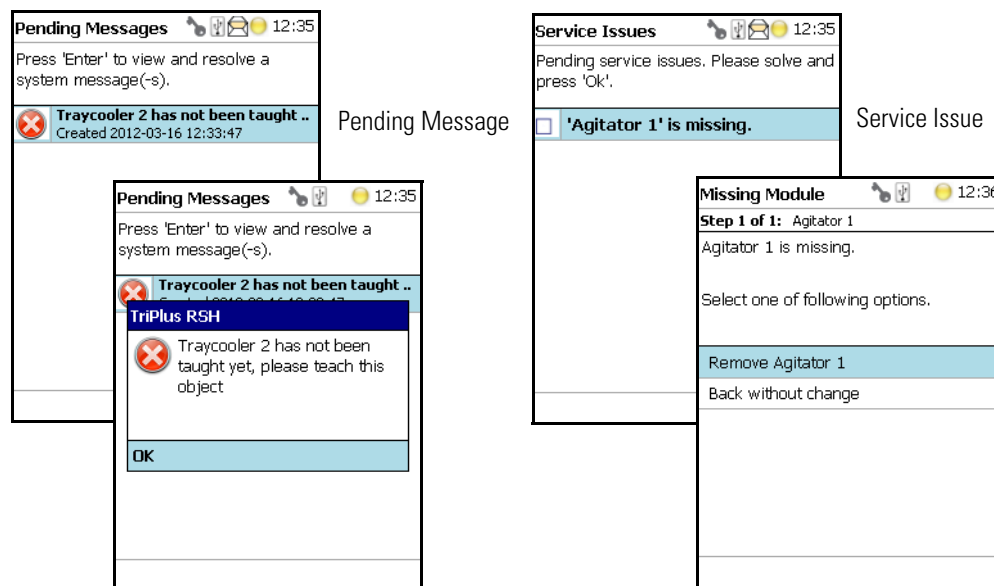
Figure 65. Indicating Messages



The envelope symbol indicates that a message pending or a **Service Issue** is found. When powered up, the TriPlus RSH SMART is always in the **User access level**. In this level, the message symbol is visible in the status line, but you have no access to verify or acknowledge the error. Changing the Access Level to **Extended User**, you can see details of the messages by selecting each message line and pressing **Enter**.

See the example of [Figure 66](#):

Figure 66. Example of Agitator Missing in Extended User Level



- The **Pending Message** in the example of shows that the reconnected **Traycooler 2** has not been taught yet.
- The message retrieved from the **Service Issue** provides self-explanatory options for resolving the problem. The Service Issue in the example shows that the **Agitator** is missing.

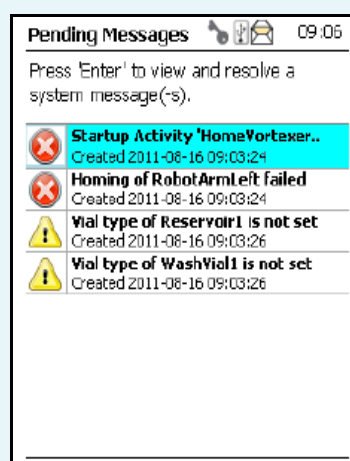
2. To retrieve the message proceed as follows:
 - a. Change the Access Level to **Extended User**.
 - b. Select **Options** to access the pull-up menu for further information.
 - c. Select the menu item **Pending Message** to receive detailed information on the error message.

A common reason for an error is typically when a **BUS cable** is not connected from one to another active module. During the boot-up procedure, the presence of all active modules is verified. If one or more modules are not found, (or it is not possible to check functions such as **Homing**), an error is recorded. See the example in [Figure 67](#).

When an error is observed, check all connections, try to eliminate the source of the problem, then restart the TriPlus RSH SMART.

The example in [Figure 67](#) shows the resulting errors when the Vortexer cable is not connected, and the homing could not be performed. All the subsequent boot-up checks failed.

Figure 67. List Items of Pending Messages



The Pending Message accompanied by the **Exclamation Mark** warning symbol indicating that a module has not been completely configured. After resolving the Service Issues, the Pending Messages, or both, restart the system. Select **Maintenance > Check Configuration**. Activating this item the entire system is checked for any open issues. If all of them are resolved, the green status light will be displayed.

See also the information provided by the error message or consult the chapter **Troubleshooting** in the *TriPlus RSH SMART Hardware Manual*.

Short-cuts from Startup Screen

Note Selecting a menu list item from the startup screen provides direct access, and offers the same functionality as when selecting the item using the path **Menu Button > Options > Setup > RSH Modules**.

The following steps are required to use the short-cuts:

1. Position the cursor on the list item at the Start Screen for which you wish to check certain parameters.
2. Press the **Enter** button to open the dialog for the selected item.
3. Selecting the **Options** pull-up menu, a list of specific tasks is provided, limited to the typical needs for routine work.

Note The section “[Setup Menu](#)” on [page 105](#) details the parameters that can be modified. Parameters which have read-only access are often self-explanatory and are usually only mentioned in the listing.

User, Extended, and Service Access Levels

The RSH Firmware is designed with three different **Access Levels**. Each level accesses own discrete items and sections of the software. The purpose of this distinction is to display only specific items and sections of the software for each level. Settings which require to be changed rarely, such as those set during installation of the TriPlus RSH SMART, are hidden for level 1 users (**User Level**), and displayed at level 2 (**Extended User Level**).

The distinction between **User Level** and **Extended User Level** contributes to the user friendliness of the TriPlus RSH SMART.

Besides being user-friendly, the distinction allows the **Extended User Level** to be reserved for a person responsible for the system, or for a specific group of users. This protection enhances the reliability of the system and the lab environment in which the TriPlus RSH SMART is used. Accidental changes can be minimized or avoided.

A **Service Level** is reserved for the Field Service Engineers. This level is mainly used during the installation phase or when servicing the TriPlus RSH SMART. Accessing the **Service Level** requires a software key provided only for trained and authorized service engineers.

For details see the following sections:

- “User Level” on page 96
- “Extended User Level” on page 97
- “Service Level” on page 97
- “Changing Access Level” on page 98
- “Example of Differences in Access Levels” on page 100



IMPORTANT Please note that the TriPlus RSH SMART starts in the **User** access level. If the **Extended User** mode is required, you must change the access level. See the section “Changing Access Level” on page 98.

User Level

The **User Level** is the normal working level recommended for routine use. This level is assigned as the default level.

The system must be completely installed, tested, and verified for the use in combination with the required GC system. When these prerequisites are fulfilled, and a routine run is to be started, the TriPlus RSH is completely controlled by the Thermo Scientific™ Chromatography Data System (CDS) as Chromeleon, Xcalibur, ChromQuest, or Chrom-Card.

With the **User Level**, specific menu items are specially marked as shown in the example of the Agitator **Options** pull-up menu. See the example in Figure 68.

Figure 68. Example of User Level Options Pull-up Menu

Agitator 1 12:56	
Press 'Enter' to edit a parameter.	
Actual Temp	40.0 °C
Max Temperature	200.0 °C
Min Temperature	30.0 °C
Stdby Temp Contr	On
Stdby Temperatur	40.0 °C
Temp Setpoint	40.0 °C
<div> <div>Check Teaching</div> <div>Set Standby Temperature</div> <div>Check Agitator</div> <div>Select</div> </div>	

You check parameters through the **Virtual Handheld Controller** or **Handheld Controller** (Terminal). All other functionality, such as the number of samples, how to treat a sample, the injection technique and so on, are under the control of the CDS.

Extended User Level

The **Extended User Level** provides the same basic functionality as the **User Level** but certain parameters of the RSH Firmware can be controlled, such as those that may be used for new modules, X-,Y-,Z-axes position teaching, changing a sync signal, and so on.

It is highly recommended to operate the TriPlus RSH in the **User Level** and to activate the **Extended User Level** only for special cases. Compared to the routine **User Level**, the **Extended User** access level provides the experienced operator more possibilities to interact with the TriPlus RSH. The distinction between the access levels enables the interface to be simplified for routine work, while providing the possibility to fine-tune the TriPlus RSH according to the specific requirements of your particular applications.

With the **Extended User Level**, specific menu items are specially marked as shown in the example of the Agitator **Options** pull-up menu.

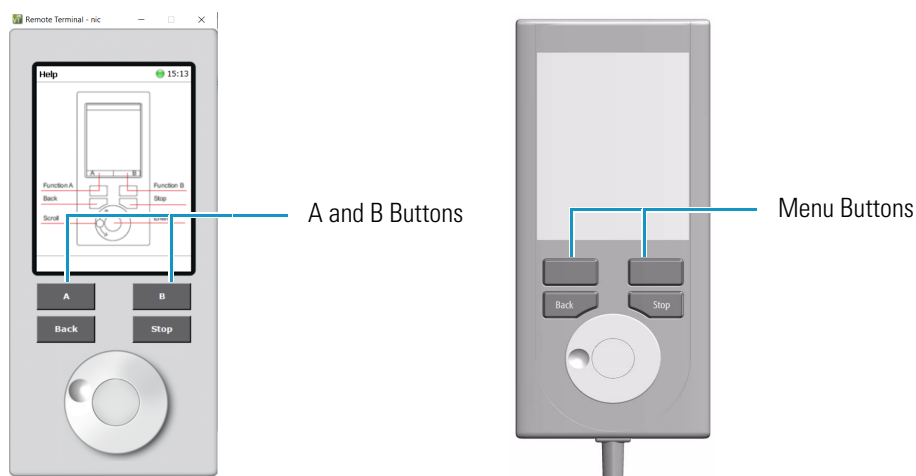
Service Level

The **Service Level** provides full access to the TriPlus RSH. This level is reserved for qualified service engineers only. This level will be required for installation or any major repairs such as replacing a device (active module). To open the **Service** access level, a software key is necessary. This key is provided on a Service USB Stick which is handed over to trained service engineers. The various menu items, accessible with **Service** rights, are described in the chapter “[Setup Menu](#)” on [page 105](#).

Changing Access Level

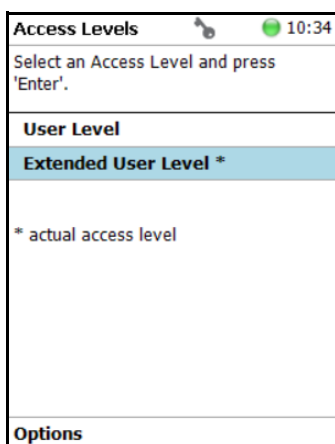
Using the **Virtual Handheld Controller** the Access levels can be changed by pressing the two characters **A** and **B** simultaneously at the keyboard. See [Figure 69](#).

Figure 69. Virtual Handheld Controller and Virtual Handheld Controller



If the TriPlus RSH is equipped with a Handheld Controller, press the two **Menu Buttons** simultaneously (see [Figure 69](#)) to access the screen shown in [Figure 70](#). The **User Access Level** is the default level.

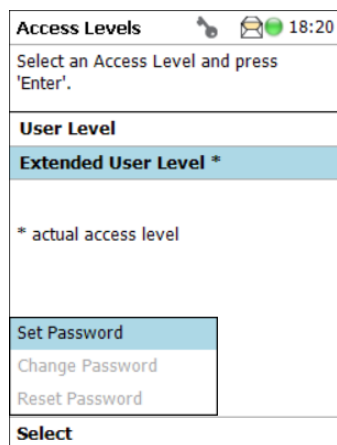
Figure 70. Changing from User Level to Extended User Level



❖ To change access level

4. Select the required level and press **Enter** to activate it. The asterisk indicates the current active level.
5. When the **Extended User Access Level** is selected, a password can be set. See [Figure 71](#).

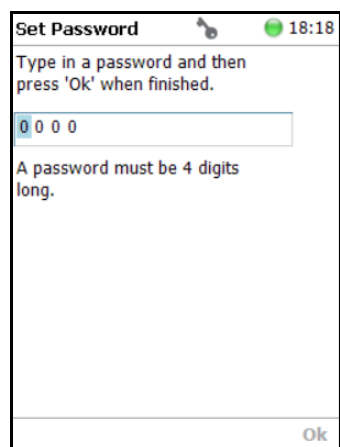
Figure 71. Selecting Extended User Level and Setting a Password



6. Select **Set Password** from the pull-up menu.
 - a. Place the cursor on the first digit and press the **Enter** button. A pop-up menu opens providing numerals from 0 to 9 for selection.
 - b. Accepting the password by pressing **Ok** stores it. The password can be changed or reset as long as you are working under the **Extended User Level**. See [Figure 72](#).

When the **User** level is active and you wish returning to the **Extended User Level**, follow the dialog shown in [Figure 72](#).

Figure 72. Entering Another Password to Access Extended User Level



Note that **Ok** is grayed-out (inactive) as long as the correct password is not entered.

Note If a password is forgotten, restore the **RSH Firmware**. See the chapter **TriPlus RSH Firmware** in the *TriPlus RSH Hardware Manual*. Use a backup file which does not yet contain the password. Be aware that changes made to the TriPlus RSH or any changes in settings made after the installation of the backup file to recover the forgotten password will no longer be active.

A password cannot be set when operating under the **User Level**.

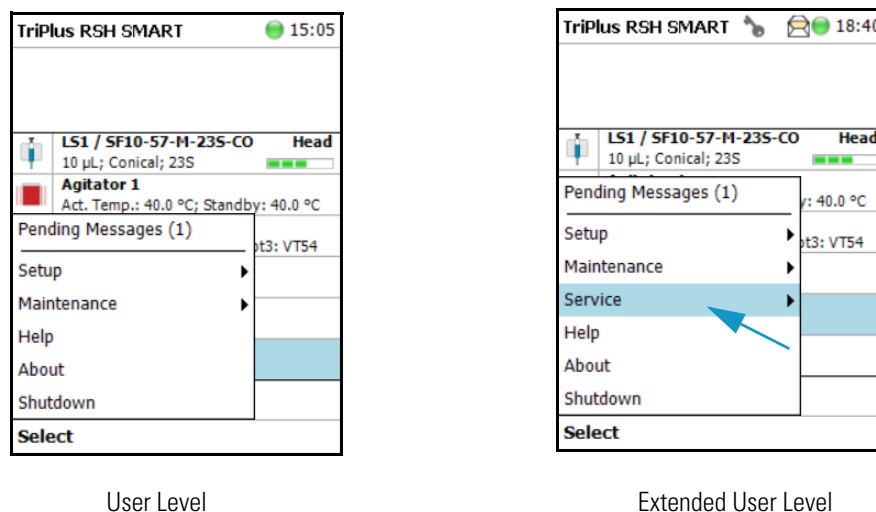
The **Service Level** is only accessible with the software key, provided with a **Service USB Stick**.

Note If the Handheld Controller (or Virtual Handheld Controller) is not in use, a time-out function begins. After 60 minutes of inactivity the software reverts automatically to the default **User Level**.

Example of Differences in Access Levels

The main difference between the two access levels is that the menu item **Service** is not available in the **User level**. See [Figure 73](#).

Figure 73. Differences in Access Levels



Note If the Handheld Controller (or the Virtual Handheld Controller) is not in use, a time-out function begins. After 30 minutes of inactivity the software reverts automatically to the default **User Level**.

Local Scripts

The functionality of the Local Scripts is for customers whose Chromatography Data System (CDS) does not support the TriPlus RSH System. Using local scripts it is possible to create, edit and execute Jobs using different methods based on templates. The templates are provided for different injection techniques like ITEX, Headspace or SPME.

The non-editable templates, called **Scripts** are managed within the **Scripts** menu. Scripts can be deleted and additional scripts can be imported from a connected USB Stick.

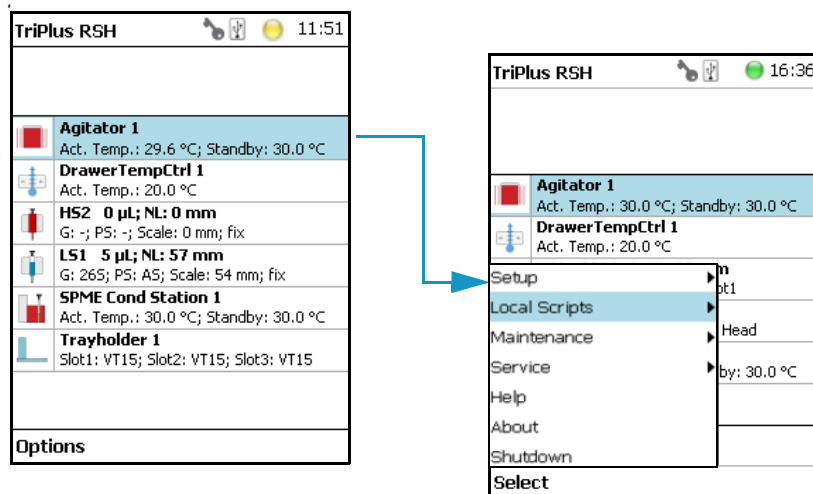
- **Methods** can be created based on a certain script. A method is a copy of a script with an editable set of parameters. Methods, for their part, are used by **Jobs**.

- A **Job** processes a configurable number of samples according to the parameters of the referenced method. Jobs can be created and started within the **Job Queue** menu. It is also possible to copy or delete Jobs and to change the order of the Jobs within the Job Queue.

The **Local Scripts** function is available under the **Options** pull-up menu.

Press the **Options** to open the pull-up menu and select the menu item **Setup**. See Figure 74.

Figure 74. Start Screen Options Pull-up Menu



Select the menu item **Local Scripts** to access to the following sub-menu:

- **Scripts Menu** — Shows the available Scripts for the different injection techniques: **Headspace Injection**, **ITEX Advanced**, **Liquid Injection** and **SPME Injection**. Scripts can be deleted and additional scripts can be imported from a USB Stick.
- **Methods Menu** — Shows the available Methods. Each method is a copy of a corresponding script. In contrast to the scripts, the parameters of a method can be edited. New methods can be created, existing ones can be copied or deleted. A new method is created based on a present script.
- **Job Queue Menu** — Creates a job based on a method. New jobs can be created, existing ones can be copied, or deleted. The order of the present jobs within the queue can be changed. The jobs can be moved upwards or downwards within the list. It is possible to start the processing of the complete queue or of a single job. It is also possible to start processing only a part of the queue top down, beginning with a certain job. To create a new job see the following procedure:

❖ To create a new job

1. In **Job Queue** menu choose **New Job** and select a method.
2. Enter a name for the new Job and press **New**.
3. Press **Enter** to edit a parameter and press **Run** when finished.

- Adapt the parameters **First Sample Index** and **Last Sample Index**, defining the total number of samples to be processed during this job and select a predefined vial tray, if required.

To start a **JobQueue**, a part of a job queue or a single job, open the Job Queue Pull up menu.



Start will start the whole JobQueue, **Start Job 2** will start only the selected Job, and **Start from Job 2** will start the JobQueue top down, beginning with the selected job. Once started, the actual task of the Job or Job Queue is displayed in the upper part of the screen.

Setup, Installation, and Maintenance Menu Items

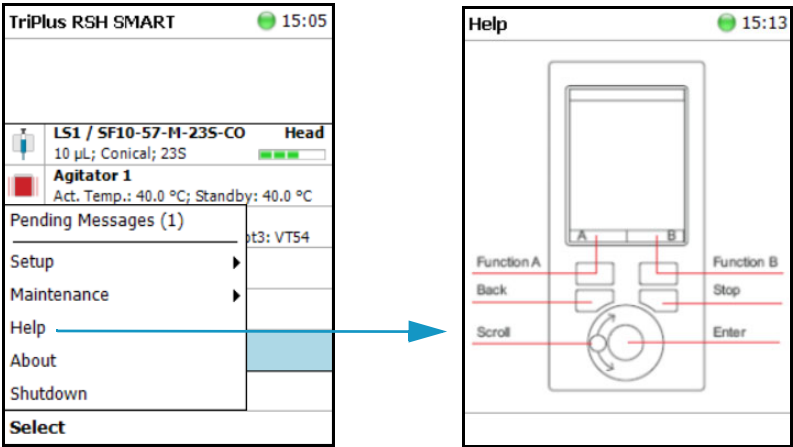
The description of the options of the RSH Firmware operated either with the Virtual Handheld Controller, or directly using the installed Handheld Controller are detailed in the following chapters:

- [Chapter 3, “Setup Menu.”](#)
- [Chapter 4, “Maintenance Menu.”](#)
- [Chapter 5, “Service Menu.”](#)

Help Menu Item

[Figure 75](#) shows the Handheld Controller functions.

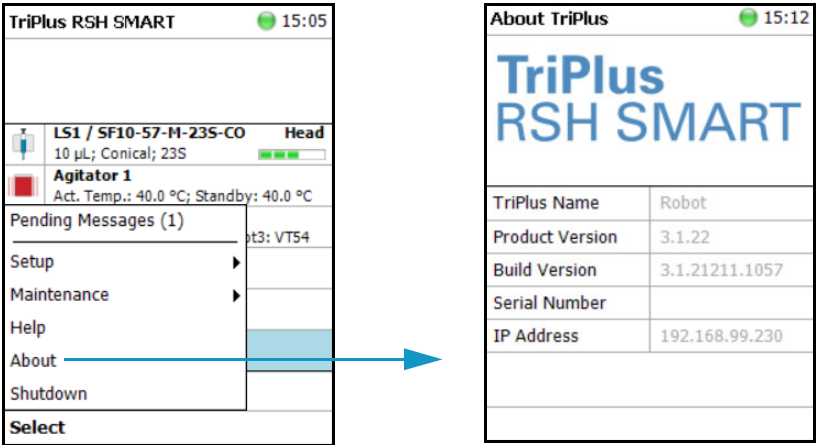
Figure 75. Menu Item Help



About Menu Item

The About menu item lists the name of the instrument, the product version, build, serial number, and IP Address of the TriPlus RSH SMART. See [Figure 76](#).

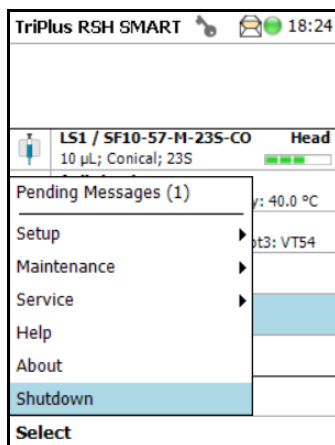
Figure 76. Menu Item About



Shutdown Menu Item

The menu item **Shutdown** gives the operator the possibility to shut down the TriPlus RSH in a controlled manner. See [Figure 77](#).

Figure 77. Menu Item Shutdown



The main advantage of this automated shutdown is that the Tool is parked. If the system is shut down by simply turning off the power supply, the slider will move very slowly downwards. Parts of the Tool, particularly the syringe needle, can touch the bench surface, or any other object. This can damage the syringe needle.

The following steps are automatically performed during a controlled Shutdown:

- The Head moves to an empty position of the ATC Station, engages and remains in this position.
- If a TR Station is part of the TriPlus RSH SMART configuration, the Head moves to the single slot.
- The software shuts down, closes the application and disables the axes.

After the TriPlus RSH has completed the shutdown procedure, it is necessary to turn off the power supply.

To restart the TriPlus RSH after the shutdown process, toggle the switch of the power supply, turn it off, wait about 30 seconds, then turn on the power of the system.

Operation of the TriPlus System in Combination with Other Chromatography Data Systems

A software driver is used for operation of the TriPlus RSH with a Thermo Scientific™ Chromatography Data System (CDS). The specific requirements for operating the integrated System within the CDS are outlined by the supplier of the CDS software.

Setup Menu

This chapter describes the options of the **Setup Menu** operated either with the Virtual Handheld Controller, or directly using the installed Handheld Controller.

Contents

- Starting Setup Menu Item
- Setup Menu Item Modules
- Setup Menu Item - Set Date and Time
- Setup Menu Item - Set TriPlus RSH SMART Name
- Setup Menu Item - Setup Network

Note Items highlighted in **green** are only visible in the access level **Extended User**. Parameters highlighted in **blue** are read only.

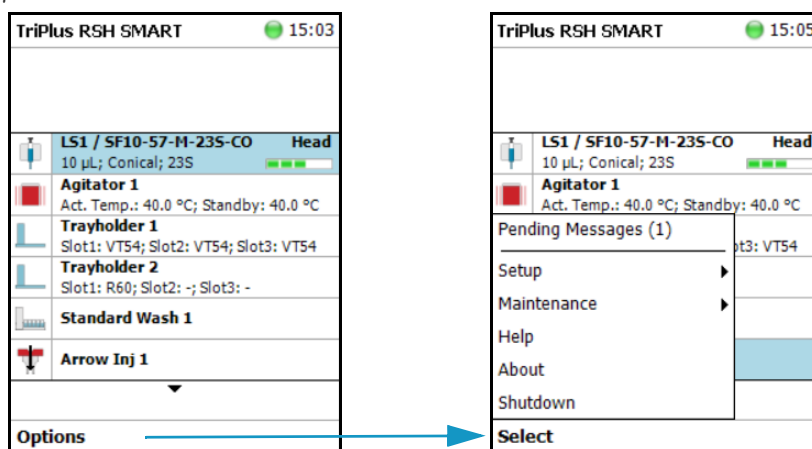
Starting Setup Menu Item

The **Setup** function is available under the **Options** pull-up menu. The **Extended User Level** provides limited higher functionality in **Setup** than in the restricted **User Level**.

The menu items are listed in alphabetical order.

Press the **Options** button to open the pull-up menu and select the menu item **Setup**. See [Figure 78](#).

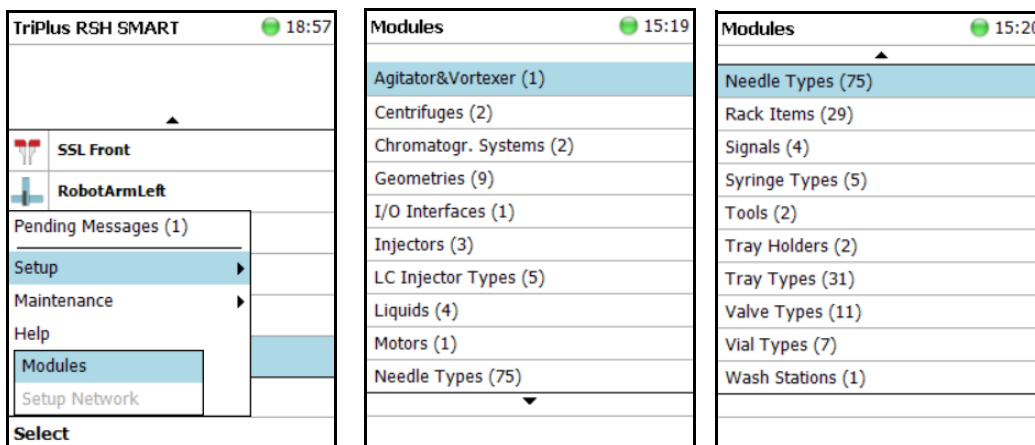
Figure 78. Start Screen Options Pull-up Menu



Setup Menu Item Modules

Select the menu item modules to open the list of all installed active and passive modules. See [Figure 79](#).

Figure 79. List of Active and Passive Modules



For details, see to the following sections:

- “Agitator&Vortexer Module” on page 108
- “Heatex Stirrer” on page 114
- “Barcode Reader” on page 118
- “Centrifuge” on page 115
- “Chromatograph Systems” on page 119
- “Dilutor” on page 120
- “I/O Interfaces” on page 130
- “Injectors” on page 133
- “OC Actuator” on page 135
- “Motors” on page 137
- “Obstacles” on page 141
- “Sample Drawers (Temperature Controlled Drawer)” on page 143
- “Tool Stations” on page 146
- “TR Station” on page 146
- “ATC Station” on page 147
- “Signals” on page 149
- “Solvent Stations” on page 152
- “SPME Conditioning Station” on page 155
- “SPME Arrow Conditioning Station” on page 157
- “Syringe Types” on page 159
- “Tool Adapters” on page 162
- “Tools” on page 164
- “Tray Holders” on page 171
- “Tray Types” on page 176
- “Trays” on page 187
- “Vial Types” on page 190
- “Vials” on page 193
- “Wash Stations” on page 198
- “Tray Slots” on page 203

Agitator&Vortexer Module

Selecting the list item **Agitator&Vortexer**, the following parameters are available for modification. See [Figure 80](#).

Figure 80. Agitator Parameters

Modules	● 15:19
Agitator&Vortexer (1)	
Centrifuges (2)	
Chromatogr. Systems (2)	
Geometries (9)	
I/O Interfaces (1)	
Injectors (3)	
LC Injector Types (5)	
Liquids (4)	
Motors (1)	
Needle Types (75)	

Agitator 1	● 16:57
Press 'Enter' to edit a parameter.	
Actual Temp	40.1 °C
Max Temperature	200.0 °C
Min Temperature	30.0 °C
Stdby Temp Contr	On
Stdby Temperatur	40.0 °C
▼	
Options	

Select **Agitator 1**, then press **Enter** to edit a parameter. See [Table 41](#).

Table 41. Agitator/Incubator Parameters (Sheet 1 of 2)

Item	Description
Actual Temperature	Reads out the actual temperature of the module; read-only function.
Max Temperature	Sets the upper temperature limit. The Maximum Temperature which can be set is 200 °C.
Min Temperature	Sets the minimal temperature limit.
Standby Temperature	<p>The Standby Temperature can be adjusted according to the application's requirements. Setting the Standby Temperature using this function, the newly-selected temperature is not immediately active. To activate it, go to the Options pull-up menu and select Set Standby Temperature.</p> <p>The Standby Temperature is activated when the TriPlus RSH SMART is powered up. In routine use, the Standby Temperature is activated after a job has been terminated. The Standby Temperature is typically lower than the application temperature. See the note below.</p>
Vial Type Pos. 1	The Vial Type for Position 1 is displayed. Read-only. <i>The Vial Type can be set with the task Setup Modules.</i>
Vial Type Pos. 2	The Vial Type for Position 2 is displayed. Read-only. <i>The Vial Type can be set with the task Setup Modules.</i>

Table 41. Agitator/Incubator Parameters (Sheet 2 of 2)

Item	Description
Vial Type Pos. 3	The Vial Type for Position 3 is displayed. Read-only. <i>The Vial Type can be set with the task Setup Modules.</i>
Vial Type Pos. 4	The Vial Type for Position 4 is displayed. Read-only. <i>The Vial Type can be set with the task Setup Modules.</i>
Vial Type Pos. 5	The Vial Type for Position 5 is displayed. Read-only. <i>The Vial Type can be set with the task Setup Modules.</i>
Vial Type Pos. 6	The Vial Type for Position 6 is displayed. Read-only. <i>The Vial Type can be set with the task Setup Modules.</i>
Cover Plate Type	Select the cover plate (lid) used for the Agitator installed. <ul style="list-style-type: none"> • Not specified If defined as NotSpecified an execution of the run is prohibited. • Standard: The lid must be opened for access. • Perforated: Syringe or SPME needle can be inserted through the holes in the lid.
Actual Position	Reads out the position of the Agitator. Read-only.
Stdby Temp Control	If switched off, the module will not go to standby temperature if idle.
Temp Gain	The coefficient used, if a temperature calibration has been performed. Possible values are between 0 and 2. Read-only.
Temp. Offset	The Offset temperature used, if a temperature calibration has been performed. Possible values are between -10 °C and +10 °C. Read-only.
<p>Note A job is often described as a sample list or sequence which is treated in a certain order. A job can also contain a single sample, often seen in method development work. In such cases, you set the Standby Temperature to the same temperature used for the application. Dropping the temperature during runs can be time-consuming and disruptive.</p>	

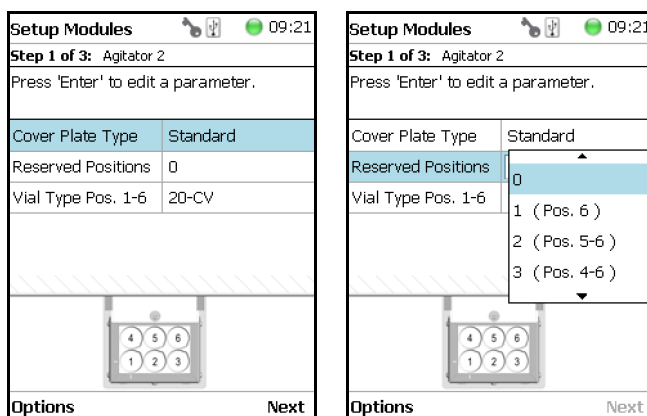
Agitator/Incubator Options Pull-up Menu

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 42](#).

Table 42. Agitator/Incubator Pull-up Menu Options

Item	Description
Check Teaching	Checks the teaching position of the module. This task serves as a quick check to determine if the X-, Y-, and Z-positions are defined correctly. If a teaching point is off, return to the Menu Setup for readjustment of the teaching position. Please note that this action can be done under the Extended User Level but not under User Level .
Setup Module	Allows the selection of the Cover Plate Type , to reserve one or more vials as a source vial (e.g. for a reagent), and to define the Vial Type for the 6 positions. See the section “ List Items Agitator/Incubator Reserved Positions and Vial Type ” on page 111.
Teach Module	The positions of the X-, Y-, and Z-axes can be defined again, teaching.
Activate Standby Temperature	Activates the newly-set Standby Temperature.
Check Agitator	Starts the spinning motion of the Agitator. It is used to test the Agitator function, or the spinning speed for particular application. Settings are: <ul style="list-style-type: none"> • Options: On; Off; Home • Speed: Select the required speed, range from 250 rpm to 750 rpm Press Run to start the Agitator To stop the motion, press Options again, select Check Agitator and set the parameter Options to Off . Press Run .

List Items Agitator/Incubator Reserved Positions and Vial Type



With the list item **Setup Module** it is possible to reserve one or more positions in the Agitator/incubator for a source vial as required by a specific application, for example to provide an internal standard solution, a reagent solution for a derivatization, or any other solution. Possible reserved positions for source vials begin at **Vial Position 6** and count backwards. In this manner, the first positions are made available for the sample vials.

The vial size can be selected for the remaining free positions and can be selected separately for the reserved vial(-s).

Note Only one vial size can be selected for the reserved vials. The consequence is that during routine applications the vial **overlapping** will be possible only within the free available sample vial positions to optimize the productivity.

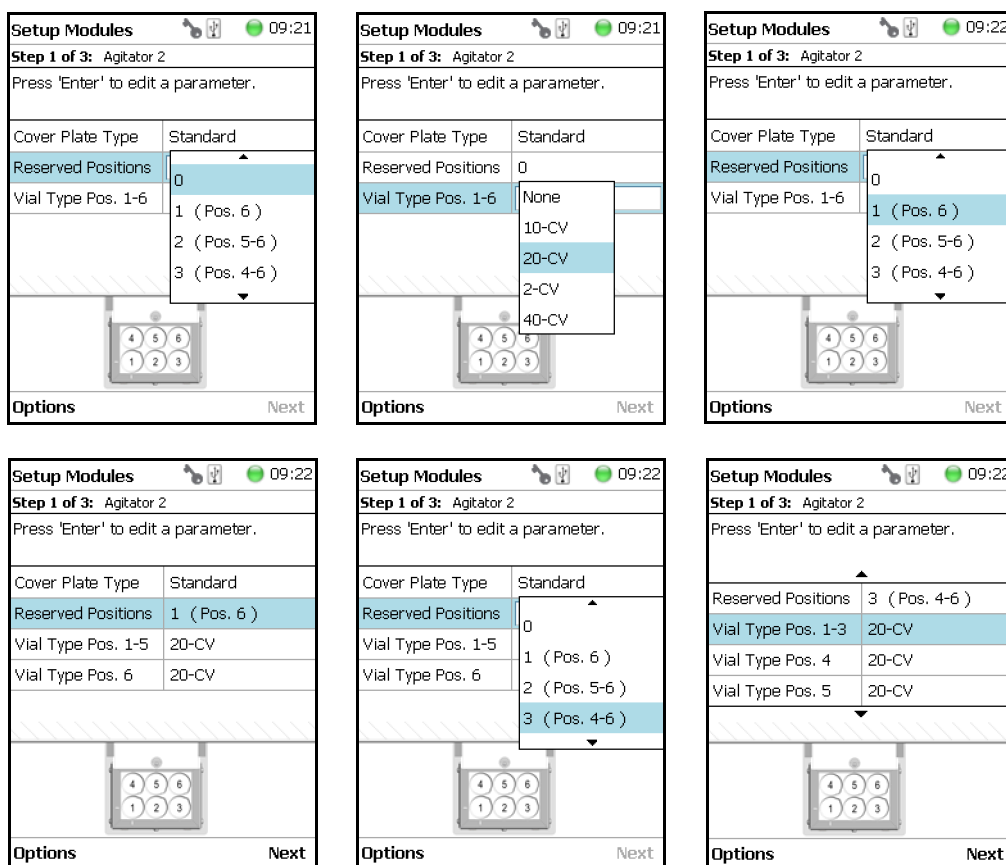
The behavior of the following two **Activities** is summarized as follows:

- **Transport Vial** activity — Allowed for available free sample vial positions and for reserved vial positions.
- **Move To Object** activity — Allowed for reserved vial positions only.

The reason for this limitation is because in the **overlapping mode** the sample vial position is managed by the scheduler.

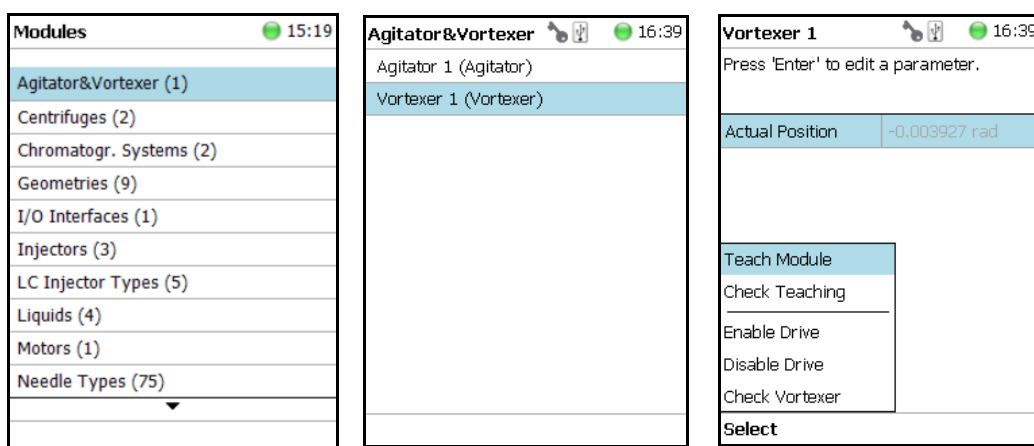
You can change the **Vial Type** at any time during a routine application selecting the menu item **Agitator**, scrolling down to the list item **Vial Type** and selecting another **Vial Type**.

Examples of **Free available** and **Reserved Vial Positions** are shown in the following images:



Selecting the list item **Agitator&Vortexer**, the following parameters are available for modification. See [Figure 81](#).

Figure 81. Vortexer Parameters



Select **Vortexer 1**, then press **Enter** to edit a parameter. See [Table 43](#).

Table 43. Vortexer Parameters

Item	Description
Actual Position	Reads out the position of the Agitator; read-only function.

Vortexer Options Pull-up Menu

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 44](#).

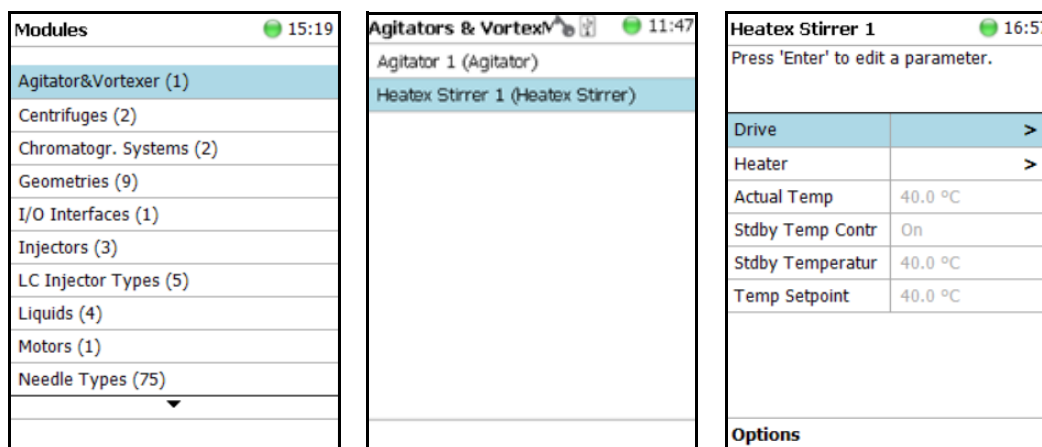
Table 44. Vortexer Pull-up Menu Options

Item	Description
Check Teaching	Checks the teaching position of the module. This task serves as a quick check to determine if the X-, Y-, and Z-positions are defined correctly. If a teaching point is off, return to the Menu Setup for readjustment of the teaching position. Please note that this action can be done only under the Extended User Level .
Teach Module	The positions of the X-, Y-, Z-axes can be defined again, for teaching.
Enable Motor	Enables the motor of the vortexer.
Disable Motor	Disables the motor of the vortexer.
Check Vortexer	Starts the spinning motion of the Vortexer. It is used to test the mixer function or the spinning speed for a particular application. Settings are: <ul style="list-style-type: none"> Option — On; Off; Home Speed — Select the required speed, range from 250 rpm to 2500 rpm Press Run to start the Vortexer To stop the motion, press Options again, select Check Vortexer and set the parameter Option to Off . Press Run .

Heatex Stirrer

Selecting the list item **Agitator & Vortexer**, the following parameters are available for modification. See [Figure 82](#).

Figure 82. Heatex Stirrer Parameters



Select **Heatex Stirrer**, then press **Enter** to edit a parameter. See [Table 45](#).

Table 45. Heater Stirrer Parameters (Sheet 1 of 2)

Item	Description
Actual Position	Actual Position
Actual Temp	Shows the actual temperature. Read-only.
Max Temperature	Sets the maximum temperature
Min Temperature	Sets the minimum temperature
Stby Temp Control	If switched off, the module will not go to standby temperature if idle. Read-only - editable in submenu Heater
Standby Temperature	<p>The Standby Temperature can be adjusted according to the application's requirements. Setting the Standby Temperature using this function, the newly-selected temperature is not immediately active. To activate it, go to the Options pull-up menu and select Set Standby Temperature.</p> <p>The Standby Temperature is activated when the TriPlus RSH SMART is powered up. In routine use, the Standby Temperature is activated after a job has been terminated. The Standby Temperature is typically lower than the application temperature.</p>
Temp Setpoint	Shows the actual target temperature. Read-only.
Temp Gain	The coefficient used, if a temperature calibration has been performed. Possible values are between 0 and 2. Read-only.

Table 45. Heater Stirrer Parameters (Sheet 2 of 2)

Item	Description
Temp.Offset	The Offset temperature used, if a temperature calibration has been performed. Possible values are between -10 °C and +10 °C. Read-only.
Vial Type	Specifies the type of the used vial.

Heatex Stirrer Options Pull-up Menu

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 46](#).

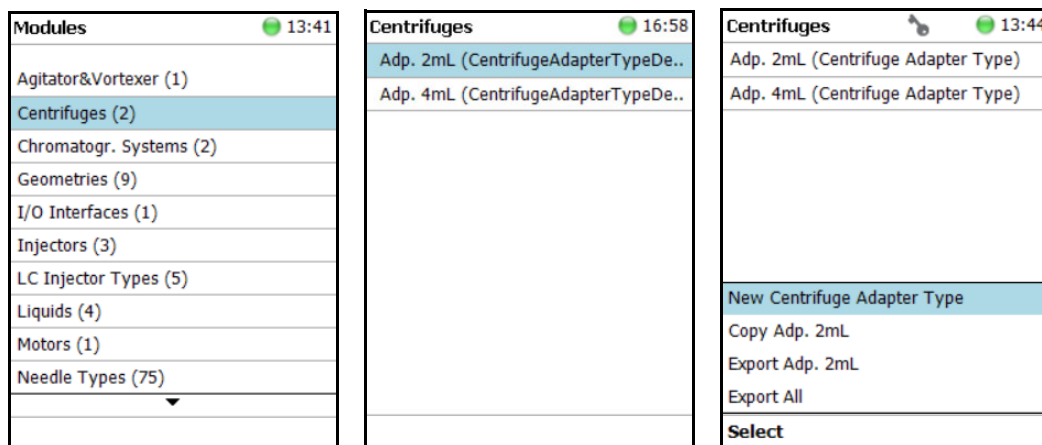
Table 46. Heater Stirrer Options Pull-up Menu

Item	Description
Check Teaching	Checks the teaching position of the module. This task serves as a quick check to determine if the X-, Y-, and Z-positions are defined correctly. If a teaching point is off, return to the Menu Setup for readjustment of the teaching position. Please note that this action can be done under the Extended User Level but not under User Level .
Teach Module	The positions of the X-, Y-, and Z-Axes can be defined again, for teaching. See sub-menu Heater .
Enable Drive	Enables the Heatex motor. See sub-menu Heater .
Disable Drive	Disables the Heatex motor. See sub-menu Heater .
Activate Standby Temperature	Activates the newly set standby temperature. See sub-menu Heater .
Check Stirrer	<p>Starts the spinning motion of the Vortexer. It is used to test the mixer function or the spinning speed for particular application. Settings are:</p> <ul style="list-style-type: none"> • Option — On; Off • Speed — Select the required speed, range from 250 rpm to 1600 rpm <p>Press Run to start the Heatex Stirrer</p> <p>To stop the motion, press Options again, select Check Heatex Stirrer and set the parameter Option to Off. Press Run.</p>

Centrifuge

Selecting the list item **Centrifuges**, the following parameters are available for modification.

Figure 83. Centrifuge Parameters



Press **Enter** to edit a parameter. See [Table 47](#).

Table 47. Centrifuge Parameters

Item	Description
Board	This menu is empty.
Drive	
Actual Speed	The actual speed of the rotor in RPM. Read-only
Actual Position	The actual position of the rotor in [°]. Read-only
Actual g-Force	The actual acceleration.
Actual Rotor Temp.	The actual temperature of the rotor in [°C]. Read-only
Actual Speed	The actual speed of the rotor in RPM. Read-only
Auto Stop	An automatic switch off of the Centrifuge Module after a certain period of time can be set.

Centrifuge Options Pull-up Menu

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 48](#).

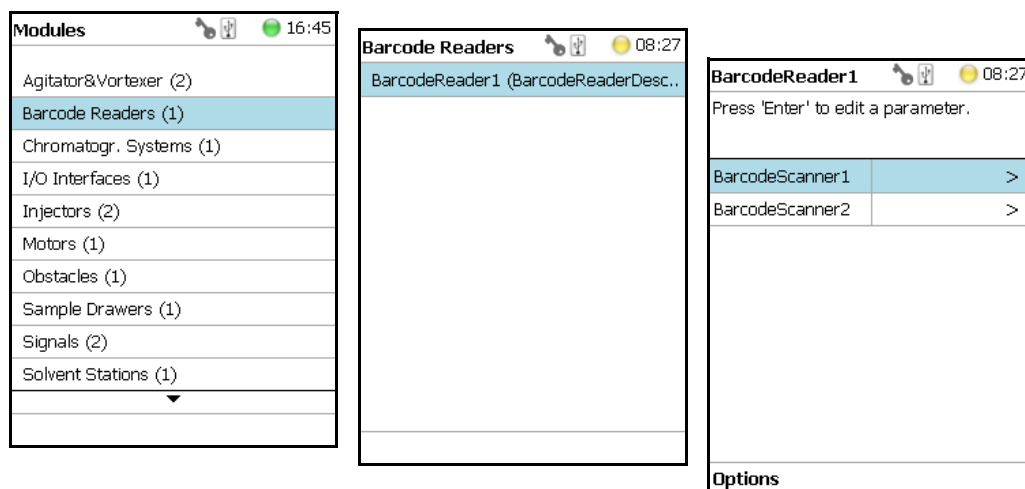
Table 48. Centrifuge Options Pull-up Menu Items

Item	Description
Check Teaching	Checks the teaching position of the module. This task serves as a quick check to determine if the X-, Y-, and Z-positions are defined correctly. In case a teaching point is off, return to the Menu "Setup" for readjustment of the teaching position. Note that this action can be done under the "Extended User Level" but not under "User Level".
Teach RSHmodule	The positions of the X-, Y-, and Z-Axes can be defined again, for teaching.
Home Centrifuge	The drive of the Centrifuge Module is homed.
Start Centrifuge	<p>This Task starts the Centrifuge Module with a selectable speed. It may be used to test the Centrifuge Module function or the spinning speed for particular applications.</p> <p>Speed: Select the required speed.</p> <p>Press "Run" to start the Centrifuge Module. To stop the Centrifuge Module, choose "Stop Centrifuge".</p>
Stop Centrifuge	Stops a running centrifuge module.
Open Cover	Opens the cover of the Centrifuge Module.
Close Cover	Closes the cover of the Centrifuge Module.
Disable Rotor	Disabling the Rotor allows the manual turning of the rotor. It can be selected, if also the cover shall be opened. Disabling of the rotor is started with Run.
Switch Position	The rotor position under the cover can be switched (Index 1 to Index 8).
Reset Emergency Shutdown	If an emergency shutdown of the Centrifuge Module has been triggered, because an imbalance of the rotor has been detected, an error message is set preventing the Centrifuge Module from being started again. This error message (visible as Pending Message) can be reset using the functionality "Reset Emergency Shutdown".

Barcode Reader

Selecting the list item **Barcode Reader**, the following parameters are available for modification. See [Figure 84](#).

Figure 84. Barcode Reader Parameters



Press **Enter** to edit a parameter. See [Table 49](#).

Table 49. Barcode Reader Parameters

Item	Description
Scanner	Select Scanner #1 or #2.
Beep After Decode	A beep tone can be activated after positive decoding of the barcode.

Barcode Reader Options Pull-up Menu

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 50](#).

Table 50. Barcode Reader Options Menu Items (Sheet 1 of 2)

Item	Description
Check Teaching	Checks the teaching position of the module. This task serves as a quick check to determine if the X-, Y-, and Z-positions are defined correctly. If a teaching point is off, return to the Menu Setup for readjustment of the teaching position. Please note that this action can be done only under the Extended User Level .

Table 50. Barcode Reader Options Menu Items (Sheet 2 of 2)

Item	Description
Teach Module	The positions of the X-, Y-, and Z-axes can be defined again, teaching.
Scan Barcode	Checks the Barcode Reader. Hold a barcode label in the beam of the laser and activate Scan Barcode . A beep tone signals a successful reading

Chromatograph Systems

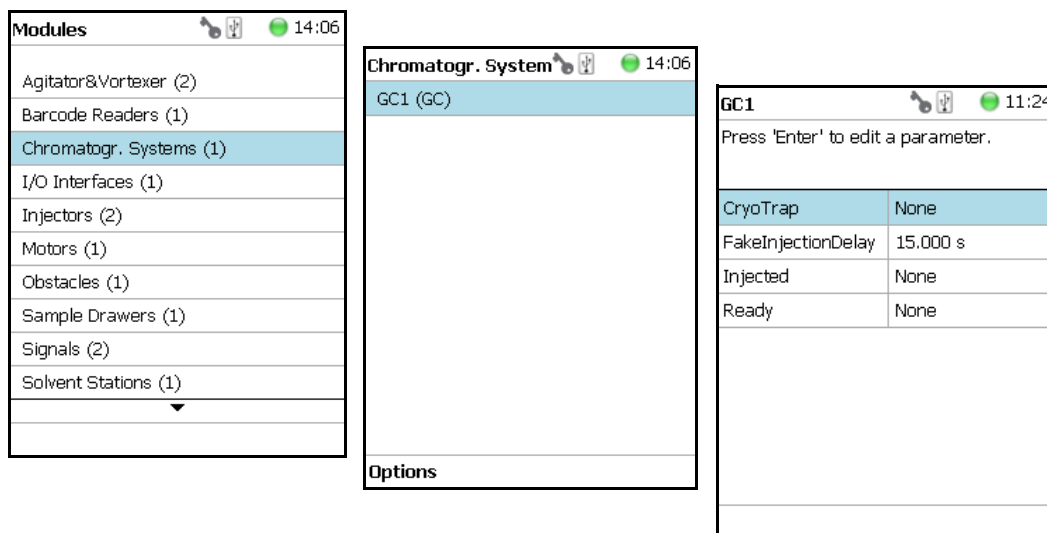
The **Chromatograph Systems** is a bundle of **Input and Output Signals** dedicated for a chromatographic system. This bundle must be configured and can be assigned to a specific chromatographic system for routine use. This minimizes erroneous functions and simplifies the user interface.

This is the last step in the setting up and synchronization of **Input/Output Signals** between the TriPlus RSH SMART system and the external device. See also the section “**I/O Interfaces**” on [page 130](#), and the section “**Signals**” on [page 149](#).

Selecting the list item **Chromatograph System**, the following parameters are available for modification. See [Figure 85](#).

- **GC1** = Name for GC System No.1
- **(GC)** = Class description GC System

Figure 85. Chromatography System - Selection and Parameters



Press **Enter** to edit a parameter. See [Table 51](#).

Table 51. Chromatography System Parameters

Item	Description
Cryo Trap	Sets start signal for the Cryo Trap, Output signal required.
Fake Injection Delay	Sets the delay time until the start of a fake injection. A fake injection performs a start of the chromatographic system, without injection of a sample.
Injected	Sets start signal for the chromatographic system, for example GC System1. Output Signal is required.
Ready	A ready signal from another device is expected as an Input Signal.

Note The synchronization between the TriPlus RSH SMART and any chromatographic system has to be checked for each particular system configuration. The setting of the synchronization signal has to be matched with the pin allocation of the synchronization cable.

The original cable are labeled. Check the labels first before connecting. This is especially important with the Y-cable configurations where two GC units are connected to a single TriPlus RSH.

Chromatograph System Options Pull-up Menu

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 52](#).

Table 52. Chromatography System Pull-up Menu Options

Item	Description
New Chromatograph System	Creates a new Chromatograph System.
Copy GC	Copies the Chromatograph System, GC1 as the example.
Delete GC	Deletes the Chromatograph System; GC1 as the example.

Dilutor

Setting Up the Dilutor Syringe Module

Note There are two different ways to access the steps for setting up the Dilutor Syringe Module.

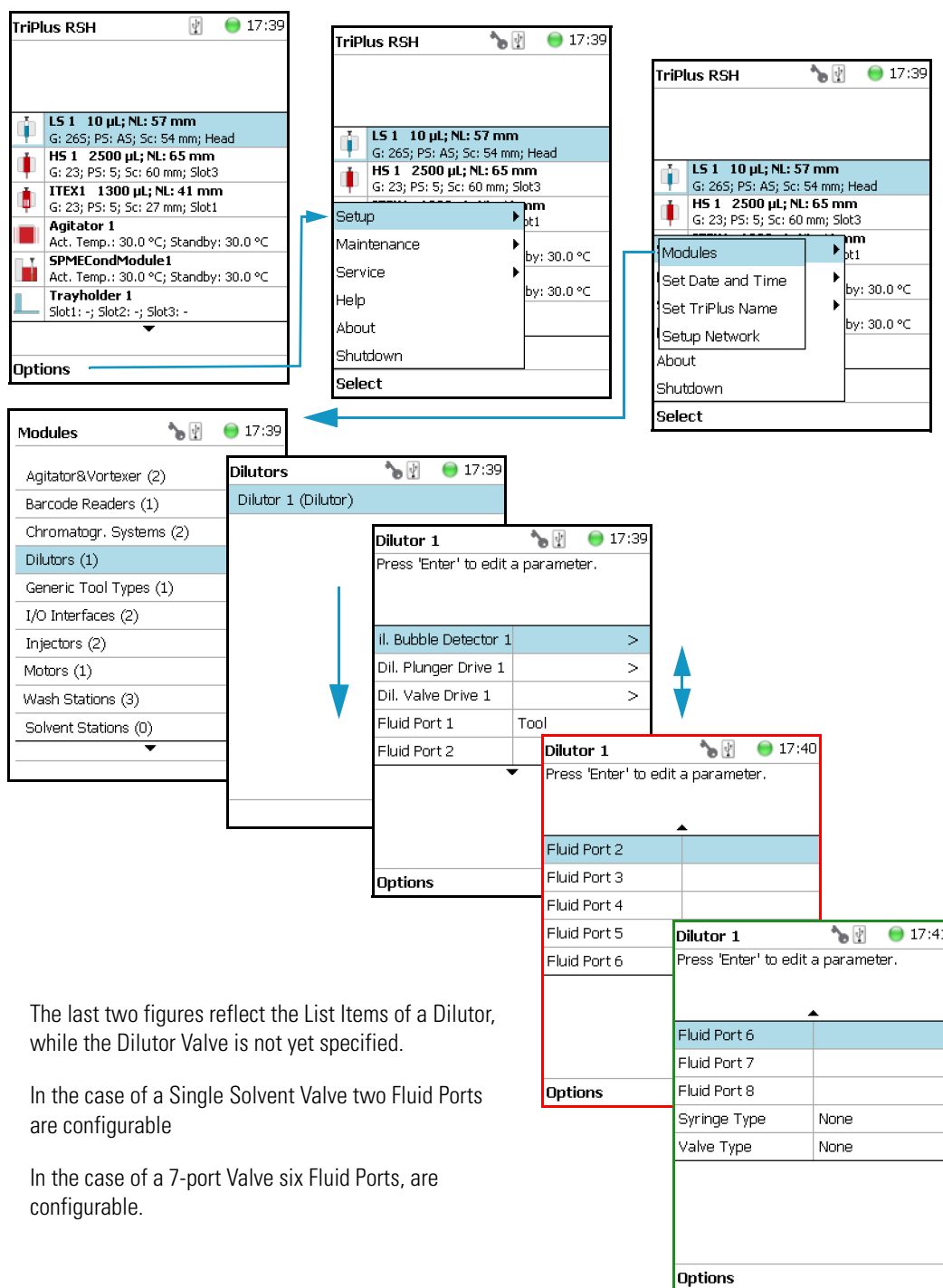
- Using the **Options** menu from the Start Screen. See “[First Path](#)” on [page 121](#).
- Selecting the menu item **Dilutor x** from the Start Screen. See “[Second Path](#)” on [page 122](#).

First Path

Use the **Options** Pull-up menu under the Start Screen.

Select the access level **Extended User** then navigate to the Start Screen. See [Figure 86](#).

Figure 86. Dilutor Module Start Screen and List Items (1)



The last two figures reflect the List Items of a Dilutor, while the Dilutor Valve is not yet specified.

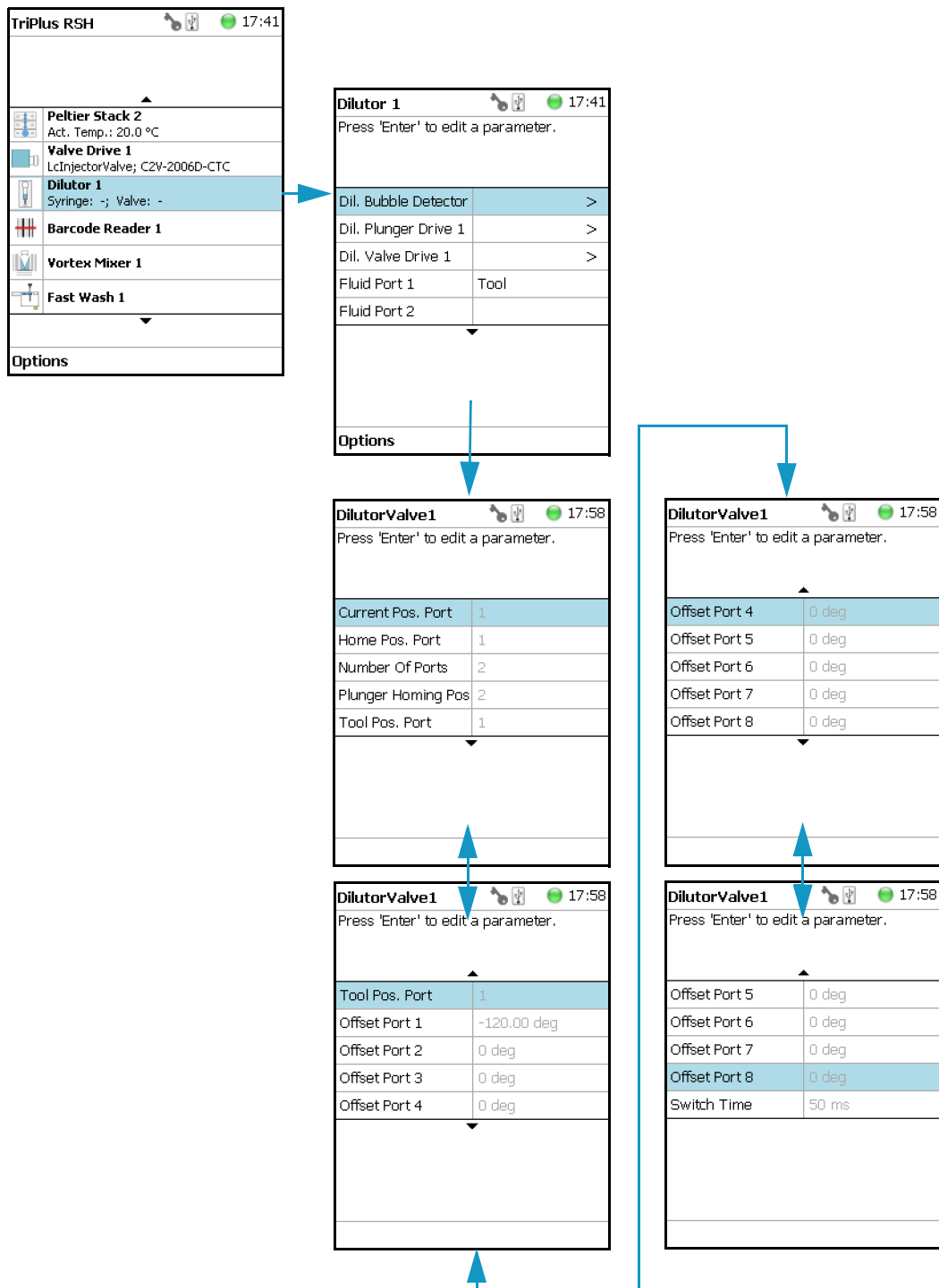
In the case of a Single Solvent Valve two Fluid Ports are configurable

In the case of a 7-port Valve six Fluid Ports, are configurable.

Second Path

The Dilutor Syringe Module List Items are accessible directly from the Start Screen. See [Figure 87](#).

Figure 87. Dilutor Module Start Screen and List Items (2)



Dilutor Module Parameters

Table 53 lists the Dilutor Module parameters.

Table 53. Dilutor Module Parameters

Item	Description
Dil. Bubble Detector	Updates the parameters of the Bubble Detector.
Dil. Plunger Drive	The actual position of the Plunger in μm . Read-only parameter.
Dil. Valve Drive	Shows the Actual Position in degree and the Valve Type of the Dilutor Valve. Read-only parameter.
Fluid Port 1 - 8	Specifies a name for each liquid at the corresponding port. The number of Fluid Ports corresponds to the number of ports of the Dilutor Valve installed.
Syringe Type	Selects the type of the Syringe in the Dilutor Syringe Module.
Valve Type	Selects the Type of the Dilutor Valve in the Dilutor Syringe Module.
Dilutor Valve	Shows some read-only parameters of the Dilutor Valve.
Current Pos. Port	The currently selected port.
Home Pos. Port	The port defined as Home Position.
Number of Ports	The number of ports.
Plunger Homing Pos.	The port used for homing the plunger.
Tool Pos. Port	The port the Dilutor Tool is connected to.
Offset Port 1-8	The offset in degrees for each port.
Switch Time	Define the time for switching between the ports.

Options Menu Items for Dilutor (x)

Selecting **Options** pull-up menu, the following tasks are opened. See Table 54 and Figure 88.

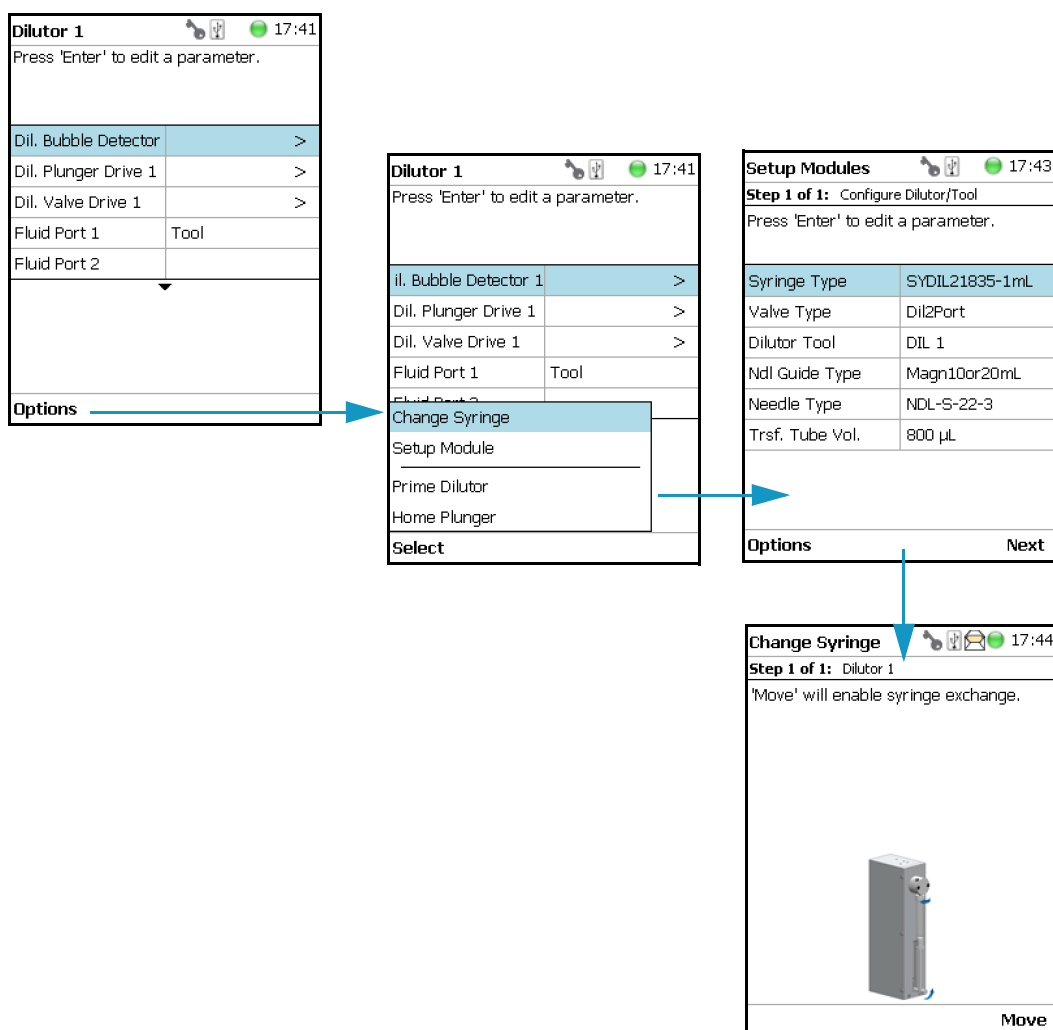
Table 54. Dilutor Module Pull-up Menu Options (Sheet 1 of 2)

Item	Description
Change Syringe	The plunger of the Dilutor is moved down to enable the exchange of the syringe.
Setup Module	Sets up the configuration parameters for the Dilutor module and the Dilutor Tool.
Prime Dilutor	A selectable Solvent Port of the Dilutor is primed. Specifies the Solvent Port as well as the total liquid volume for priming. The number of cycles is calculated by the total volume divided by the volume of the Transfer Tubing.

Table 54. Dilutor Module Pull-up Menu Options (Sheet 2 of 2)

Item	Description
Home Plunger	The Plunger is moved to the home position and the Z-Axis is referenced.
Home Drive	Moves the Dil. Plunger Motor to Home position.
Enable Drive	Enables the selected motor after it has been disabled.
Disable Drive	Disables the selected motor to permit moving it manually.

Figure 88. Dilutor Module Options Menu (1)



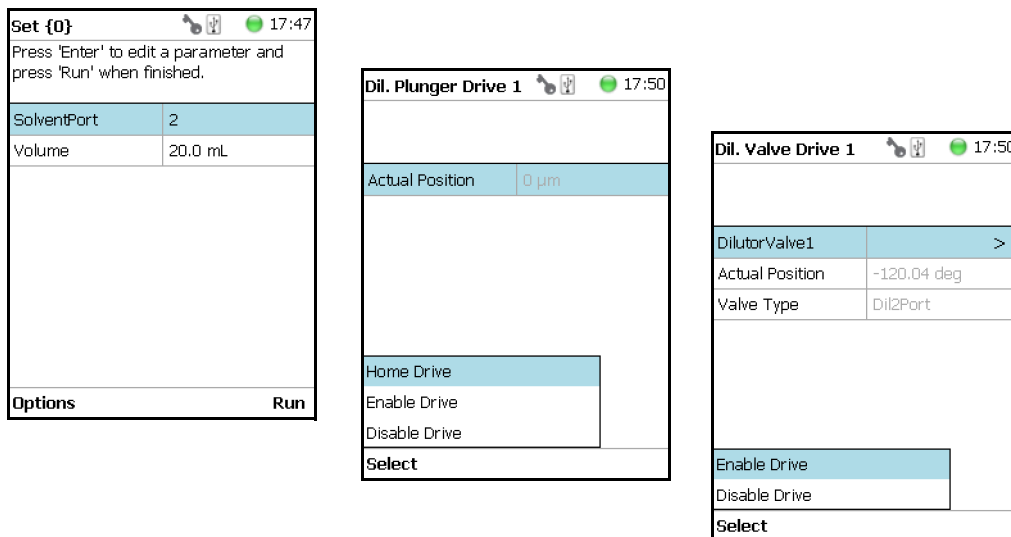
Selecting the item **Setup Module** from the **Options** Pull-up Menu allows you to setup the Dilutor Module and the corresponding Tool in one menu.

All parameters can also be adapted separately within the corresponding sub-menus of the Dilutor Tool and the Dilutor Module.

Using the **Options** Pull-up menu in the sub-menus **Dil. Plunger Drive** and **Dil. Valve Drive**, the corresponding motor (drive) can be disabled or enabled.

This functionality is useful if the plunger or the valve motor must be moved manually.
See [Figure 89](#).

Figure 89. Menu Options (2)



Setting Up the Dilutor Tool

Note There are two different ways to access the steps for setting up the Dilutor Syringe Module.

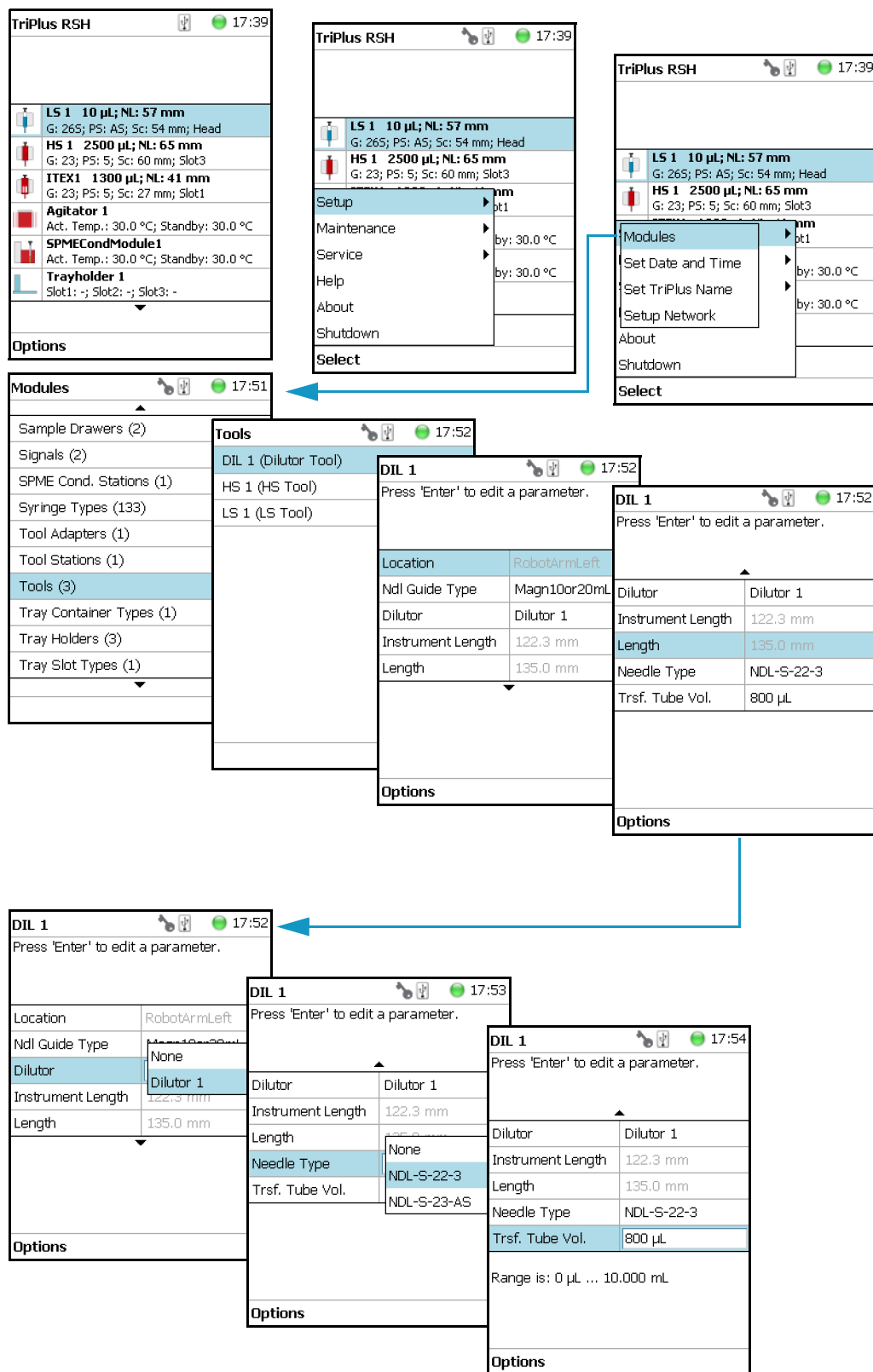
- One path uses the **Options** menu from the Start Screen. See “[First Path](#)” on [page 125](#).
- The second path is by selecting the menu item **DIL x** from the Start Screen. See “[Second Path](#)” on [page 127](#).

First Path

The **Options** Pull-up menu under the Start Screen is used.

Select the access level **Extended User** then navigate to the Start Screen. See [Figure 90](#).

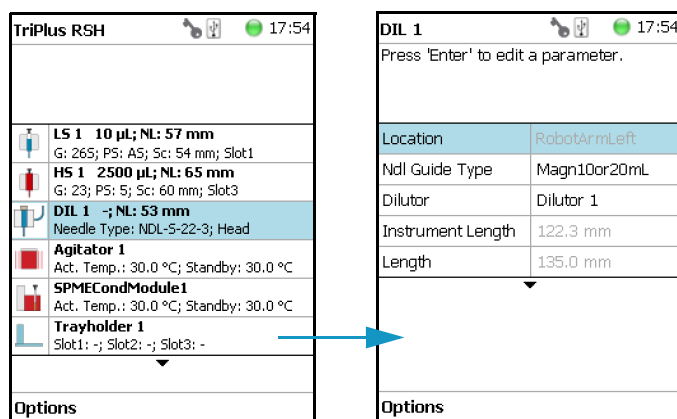
Figure 90. Dilutor Tool Start Screen and List Items (1)



Second Path

The Dilutor Tool List Items can be accessed directly from the Start Screen. See [Figure 91](#).

Figure 91. Dilutor Tool Start Screen and List Items (2)



Dilutor Tool Parameters

[Table 55](#) lists the Dilutor Tool parameters.

Table 55. Dilutor Tool Parameters

Item	Description
Location	The location of the Tool. Read-only parameter.
Dilutor	Selects the corresponding Dilutor Module to which the Tool will be connected.
Instrument Length	The total length of the instrument without the height of the instrument base plate. Read-only parameter.
Length	The total length of the instrument including the height of the instrument base plate. Read-only parameter.
Ndl Guide Type	Selects the Type of the Needle Guide.
Needle Type	Selects the needle type to use.
Trsf. Tube Vol.	Specifies the volume of the Transfer Tubing. The Volume is calculated using the following formula:

$$V = \pi \times r^2 \times l$$

where:

V = volume of the tubing.

r = half of the inner diameter of the tubing

l = length of the tubing

Typical values for the volume of the transfer tubing are in the range of 800 µL.

Options Menu Items for DIL (x)

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 56](#).

Table 56. Dilutor Tool Pull-up Menu Options

Item	Description
Calibrate Tool	Calibrates the Tool installed in the head.
Check Tool Calibration	Checks the calibration point of the Tool installed in the head.
Select Tool	Selects another Tool. The currently attached Tool is first parked and the newly-required Tool is picked up.
Park Tool	Parks a Tool without picking up another Tool from the ATC Station.

Calibrating the Dilutor Tool

Note Refer also to the section **Calibrate Tools** in the *TriPlus RSH SMART User Guide*.

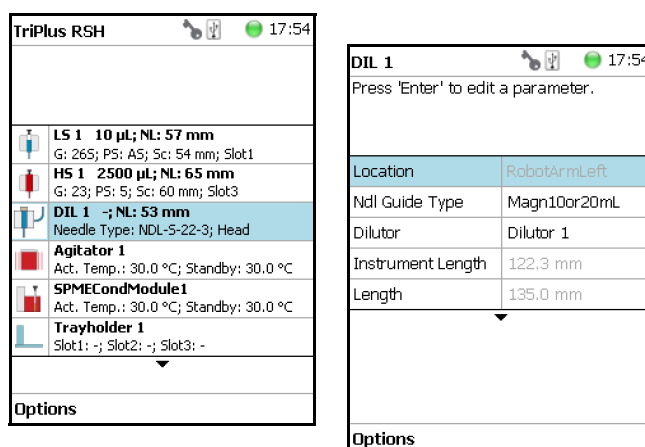
The calibration of the motors is basically a check to determine whether the mechanical stop points of the various axes can be detected reliably. A clearance distance (offset) from the mechanical stop point is assigned and stored as the electronic stop point. This calibration of the axes is mandatory and ensures reliable performance.

This step must be repeated if a motor has failed, has been replaced, or when any other major error has occurred. This calibration task brings the robot back to reliable operation.

❖ To calibrate the dilutor tool

1. Select the access level **Extended User**, then from the Start Screen select the item **Dilutor Tool DIL1**. See [Figure 92](#).

Figure 92. Dilutor Tool Calibration (1)



2. Press **Options**, select **Calibrate Tool** and follow the wizard. See [Figure 93](#).

Figure 93. Dilutor Tool Calibration (2)

DIL 1 17:54

Press 'Enter' to edit a parameter.

Location	RobotArmLeft
Ndl Guide Type	Magn10or20mL
Dilutor	Dilutor 1
Instrument Length	122.3 mm
Length	135.0 mm

Options

DIL 1 17:54

Press 'Enter' to edit a parameter.

Location	RobotArmLeft
Ndl Guide Type	Magn10or20mL
Dilutor	Dilutor 1
Instrument Length	122.3 mm
Length	135.0 mm

Calibrate Tool

Check Tool Calibration

Select Tool

Park Tool

Select

Calibrate Tools 17:55

Step 1 of 3: Calibrate DIL 1

Move the Tool manually to the Reference point and press 'Save'.

Pos.	Actual TP	Needle Guide
X	23.0 mm	24.0 mm
Y	256.0 mm	256.2 mm
Z	299.2 mm	299.6 mm

Options Save

Calibrate Tools 17:55

Step 1 of 3: Calibrate DIL 1

Press 'Enter' to manually adjust the reference position or press 'Next'.

Pos.	Actual TP	Needle Guide
X	24.0 mm	24.0 mm
Y	256.2 mm	256.2 mm
Z	299.6 mm	299.6 mm

Options Next

Calibrate Tools 17:55

Step 2 of 3: Assign Tool parameters

Press 'Enter' to edit a parameter.

Ndl Guide Type	Magn10or20mL
Needle Type	None
	NDL-S-22-3
	NDL-S-23-AS

Please note: The Needle Guide Type has to correspond with the vial cap type.

Options Next

Calibrate Tools 17:55

Step 2 of 3: Assign Tool parameters

Press 'Enter' to edit a parameter.

Ndl Guide Type	Magn10or20mL
Needle Type	NDL-S-22-3

Please note: The Needle Guide Type has to correspond with the vial cap type.

Options Next

Calibrate Tools 17:56

Step 3 of 3: Finish Calibrating

Press 'Ok' to move the Head back to home position.

Ok

Alternatively, the Dilutor Tool can also be calibrated from the Start Screen using the path **Options > Service > Installation > Calibrate Tools**. The wizard will guide you through the calibration process.

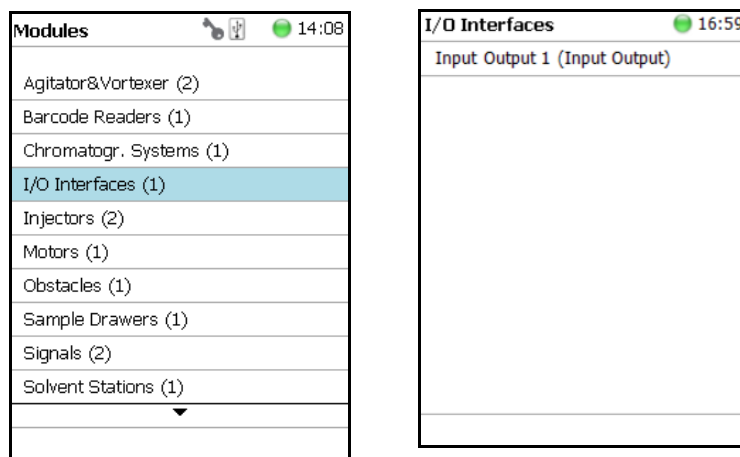
Note It is recommended to create a backup file when a module has been added or moved within the TriPlus RSH SMART system.

I/O Interfaces

This section provides the signal settings and synchronization to the external device, such as a GC System. It is the second step in the setting up and synchronization of Input/Output Signals between the system and the external device. See [Figure 94](#).

See also the sections “[Chromatograph Systems](#)” on [page 119](#) and “[Signals](#)” on [page 149](#).

Figure 94. Menu Item for I/O Interfaces



Press **Enter** to edit a parameter.

Selecting the list item **I/O Interfaces**, the following parameters are available for modification. See [Table 57](#).

Table 57. I/O Interfaces Parameters (Sheet 1 of 3)

Item	Description
Immediate <i>Ignores any Input or Output Signal</i>	Signal On Debounce Time
Opto In1 <i>Opto-isolator or Opto-coupler</i>	Signal On Debounce Time Negative Logic
PWM Out <i>Pulse-Width Modulation</i>	Signal On Output Voltage
Reset Button <i>Reset Button on Control Board</i>	Signal On Debounce Time Low Active
Simulated <i>This signal can be used for testing, simulation of sending a signal (Output Signal)</i>	Signal On Trigger Event Waiting Time

Table 57. I/O Interfaces Parameters (Sheet 2 of 3)

Item	Description
Software In <i>Signal for Handshake with CDS Software</i>	Signal On
Software Out <i>Signal for Handshake with CDS Software</i>	Signal On
SW Out1 <i>Switch-out Signal, Relay contact</i>	Signal On Low Active
SW Out2 <i>Switch-out Signal, Relay contact</i>	Signal On Low Active
TTL In1 <i>Transistor-Transistor Logic</i>	Debounce Time Low Active
TTL In2 <i>Transistor-Transistor Logic</i>	Signal On Debounce Time Low Active
TTL In3 <i>Transistor-Transistor Logic</i>	Signal On Debounce Time Low Active
TTL Out1 <i>Transistor-Transistor Logic</i>	Signal On Low Active
TTL Out2 <i>Transistor-Transistor Logic</i>	Signal On Low Active
TTL Out3 <i>Transistor-Transistor Logic</i>	Signal On Low Active
Beep Volume	Selectable scale from 1 to 5
Debounce Time	Specifies how long the signal is applied.
Low Active	<p>The standby status of a signal from the chromatographic system can be High Active or Low Active. Depending on what has to be applied for the specific system, one has to match the signal logic to that of the TriPlus RSH.</p> <p>By setting a mark to Low Active means that Low Active is selected. Low Active disabled means that High Active is selected.</p> <p>Information for the required signal logic is provided with the schematic of the sync cable which is part of the GC mounting kit.</p>
Signal On	Signal On means that the signal has been sent or received.

Table 57. I/O Interfaces Parameters (Sheet 3 of 3)

Item	Description
Output/Voltage	An output voltage in the range from 0 V to 35 V can be selected.
Trigger Event	Select the desired type of output signal for testing.
Waiting Time	Select the time to be waited until the signal is activated, delay time in seconds.
Beep Volume	The sound volume for the Beep tone can be selected.

Input/Output Interface Pull-up Menu

Selecting **Beep** from the **Options** pull-up menu, the following tasks are opened. See [Table 58](#).

Table 58. Input/Output Interface Pull-up Menu

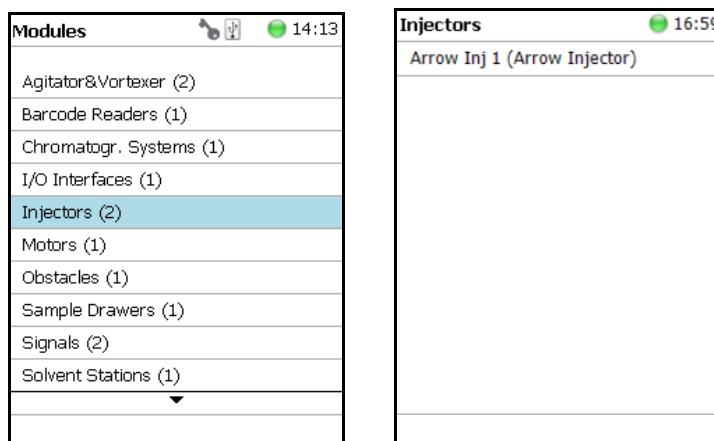
Item	Description
Reset to Default	Resets the selected module parameter to default value.
Beep	Activates a Beep sound local on the TriPlus RSH. If activated, you can select the Duration , Frequency and the Volume of the tonal sound.
Duration	The time for the tonal sound is selectable from 100 ms to 60 seconds.
Frequency	The frequency of the tonal sound is selectable from 100 Hz to 10000 Hz.
Run	Activates the tonal sound with the selected parameters for testing.
Beep Utility	Sets the frequency and the time length of the beep tone.

From all other list parameters the pull-up menu **Beep** is directly available.

Injectors

Selecting the list item **Injectors**, the following parameters are available for modification. See [Figure 95](#).

Figure 95. Injectors - Selection and Parameters



Press **Enter** to edit a parameter. See [Table 59](#).

Table 59. Injector Parameters (Sheet 1 of 2)

Item	Description
Default Needle Penetration Depth	Defines the Needle Penetration Depth in the GC injector.
Max Needle Penetration Depth	Sets the upper limit of Needle Penetration Depth into the GC injector.
Min Needle Penetration Depth	Sets the minimum limit of Needle Penetration Depth into the GC injector.
	WARNING This parameter is used for SPME and SPME Arrow Tools only. This parameter is not used for LS , HS , or ITEX DHS Tools. The default value is 18 mm. The adjustable range is from 10 mm to 50 mm.
Position Tolerance	Checks the difference between the taught X-Y-Axes positions against the actual position each time the head moves to the GC Injector. If the difference is greater than the Position Tolerance of 3.0 mm (default value) the TriPlus RSH SMART immediately stops. This is a safety feature to avoid needle bending.
	WARNING It is highly recommended to check the teaching positions of the injectors again when the GC is ready (heated up to the level as used for routine runs).

Table 59. Injector Parameters (Sheet 2 of 2)

Item	Description
Z Tolerance	<p>A tolerance window to give a plus/minus range (expressed in mm) in which the Head must expect an object.</p> <ul style="list-style-type: none"> • If the value of this item is > 0, indicates a relative detection mode is triggered, and the sensor from the Head needle guide is active. • If the value of this item is set to 0, the sensor of the needle guide is turned off and the syringe slider moves to an absolute value: the Z-axis position as specified for the object.

Injectors Options Pull-up Menu

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 60](#).

Table 60. Option Menu for Injectors

Item	Description
Reset to Default	Resets the selected module parameter to default value.
Teach Module	The positions of the X-, Y-, and Z-axes can be defined again, (teaching).
Check Teaching	<p>Checks the teaching position of the module. This task serves as a quick check to determine if the X-, Y-, and Z-positions are defined correctly. If a teaching point is incorrect, return to the Setup Menu for readjustment of the teaching position.</p> <p>This action can be done only under the Extended User Level.</p>

OC Actuator

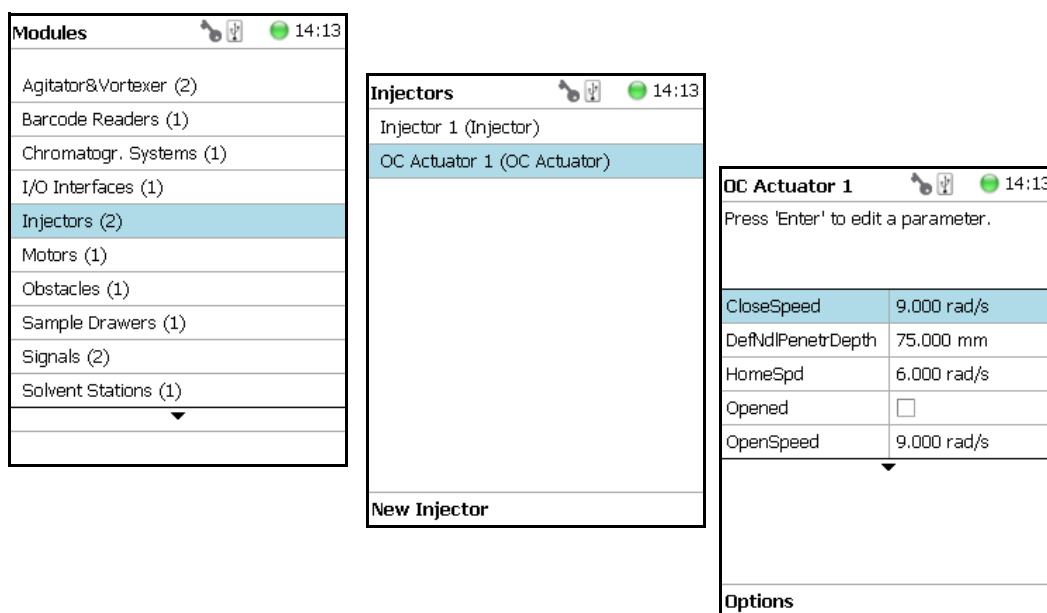
The OC Actuator allows the opening and closing of the On-column Injector rotary valve when the syringe needle is inserted or removed.

The OC Actuator is an active module, which means that the **OC Electronic Box** is connected to the Bus and the cable from the GC Injector is connected to the Box.

Note The OC Adapter is part of the GC On-Column Injector and it is not provided with the TriPlus RSH.

Selecting the list item **OC Actuator**, the following parameters are available for modification. See [Figure 96](#).

Figure 96. OC Actuator - Selection and Parameters



Press **Enter** to edit a parameter. See [Table 61](#).

Table 61. OC Actuator Parameters (Sheet 1 of 2)

Item	Description
Def Ndl Penetr Depth	Defines the Needle Penetration Depth in the OC injector.
Opened	Changes the status Opened or Closed . This parameter is a check if the gas lock is opened or closed. If marked as true (check box marked) the injector is defined as open . This can be verified by inserting a syringe manually and if a resistance is noted, the gas lock is closed. If a mismatch is observed, check the settings of the parameters Homing Direction and Homing Position .

Table 61. OC Actuator Parameters (Sheet 2 of 2)

Item	Description
Actual Position	Reads out the position of the OC Actuator. This information can be used for troubleshooting purposes.
Homing Direction	Changes the direction of homing.
Homing Position	Changes the position of homing.
Max Ndle Penetr Depth	Defines the maximum allowed syringe needle penetration in millimeters.
Position Tolerance	Checks the difference between the taught X-Y-axes positions against the actual position each time the head moves to the OCI. If the difference is greater than the Position Tolerance of 1.5 mm (default value) then the TriPlus RSH SMART immediately stops. This is a safety feature to avoid needle bending.

OC Actuator Options Pull-up Menu

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 62](#).

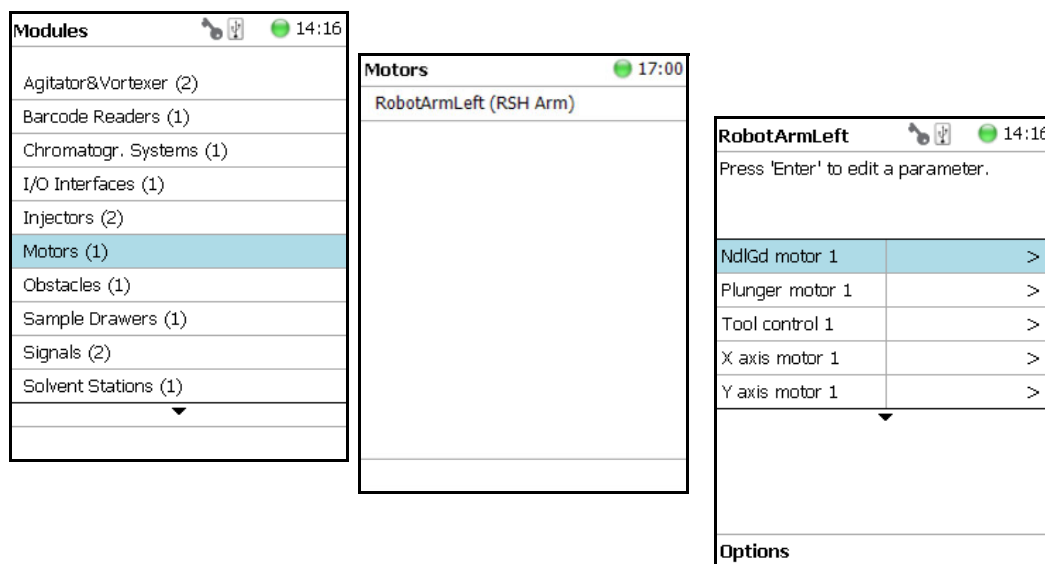
Table 62. OC Actuator Options Pull-up Menu

Item	Description
Reset to Default	Resets the selected module parameter to default value.
Check Teaching	Checks the teaching position of the module. This task serves as a quick check to determine if the X-, Y-, and Z-positions are defined correctly. If a teaching point is incorrect, return to the Menu Setup for readjustment of the teaching position. Please note that this action can be done only under the Extended User Level .
Teach Module	The positions of the X-, Y-, Z-axes can be defined again, (teaching).
Check OC Alignment	Verifies the Needle Penetration in the OC Injector.
Check OC Actuator	Verifies the opening and closing of the OC Actuator.

Motors

Upon selecting the list item **Motors**, the following parameters are available for modification. See [Figure 97](#).

Figure 97. Motors Menu



Press **Enter** to edit a parameter. See [Table 63](#).

Table 63. List of Motors (Sheet 1 of 2)

Item	Description
Needle Gd Motor (#) (Motor V)	Actual position — Reads only for information.
Plunger Motor (#) (Motor W)	Actual position — Reads only for information. Check Plunger — Checks the presence of the plunger.
Tool Control	Shows which Tool is assigned and whether it is attached to the head. See the section “Tools” on page 164 .
X Motor (#)	Actual position — Reads only for information. Total Axis Length — The length of the 850 mm or 1200 mm X-axis.
Y Motor (#)	Actual position — Reads only for information.
Z Motor (#)	Actual position — Reads only for information.
Acceleration Factor	Allows adjusting the acceleration of the motors. Note that a change of the Acceleration Factor does affect all the motors.

Table 63. List of Motors (Sheet 2 of 2)

Item	Description
Default Strategy	<p>Defines of the global movement of the TriPlus RSH SMART Head across the system platform. The following selections are possible:</p> <ul style="list-style-type: none"> • Parallel — Allows simultaneously movement of all axes. This is the default mode. When the TriPlus RSH SMART operates in this mode, the positions and heights of the known modules are respected. The TriPlus RSH SMART changes the strategy automatically to accommodate the existing modules. <i>For example:</i> if one module is higher than another, the TriPlus RSH SMART would lower the Z-axis to the zero position to allow the modules to cross over. If an external object is within the platform, for example a GC Detector, then the X-, Y-, and Z-positions of this potential obstacle are not known to the TriPlus RSH. In such a case, it is necessary to switch the strategy to Safe mode. • Safe — The Y-axis moves from any point first to zero Y (back to the X-axis) before the X-movement is started. This mode allows bypassing of an object (such as a large GC detector) that would be directly in the travel path if the Parallel mode is used.
Default Waste	<p>Selects the corresponding Wash Module installed.</p> <p>None: Important: A Waste Module must be defined; default value is None.</p> <p>The selection defines a Waste Positions of the Fast Wash Module, Large Wash Module, or Standard Wash Module.</p>

Motors Pull-up Menu Options

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 64](#).

Table 64. Option Pull-up Menu for Motors (Sheet 1 of 3)

Item	Description
Calibrate Motors	<p>Calibrates the motors. This task might be necessary after a motor has been disconnected. This is a recovery feature.</p> <p>For further details see “Service Menu” on page 221.</p>

Table 64. Option Pull-up Menu for Motors (Sheet 2 of 3)

Item	Description
Teach Home Position	Allows a Home Position of the head to be defined, which can be at any X-, Y-, or Z-position.
Home RSH Head	Moves the TriPlus RSH SMART Head to Home position and references all axes.
Disable RSH Head	All axes are electrically isolated, enabling the operator to move the axes manually.
Enable RSH Head	The axes (motors) are reconnected to mains again.
Move to Home	Moves the TriPlus RSH SMART Head back to Home position, without referencing the axes.
Select Tool Utility	Picks the Tool from the TR Station.
<i>Visible only when TR Station is installed</i>	
Purge Syringe	The gas purge valve, used for example for cleaning the headspace syringe, is manually activated. Can be used to check the functionality of the purge valve.
<i>Visible only when HS Tool or ITEX Tool is installed</i>	
ATC Tool	Provides the possibility to change a Tool on demand. If this task is activated, a window opens for the Tool; select the required Tool, and press Run . The RSH Head moves to an open Slot (starting with Slot1, if occupied it moves to Slot 2 or 3), ejects the Tool, and moves to the Slot where the required Tool is parked. The new Tool will be mounted, and the TriPlus RSH SMART will be ready for the next application.
<i>Visible only if ATC Station is installed</i>	
TR Tool	The installed Tool will be parked in the TR Station.
<i>Visible only if TR Station is installed.</i>	
Configure SPME Tool	Configures the SPME Tool with Fiber adjustments.
<i>Visible only if SPME Tool is installed.</i>	
Configure SPME Arrow Tool	Configures the SPME Arrow Tool with Fiber adjustments.
<i>Visible only if SPME Arrow Tool is installed.</i>	
Home Motor	Allows the Home position of the selected motor.
Enable Motor	Allows enabling the selected motor after it has been disabled.

Table 64. Option Pull-up Menu for Motors (Sheet 3 of 3)

Item	Description
Disable Motor	Allows disabling the selected motor to permit moving the corresponding axis manually.
Calibrate Tool	Allows calibrating the Tool installed in the head.
Check Tool Calibration	Allows checking the calibration point of the Tool installed in the head.
Select Tool	Allows selecting another Tool. The currently-attached Tool is first parked and the newly-required Tool is picked up.
Park Tool	Allows parking a Tool without picking up another Tool from the TR Station.
Reset to Default	Resets the selected module parameter to the default value.

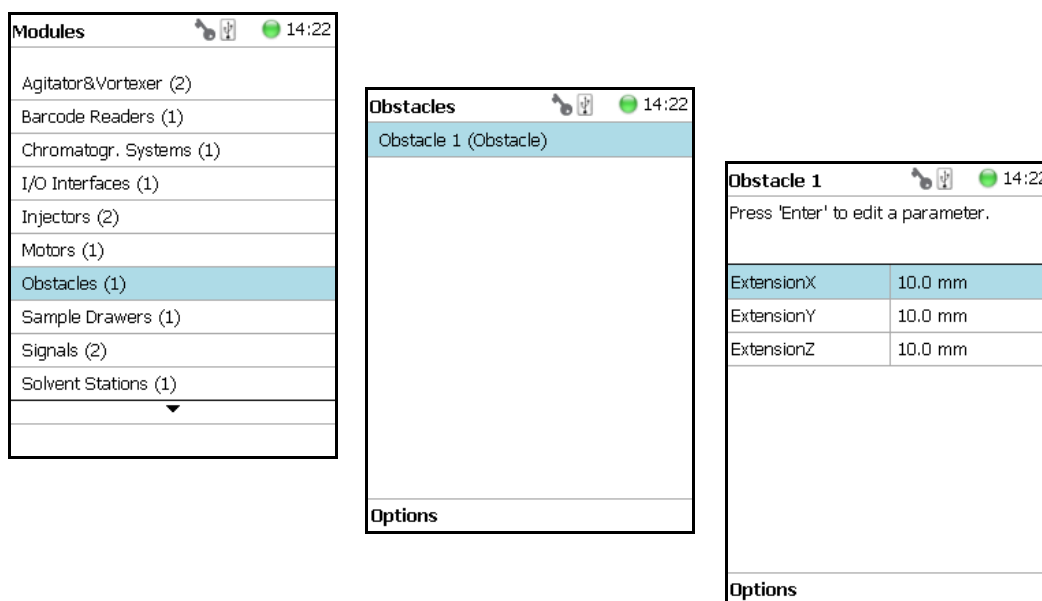
Obstacles

Obstacles is a module or detector that could get in the path way of the TriPlus RSH. The dimensions and the position of the Obstacle can be defined. The TriPlus RSH SMART will exclude this area from the allowed path way and will bypass it.

A **Teach Position** can be defined. It is thought for third-party modules that are not necessarily mounted on the X-Axis of the TriPlus RSH. Using this functionality, you can teach the position for the placement of a single vial.

Upon selecting the list item **Tools Station**, the following parameters are available for modification. See [Figure 98](#).

Figure 98. Obstacle - Selection and Parameters



Press **Enter** to edit a parameter. See [Table 65](#).

Table 65. Obstacle Parameters

Item	Description
Extension X	Extension from the center point of the Obstacle in X-axis direction.
Extension Y	Extension from the center point of the Obstacle in Y-axis direction.
Extension Z	Extension from the center point of the Obstacle in Z-axis direction.

Obstacle Options Pull-up Menu

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 66](#).

Table 66. Obstacle Option Parameters

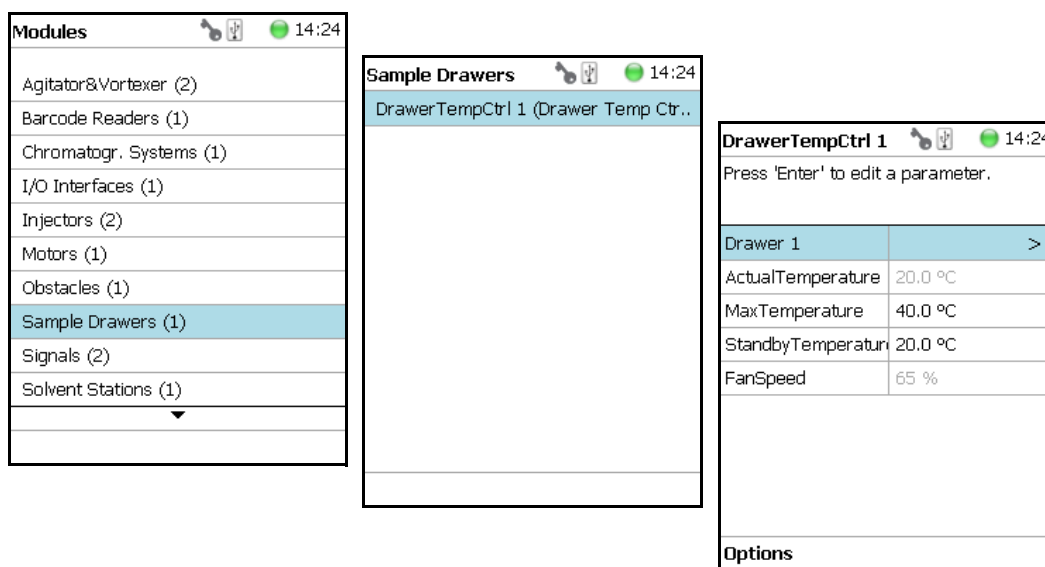
Item	Description
New Obstacle	Creates a new obstacle.
Copy Obstacle	Copies the present obstacle.
Delete Obstacle	Deletes the present obstacle.
Reset to Default	Resets the selected module parameter to default value.
Check Teaching	Checks the teaching position of the module. This task serves as a quick check to determine if the X-, Y-, and Z-positions are defined correctly. If a teaching point is incorrect, return to the Menu Setup for readjustment of the teaching position. Please note that this action can be done only under the Extended User Level .
Teach Module	The positions of the X-, Y-, and Z-axes can be defined for teaching.

Sample Drawers (Temperature Controlled Drawer)

Note The Temperature Controlled Drawer can be adjusted through the BUS protocol. For the power supply it is mandatory to use a second Power Module. Do not use the same power supply as used for the TriPlus RSH.

Selecting the list item **Sample Drawers**, the following parameters are available for modification. See [Figure 99](#).

Figure 99. Menu Item Temperature Controlled Drawer and Menu List Item



Press **Enter** to edit a parameter. See [Table 67](#).

Table 67. Temperature Controlled Drawer Module Parameters (Sheet 1 of 3)

Item	Description
Drawer #	This parameter is for information only. The status of the drawer can be checked in Drawer Status .
Actual Temperature	This parameter is for information only.
Max Temperature	The maximum temperature which can be set is 40 °C, but this parameter is often defined by your specific needs.
Min Temperature	Sets the minimum temperature.
Standby Temperature	The Standby Temperature can be adjusted according to the application's requirements. Setting the Standby Temperature using this function, the newly-selected temperature is not immediately active. To activate it, go to the Options pull-up menu and select Set Standby Temperature . The Standby Temperature is activated when the TriPlus RSH SMART is powered up.

Table 67. Temperature Controlled Drawer Module Parameters (Sheet 2 of 3)

Item	Description
Standby Temperature (Continued)	In routine use, the Standby Temperature is usually activated after a job has been terminated. The Standby Temperature is typically around ambient temperature; this helps to dry out the internal parts of a Temperature Controlled Drawer eliminating condensation.
Temp Setpoint	Shows the actual target temperature. Read-only.
CloseSpeed	The speed for closing the drawer can be adapted to a value between 15 and 100%. The default value is 80%.
OpenSpeed	The speed for opening the drawer can be adapted to a value between 15 and 100%. The default value is 80%.
Fan Speed	Shows read-only information, and can be used for diagnostic purposes.
Stdby Temp Control	If switched off, the module will not go to standby temperature if idle.
Temp. Gain	The coefficient used, if a temperature calibration has been performed. Possible values are between 0 and 2. Read-only.
Temp. Offset	The Offset temperature used, if a temperature calibration has been performed. Possible values are between -10 °C and +10 °C. Read-only.
In the field Drawer#	<ul style="list-style-type: none"> • Slot1 to Slot2 — Defines the position of the Tray. • Drawer Status — Displays the status of the Drawer position. The following positions are possible: <ul style="list-style-type: none"> – Closed – Opened <p>Status Opening indicates an error. Readout functions only.</p> • Slot Count — Indicates the total number of Slots available in the Temperature Controlled Drawer Module. • Magnet Location — It is possible to use either the magnet plate on the right-hand side or the magnet plate on the left-hand side of the drawer for opening and closing. The actual setting is displayed.

Table 67. Temperature Controlled Drawer Module Parameters (Sheet 3 of 3)

Item	Description
In the field Tray (Tray or Well Plate)	<ul style="list-style-type: none"> • Cap Type — This is a read-only parameter. The parameter can be in the class Vial Type. • Tray Type — Defines the pattern and sampling sequences of sample locations within a Tray. • Well Plate Type — Defines the pattern and sampling sequences of sample locations within a Well Plate. • Vial Type — Defines the Vial specifications.

Temperature Controlled Drawer Option Pull-up Menu

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 68](#).

Table 68. Option Pull-up Menu for Temperature Controlled Drawer

Item	Description
Check Teaching	Checks the teaching position of the module. This task serves as a quick check to determine if the X-, Y-, and Z-positions are defined correctly. If a teaching point is off, return to the Menu Setup for readjustment of the teaching position. Please note that this action can be done only under the Extended User Level .
Teach module	The positions of the X-, Y-, and Z-axes can be defined again, teaching.
Use magnet plates on left-hand / right-hand side	Determines which magnet plate on the left-hand side or on the right-hand side shall be used for opening and closing the drawer.
Activate Standby Temperature	This task activates the newly-set Standby Temperature.
New Tray Adapter	Allows creating a new Tray Adapter
New Rack	Allows creating a new Tray
New Well Plate	Allows creating a new Well Plate
Delete Tray Type	Allows deleting the present Tray Type.
Adjust Needle Penetration	Allows adjusting the Needle Penetration Depths in the vial. Manually turn the needle as far down in the vial as required. The cut-out in the Tray Holder frame as well as in the Rack allows visual control of the needle tip.
<p>Note The value found is not stored automatically. This task allows for a check only. If the needle penetration should be changed, select the Rack Type to enter the newly-established Needle Penetration value.</p>	

Tool Stations

The following stations are actively supported:

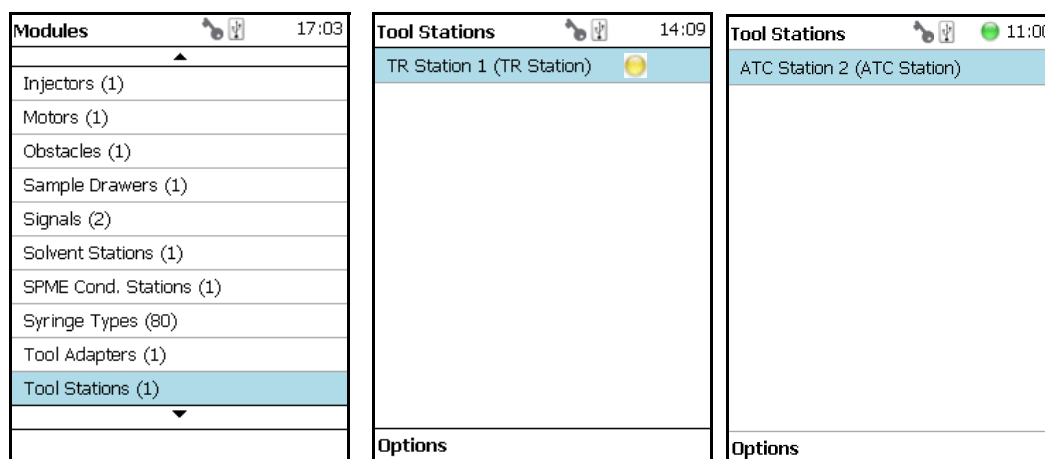
- **TR Station** — Passive module with single slot for a single Tool. See the section “[TR Station](#)” on [page 146](#).

Note TR Station is not supported in combination with the RSH Firmware version 1.5.0 or higher.

- **ATC Station** — Active module with three slots for three Tools. See the section “[ATC Station](#)” on [page 147](#).

Selecting the list item **Tool Station**, the following parameters are available for modification. Press **Enter** to edit a parameter. See [Figure 100](#)

Figure 100. Menu Item Tool Stations and Menu List Items for Tool Stations



TR Station

Selecting the item **TR Station**, the following parameters are available for modification. See [Table 69](#).

Table 69. List Item of TR Station

Item	Description
Slot1	Slot available for Tool.
TR Slot Index	For information only.

TR Station Pull-up Menu Options

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 70](#).

Table 70. Pull-up Menu Options for TR Station

Item	Description
New TR Station	Creates a new TR Station.
Copy TR Station1	Copies the present TR Station.
Delete TR Station	Deletes the present TR Station.
Teach Module	The positions of the X-, Y-, and Z-axes can be defined, for teaching.
Check Teaching	Checks the teaching position of the module. This task serves as a quick check to determine if the X-, Y-, and Z-positions are defined correctly. If a teaching point is off, return to the Menu 'Setup' for readjustment of the teaching position. Please note that this action can be done under only the Extended User Level .
Pick Tool	Picks the Tool up from the TR Station.
Park Tool	Parks the Tool in the TR Station.

ATC Station

Selecting the list item **ATC Station**, the following parameters are available for modification. See [Table 71](#).

Table 71. ATC Station Parameters (Sheet 1 of 2)

Item	Description
Slot1 to Slot3	A slot can be selected to see which Tool has been assigned to this particular slot.
Tool EEPROM Access	Disabling the EEPROM Access, the Tool from the ATC Station will be electrically isolate. This is a protective measure when the TriPlus RSH SMART Head positions the Tool in the ATC Station. For automation, Tool change or Tool calibration, the automatic disabling and enabling of EEPROM Access is built into the wizards. However, when working with the Virtual Handheld Controller, the closure of its window before a task is finished might cause the ATC Station to remain disabled. This feature gives the operator the possibility to manually control the ATC Station.
ATC Slot Index	For information only.

Table 71. ATC Station Parameters (Sheet 2 of 2)

Item	Description
Tool Present	Indicates if the Tool is parked in the Slot or not. If not present, the Tool is either mounted in the TriPlus RSH SMART Head or not recognized by the system.
Fiber Protection	This parameter allows defining the Slot Position for the SPME Tool.

Options Pull-up Menu for ATC Station

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 72](#).

Table 72. Option Pull Menu for ATC Station

Item	Description
Check Teaching	Checks the teaching position of the module. This task serves as a quick check to determine if the X-, Y-, and Z-positions are defined correctly. If a teaching point is off, return to the Menu Setup for the re-adjustment of the teaching position. Please note that this action can be done only under the Extended User Level .
Teach Module	The positions of the X-, Y-, and Z-axes can be defined for teaching.
ResetEeprom	In the case of a broken communication to the ATC Station, this parameter re-establishes the communication on the running system, without shutting down the entire TriPlus RSH SMART system.
Park Tool	Allows parking a Tool in a slot without picking up another Tool.

Signals

Note Synchronization signals are inputs that tell the TriPlus RSH SMART when to wait or to proceed with a sample-processing step. Output signals are sent from the system to external devices to indicate the status or completion of particular processing steps.

❖ How to set-up the synchronization signals from the TriPlus RSH SMART to an external device

The synchronization signals must be set step-by step.

1. The first step is assigning an **Input Signal** and an **Output Signal**. The next step is to establish what type of contact is required to receive or send a TTL signal.

It could be **Transistor-Transistor Logic (TTL)**, a **relays contact**, an **Opto-coupler**, or another type. Add the required parameters such as **Pulse Duration** and **Blocking Time**. This section provides informations for copying the default signals, and adding for example a second output signal if required.

An output signal is required to send a start signal to an external device. Typically the Switch Out Signal1 (**SWOut1**) is used.

A second output signal, named **Destination Aux**, can be used for cases where one command is sent to two different GC which must be started at the same time. A Y-shape synchronization cable is required for connecting the TriPlus RSH SMART to the two GC units. One signal used could be **SWOut1** and the second signal would be **SWOut2**. The assigned signals have to be matched with the pin allocation of the synchronization cable.

2. The second step is to synchronize the signal parameters with the GC. This step is made in the section “**I/O Interfaces**” on [page 130](#).

The **Ready** signal from the GC is usually sent to the system, and a **TTL-In** signal is used to receive the **Ready** signal. Depending on the GC manufacturer settings, the signal is set to **active high** or **active low**.

3. The third step is to bundle the required Input and Output Signals for a specific chromatographic system. This bundle can be configured once and tested in the combination of the TriPlus RSH SMART and the other device. This bundling is described in the section “**Chromatograph Systems**” on [page 119](#) as the last step in setting up signals.

Selecting the list item **Signals**, the following parameters are available for modification. See [Figure 101](#).

Figure 101. Menu List Item Signals and List Items Input and Output Signals

Modules 14:27	Signals 17:00
Agitator&Vortexer (2)	GCReady1 (Input Signal)
Barcode Readers (1)	GCReady2 (Input Signal)
Chromatogr. Systems (1)	Injected1 (Output Signal)
I/O Interfaces (1)	Injected2 (Output Signal)
Injectors (2)	
Motors (1)	
Obstacles (1)	
Sample Drawers (1)	
Signals (2)	
Solvent Stations (1)	

Press **Enter** to edit a parameter. See [Table 73](#) and [Table 74](#).

Table 73. Input Signal Parameters

Items	Description
Input Signal	Selects the required Input Signal. A TTL-In contact is typically used for the Ready Signal.
Signal On	Indicates the signal has been received. A crossed-out box means that a signal has been received.
Blocking Time	Used to program a time delay after receiving the signal (usually the Ready Signal from an external device).
Source	Selects the required Input Signal for synchronization with an external device. Usually a TTL-In contact is used to receive the Ready Signal from an external device.

Table 74. Output Signal Parameters (Sheet 1 of 2)

Item	Description
Output Signal	Selects the required Output Signal
Signal On	Indicates if the signal has been received. A crossed-out box means that a signal has been received.
Destination	Selects the required Output signal for the synchronization with an external device. Usually a switch out signal (SW Out) contact is used to send the Start Signal to an external device.

Table 74. Output Signal Parameters (Sheet 2 of 2)

Item	Description
Destination Aux	Used for cases where one command is sent to two different GC which must be started at the same time.
Pulse Duration	Selects the time how long the signal is sent.

Signals Option Pull-up Menu

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 75](#).

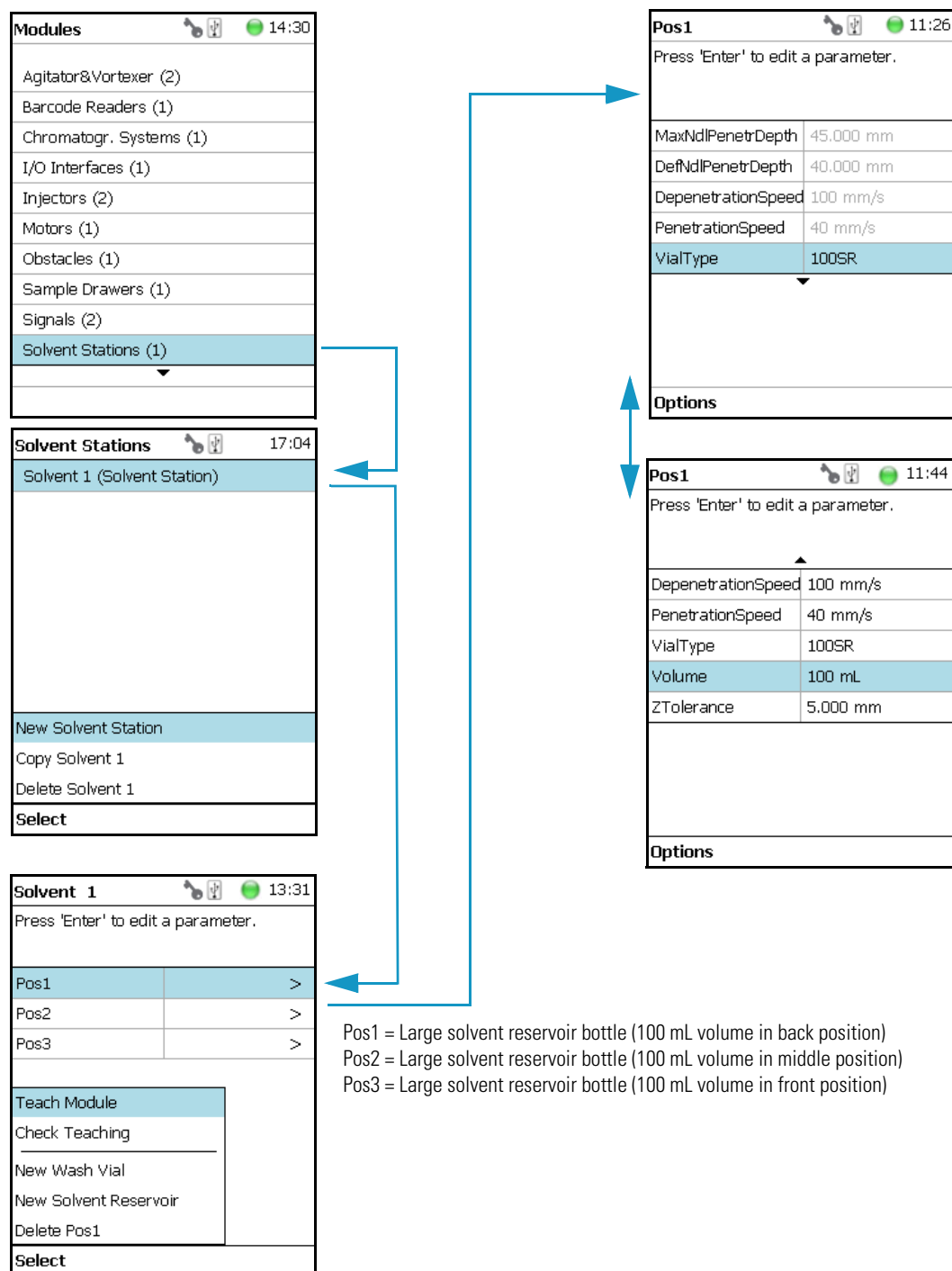
Table 75. Option Pull-up Menu for Signals

Item	Description
New Signal	<p>Creates a new Input or Output Signal. A dialog window opens allowing you to assign a unique name to the new signal. When finished, press New and the entire class with the corresponding parameters is copied over.</p> <p>Select the required contact, such as a TTL-In or a SW Out using the parameter Source.</p> <p>The signal name does not require to be in a consecutive order for example, Input Signal 2, it can also be a specifically-named signal such as Inject or Start. Some cycles require a specifically-named signal. Check the cycle description for specific names.</p>
Copy Input Signal	An Input Signal can be copied with this task. The task functions in a similar manner as described above with New Signal .
Copy Output Signal	Copies an Output Signal. The task functions in a similar manner as described above with New Signal .
Delete Input Signal	Deletes an Input Signal which is no longer required for the system configuration in combination with an external device.
Delete Output Signal	Deletes an Output Signal which is no longer required for the system configuration in combination with an external device.
Set Signal	Activates the selected signal for the time set with the parameter Duration . Since the Duration time is usually short, a status change in the parameter Signal ON is not visible.
Reset to Default	Resets the selected module parameters to default value.

Solvent Stations

Selecting the list item **Solvent Stations** opens up the following parameters. See [Figure 102](#).

Figure 102. Menu Items for Solvent Stations and Menu Item Large Solvent Station



Selecting one of the positions allows to access following parameters. See [Table 76](#).

Table 76. Solvent Station Parameters

Item	Description
Max Needle Penetration Depth	The maximum allowed Needle Penetration can be defined as a safety measure so that you cannot destroy the needle tip by going too far down. The maximum needle penetration must not exceed the length of the syringe needle, considering the loss of approximately 12 mm due to the needle guide, and so on. For a typical needle length of 57 mm or 85 mm for the long needle, the maximum penetration depth must not exceed 45 mm or 73 mm.
Default Needle Penetration Depth	The default value of the syringe needle penetration depth in the reservoir vial is set by this parameter.
Depenetration Speed	Selects the required speed for pulling the syringe needle out of the reservoir vial.
Diameter	Defines the diameter of the solvent reservoir.
Height	Defines the height of the solvent reservoir.
Penetration Speed	Sets the syringe needle penetration speed. It is recommended to use the default value first. Changing this parameter in one or the other direction might lead to needle bending.
Vial Type	Selects a predefined Vial Type.
Volume	Defines the volume of the reservoir container.
Z-Tolerance	A tolerance window to give a plus/minus range (expressed in mm) where the Head must expect an object. <ul style="list-style-type: none"> • If the value is set > 0, indicates a relative detection mode, and the sensor from the Head needle guide is active. • If the value is set to 0, the Needle Guide Motor detection current is turned off and the syringe slider moves to an absolute value, the Z-axis position as specified by the object.

Solvent Station Options Pull-up Menu

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 77](#).




Table 77. Solvent Station Options Parameters

Item	Description
New Solvent Station Description	Creates a new Solvent Station.
Copy Solvent Station 1	Copies the present Solvent Station.
Delete Solvent Station 1	Delete the present Solvent Station.
Check Teaching	Checks the teaching position of the module. This task serves as a quick check to determine if the X-, Y-, and Z-positions are defined correctly. a teaching point is incorrect, return to the Menu Setup for readjustment of the teaching position. Please note that this action can be done only under the Extended User Level .
Teach Module	Resets the selected module parameter to default value.

SPME Conditioning Station

Upon selecting the list item **SPME Conditioning Station**, the following parameters are available for modification. See [Figure 103](#).

Figure 103. Menu Item and List Items for SPME Conditioning Station

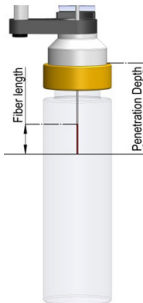
Modules   14:32	Modules  18:32
▲	▲
Signals (2)	Solvent Stations (0)
Solvent Stations (1)	SPME Cond. Stations (0)
SPME Cond. Stations (1)	Tool Adapter Stations (0)
Syringe Types (81)	Tool Stations (0)
Tool Adapters (1)	Tray Container Types (0)
Tool Stations (1)	Tray Slot Types (0)
Tools (3)	Tray Slots (0)
Tray Holders (3)	Trays (0)
Tray Types (9)	Valve Drives (0)
Vial Types (8)	Vials (0)
▼	

Select **SPME Cond Station** then press **Enter** to edit a parameter. See [Table 78](#).

Table 78. SPME Conditioning Station Parameters (Sheet 1 of 2)

Item	Description
Actual Temperature	Reads out the actual temperature of the module; read-only function.
Max Temperature	Sets the upper temperature limit. The Maximum Temperature which can be set is 350 °C, but this parameter is often defined by the specific needs for the application.
Min Temperature	Sets the lower temperature limit.
Standby Temperature	The Standby Temperature can be adjusted according to the application's requirements. Setting the Standby Temperature using this function, the newly-selected temperature is not immediately active. To activate it, go to the Options pull-up menu and select Set Standby Temperature . The Standby Temperature is activated when the TriPlus RSH SMART is powered up. In routine use, the Standby Temperature is activated after a job has been terminated. The Standby Temperature is typically lower than the application temperature.
Temp Setpoint	Shows the actual target temperature. Read-only.

Table 78. SPME Conditioning Station Parameters (Sheet 2 of 2)

Item	Description
Default Needle Penetration Depth	Defines the penetration depth of the SPME Needle in the module. The value reflects the total length including the length of the fiber. 
Max Needle Penetration Depth	Upper limit of penetration depth of the SPME needle in the module. The value reflects the total length including the length of the fiber.
Stdby Temp Control	If switched off, the station will not go to standby temperature if idle.
Temp. Gain	The coefficient used, if a temperature calibration has been performed. Possible values are between 0 and 2. Read-only.
Temp.Offset	The Offset temperature used, if a temperature calibration has been performed. Possible values are between -10 °C and +10 °C. Read-only.

SPME Conditioning Station Options Pull-up Menu

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 79](#).

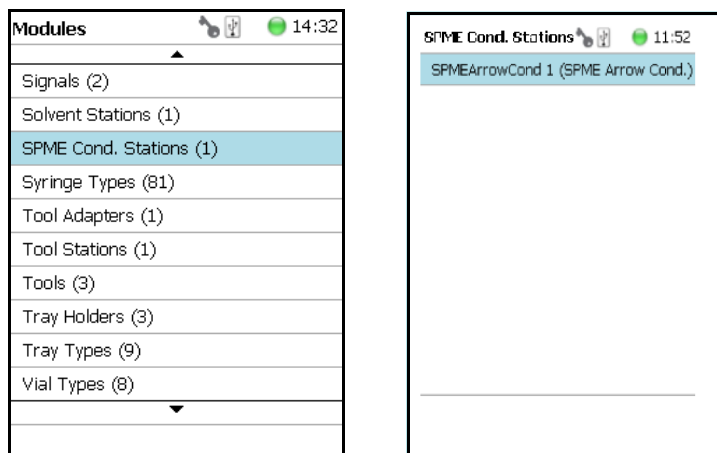
Table 79. Option Pull-up Menu for SPME Conditioning Station

Item	Description
Reset to Default	Sets the value for the selected item back to the default value.
Check Teaching	Checks the teaching position of the module. This task serves as a quick check to determine if the X-, Y-, and Z-positions are defined correctly. If a teaching point is off, return to the Menu Setup for readjustment of the teaching position. Please note that this action can be done only under the Extended User Level .
Teach Module	The positions of the X-, Y-, and Z-axes can be defined again, teaching.
Activate Standby Temperature	Activates the newly-set Standby Temperature.

SPME Arrow Conditioning Station

Upon selecting the list item **SPME Arrow Conditioning Station**, the following parameters are available for modification. See [Figure 104](#).

Figure 104. Menu Item and List Items for SPME Arrow Conditioning Station



Select **SPME Arrow Cond** then press **Enter** to edit a parameter. See [Table 77](#).

Table 80. SPME Arrow Conditioning Station Parameters (Sheet 1 of 2)

Item	Description
Actual Temp	Reads out the actual temperature of the module; read-only function.
Gas Valve	Shows if the gas valve is actually open, or closed.
Max Temperature	Sets the upper temperature limit. The Maximum Temperature which can be set is 350 °C, but this parameter is often defined by the specific needs for the application.
Min Temperature	Sets the lower temperature limit.
Stdby Temp Control	If switched off, the module will not go to standby temperature if idle.
Standby Temperature	<p>The Standby Temperature can be adjusted according to the application's requirements. Setting the Standby Temperature using this function, the newly-selected temperature is not immediately active. To activate it, go to the Options pull-up menu and select Set Standby Temperature.</p> <p>The Standby Temperature is activated when the TriPlus RSH SMART is powered up. In routine use, the Standby Temperature is activated after a job has been terminated. The Standby Temperature is typically lower than the application temperature.</p>

Table 80. SPME Arrow Conditioning Station Parameters (Sheet 2 of 2)

Item	Description
Temp Setpoint	Shows the actual target temperature. Read-only.
Def Ndl Penetr Depth	Defines the penetration depth of the SPME Arrow fiber in the module.
Max Ndl Penetr Depth	Upper limit of penetration depth of the SPME Arrow fiber in the module.
Temp. Gain	The coefficient used if a temperature calibration has been performed. Possible values are between 0 and 2. Read-only.
Temp.Offset	The Offset temperature used if a temperature calibration has been performed. Possible values are between -10 °C and +10 °C. Read-only.

SPME Arrow Conditioning Station Options Pull-up Menu

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 81](#).

Table 81. Option Pull-up Menu for SPME Arrow Conditioning Station

Item	Description
Reset to Default	Sets the value for the selected item back to the default value.
Check Teaching	Checks the teaching position of the module. This task serves as a quick check to determine if the X-, Y-, and Z-positions are defined correctly. If a teaching point is off, return to the Menu Setup for readjustment of the teaching position. Please note that this action can be done under the Extended User Level but not under User Level .
Teach Module	The positions of the X-, Y-, and Z-axes can be defined again, teaching.
Activate Standby Temperature	Activates the newly-set Standby Temperature.
Open gas valve for 5 minutes	Opens the gas valve for flushing the back conditioning chamber.
Close gas valve	Closes the gas valve.

Syringe Types

Syringe Type defines the syringe. Selecting the list item **Syringe Type**, the following parameters are available for modification. See [Figure 105](#).

Figure 105. Menu List Item Syringe Types and List Items Syringe Types

Modules	17:18
Solvent Stations (1)	
SPME Cond. Stations (1)	
Syringe Types (80)	
Tool Adapters (1)	
Tool Stations (1)	
Tools (1)	
Tray Types (6)	
Vial Types (8)	
Vials (2)	
Wash Stations (2)	

Syringe Types	17:01
365D0291-SM (LS D7mm; NL57mm)	
36SA10A1-SM (SPME Arrow)	
HS-2.5 mL (HS Syringe 2.5mL)	
SF100-57-T-26S-CO (LS D7mm; NL57)	
SITEX-1300-T-41-23-SP (ITEX Syrin..)	
SYDIL21834-100uL (Dilutor Syringe)	
SYDIL21835-1mL (Dilutor Syringe)	
SYDIL21836-5mL (Dilutor Syringe)	
SYDIL21837-10mL (Dilutor Syringe)	

Press **Enter** to edit a parameter.

Selecting a syringe, for example a 10 μ L Liquid Syringe, opens all the necessary parameters to define the syringe in geometry, and to define default values for an optimized use. See [Table 82](#).

Note that the same parameters are used for both a liquid syringe and a headspace syringe. The SPME technique requires additional parameters.

Table 82. List of Syringe Types Parameters (Sheet 1 of 2)

Item	Description
Bottom Sense	When this function is enabled, the needle goes down to the bottom of the internal standard vial. See the section “ Bottom Sense Parameter — Criteria for Syringe Needle ” on page 160 .
Def Aspirate	Specifies the default aspirate flow rate in μ L/s.
Def Aspirate Acc	Specifies the default aspirate acceleration in μ L/s*s.
Def Aspirate Delay	Specifies the default aspirate delay time after the end of the aspiration.
Def Dispense	Specifies the default dispense flow rate in μ L/s.
Def Dispense Acc	Specifies the default dispense acceleration in μ L/s*s.
Def Dispense Delay	Specifies the default dispense delay after the end of the dispense.

Table 82. List of Syringe Types Parameters (Sheet 2 of 2)

Item	Description
Def Fill Strokes Asp	Specifies the default fill strokes aspiration flow rate in $\mu\text{L/s}$.
Def Fill Strokes Disp	Specifies the default fill strokes dispense flow rate in $\mu\text{L/s}$.
Def Fill Strokes Count	Specifies the default number of syringe plunger strokes from the same vial, to have a homogeneous phase between the headspace gas in the vial and the sample in the syringe.
Def Fill Strokes Vol	Specifies the default fill strokes volume in μL .
Def Pen Vel	Specifies the default penetration velocity in mm/s .
Max Aspirate	Maximum Aspirate Flow Rat in $\mu\text{L/s}$.
Max Dispense	Specifies the maximum dispense flow rate in $\mu\text{L/s}$.
Max Fill Strokes Asp	Specifies the maximum fill strokes aspirate flow rate in $\mu\text{L/s}$.
Max Fill Strokes Disp	Specifies the maximum fill strokes dispense flow rate in $\mu\text{L/s}$.
Max Pen Depth	Specifies the maximum penetration depth in mm .
Max Pen Force	Specifies the maximum penetration force in N .
Max Pen Vel	Specifies the maximum penetration speed in mm/s .
Needle Gauge	Specifies the syringe suppliers specific.
Needle Inner Dia	Specifies the internal diameter of the syringe needle in mm .
Needle Length	Specifies the length of the syringe needle in mm .
Needle Out Dia	Specifies the external diameter of the syringe needle in mm .
Plunger Type	Specifies the syringe suppliers specific.
Point Style	Specifies the syringe suppliers specific.
Scale Length	Specifies the length of the scale in mm
Syringe Volume	Specifies the volume of the syringe in μL .
Gas Inlet Pos	Specifies the position in mm of the gas inlet. HS Tool only.
Fiber Length	Specifies the length in mm of the SPME fiber.
Fiber Type	Specifies the type of the SPME fiber. SPME Tool only.

Bottom Sense Parameter — Criteria for Syringe Needle

In order to use the parameter **Bottom Sense** successfully, consider the following points:

- For successful bottom detection, the syringe needle must be intact (not bent from previous use).

- The needle length does not exceed 65 mm. If longer needles are used, for example 80 mm in length, then the needle gauge 26 and 26S (outer needle diameter 0.47 mm) is too thin to withstand the touchdown pressure.
The needle gauge has to be changed to 23 or 23S (outer needle diameter 0.63 mm).

Syringe Types Options Pull-up Menu

The Pull-up Menu allows to:

- create a new Syringe Type definition based on a template (**New Syringe Type**)
- make a copy of an existing Syringe Type definition
- export a Syringe Type definition to the USB stick

Note All predefined Syringe Type definitions are write-protected and cannot be deleted. The corresponding parameters can only be viewed, but not adapted. Copied or new created Syringe Types can be adapted and also deleted.

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 83](#).

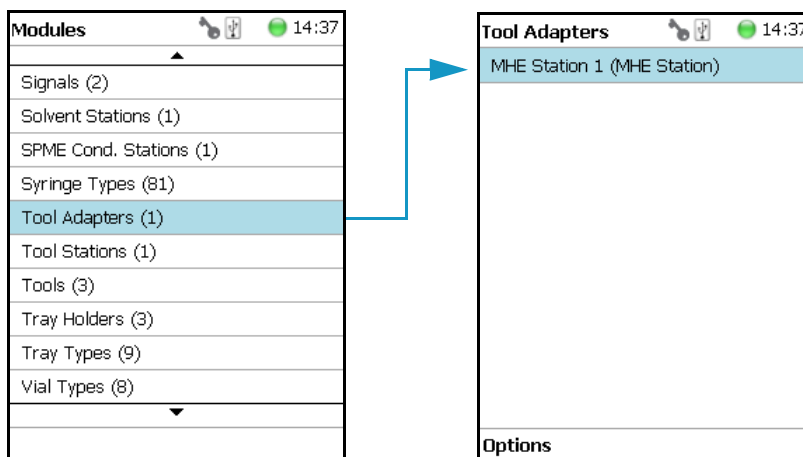
Table 83. Option Pull-up Menu for Syringe Types

Item	Description
New Syringe Type	Creates a new Syringe Type template.
Copy Syringe Type	Copies the present Syringe Type template.
Export Syringe Type	Exports the present Syringe Type template to a USB stick.
Export All	Exports all Syringe Type templates at once to a USB stick.
Delete Syringe Type	Deletes the present Syringe Type template.

Tool Adapters

Selecting the list item **Tool Adapters**, the following parameters are available for modification. See [Figure 106](#).

Figure 106. Menu Item Tool Adapter and List Item MHE Station



Selecting the list item **Tool Adapters** opens the dialog window for **MHE Station**.

Press **Enter** to edit a parameter. See [Table 84](#).

Table 84. MHE Station Adapter Parameters

Item	Description
Z-Tolerance	<p>A tolerance window to give a plus/minus range (expressed in mm) where the Head must expect an object.</p> <p>If the value of this item is > 0, this indicates a relative detection mode, and the sensor from the Head needle guide is active.</p> <p>If the value of this item is set to 0 the Needle Guide Motor detection current is turned off and the syringe slider moves to an absolute value, the Z-axis position as specified by the object.</p>

Tool Adapter Options Pull-up Menu

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 85](#).

Table 85. Options Pull-up Menu for Tool Adapter Options (Sheet 1 of 2)

Item	Description
New MHE Station	Creates a new MHE Station.
Copy MHE Station	Copies the present MHE Station.

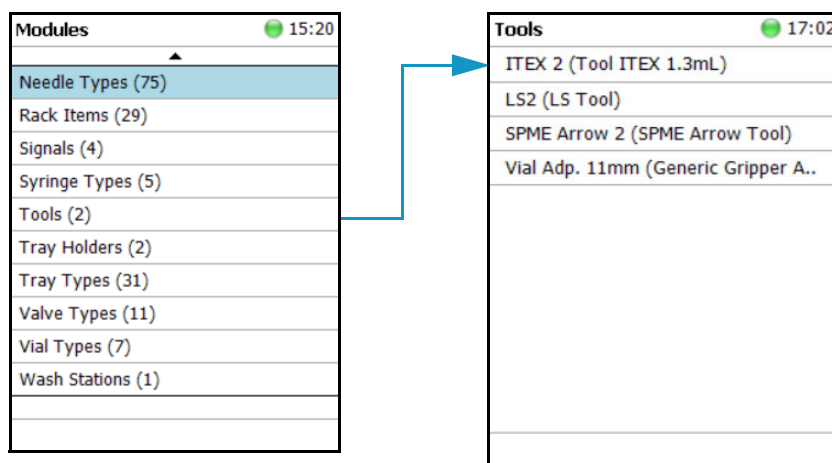
Table 85. Options Pull-up Menu for Tool Adapter Options (Sheet 2 of 2)

Item	Description
Delete MHE Station	Deletes of the present. MHE Station.
Check Teaching	Checks the teaching position of the station. This task serves as a quick check to determine if the X-, Y-, and Z-positions are defined correctly. If a teaching point is incorrect, return to the Menu Setup for readjustment of the teaching position. Please note that this action can be done only under the Extended User Level .
Teach Module	The positions of the X-, Y-, and Z-axes can be defined again, (teaching).
Reset to Default	Resets the selected module parameter to default value.

Tools

In the class Tools, the various Tool Types are defined. Selecting the list item **Tools**, the following parameters are available for modification. See [Figure 107](#).

Figure 107. Tools Menu List Items



- [Figure 108](#) shows the Syringe Type selection for HS, LS, and SPME Tools.
- [Figure 109](#) shows the Syringe Type selection for ITEX DHS Tool.

Figure 108. Syringe Type Selection for HS, LS, and SPME Tools

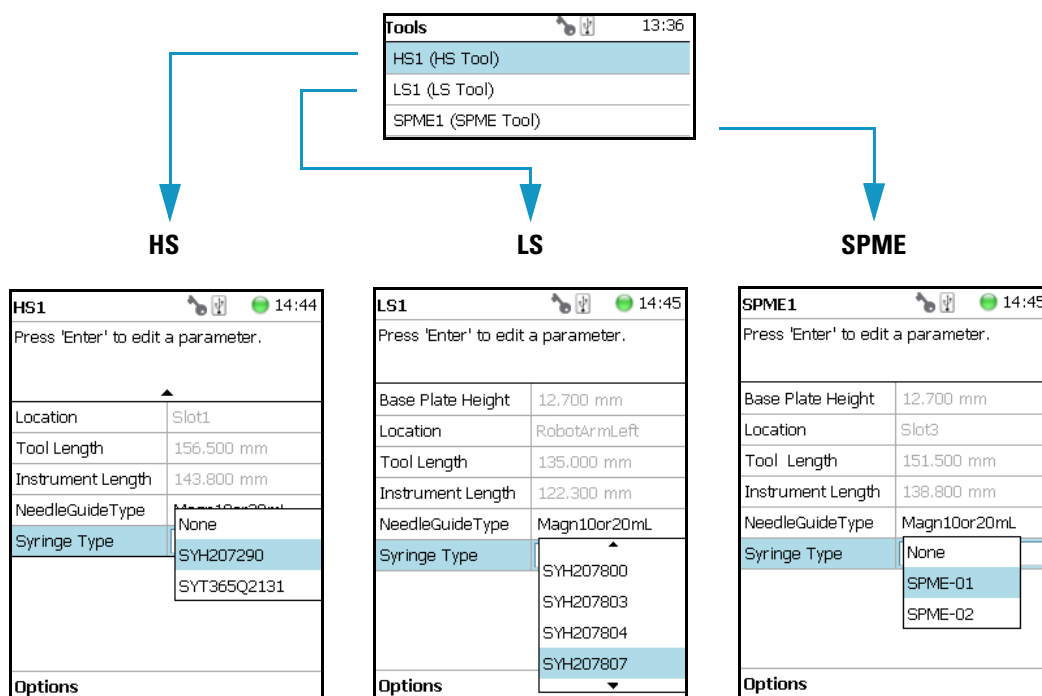
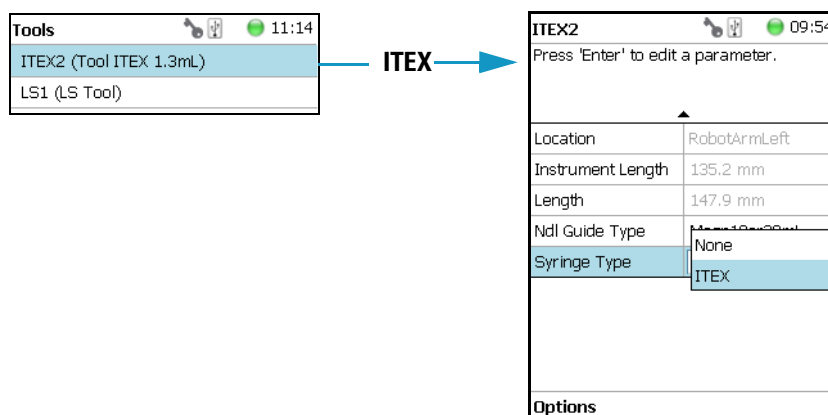


Figure 109. Syringe Type Selection for ITEX DHS Tool

Press **Enter** to edit a parameter. See [Table 86](#).

Table 86. List Item Parameters for HS, LS, SPME, and ITEX DHS Tools (Sheet 1 of 5)

Item	Description
Parameters for HS Tool	
Syringe Heater	<p>This menu list item is specific for the HS Tool. Selecting the item opens the parameters for:</p> <ul style="list-style-type: none"> • Actual Temperature — Reads out the actual temperature of the syringe; read-only function. • Max Temperature — Sets the upper temperature limit. The Maximum Temperature which can be set is 200 °C, but this parameter is often defined by the specific needs for the application. • Min Temperature — Sets the lower temperature limit. The Minimum Temperature which can be set is 40 °C. • Standby Temperature — The Standby Temperature can be adjusted according to the application's requirements. Setting the Standby Temperature using this function, the newly-selected temperature is not immediately active. To activate it, go to the Options pull-up menu and select Set Standby Temperature. <p>The Standby Temperature is activated when the TriPlus RSH SMART is powered up. In routine use, the Standby Temperature is activated after a job has been terminated. The Standby Temperature is typically lower than the application temperature.</p>

Table 86. List Item Parameters for HS, LS, SPME, and ITEX DHS Tools (Sheet 2 of 5)

Item	Description
Syringe Heater (Continued)	<ul style="list-style-type: none"> • Temp Setpoint — Read out the setpoint of the temperature. • Stdbby Temp Control — If switched off, the module will not go to standby temperature if idle. • Temp Gain — The coefficient used, if a temperature calibration has been performed. Possible values are between 0 and 2. Read-only. • Temp. Offset — The Offset temperature used, if a temperature calibration has been performed. Possible values are between -10 °C and +10 °C. Read-only.
Location	Location (Slot Position) where the specific Tool is parked.
Length	Defines total length of the Tool. Read-only function.
Instrument Length	Defines total length of the syringe (instrument). Read-only function.
Needle Guide Type	<p>Defines if an adapter, such as the magnetic ring or the foil cutter, is connected to the Needle Guide.</p> <p>Important: The Needle Guide Type has to be defined, default value is Not Specified. See “Installation Item” on page 223.</p>
Syringe Type	All syringes with the same geometry (barrel diameter, needle length) and corresponding syringe type to the Tool are filtered by the software and are selectable for use.
Parameters for ITEX DHS Tool	
Syringe Heater	<p>This menu list item is specific for the ITEX DHS Tool. Selecting the item opens the parameters for:</p> <ul style="list-style-type: none"> • Actual Temperature — Reads out the actual temperature of the syringe; read-only function. • Max Temperature — Sets the upper temperature limit. The Maximum Temperature which can be set is 150 °C. • Min Temperature — Sets the lower temperature limit. The Minimum Temperature which can be set is 40 °C.

Table 86. List Item Parameters for HS, LS, SPME, and ITEX DHS Tools (Sheet 3 of 5)

Item	Description
Syringe Heater (Continued)	<ul style="list-style-type: none"> The Standby Temperature can be adjusted according to the application's requirements. Setting the Standby Temperature using this function, the newly-selected temperature is not immediately active. To activate it, go to the Options pull-up menu and select Set Standby Temperature. <p>The Standby Temperature is activated when the TriPlus RSH SMART is powered up. In routine use, the Standby Temperature is activated after a job has been terminated. The Standby Temperature is typically lower than the application temperature.</p> <ul style="list-style-type: none"> Temp Setpoint — Read out the setpoint of the temperature. Stdby Temp Control — When off, the module will not go to standby temperature if idle. Temp Gain — The coefficient used if a temperature calibration has been performed. Possible values are between 0 and 2. Read-only. Temp. Offset — The Offset temperature used if a temperature calibration has been performed. Possible values are between -10 °C and +10 °C. Read-only.
Trap Heater	<p>This menu list item is specific for the ITEX DHS Tool. Selecting the item opens the parameters for:</p> <ul style="list-style-type: none"> Actual Temperature — Reads out the actual temperature of the trap. Read-only function. Max Temperature — Sets the upper temperature limit. The Maximum Temperature which can be set is 350 °C. Min Temperature — Sets the lower temperature limit. The Minimum Temperature which can be set is 100 °C. The Standby Temperature can be adjusted according to the application's requirements. Setting the Standby Temperature using this function, the newly-selected temperature is not immediately active. To activate it, go to the Options pull-up menu and select Set Standby Temperature.

Table 86. List Item Parameters for HS, LS, SPME, and ITEX DHS Tools (Sheet 4 of 5)

Item	Description
Trap Heater (Continued)	<p>The Standby Temperature is activated when the TriPlus RSH SMART is powered up. In routine use, the Standby Temperature is activated after a job has been terminated. The Standby Temperature is typically lower than the application temperature.</p> <ul style="list-style-type: none"> • Temp Setpoint — Read out the setpoint of the temperature. • Stdby Temp Control — When off, the module will not go to standby temperature if idle. • Temp Gain — The coefficient used if a temperature calibration has been performed. Possible values are between 0 and 2. Read-only. • Temp. Offset — The Offset temperature used if a temperature calibration has been performed. Possible values are between -10 °C and +10 °C. Read-only.
Location	Slot Position where the specific Tool is parked.
Length	Defines the total length of the Tool. Read-only function.
Instrument Length	Defines the total length of the syringe (instrument). Read-only function.
Needle Guide Type	<p>Defines if an adapter, such as the magnetic ring or the foil cutter, is attached to the Needle Guide.</p> <p>Important: The Needle Guide Type must be defined. The default value is Not Specified. See “Installation Item” on page 223.</p>
Syringe Type	Use the ITEX syringe only.
Parameters for LS and SPME Tools	
Location	Slot Position where the specific Tool is parked.
Instrument Length	Defines the total length of the syringe (instrument). Read-only function.
Length	Defines the total length of the Tool. Read-only function.
Needle Guide Type	<p>Defines if an adapter, such as the magnetic ring or the foil cutter, is attached to the Needle Guide.</p> <p>Important: The Needle Guide Type must be defined. The default value is Not Specified. See “Installation Item” on page 223.</p>

Table 86. List Item Parameters for HS, LS, SPME, and ITEX DHS Tools (Sheet 5 of 5)

Item	Description
Needle Penetration Depth	Defines the penetration depth of the fiber in the vial.
Syringe Type	All syringes with the same geometry (barrel diameter, needle length) and corresponding syringe type to the Tool are pre-selected by the software and are selectable for use.

Tools Options Pull-up Menu

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 87](#).

Table 87. Options Parameters for HS, LS, SPME, and ITEX DHS Tools

Item	Description
Calibrate Tool	Calibrates the specified Tool. Note This might be necessary after a Tool has been accidentally dropped, and assuming that the Needle Guide was bent. A re-calibration corrects for the difference.
Check Tool Calibration	A calibration check is activated.
Select Tool	Selects another Tool. The current Tool is parked first and the new required one is picked up.
Purge Syringe	Available only with HS and ITEX DHS Tools. Allows to purge manually a headspace syringe.
Park Tool	Parks a Tool without picking up another Tool from the ATC Station.
Configure SPME Tool	This line is visualized when a SPME Tool is selected. This task allows to configure a SPME Tool. Fiber adjustment.

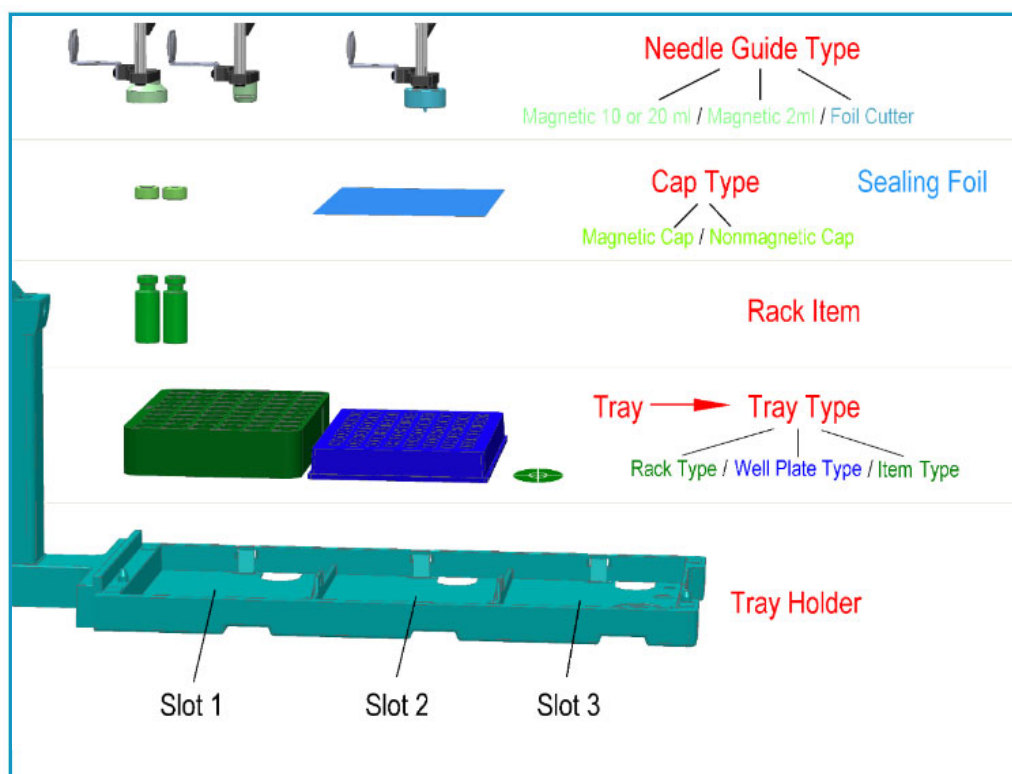
Naming Convention and Relationship between Software Classes, Tray Holder, Trays, Tray Types, and Cap Type

The RSH Firmware filters the selection of the subsequent classes based on the selection of the initial item. The following points are very important:

- First, the **Needle Guide Type** must be defined. If **Not Specified** is selected under **Needle Guide Type**, the execution of the run will be prohibited.
- In addition, the **Cap Type** and **Needle Guide Type** must be compatible in order to transport a vial. If a mismatch is observed, the software will prohibit the execution of the run; for example when a 2 mL vial with a magnetic cap is in use, but the **Needle Guide Type** is selected for a 20 mL vial.

Figure 110 illustrates the interdependency between the various software classes and subclasses. The different colors depict the main classes and the parameters assigned to each of them. See [Color Coding](#) and “Software Classes” on [page 171](#).

Figure 110. Relationship between Software Classes: Tray Holder, Tray, Tray Type, Cap Type, and Needle Guide Type.



Color Coding

The software classes are labeled in **red**. All related software classes where a **Vial** is used are displayed using a **green** shade. The classes related to **Well Plates** are displayed using a **blue** shade.

Software Classes

- The **Tray Holder** is the basic item encompassed by this software class; all the other subsequent software categories, such as Tray, Vial Type, and Cap Type are pre-defined by the Tray Holder.
- A **Tray** is a generic term and can be a Rack for holding vials or a Well Plate (Deep Well or Micro Titer Plate).
- A **Tray Type** is linked to each Tray. Depending on the actual Tray used, the Tray Type can be either a **Rack Type** or a **Well Plate Type**.
- The **Vial Type** depends on the Rack Type, but the Well Plate Type does not have any type of vial associated with it (i.e. the class of software that defines the vial type does not exist for a Well Plate).
- The **Cap Type** is linked to the **Vial Type**. This class defines the cap material, and whether or not the vial is transportable by magnetic force.
- The **Sealing Foil** is actually not a software subclass but the presence of the Sealing Foil with a Well Plate is automatically linked to the Needle Guide Type, which in turn will determine whether the Foil Cutter will be used.
- The **Needle Guide Type** is not a software class directly linked to the class Tray Holder and its subclasses; rather, it is linked to the class **Tools**.

The Needle Guide Type will determine which adapter has to be used to handle the selected vial or well plate.

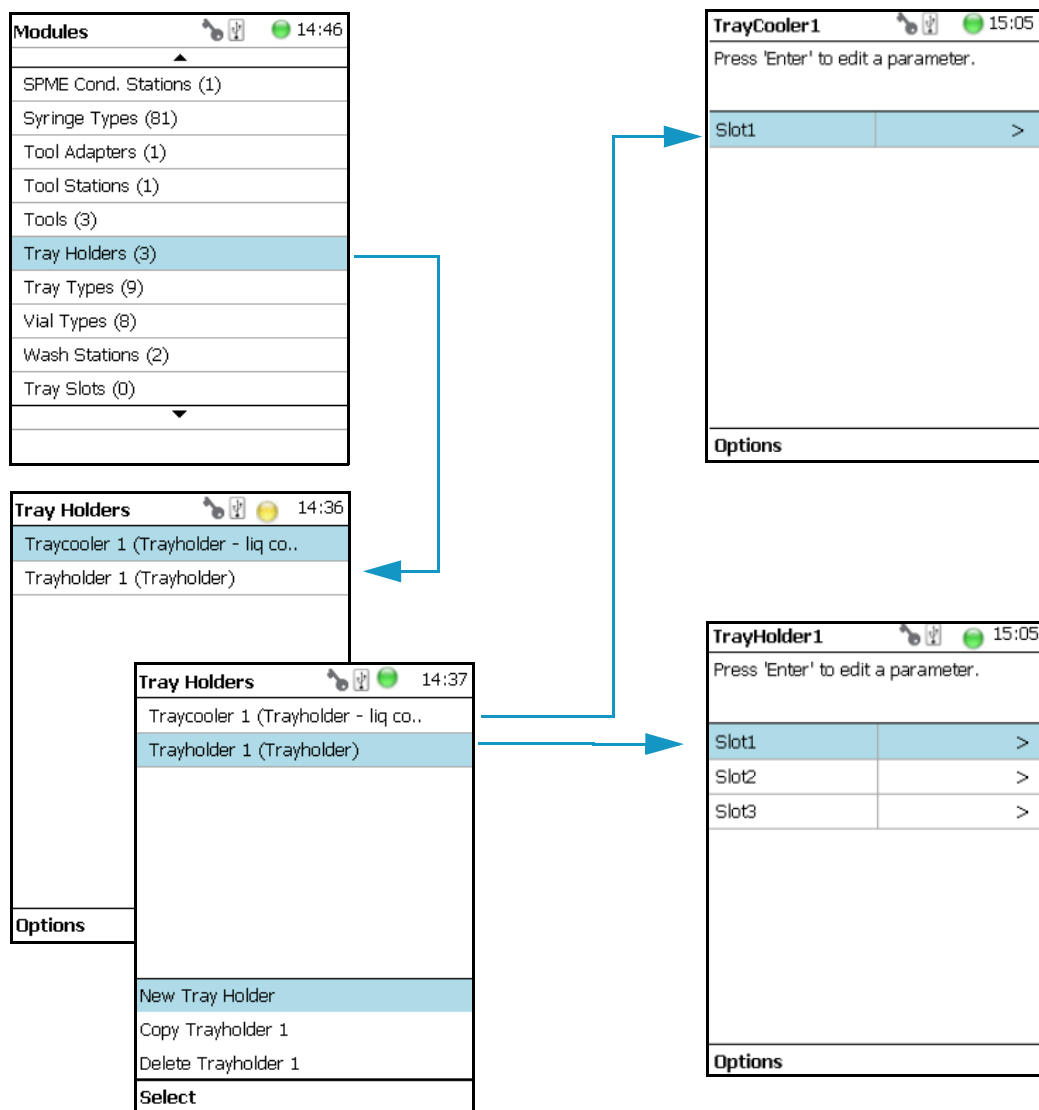
Tray Holders

Tray Holders are passive modules. These modules are described by their geometric design parameters, but there is no control whatsoever through the TriPlus RSH.

A Tray Holder can be a Liquid Cooled Tray (using a circulation bath for heating/cooling), or a Tray Holder without any temperature control.

Selecting the list item **Tray Holder**, the following parameters are available for modification. See [Figure 111](#).

Figure 111. Menu Item 'Tray Holder and List Items for Tray Holders



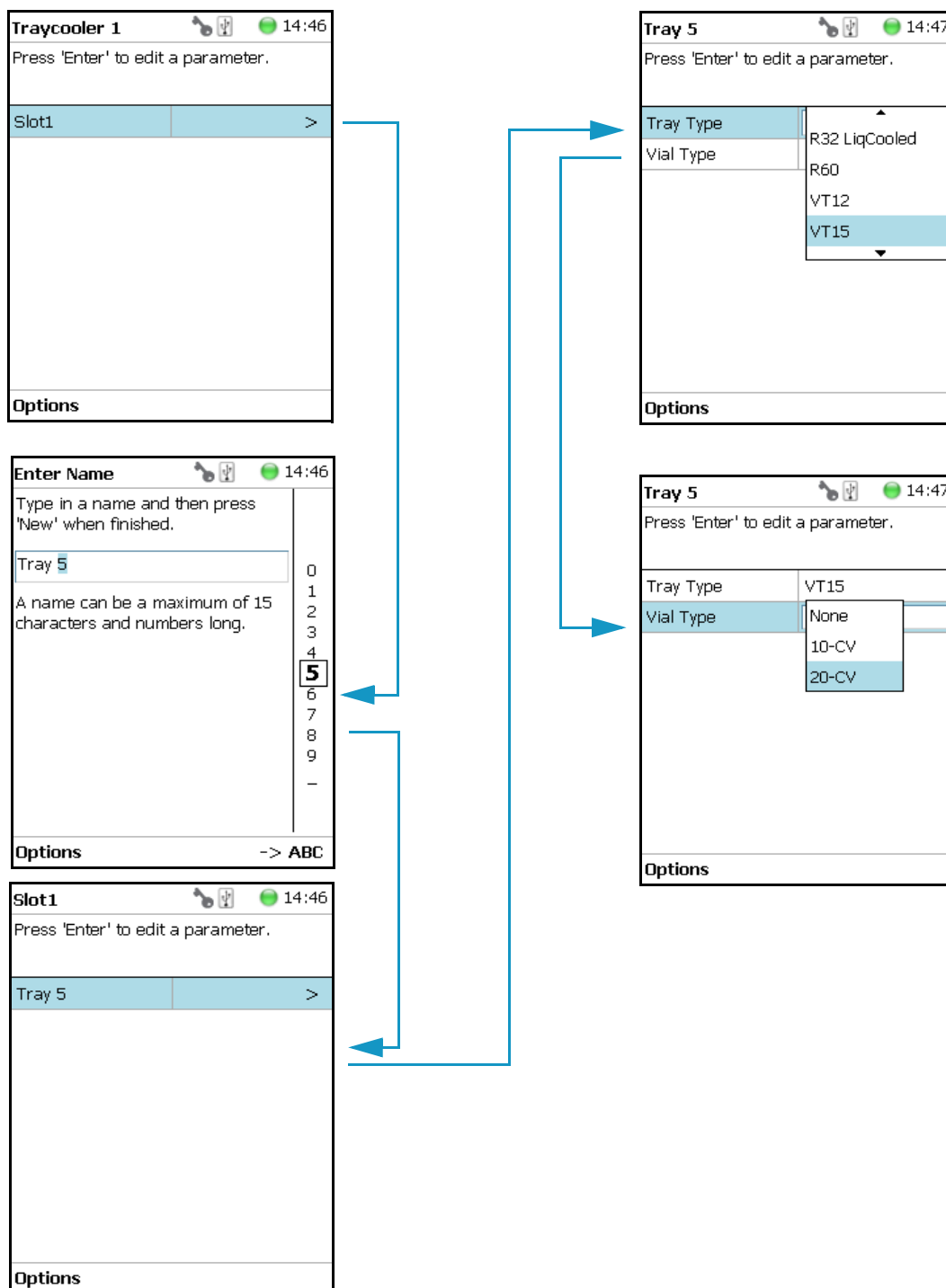
Press **Enter** to edit a parameter.

Select the Tray Holder, If the required **Tray Holder** is not assigned yet, use the button **New Tray Holder**. Select the type and assign the name.

Selecting the list item **Slot** opens the dialog window for **Tray** (Rack), containing the parameters **Tray Type** and **Vial Type**.

If no Tray is assigned yet, use the button **New** to assign a Tray to a particular Slot. The dialog for naming a Tray can be started by pressing the **Enter** button. See the examples. See [Figure 112](#).

Figure 112. Tray Type and Vial Type Selections to Assign to Tray



The parameters are the follows:

- **Slot(#)** — Selects the required Slot number to assign a Tray Type and Vial Type.
- **Tray(#)** — Selects the required Tray number to assign the Tray Type and Vial Type.

- **Cap Type** — Describes the Cap Type. Read-only. The definition is made in the class Vial Type.
- **Tray Type** — A list with all predefined Tray Types opens up for selection.
- **Tray Item** — A list with all predefined Tray Item opens up for selection.
- **Vial Type** — A list with all predefined Vial Types opens up for selection.
- **Well Plate(#)** — Select the required Well Plate number to assign the Well Plate Type.
- **Well Plate Type** — A list with all predefined Well Plate Types opens up for selection.

Note A passive Tray Holder module can adapt Trays made for different vial sizes. When the different Trays are used, consider the various vial heights, and ensure that the Drawer Magnet, connected to the lower needle guide, does not catch at front row of vials from behind the Tray.

Tray Holder Options Pull-up Menu

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 88](#).

Table 88. Tray Holder Options Pull-up Menu

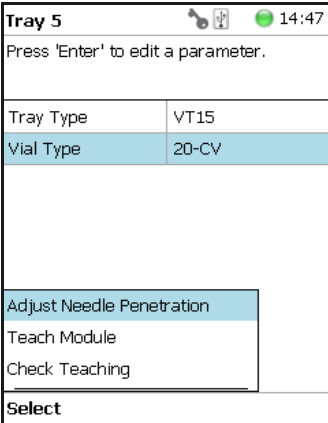
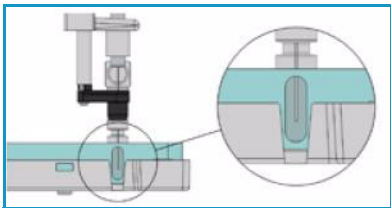
Item	Description
Create New Tray System	Guides through a wizard for creating a new Tray System. This includes the Tray Holder, Slots, Tray, Tray Type, and Vial Type.
New Tray Holder	Creates of a new Tray Holder.
Delete Tray Holder	Deletes the present Tray Holder.

Another Option pull-up Menu is available when the list item **Tray(#)** is selected. See [Table 89](#).

Table 89. Tray Holder Options Pull-up Menu Parameters When Tray(#) is Selected (Sheet 1 of 2)

Item	Description
New Tray	Allows creating a new Tray (Rack).
New Well Plate	Allows creating a new well plate.
Delete Tray Type	Allows deleting the present Try Type.

Table 89. Tray Holder Options Pull-up Menu Parameters When Tray(#) is Selected (Sheet 2 of 2)

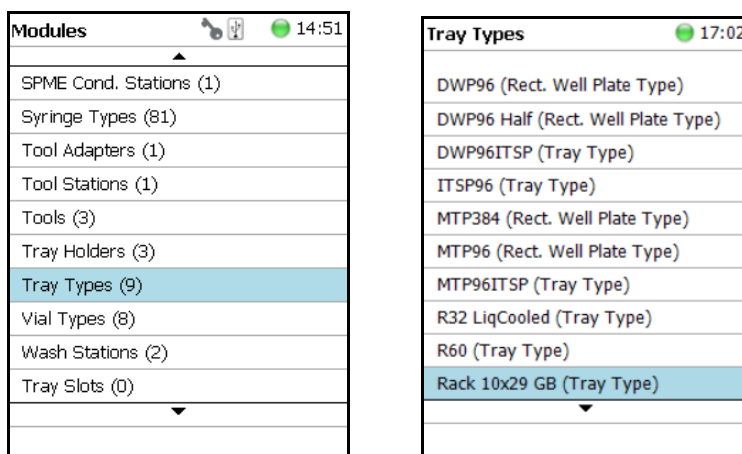
Item	Description
<p>Adjust Needle Penetration</p> 	<p>Adjusts the Needle Penetration Depths in the vial.</p>  <p>Manually turn the needle as far down in the vial as required. The cut-out in the Tray Holder frame as well as in the Tray allows visual control of the needle tip.</p> <p>Note: The value found is not stored automatically. This task allows a check only. If the needle penetration must be changed, select the Tray Type to enter the new established Needle Penetration value.</p>
<p>Check Teaching</p>	<p>Checks the teaching position of the module.</p> <p>This task serves as a quick check to determine if the X-, Y-, and Z-positions are defined correctly.</p> <p>If a teaching point is incorrect, return to the Menu Setup for readjustment of the teaching position. Note that this action can be done only under the Extended User Level.</p>
<p>Teach Module</p>	<p>The positions of the X-, Y-, and Z-axes can be defined again, teaching.</p>

Tray Types

A Tray Type contains all the information about the geometry of the Tray. Parameters such as how many sample vials are in a column and in a row, and the distance from vial to vial are all summarized in this class for each Tray Type.

Selecting the list item **Tray Types**, the following parameters are available for modification. See [Figure 113](#).

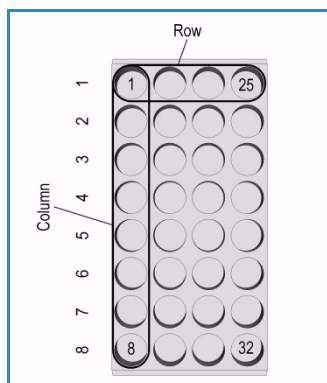
Figure 113. Menu Item 'Tray Types and Menu List Items Tray Types



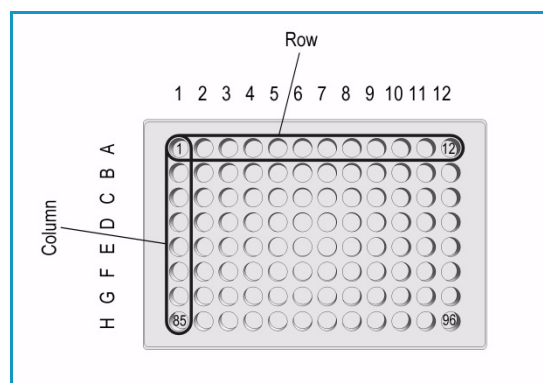
The individual parameters are identical for each Tray Type. The main difference depends on the primary differentiation of a **Tray Type** or **Plate Type**. In a Tray Type vials are inserted, the combined height of a Tray and the height of the vial above the upper surface of the Tray yields to the total height of the Tray Module.

A Plate has no vial inserted and the total height of the Tray corresponds with the height of the Well Plate.

The second main difference is the order of sample treatment. A Tray Type R60 has the vial numbering in the order of the Y-axis; in a Well Plate the numbering order is by the X-axis.



Tray type R32 LiqCooled



Well Plate type MTP96

Press **Enter** to edit a parameter. See [Table 90](#).

Table 90. Tray Type Parameters (Sheet 1 of 3)

Item	Description
1st Sample Offset X	Offset distance from Tray Zero Point to first position in X-axis direction. Unit: mm.
1st Sample Offset Y	Offset distance from Tray Zero Point to first position in Y-axis direction. Unit: mm.
1st Sample Offset Z	Offset distance from Tray Zero Point to first position in Z-axis direction. Unit: mm. (This parameter is currently not used with released Tray Types. Value = 0)
Alt Sample Offset X	Offset from Tray Zero Point to first sample position of staggered row/column in direction X-axis. Unit: μm .
Alt Sample Offset Y	Offset from Tray Zero Point to first sample position of staggered row/column in direction Y-axis. Unit: μm .
Alt Sample Offset Z	Offset from Tray Zero Point to first sample position of staggered row/column in direction Z-axis. Unit: μm . (This parameter is currently not used with released Tray Types. Value = 0)
Cavity Depth	Defines the total depth of the cavity. Unit: mm.
Cavity Diameter	Defines the diameter of the cavity. Unit: mm.
Columns	Number of columns.
Indexing Orientation	Defines the order of sampling either in Column Direction (DirectionX) or in Row direction (DirectionY). <i>Examples:</i> Tray R60: Column Direction. Tray VT54: Row Direction.
Length X	Total length of the Tray in X-axis direction, outer frame of Tray is considered. Unit: mm.
Length Y	Total length of the Tray in Y-axis direction, outer frame of Tray is considered. Unit: mm.
Length Z	Total length of the Tray in Z-axis direction, outer frame of Tray is considered. Unit: mm.
Penetr. Vial Index	Specifies the position in the Tray where the cut-out for needle penetration adjustment is located.
Rows	Number of rows.

Table 90. Tray Type Parameters (Sheet 2 of 3)

Item	Description
Slot Offset X	<p>Distance from Tray Holder Zero Point to Slot in X-axis direction.</p> <p>Used for Trays which are larger than the footprint of the Slot, (Oversize).</p> <p>This parameter is for example used for the Tray Type R60. Value = -13.5 mm.</p>
Slot Offset Y	<p>Distance from Tray Holder Zero Point to Slot in Y-axis direction.</p> <p>Used for Trays which are larger than the footprint of the Slot, (Oversize).</p> <p>This parameter is for example used for the Tray Type R60. Value = -13.5 mm.</p>
Slot Offset Z	<p>Distance from Tray Holder Zero Point to Slot in Z-axis direction.</p> <p>Used for Trays which are larger than the footprint of the Slot, (Oversize).</p> <p>This parameter is for example used for the Tray Type R60. Value = -3.8 mm.</p>
Slot Span	<p>Number of the Tray installed on the Tray Holder.</p> <p>Examples: Tray 60: Slot Span 1. Tray 54: Slot Span 3.</p> <p>Note: A Tray Type with a Slot Span >1 has to be positioned in Slot 1. The Rack does span from Slot 1 to Slot 2 to Slot 3.</p>
Total Column Length X	<p>Defines the total length of the Column (X-axis). Distance from center to center of cavity is measured. Unit: mm.</p>
Total Row Length Y	<p>Defines the total length of the Row (Y-axis). Distance from center to center of cavity is measured. Unit: mm.</p>
Uses Adapter	<p>Select this parameter when an Adapter is used to compensate for vial height. The adapter installed plus the vial height must not exceed the total height of a 20 mL vial.</p> <p>Example: 10 mL vial plus corresponding adapter must be equal to the height of a 20 mL vial.</p>

Table 90. Tray Type Parameters (Sheet 3 of 3)

Item	Description
Z Tolerance	<p>A tolerance window to give a plus/minus range (expressed in mm) where the Head must expect an object.</p> <p>If the value of this item is > 0, indicates a relative detection mode, and the sensor from the Head needle guide is active.</p> <p>If the value of this item is set to 0, the Needle Guide Motor detection current is turned off, and the syringe slider moves to an absolute value. The Z-axis position as specified by the object.</p> <p>The Z Tolerance is calculated in combination with a Rack from the Vial top. The Rack plate top surface is not used as reference.</p> <p>The Z Tolerance is calculated in combination with a Well Plate (MTP) from the plate top surface. Unit: mm.</p>
DefNdlPenetrDepth <i>(Parameter used for MTP only)</i>	<p>Defines the default value for the syringe needle penetration depth in the well of the Micro Titer Plate (MTP). Unit: mm.</p>
Depenetration Speed <i>(Parameter used for MTP only)</i>	<p>Defines the speed of the syringe needle de-penetration from the well of the Micro Titer Plate (MTP). Unit: mm/s.</p>
Sealing Foil <i>(Parameter used for MTP only)</i>	<p>Setting the mark to Has Foil indicates that the plate is sealed with a foil. The Foil Piercing Tool will be applied.</p>
MaxVolume <i>(Parameter used for MTP only)</i>	<p>Defines the maximum volume of the well of a Micro Titer Plate (MTP). Unit: mL.</p>
Penetration Speed <i>(Parameter used for MTP only)</i>	<p>Defines the speed of the syringe needle penetration from the well of the Micro Titer Plate (MTP). Unit: mm/s.</p>
Bottom Sense supported <i>(Parameter used for MTP only)</i>	<p>Setting the mark to Bottom Sense supported enables the functionality of needle bottom sensing.</p>

The tray type parameters are described in the following table. See [Table 91](#).

Table 91. Tray Type Parameters (Sheet 1 of 7)

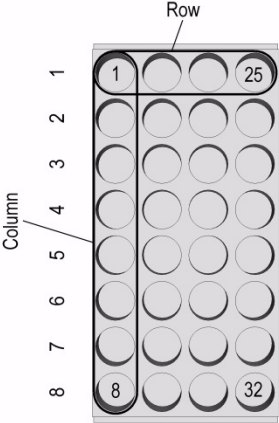
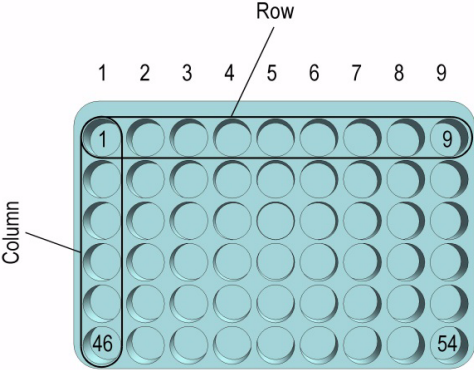
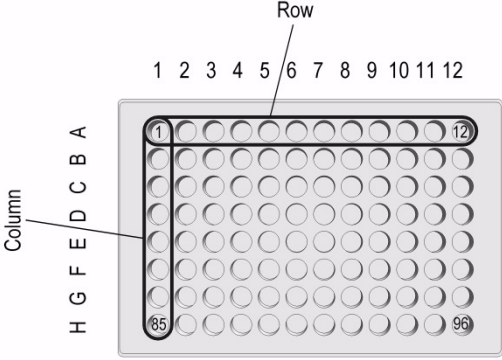
Tray Type Parameter	Illustration
Rows — Number of Rows	Figure 114. Tray type R32 Liquid Cooled
Columns — Number of Columns	
Definition of Row and Column	
<i>Example:</i> Regular order of vials.	
	
Rows — Number of Rows	Figure 115. Tray type VT54
Columns — Number of Columns	
Definition of Row and Column	
<i>Example:</i> Regular order of vials.	
	
Rows — Number of Rows	Figure 116. Tray type MTP 96
Columns — Number of Columns	
Definition of Row and Column	
<i>Example:</i> Regular order of wells.	
	

Table 91. Tray Type Parameters (Sheet 2 of 7)

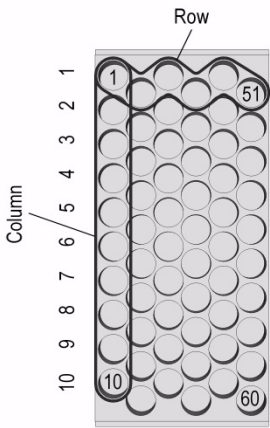
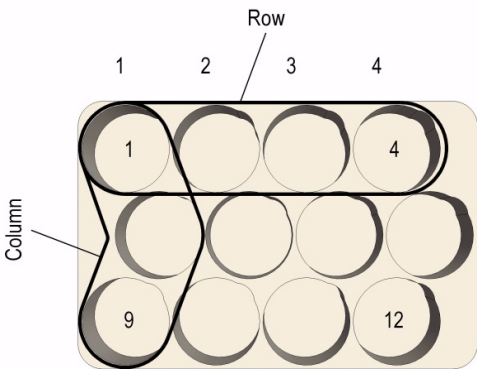
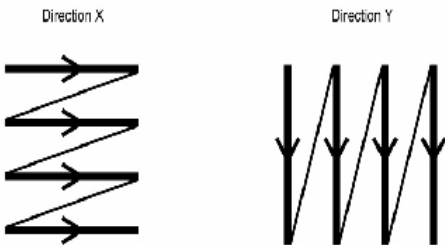
Tray Type Parameter	Illustration
Rows — Number of Rows Columns — Number of Columns Definition of Row and Column <i>Example:</i> Staggered order of vials.	<p>Figure 117. Tray type R60</p> 
Rows — Number of Rows Columns — Number of Columns Definition of Row and Column <i>Example:</i> Staggered order of vials.	<p>Figure 118. Tray type R12</p> 
Indexing Orientation Direction X (or Row Direction with RSH Firmware 1.4.0 or lower) Direction Y (or Column Direction with RSH Firmware 1.4.0 or lower)	<p>Figure 119. Indexing orientation</p> 

Table 91. Tray Type Parameters (Sheet 3 of 7)

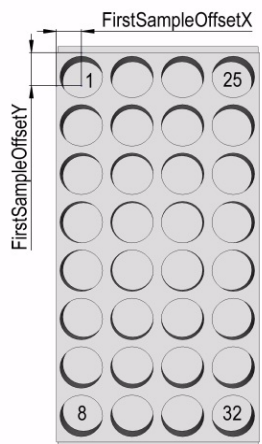
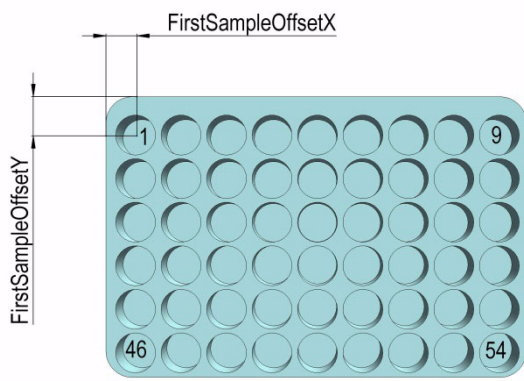
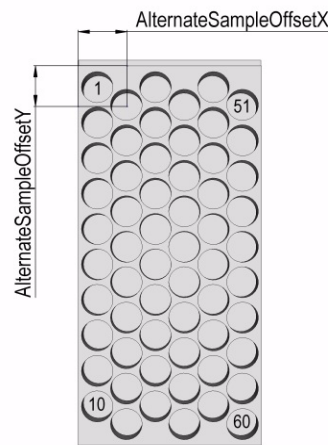
Tray Type Parameter	Illustration
1st Sample Offset X 1st Sample Offset Y (1st Sample Offset Z)	<p>Figure 120. Tray type R32 LiqCooled</p> 
1st Sample Offset X 1st Sample Offset Y (1st Sample Offset Z)	<p>Figure 121. Tray type VT54</p> 
Alt Sample Offset X Alt Sample Offset Y (Alt Sample Offset Z)	<p>Figure 122. Tray type R60</p> 

Table 91. Tray Type Parameters (Sheet 4 of 7)

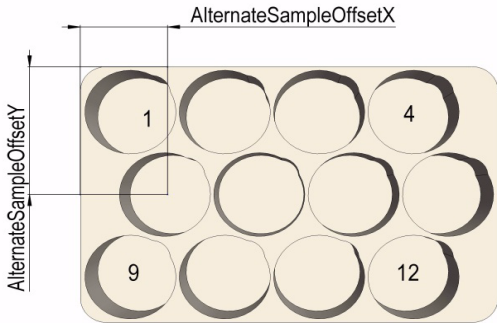
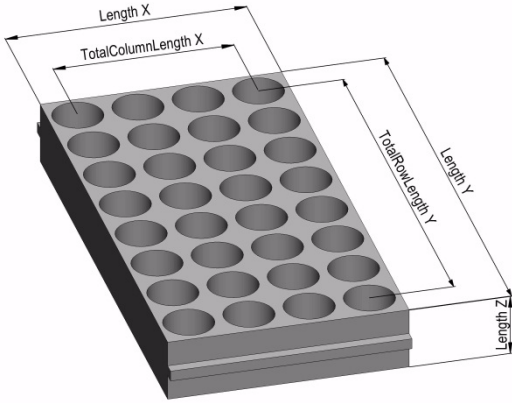
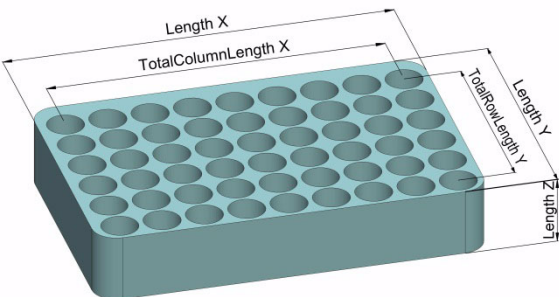
Tray Type Parameter	Illustration
Alt Sample Offset X	<p>Figure 123. Tray type R12</p> 
Alt Sample Offset Y	
(Alt Sample Offset Z)	
Length X	<p>Figure 124. Tray type R32 Liquid Cooled</p> 
Length Y	
Length Z	
Total Column Length X	<p>Figure 125. Tray type VT54</p> 
Total Row Length Y	

Table 91. Tray Type Parameters (Sheet 5 of 7)

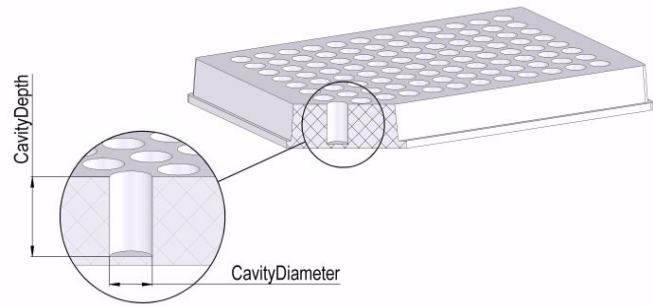
Tray Type Parameter	Illustration
Cavity Depth	Figure 126. Tray type MTP96
Cavity Diameter	 <p>The diagram shows a 96-well microplate (MTP96) with a grid of wells. A circular inset provides a magnified view of a single well. In this inset, a vertical double-headed arrow indicates the 'CavityDepth' from the top of the well to the bottom. A horizontal double-headed arrow at the base of the well indicates the 'CavityDiameter'.</p>
Penetration Vial Index	Figure 127. Tray type VT54
Z Tolerance	Figure 128. Tray type R60
Z Tolerance	Figure 129. Tray type MTP96

Table 91. Tray Type Parameters (Sheet 6 of 7)

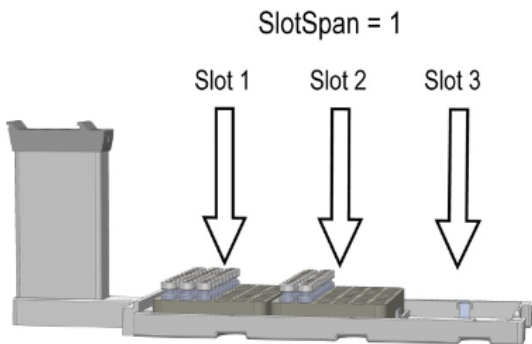
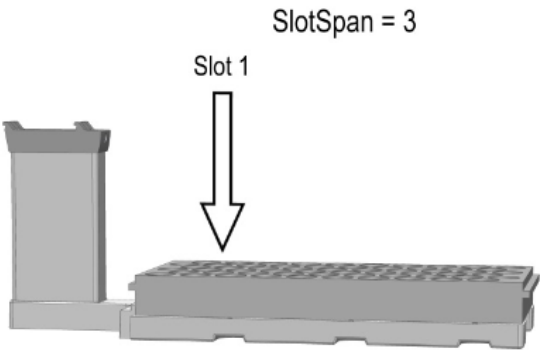
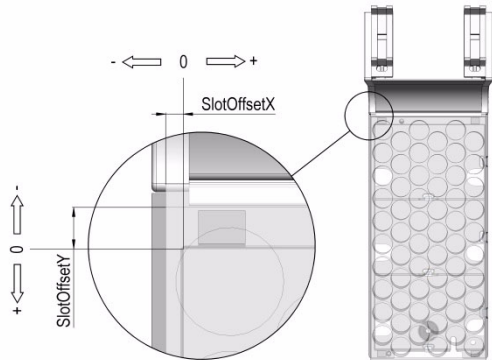
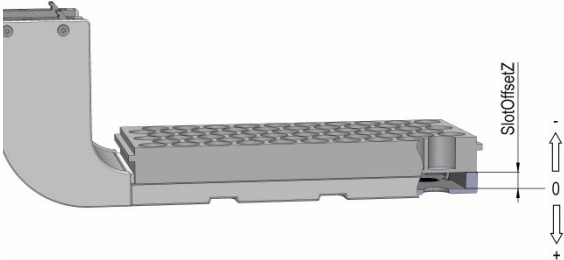
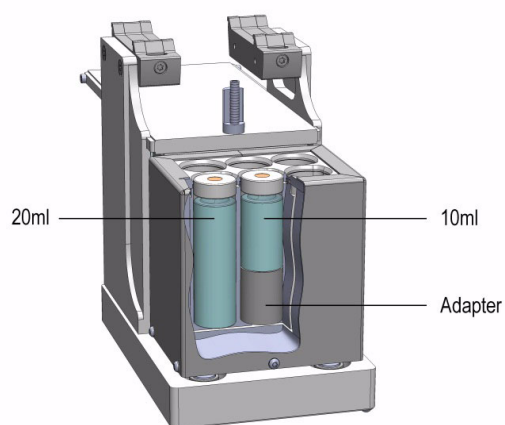
Tray Type Parameter	Illustration
<p>Slot Span</p> <p><i>Example:</i> Slot Span = 1</p>	<p>Figure 130. Tray Holder with Tray Type VT54 inserted</p> 
<p>Slot Span</p> <p><i>Example:</i> Slot Span = 3</p>	<p>Figure 131. Tray Holder with Tray Type R60 inserted</p> 
<p>Slot Offset X</p> <p>Slot Offset Y</p> <p>Note that the value has a negative sign if the Tray is oversize, which means larger than the Tray Holder.</p>	<p>Figure 132. Tray Holder with Tray Type R60 inserted</p> 

Table 91. Tray Type Parameters (Sheet 7 of 7)

Tray Type Parameter	Illustration
Slot Offset Z	Figure 133. Tray Holder with Tray Type R60 inserted
<p>Note that the value has a negative sign if the Tray is not inserted in the slot, support for Tray is higher up.</p>	
	

Uses Adapter

Figure 134. Agitator

Tray Types Options Pull-up Menu

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 92](#).

Table 92. Tray Types Options Pull-up Menu

Item	Description
New Tray Type	Creates a new Tray Type.
Copy Tray Type	Copies the present Tray Type (for example VT54).
Delete Tray Type	Deletes the present Tray Type (for example VT54).
Reset to Default	Resets the selected Tray parameter to default value.





Trays

The term Trays is a generic term. A Tray can be a Tray or a Well-plate.

A Tray is prepared to accept vials, a well-plate can be typically a Deep well-plate or a Micro Titer-plate. The software has a structure which interlinks the classes **Vial Type**, **Tray Type** (or **Well Type**) with the Tray. To create a new Tray these classes have to be prepared in the order **Vial Type** and **Tray Type**. The allocated types are then ready for selection in the class Trays.

Selecting the list item **Tray Types**, the following parameters are available for modification. See [Figure 135](#).

Figure 135. Menu Item Trays Menu List Item Trays

Modules	 	10:54
		
Syringe Types (80)		
Tool Adapters (1)		
Tool Stations (1)		
Tools (3)		
Tray Holders (2)		
Tray Types (6)		
Trays (2)		
Vial Types (8)		
Vials (2)		
Wash Stations (2)		
		

Press **Enter** to edit a parameter. See [Table 93](#).

Table 93. Tray Type and Vial Type Parameters

Item	Description
Cap Type	Read-only parameter. Definition is made in the class Vial Type.
Tray Type	A Tray Type is assigned the specified Tray.
Vial Type	A Vial Type is assigned to the specified Tray and selected Tray Type.

Trays Options Pull-up Menu for Vial Tray

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 94](#).

Table 94. Trays Options Pull-up Menu for Vial Tray (1)

Item	Description
New Tray	Creates a new Tray.
Delete Tray	Deletes a present Tray.

In the case no Tray (or Plate) is available, the command **New Tray** is available with the **Menu Button Option**. Follow the dialog with the known possibilities to assign a name as shown in [Figure 136](#).

Figure 136. Menu Button New Tray and Defining Name for New Tray

Tray 5	
Press 'Enter' to edit a parameter.	
Tray Type	VT15
Vial Type	20-CV
Options	

Trays	
Tray 5 (Tray)	
Tray 6 (Tray)	
Options	

Another pull-up menu is available from the menu list items **Tray Type** and **Vial Type**. Selecting the item **Adjust Needle Penetration** allows checking the needle penetration in the vial.

The position of cut-out in the Tray is specified in the Tray Type, therefore is the position known. Starting this task, moves the TriPlus RSH SMART Head to the defined vial position where it waits for the manual adjustments. [Figure 137](#), illustrates the cut-out in the Tray.

Figure 137. Adjust Needle Penetration Into the Vial

Tray 5	
Press 'Enter' to edit a parameter.	
Tray Type	VT15
Vial Type	None 10-CV 20-CV
Options	

Set Ndl Penetration	
Press 'Move' to position the Head on the vial to adjust needle penetration.	
PenetrationDepth	0 µm
Move	

Trays Options Menu Parameters are detailed in [Table 95](#).

Table 95. Trays Options Pull-up Menu Parameters for Vial Tray (2)

Item	Description
Adjust Needle Penetration	Adjusts the Needle Penetration Depths in the vial. Manually turn the needle as far down in the vial as required. The cut-out in the Tray Holder frame as well as in the Tray allows visual control of the needle tip. Note: The value found is not stored automatically. This task allows a check only. If the needle penetration must be changed, select the Tray Type to enter the newly established Needle Penetration value.
Check Teaching	Checks the teaching position of the module. This task serves as a quick check to determine if the X-, Y-, and Z-positions are defined correctly. If a teaching point is incorrect, return to the Menu Setup for readjustment of the teaching position. Please note that this action can be done only under the Extended User Level .
Teach Module	The positions of the X-, Y-, and Z-axes can be defined again, for teaching.

Trays Options Pull-up Menu for Well Plate

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 96](#).

Table 96. Trays Options Pull-up Menu for Well Plate

Item	Description
New Tray	Creates a new Tray Type.
Copy Well Plate (#)	Copies the present Well Plate.
Delete Well Plate (#)	Deletes the present Well Plate.
Check Teaching	Checks the teaching position of the module. This task serves as a quick check to determine if the X-, Y-, and Z-positions are defined correctly. If a teaching point is incorrect, return to the Menu Setup for readjustment of the teaching position. Please note that this action can be done only under the Extended User Level .
Teach Module	The positions of the X-, Y-, and Z-axes can be defined again, for teaching.



Vial Types

The Vial Type describes the geometry of the vials used and adds parameters such as syringe needle penetration, search distance, or Z-Tolerance. The Vial Type is a group of parameters which can be linked to a Tray.

All vial types to be used within Wash Stations are defined as **Vial Types**.

Selecting the list item **Vial Types**, the following parameters are available for modification. See [Figure 138](#).

Figure 138. Menu Items Vial Types and List Items for Vial Type

Modules  17:25	Vial Types  15:56
Syringe Types (80)	100SR (Wash Vial Type)
Tool Adapters (1)	10SR (Wash Vial Type)
Tool Stations (1)	2SR (Wash Vial Type)
Tools (2)	Waste Cup (Waste Vial Type)
Tray Holders (2)	Waste Insert (Waste Vial Type)
Tray Types (6)	Waste Port (Waste Vial Type)
Trays (1)	Waste Vial (Waste Vial Type)
Vial Types (8)	
Vials (2)	
Wash Stations (2)	

Vial Types Parameters are detailed in [Table 97](#).

Table 97. Vial Types Parameters (Sheet 1 of 3)

Item	Description
Default Needle Penetration Depth	Sets the default value of the syringe needle penetration depth in the reservoir vial.
Allow Needle Transport <i>Available for Vial Type only.</i>	<p>Sets the transport to Needle Transport. In order to allow another transport as the common Magnetic Transport, the syringe needle is inserted in the vial septum.</p> <p>If the weight of the vial is not too high, the vial sticks to the needle.</p> <p>All parameter as used for the magnetic transport (such as stripping of) are not functional.</p>

Table 97. Vial Types Parameters (Sheet 2 of 3)

Item	Description
<p>Cap Type</p> <p><i>This parameter has to correspond with the Tool parameter “Needle Guide Type”.</i></p>	<p>The type of cap used for the vial can be defined. The following options are available:</p> <ul style="list-style-type: none"> • No Cap — Mainly used for Well-plates • Magnet Cap — A magnetic cap is used to transport a vial, typically from a Tray to the Agitator. • Non Magnetic Cap — For applications which do not require the sample vials to be transported.
Depenetration Speed	Defines the speed to retrieve the syringe needle from the vial.
Diameter	Defines the diameter of the reservoir container.
<p>Dispose In Waste Container</p> <p><i>Available for Vial Type only.</i></p>	<p>Used if e.g. a pipetting tip or a SPE cartridge has to be expelled into a dedicated Waste Container.</p> <p>All parameters as used for liquid disposal, such as rinsing syringe, and so on are not functional.</p>
Height	Defines the height of the reservoir container.
Max Ndl Penetr Depth	<p>The maximum allowed Needle Penetration can be defined as a safety measure so that you cannot destroy the needle tip by going too far down.</p> <p>The maximum needle penetration must not exceed the length of the syringe needle, considering the loss of approximately 12 mm due to the needle guide.</p> <p>For a typical needle length of 57 mm or 85 mm for the long needle, the maximum penetration depth must not exceed 45 mm or 73 mm.</p>
Penetration Speed	The syringe needle penetration speed is set by this parameter. It is recommended to use the default value first. Changing this parameter in either direction might lead to needle bending.
Strip Distance	When a magnetic cap is used, the distance to move the TriPlus RSH SMART Head to the side (in the Y-direction) to wipe off the vial can be defined. Measured in mm.
Volume	This parameter defines the volume of the vial.

Table 97. Vial Types Parameters (Sheet 3 of 3)

Item	Description
Z-Tolerance	<p>A tolerance window to give a plus/minus range (expressed in mm) where the Head must expect an object.</p> <p>If the value of this item is > 0, this indicates a relative detection mode, and the sensor from the Head needle guide is active.</p> <p>If the value of this item is set to 0, the sensor of the needle guide is turned off, and the syringe slider moves to an absolute value, Z-axis position as specified in the object.</p>
<p>IMPORTANT Using the SPME technique pay special attention to the parameters DefNdlPenetrDepth and MaxNdlPenetrDepth.</p> <p>The penetration depth is always the penetration of the needle itself. Consider the length of the SPME fiber, 10 mm or 20 mm length. When the fiber is lowered, it must not touch the bottom of the vial.</p>	

Vial Type Options Pull-up Menu

Selecting **Options** pull-up menu, the following tasks are opened. See [Table 98](#).

Table 98. Vial Type Options Pull-up Menu

Item	Description
New Vial Type	Creates a new Vial Type.
Copy Vial Type	Copies the present Vial Type.
Delete Vial Type	Deletes a present Vial Type.
Export Rack Item	Exports the Vial Type template to a USB stick.
Export All	Exports all Vial Type templates to a USB stick.
Reset to Default	Resets the selected module parameter to the default value.

Vials

In this class of **Vials**, dedicated vials can be added to the system configuration.

The use of the **Vial** can be specified according to the following categories:

- Wash Vial
- Waste Vial
- Reservoir
- Attachable

The use of these **Vials** is in assigning an extra, custom specific vial, for any use, such as providing a dedicated vial for a reagent, internal standard or a dilution vial.

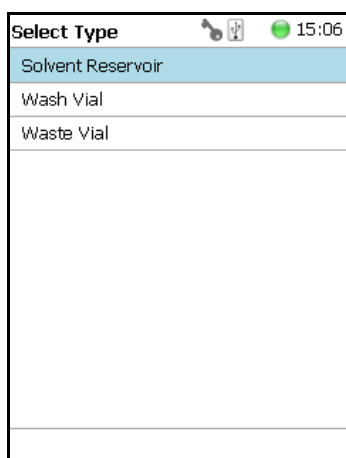
When the application requires a second Waste Vial or an extra Wash Vial, then this class of **Vial** could be used to define the non-standard vial.

The three categories **Wash Vial**, **Waste Vial**, and **Solvent Reservoir** contain the same available parameters under the **User Access Level**.

The category **Attachable** defines the dimensions and the **Strip-Distance** for any movable object that can be picked up and transported by a Tool with a Magnetic Needle Guide.

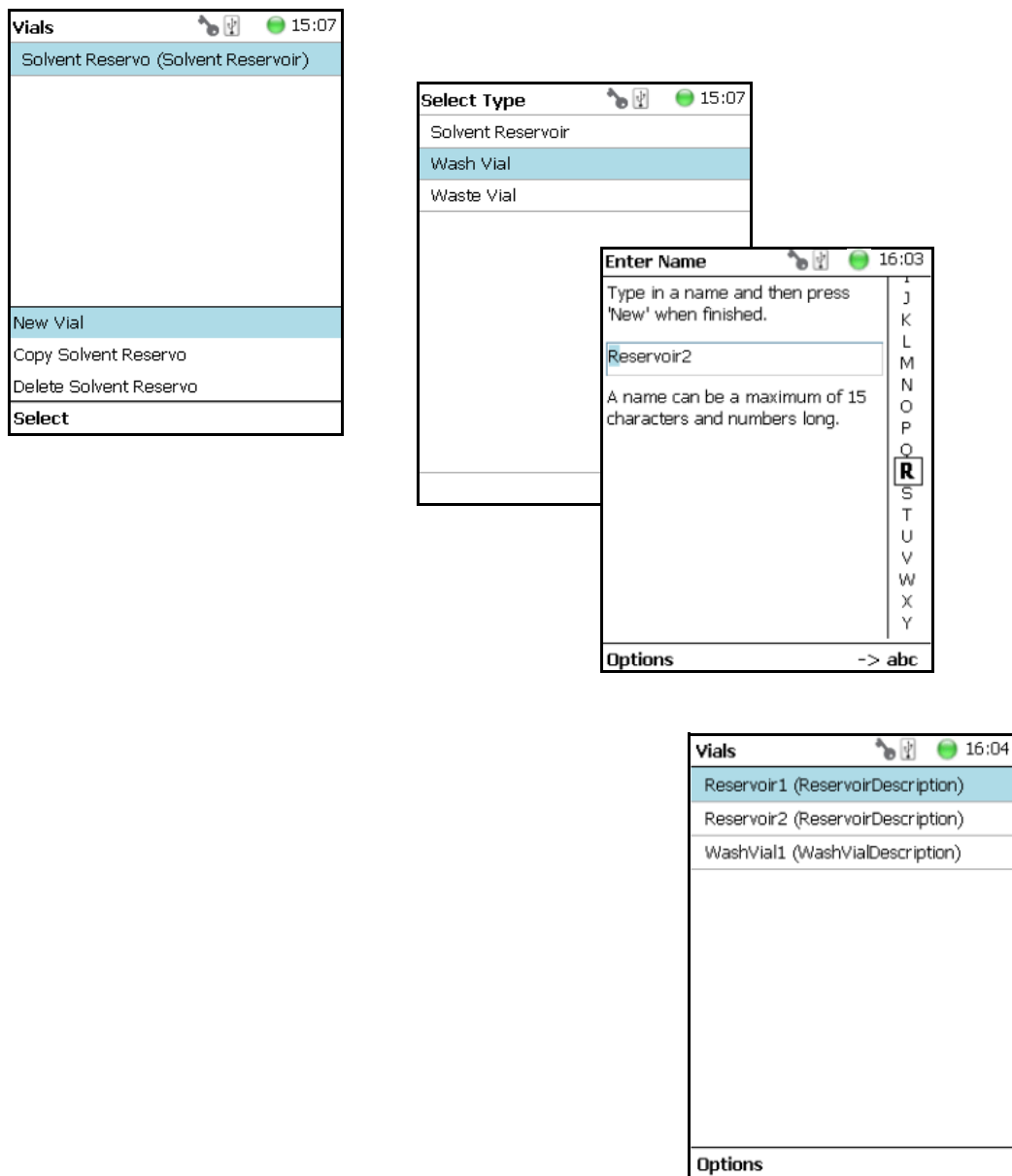
Selecting the list item **Vial**, the following parameters are available for modification.
See [Figure 139](#).

Figure 139. Menu List Vials and Menu List Items for Vials



If there is not **Vial** available (Solvent Reservoir, Wash Vial or Waste Vial), the command **New Vial** is available in the **Options** pull-down menu. Follow the dialog with the selectable possibilities to assign a name as shown in [Figure 140](#).

Figure 140. Menu Button New Vial, Selection of Vial Types, and Defining Name for New Vial



The parameters available for the Vial Type **Reservoir** are slightly different from the parameters for the Wash Vial and Waste Vial.

See the examples in [Figure 141](#) and [Figure 142](#), and the description in [Table 99](#).

Figure 141. Menu List Item Reservoir Parameters for Vial Type Reservoir

Vials 12:11	
Reservoir1 (Reservoir)	
WashVial1 (WashVial)	
WasteVial1 (WasteVial)	
Options	

Reservoir1 12:11	
Press 'Enter' to edit a parameter.	
DefaultPenetration...	0 µm
DepenetrationSpeed	0 mm/s
MaxPenetrationDepth	0 µm
PenetrationSpeed	0 mm/s
VialType	None
Volume	0 uL
Options	

Figure 142. Parameters for Vial Types Wash or Waste Parameters for Vial Types Wash or Waste

Wash Vial 1 14:42	
Press 'Enter' to edit a parameter.	
Depenetr. Speed	0 mm/s
Penetration Speed	0 mm/s
Vial Type	None
Volume	0 uL
Z Tolerance	0 µm
Reset to Default	
Teach Module	
Check Teaching	
Select	

WashVial1 12:11	
Press 'Enter' to edit a parameter.	
Height	50.000 mm
MaxPenetrationDepth	0 µm
PenetrationSpeed	40 mm/s
Volume	0 uL
ZTolerance	5.000 mm
Options	

Table 99. Vials Parameters (Sheet 1 of 3)

Item	Description
Max Ndl Penetr Depths	<p>The maximum allowed Needle Penetration can be defined as a safety measure so that you cannot destroy the needle tip by going too far down.</p> <p>The maximum needle penetration must not exceed the length of the syringe needle, considering the loss of approximately 12 mm due to the needle guide, and other factors. For a typical needle length of 57 mm or 85 mm for the long needle, the maximum penetration depth must not exceed 45 mm or 73 mm.</p>
Def Ndl Penetr Depth	The default value of the syringe needle penetration depth in the reservoir vial is determined by this parameter.

Table 99. Vials Parameters (Sheet 2 of 3)

Item	Description
Depenetration Speed	This parameter allows you to select the required speed for pulling the syringe needle out of the reservoir vial.
Diameter	Specific for Waste Vial. Defines the diameter of the reservoir container.
Height	Specific for Waste Vial. Defines the height of the reservoir container.
Penetration Speed	The syringe needle penetration speed is set by this value. It is recommended to use the default value first. Changing this parameter in one or the other direction might lead to needle bending.
Vial Type	A list with all predefined Vial Types opens up for selection. Special cases for Waste Vial : <ul style="list-style-type: none"> • None — It is selectable, however if selected in combination with a Wash Module is an error message (Pending Message) propagated. Incompatible Type. • Waste Port — Used for the Fast Wash and Large Wash Module. • Waste Vial — Used for Standard Wash Module. • Waste Inset — This type is used for Standard Wash Module with inserted Waste Line Adapter.
Volume	Specific for Wash and Waste Vial . Defines the volume of the reservoir container.
Z-Tolerance	A tolerance window to give a plus/minus range (expressed in mm) where the Head must expect an object. <ul style="list-style-type: none"> • If the value of this item is > 0, indicates a relative detection mode, and the sensor from the Head needle guide is active. • If the value of this item is set to 0 the sensor of the needle guide is turned off and the syringe slider moves to an absolute value, the Z-axis position as specified by the object.
Strip Distance	When a magnetic cap is used, defines the distance in millimeters to move the head in the Y-direction in order to wipe off the vial.

Table 99. Vials Parameters (Sheet 3 of 3)

Item	Description
Diameter	Diameter of the attachable object, measured in mm.
Height	Height of the attachable object, measured in mm.

Vials Option Pull-up Menu

Selecting **Options** pull-up menu, the following tasks are opened See [Table 100](#).

Table 100. Vials Options Pull-up Menu

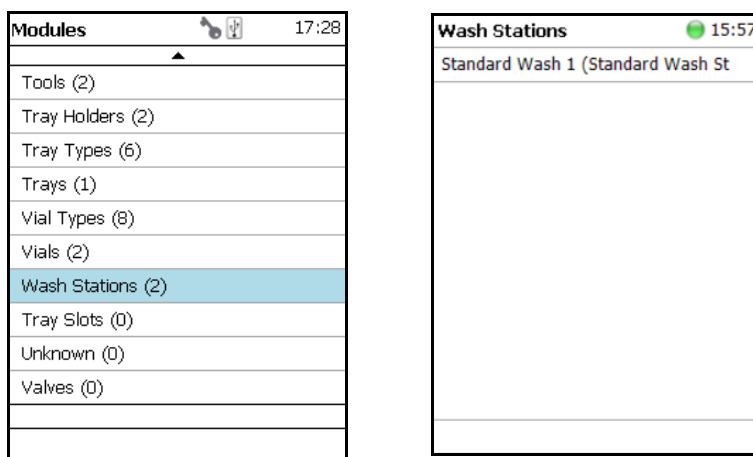
Item	Description
New Vial	Creates of a new Vial.
Copy Vial	Copies the present Vial.
Delete Vial	Deletes the present Vial.
Reset to Default	Resets the selected Vial parameter to default value.
Check Teaching	Checks the teaching position of the module. This task serves as a quick check to determine if the X-, Y-, and Z-positions are defined correctly. If a teaching point is off, return to the Menu Setup for readjustment of the teaching position. Please note that this action can be done only under the Extended User Level .
Teach Module	The positions of the X-, Y-, and Z-axes can be defined again, (teaching).

Wash Stations

Four different wash stations are available with the TriPlus RSH: **Standard Wash Station**, **Large Volume Wash Station**, **Large Solvent Station** and **Fast Wash Station** (active module).

Selecting the list item **Wash Stations** opens up the following parameters. See [Figure 143](#).

Figure 143. Menu Item Wash Stations Menu and List Items Wash Modules



Press **Enter** to edit a parameter.

Select the required menu list item to access the parameters. The wash stations differ in number of positions, Wash Vial size.

- The **Standard Wash Station** accepts 10 mL vials.
- The **Large Volume Wash Station** contains two 100 mL vials, and a Waste position with a drainage tubing.
- The **Large Solvent Station** contains three 100 mL vials, and a Waste position with a drainage tubing.
- The **Fast Wash Station** contains active pumps to deliver two different wash solvents

The available menu list parameters are identically for the **Standard**, **Large Solvent Wash** and **Large Volume Wash Stations**, aside from the number of positions. See [Table 101](#) for details.

The menu list parameters for the **Fast Wash Station** are detailed in [Table 102](#).

Table 101. Parameters for Standard Large Solvent, Large Volume Wash Stations (Sheet 1 of 2)

Item	Description
Pos 1 to Pos 4	Positions 1 and 2 are available for the Large Solvent Wash Station . Positions 1 to 4 are available for the Standard Wash Station . Each Position can be defined by using the next parameters.
Waste	Defines the Waste position.
Max Ndl Penetr Depth	The maximum allowed Needle Penetration can be defined as a safety measure so that the you cannot destroy the needle tip by going too far down. The maximum needle penetration must not exceed the length of the syringe needle, considering the loss of approximately 12 mm due to needle guide, and so on. For a typical needle length of 57 mm or 85 mm for the long needle, the maximum penetration depth must not exceed 45 mm or 73 mm.
Def Ndl Penetr Depth	This parameters sets the default value of the syringe needle penetration depth in the reservoir vial.
Depenetration Speed	This parameter allows you to select the required speed for pulling the syringe needle out of the reservoir vial.
Penetration Speed	The syringe needle penetration speed is set by this parameter. It is recommended to use the default value first. Changing this parameter in one or the other direction might lead to needle bending.
Vial Type	Defines the Vial Type of the reservoir container in Positions or the corresponding Waste Type in Waste Position. Selection for Wash Positions are: Vial Types None, 2SR, 10SR, or 100SR. Selection for Waste Position are: <ul style="list-style-type: none"> • None — If None is selected, an error (Pending Message) will be propagated. • Waste Port — Large Wash and Fast Wash Module • Waste Vial — Standard Wash. • Waste Inset — Standard Wash with inserted Drainage Adapter.
Volume	Defines the volume of the reservoir vial.

Table 101. Parameters for Standard Large Solvent, Large Volume Wash Stations (Sheet 2 of 2)

Item	Description
Z-Tolerance	<p>A tolerance window to give a plus/minus range (expressed in mm) where the Head must expect an object.</p> <p>If the value of this item is > 0, this indicates a relative detection mode, and the sensor from the Head needle guide is active.</p> <p>If the value of this item is set to 0 the Needle Guide Motor detection current is turned off, and the syringe slider moves to an absolute value, Z-axis position as specified in the object.</p>
Diameter	<p>Specific for Waste Vial.</p> <p>Defines the diameter of the reservoir container.</p>
Height	<p>Specific for Waste Vial.</p> <p>Defines the height of the reservoir container.</p>
Is Detectable	Specific for Waste Vial.
<i>Visible for Waste Position only.</i>	Differentiates if the Waste position is a Vial, which is detectable, or if it is a nipple with a connected waste tubing.

Table 102. Parameters for Fast Wash Stations (Sheet 1 of 3)

Item	Description
Wash 1 to Wash 2	Wash positions 1 and 2 can be assigned to Fast Wash Station.
Waste	Defines the Waste position.
Max Flow Rate	Sets the upper limit of flow rate for the selected Wash Position.
Post Rinse Liner	<p>Activates the solvent pump to rinse the wash liner of the selected Wash Position. Number of rinse cycles is selectable after the syringe needle has been removed from the Wash Station.</p> <p>Note Without the syringe needle inserted in the liner, the solvent flow is unrestricted. Expect a higher solvent consumption.</p>

Table 102. Parameters for Fast Wash Stations (Sheet 2 of 3)

Item	Description
Pre Rinse Liner	<p>Activates the solvent pump to rinse the wash liner of the selected Wash Position. Number of rinse cycles is selectable before the syringe needle has been inserted into the Wash Station.</p> <p>Note Without the syringe needle inserted in the liner, the solvent flow is unrestricted. Expect a higher solvent consumption.</p>
Def Ndl Penetr Depth	<p>Sets the default value of the syringe needle penetration depth in the reservoir vial.</p> <p>The default values are:</p>
Depenetration Speed	<p>Selects the required speed for pulling the syringe needle out of the reservoir vial.</p>
Max Ndl Penetr Depth	<p>The maximum allowed Needle Penetration can be defined as a safety measure so that the you cannot destroy the needle tip by going too far down.</p> <p>The maximum needle penetration must not exceed the length of the syringe needle, considering the loss of approximately 12 mm due to needle guide, and so on. For a typical needle length of 57 mm or 85 mm for the long needle, the maximum penetration depth must not exceed 45 mm or 73 mm.</p>
Penetration Speed	<p>The syringe needle penetration speed is set by this parameter. It is recommended to use the default value first. Changing this parameter in one or the other direction might lead to needle bending.</p>
Z-Tolerance	<p>A tolerance window to give a plus/minus range (expressed in mm) where the Head must expect an object.</p> <p>If the value of this item is > 0, this indicates a relative detection mode, and the sensor from the Head needle guide is active.</p> <p>If the value of this item is set to 0 the Needle Guide Motor detection current is turned off, and the syringe slider moves to an absolute value, Z-axis position as specified in the object.</p>
Diameter	<p>Specific for Waste Vial. Defines the diameter of the reservoir container. The default value is 20 mm</p>

Table 102. Parameters for Fast Wash Stations (Sheet 3 of 3)

Item	Description
Height	Specific for Waste Vial. Defines the height of the reservoir container. The default value is 80 mm
Vial Type	<p>Defines the Vial Type of the reservoir container in Positions or the corresponding Waste Type in Waste Position.</p> <p>Selection for Wash Positions are: Vial Types None, 2SR, 10SR, or 100SR.</p> <p>Selection for Waste Position are:</p> <ul style="list-style-type: none"> • None — If None is selected, an error (Pending Message) will be propagated. • Waste Port — Large Wash and Fast Wash Module • Waste Vial — Standard Wash. • Waste Inset — Standard Wash with inserted Drainage Adapter.
Volume	Defines the volume of the reservoir vial.

Wash Stations Option Pull-up Menu

Selecting **Options** pull-up menu, the following tasks are opened.

See [Table 103](#) for **Standard** and **Large Volume Wash Stations**, and [Table 104](#) for **Fast Wash Station**.

Table 103. Standard and Large Volume Wash Option Parameters

Item	Description
Check Teaching	<p>Checks the teaching position of the module.</p> <p>This task serves as a quick check to determine if the X-, Y-, and Z-positions are defined correctly.</p> <p>If a teaching point is incorrect, return to the Menu Setup for readjustment of the teaching position. Please note that this action can be done only under the Extended User Level.</p>
Teach Module	The positions of the X-, Y-, and Z-axes can be defined again (teaching).
New Wash Station	Creates of a new Wash Station.
Copy Wash Station	Copies of the present Wash Station.
Delete Wash Station	Deletes of the present. Wash Station.



Table 104. Fast Wash Option Parameters

Item	Description
Teach Module	The positions of the X-, Y-, and Z-axes can be defined again (teaching).
Reset to Default	Resets the selected station parameter to default value.
Check Teaching	Checks the teaching position of the module. This task serves as a quick check to determine if the X-, Y-, and Z-positions are defined correctly. If a teaching point is incorrect, return to the Menu Setup for readjustment of the teaching position. Please note that this action can be done under the Extended User Level but not under User Level .
New Wash Station	Creates of a new Wash Station.
Prime Wash Liner	Primes the tubing of the selected Wash Position.
Duration	Sets the time required for priming.

Tray Slots

This menu List Item will be implemented in future. See [Figure 144](#).

Figure 144. Menu Item Tray Slots

Modules	  17:29
▲	
Tools (2)	
Tray Holders (2)	
Tray Types (6)	
Trays (1)	
Vial Types (8)	
Vials (2)	
Wash Stations (2)	
Tray Slots (0)	
Unknown (0)	
Valves (0)	

Setup Menu Item - Set Date and Time

Visible in **Extended User** access level only.

- 1. In the **Options > Setup** pull-up menu select the list item **Set Date and Time**.
See [Figure 145](#) and [Table 105](#).

Figure 145. Set Date and Time

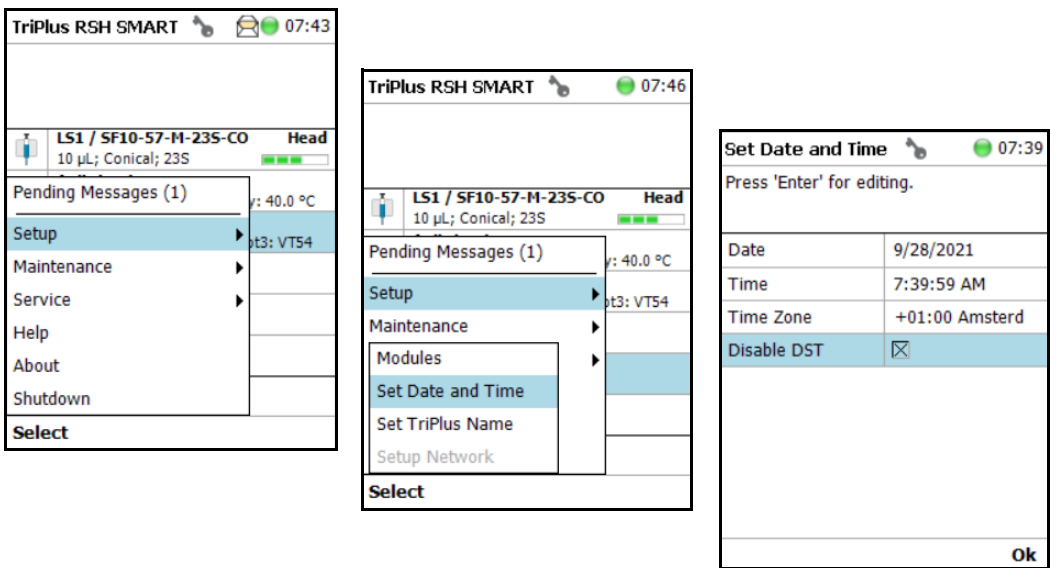
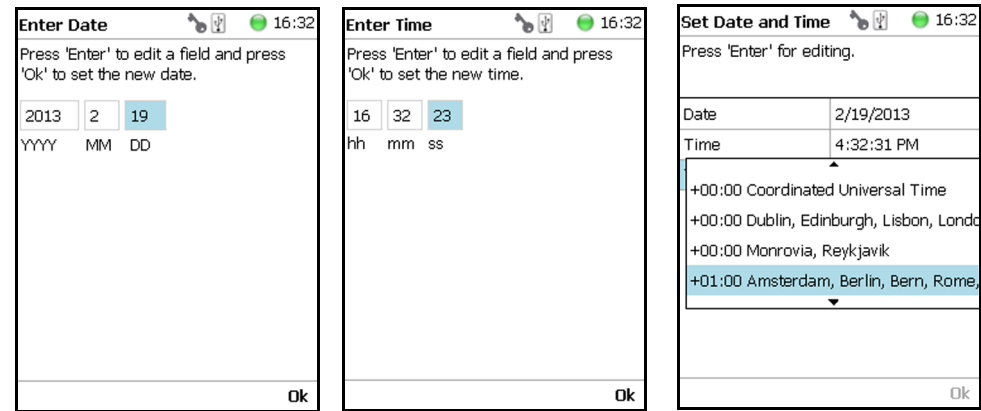


Table 105. Date and Time Format

Item	Description
Set Date and Time	Date: format yyyy-mm-dd
	Time: format hh:mm:ss
	Time Zone: Greenwich Mean Time (GMT) plus or minus the hour deviation from Greenwich standard time. Set your local time.

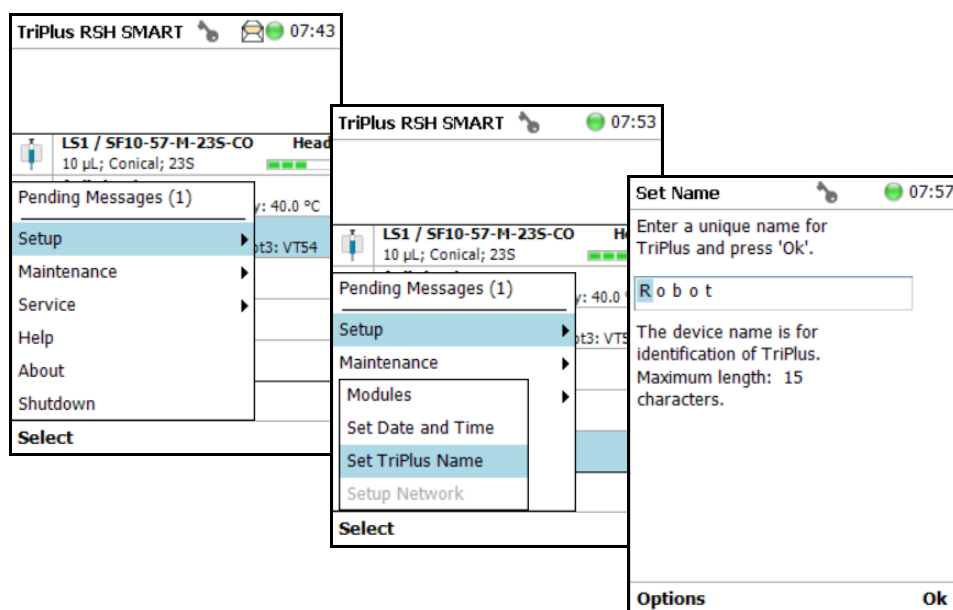


Setup Menu Item - Set TriPlus RSH SMART Name

Visible in **Extended User** access level only.

1. In the **Option** > **Setup** pull-up menu select the list item **Set TriPlus Name**. See Figure 146.

Figure 146. Set TriPlus RSH SMART Name



2. Press **Enter** to receive the alphabetical selection of characters or press the **Default Action** button to change from capital to lower case characters or to numbers. The name has to start with an alphabetical character.
3. Set a unique name for the TriPlus RSH. This name will be stored and can be used for identification of the system.
4. Press **Option** to receive the list item **Insert** or **Delete Character** or **Clear Text**.
5. Press **Ok** when finished.

Setup Menu Item - Setup Network

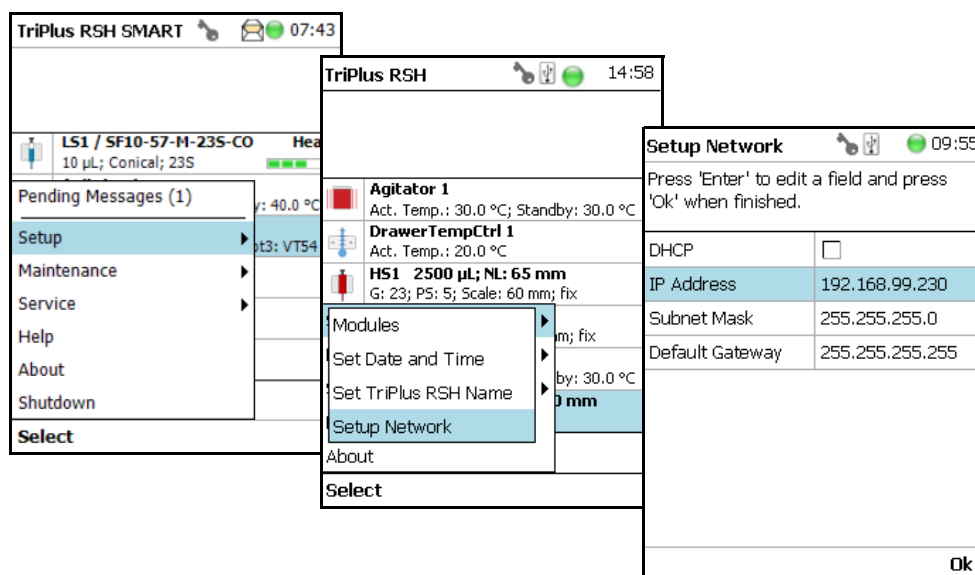
Visible in **Extended User** access level only.

In order to select the required network setup according to your laboratory setting, the following possibilities are available:

- **Direct connection** (Peer-to-Peer) — The TriPlus RSH SMART is directly connected to the computer via the LAN cable. There is no corporate network or router connection.
 - IP Address TriPlus RSH: 192.168.99.230

- IP Address computer: 192.168.99.210
 - Subnet Mask: 255.255.255.0
 - Default Gateway: not required, leave the field empty (if an address is entered, it will not be used).
- **Corporate Network with DHCP Protocol** — Ask the network administrator to verify and integrate the setup within the corporate network. Select the DHCP Protocol, the network will assign an IP Address and a Subnet Mask to the TriPlus RSH.
 - **Corporate Network with Fixed IP Address** — Ask the network administrator to provide the **IP Address**, **Subnet Mask** and **Default Gateway** to configure the TriPlus RSH SMART within the corporate network.
1. In the **Options > Setup** pull-up menu select the list item **Setup Network**.
See [Figure 147](#) and [Table 106](#).

Figure 147. Setup Network



2. Select either the mode **DHCP** or enter a unique fixed IP Address.
3. Press **Ok** when finished.

Table 106. Setup Network Parameters

Items	Description
Setup Network	Defines the Network communication parameters.
DHCP	Dynamic Host Configuration Protocol. If activated, an IP Address is dynamically sought throughout the provided network. It is advisable not to use the DHCP mode but to use a fixed IP Address.

Table 106. Setup Network Parameters

Items	Description
IP Address	The IP Address is a fixed system address. The IP Address is often provided by the network administrator. Default Address TriPlus RSH: 192.168.99.230
Subnet Mask	The Subnet Mask is used for network configuration; it must be provided by the network administrator. Default Subnet mask: 255.255.255.0
Default Gateway	The Gateway is used if independent networks must communicate interactively. Communication within the network is provided by a hub or switch, defined as Gateway . Default Gateway is 192.168.99.1
MAC Address	Unique hardware identification number of the system. Read only.

Note For more information see Setting up the Network Interface in the *TriPlus RSH SMART Hardware Manual*.

Maintenance Menu

This chapter describes the options of the **Maintenance Menu** operated either with the Virtual Handheld Controller, or directly using the installed Handheld Controller.

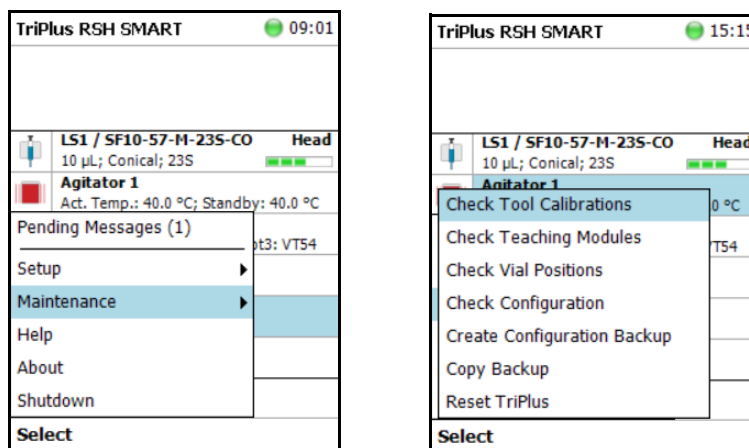
Contents

- Maintenance Menu
- Check Tool Calibrations
- Check Teaching Modules
- Check Configuration
- Reset Configuration
- Create Diagnostic Backup
- Create Configuration Backup
- Copy Backup
- Restore Backup

Maintenance Menu

The Maintenance function is available from the **Options** pull-up menu. See [Figure 148](#).

Figure 148. Maintenance Menu



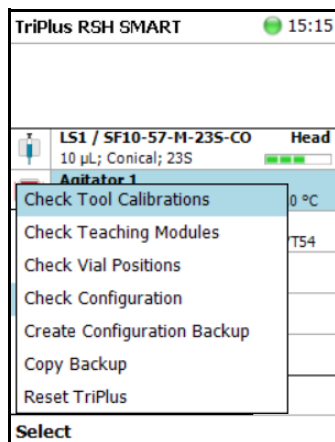
1. Select **Options** to open the pull-up menu, then select **Maintenance** to access the list items **Check Tool Calibrations**, **Check Teaching Modules**, **Backup**, and **Restore**.

Refer to the following sections:

- “[Check Tool Calibrations](#)” on [page 211](#)
- “[Check Teaching Modules](#)” on [page 211](#)
- “[Check Vial Positions](#)” on [page 212](#)
- “[Replace Unavailable Tools](#)” on [page 212](#)
- “[Check Configuration](#)” on [page 213](#)
- “[Reset Configuration](#)” on [page 214](#)
- “[Create Diagnostic Backup](#)” on [page 215](#)
- “[Create Configuration Backup](#)” on [page 216](#)
- “[Copy Backup](#)” on [page 217](#)
- “[Restore Backup](#)” on [page 217](#)
- “[Import Templates](#)” on [page 218](#)

Check Tool Calibrations

Check Tool Calibrations accesses the **Calibration Wizard** without leaving the **Maintenance** menu.

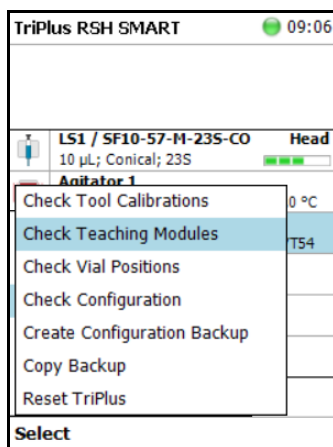


Follow the dialog shown on the display of the Handheld Controller, or on the screen of the Virtual Handheld Controller.

Details are described in **TriPlus RSH SMART Check Tool Calibration** in the *TriPlus RSH SMART Hardware Manual*.

Check Teaching Modules

Select **Check Teaching Modules** and the TriPlus RSH SMART Head moves from one module to the next, in the order listed in the table **modules**.



The unit waits at the programmed teaching point for visual inspection; press the button **Next** to continue.

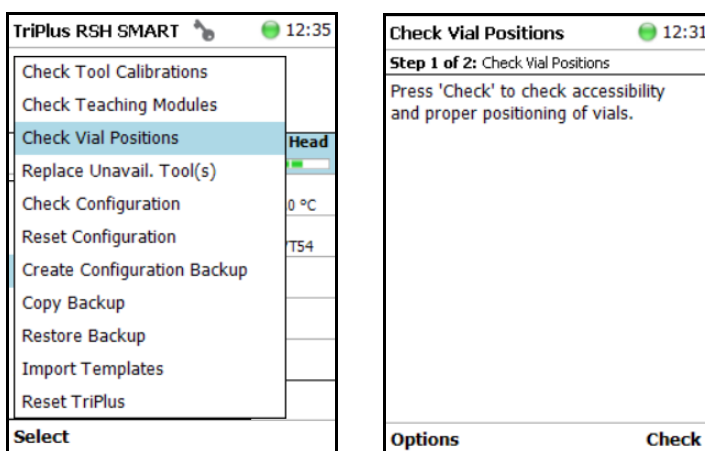
If a teaching point is incorrect return to the Menu **Setup** to readjust the teaching position of the module involved. The automated check of the teaching position of all the modules is stopped by pressing the **Back** button.

Check Vial Positions

Check Vial Positions is a universal function to automatically check certain vial positions, one after another, for accessibility and proper positioning of the vials, using the mounted Tool.

Once the process is started, the TriPlus RSH SMART moves to all wash and solvent vials, and to the three vials used for 3-corner teaching of each defined rack. On each position the tool will freeze for 1 second, before it moves to the next position.

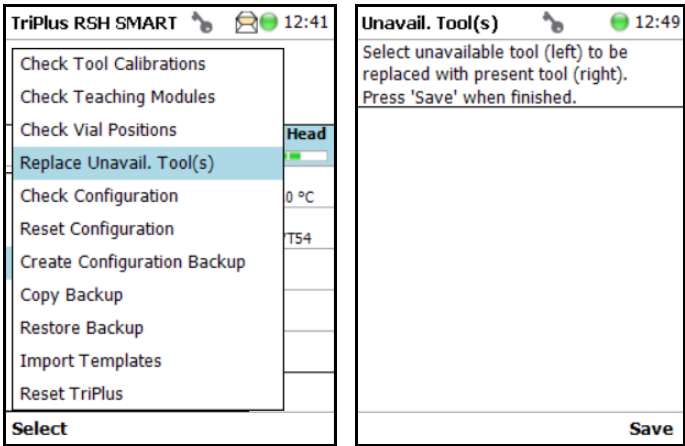
Any collision will terminate the process and trigger a "Move to Home" of the TriPlus RSH SMART Head. The function is available from User Level.



Replace Unavailable Tools

The Replace Unavailable Tool function replaces a tool that is no longer available on the TriPlus RSH SMART, but remains in the database, with a new tool of the same type (e.g. LS with LS, HS with HS, SPME with SPME etc.).

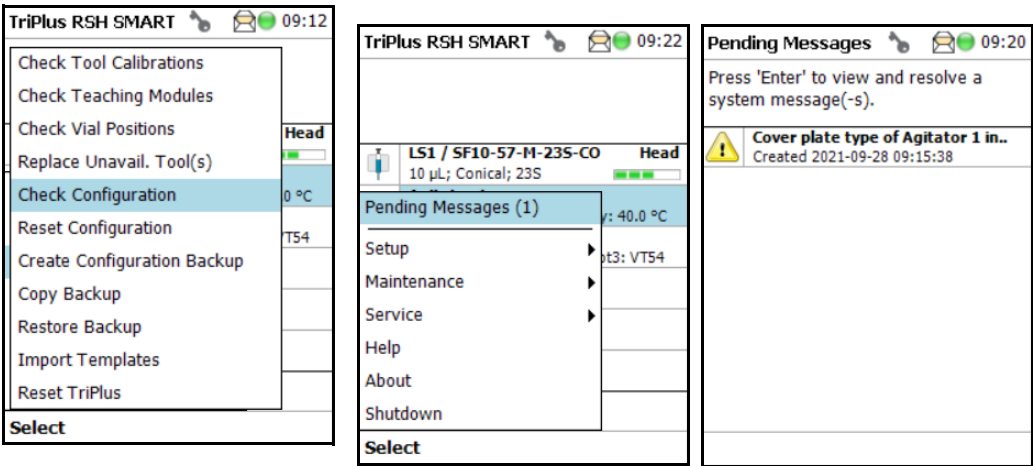
If a tool e.g. with the name "LS 3" has been used on the system and is now no longer available, its name "LS 3" still exists in the database. If another (new) LS tool is added to the system, it will be assigned the next free name e.g. "LS 4". Using the Replace Unavailable Tool function it is possible to replace the unavailable tool with the new tool of the same type in a way that the new tool will inherit the name of the tool no longer present on the system.



Check Configuration

Selecting **Check Configuration** to check the entire system configuration for any mismatches. **Pending Messages** or **Service Issues** which have been clicked away can be retrieved again.

The software checks the entire configuration for any hidden problems. The message symbol (envelope) in the Status Line indicates that one or more mismatches have been detected.

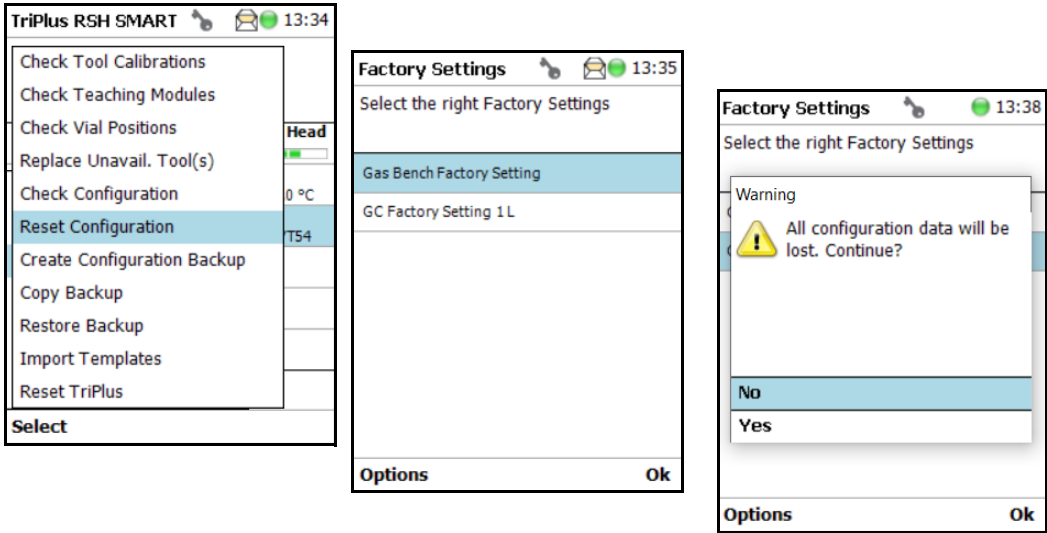


From the pull-up menu select the **Pending Messages** or **Service Issues**.

Note Pending messages can be opened and viewed in the **Extended User** access level only.

Reset Configuration

Use the **Reset Configuration** to make the TriPlus RSH SMART Firmware (Application) reset the configuration to a standard application package.



WARNING As detailed in the **Warning Message**, the configuration data will be lost. This means that in the software, Configuration data base will be deleted and the few parameters such as the X-Axis length and the Signal settings (see [Table 107](#) and [Table 108](#)) will be reset to default and re-entered.



All other parameters from the TriPlus RSH SMART system configuration (e.g. teaching points for modules, and so on) will be deleted. Consequently, you must follow all the steps in the **Installation Wizard** again.

Path from Start Screen: **Options > Service > Installation**.
Extended User level access is required.

Table 107. List Items for Reset Configuration

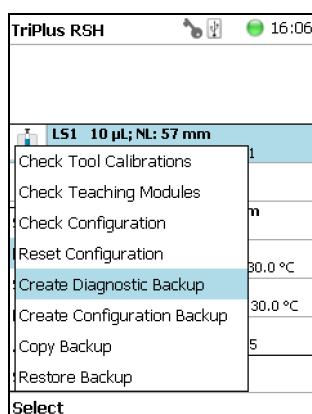
Item	Description
Factory Setting 1-S	This will set the length of the X-Axis to 850 mm.
Factory Setting 2-L	This will set the length of the X-Axis to 1205 mm
Factory Setting 3 ITSP-S	This will set the basic configuration for the dedicated application ITSP. The dedicated Tray Types and the Waste Container for depositing the used ITSP cartridge are configured besides the standard parameters as listed below.

Table 108. System Parameters Affected by Reset Configuration

Item	Default Value Settings with Reset Configuration
I/O Interface	TTLIn1 and TTLIn2; negative logic; 20 ms Debounce Time SWOut1 and SWOut2: PWMOut 36V.
Signals	Input Signals: TTLIn1 and TTLIn2 Output Signals: SWOut1 and SWOut2
Chromatography System	GC1: Input1, Output1
Plunger Check	Activated (Used in Service Installation Wizard Calibrate Tool.)

Create Diagnostic Backup

By using the command **Create Diagnostic Backup**, essential information from the current status of the TriPlus RSH SMART is extracted, and saved in an encrypted form on the SD Card.



- The primary use of the Diagnostic Backup file is for supporting and troubleshooting a TriPlus RSH SMART system.

For this purpose it is necessary to send the file by e-mail to the Thermo Fisher Scientific technical support center: gc.gcms.customersupport@thermofisher.com, with the file description provide as well the TriPlus RSH SMART Firmware version used. Refer also to the chapter **TriPlus RSH SMART Firmware** in the *TriPlus RSH Hardware Manual*.

The following software components are saved:

- **Application Software**
- **Device Firmware** — The Firmware of all active modules which are part of the specific TriPlus RSH configuration
- **Configuration** (Data Base)

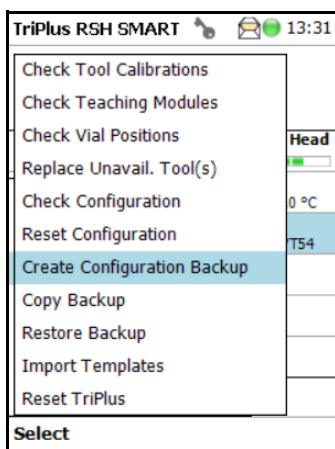
- **Presets** — Defines a model configuration such as liquid and headspace injection technique, and so on.

This tool is available in the **Extended User** and **Service** access levels. After successful creation of the **Diagnostic Backup**, copy the file directly onto the USB Stick. The creation of the Diagnostic Backup file, with extension ***.pack**, does take approximately eight minutes. The size of the file is in the range of 12 MB, depending on the configuration of the TriPlus RSH SMART.

The **Diagnostic Backup** file can also be used for a **Restore** procedure.

Create Configuration Backup

This command creates a configuration backup file of the TriPlus RSH SMART in its current status. This configuration backup is stored on the SD Card installed on the Control Board. Refer also to the chapter **TriPlus RSH SMART Firmware** in the *TriPlus RSH SMART Hardware Manual*.



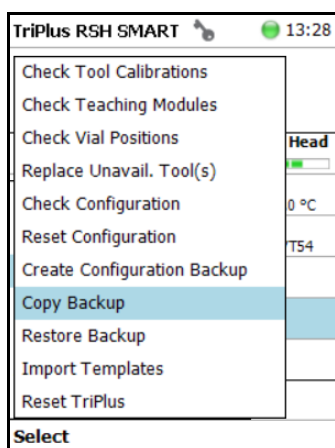
The command is available in all access levels. After successful creation of the Configuration Backup, copy the file directly onto the USB Stick. The creation of the Configuration Backup file does take approximately one to two minutes. The file size is in the range of 1.3 MB, depending on the TriPlus RSH SMART configuration. The file extension is ***.pack**.

The **Configuration Backup** file can also be used for a **Restore** procedure.

Copy Backup

Note Be aware that only one backup file can be stored on the SD Card. If for example, a Diagnostic Backup file is created and directly followed by creating a Configuration Backup file, the first file (in this example the Diagnostic Backup file) will be overwritten. To save both files, it is necessary to copy each file immediately onto the USB Stick

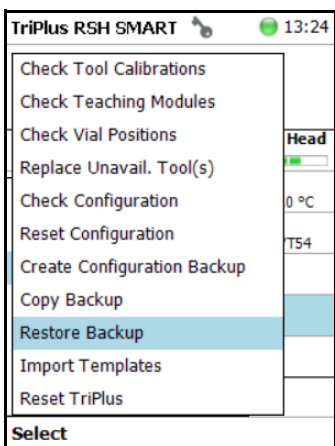
It is good practice to store the configuration backup in a safe place, if possible on a network-server. You must keep an authorized configuration backup outside of your premises.



To copy a configuration backup from the SD Card, insert the USB stick into the connector USB Host on the back of the TriPlus RSH SMART. Refer also to the chapter **TriPlus RSH SMART Firmware** in the *TriPlus RSH SMART Hardware Manual*.

Restore Backup

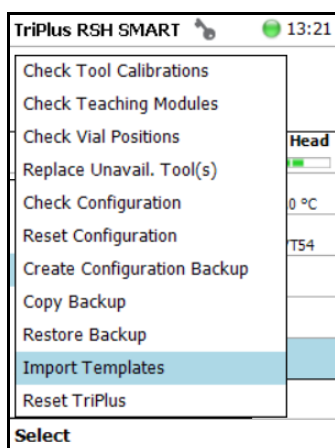
The function **Restore** allows loading a **Backup** file saved from the same TriPlus RSH SMART system back to the system. Only a Backup file (*.pack file) can be used. The key, the encryption of the Application, and the device Firmware files must match. Refer also to the chapter **TriPlus RSH SMART Firmware** in the *TriPlus RSH SMART Hardware Manual*.



Import Templates

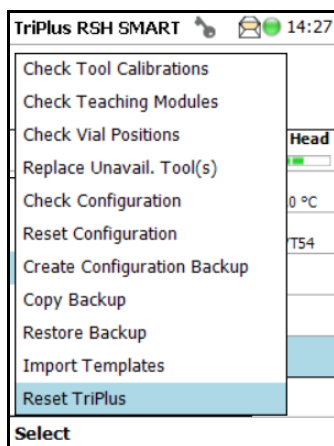
Selecting the menu item **Import Templates** as an **Extended User** to import one or more customized templates for several items such as:

- Needle Types
- Tray Items
- Syringe Types
- Tray Slot Types
- Tray Types
- Valve Types
- Vial Types
- Tray Container Types



Reset TriPlus

Selecting the Menu Item Reset TriPlus from the Maintenance Menu will set the System back and send the head back to the Home Position if necessary.



Service Menu

This chapter describes the options of the **Service Menu** operated either with the Virtual Handheld Controller, or directly using the installed Handheld Controller.

Contents

- [Service Menu](#)
- [Installation Item](#)
- [Create New Tray System Item](#)
- [Teach Home Position](#)

Note Items highlighted in **green** are only visible in the **Extended User** access level.

Service Menu

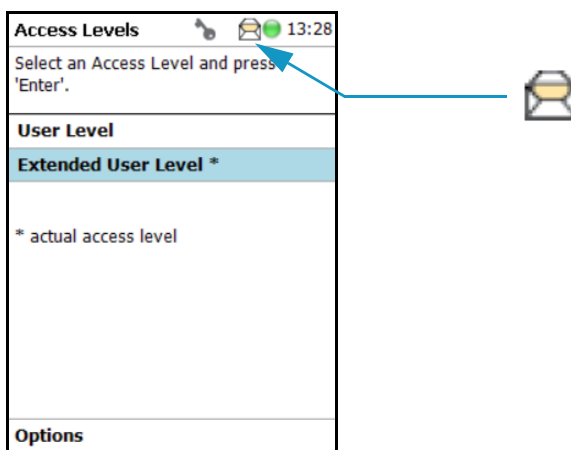
The Menu **Service** is only available under the **Extended User Level**. The menu contains the items **Installation** and **Create New Tray System**. The item **Installation** is a wizard that guides through the installation procedure covering all points, and controlling the status of the system. The **Create New Tray System** item will be used during routine operation.

- See “Prerequisites” on page 222
- See “Installation Item” on page 223
- See “Create New Tray System Item” on page 255

Prerequisites

When the TriPlus RSH SMART is powered on, the **User Access Level** is always active by default. To enable access to the **Extended User Level** press the two **Menu Buttons** simultaneously, or press the two characters **A** and **B** simultaneously on the keyboard if you are working with a Virtual Handheld Controller. For more details, see the section “[User, Extended, and Service Access Levels](#)” on page 96.

Figure 149. Changing Access Level



When the TriPlus RSH SMART is powered up the first time, the **Message Envelope** is shown in the Menu Screen Status Bar. See the example in [Figure 149](#). \

The reason for this message is that a TriPlus RSH SMART cannot be operated as long as the motors are not calibrated. The modules cannot operate if this step has not been completed.

When pending messages are indicating, verify the message. If the message can be explained with the concept as described above, click it away. For confirmation check all cables from the active modules are properly connected.

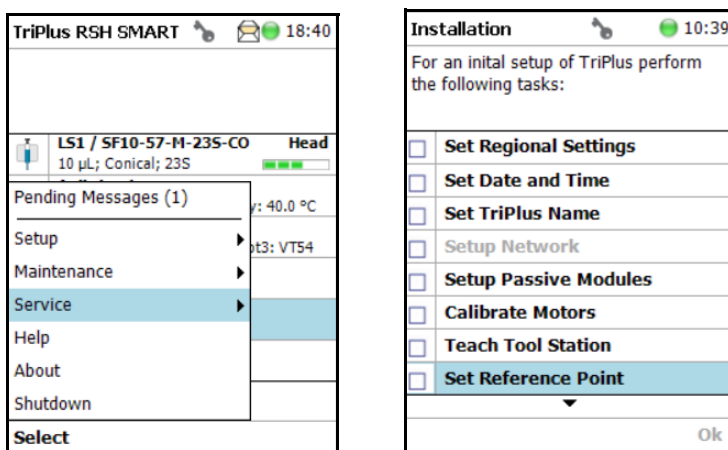
Installation Item

Note During a new installation of the TriPlus RSH SMART, it is advisable to first configure the Passive modules before activating the **Installation Wizard Service**. One wizard item is Teaching Module. If the Passive modules, such as the Injector, Wash Module, and so on, are not yet configured, it will be necessary to restart this wizard again.

The **Quick Reference Guide** in the *TriPlus RSH SMART Hardware Manual* shows the order of installation. Use this guide as reference.

Select **Options** to open the pull-up menu. Select the menu item **Service**; then the list item **Installation** to start the wizard. See [Figure 150](#).

Figure 150. Selecting the Menu List Item Installation

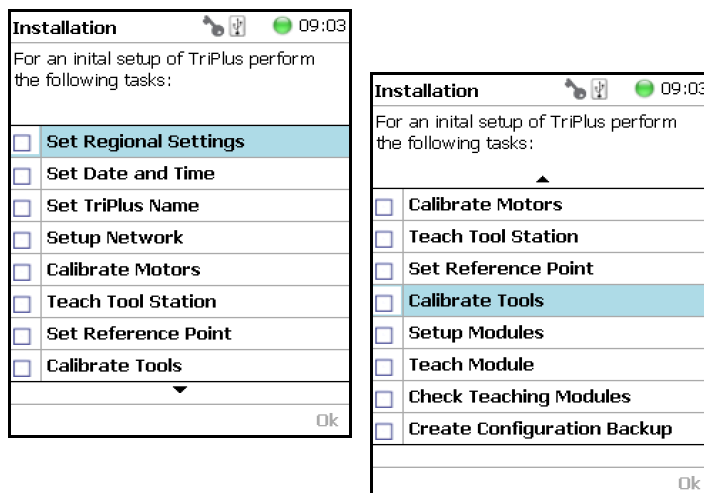


The **Installation** wizard begins with the basic setup items. Some of the list items can be accessed under the menu item **Setup**.

The **Installation** wizard includes twelve points. See [Figure 151](#). When the TriPlus RSH SMART is powered up the very first time, specific sections are grayed out until the section Calibration Motors has been completed. Each point ticks off as it is completed.

When the TriPlus RSH SMART is powered on for the very first time, these wizard items which have to be accomplished are active (black). The grayed out wizard items will be active as soon as the system is calibrated (Calibrate Motors), and if the hardware configuration of the TriPlus RSH SMART requires these points.

Figure 151. Installation Wizard.



See the following sub-sections:

- “Set Regional Settings” on [page 225](#)
- “Set Date and Time” on [page 226](#)
- “Set TriPlus RSH SMART Name” on [page 227](#)
- “Setup Network” on [page 228](#)
- “Calibrate Motors” on [page 231](#)
- “Teach Tool Station” on [page 234](#)
- “Configure SPME Tool” on [page 239](#)
- “Set Reference Point” on [page 241](#)
- “Calibrate Tools” on [page 242](#)
- “Setup Modules” on [page 245](#)
- “Teach Module” on [page 247](#)
- “Check Teaching Modules” on [page 252](#)
- “Create a Backup File” on [page 253](#)

Set Regional Settings

❖ To set regional setting

1. Select the wizard item **Set Regional Setting** to adjust the language and the region.
See [Figure 152](#).

Figure 152. Wizard Item Set Regional Settings

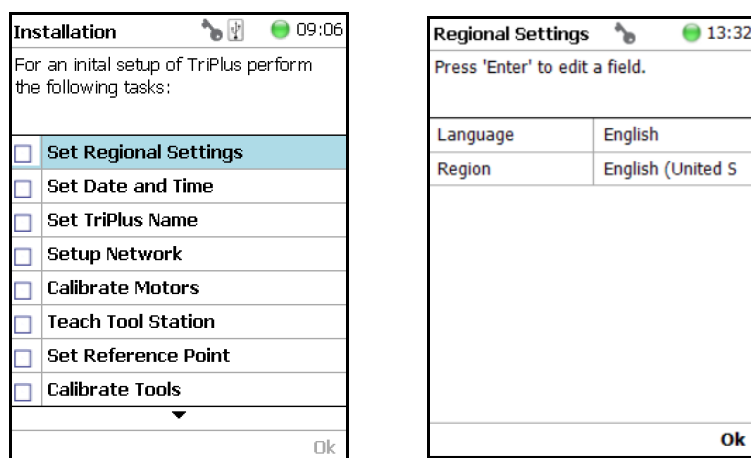


Table 109. Set Regional Settings

Item	Description
Language	English is the default language.
Regional Setting	Corresponds to the country settings of the computer operating system. The country setting influences formatting for dates and numbers.



IMPORTANT When a Set Regional Setting parameter is changed, a reboot of the system is required. Please note that the Regional Settings are active for the Handheld Controller only, the Virtual Handheld Controller is dependent on the settings of the computer operating system.

Set Date and Time

❖ To set date and time

- 1. Select the wizard item **Set Date and Time** to adjust the date and time. See [Figure 153](#) and [Table 110](#).

Figure 153. Wizard Item Set Date and Time

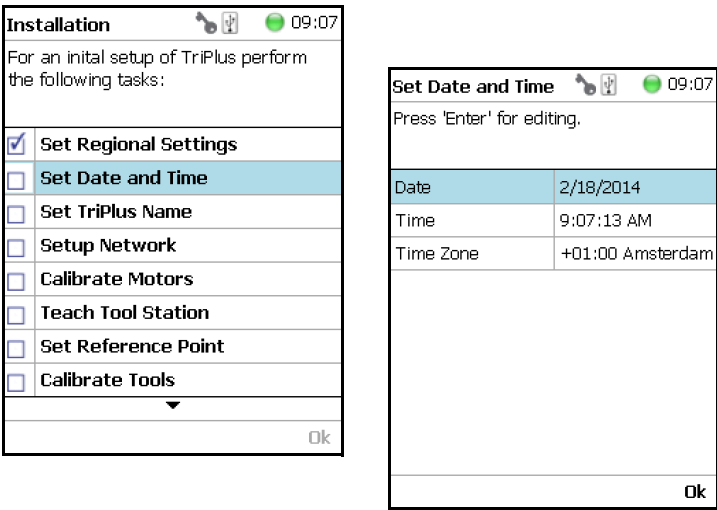
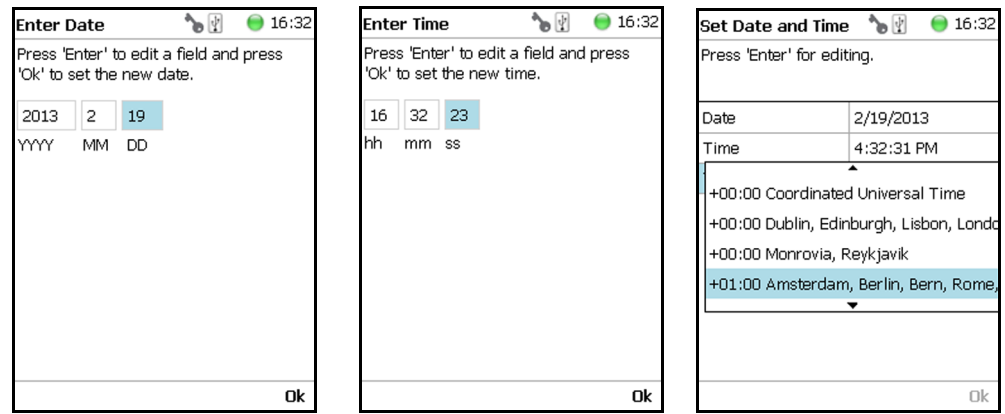


Table 110. Set Date and Time Parameters

Item	Description
Date	The format is: yyyy/mm/dd
Time	The format is hh:mm:ss
Time Zone	Greenwich Mean Time (GMT) plus or minus the time deviation (in hours) from Greenwich standard time.

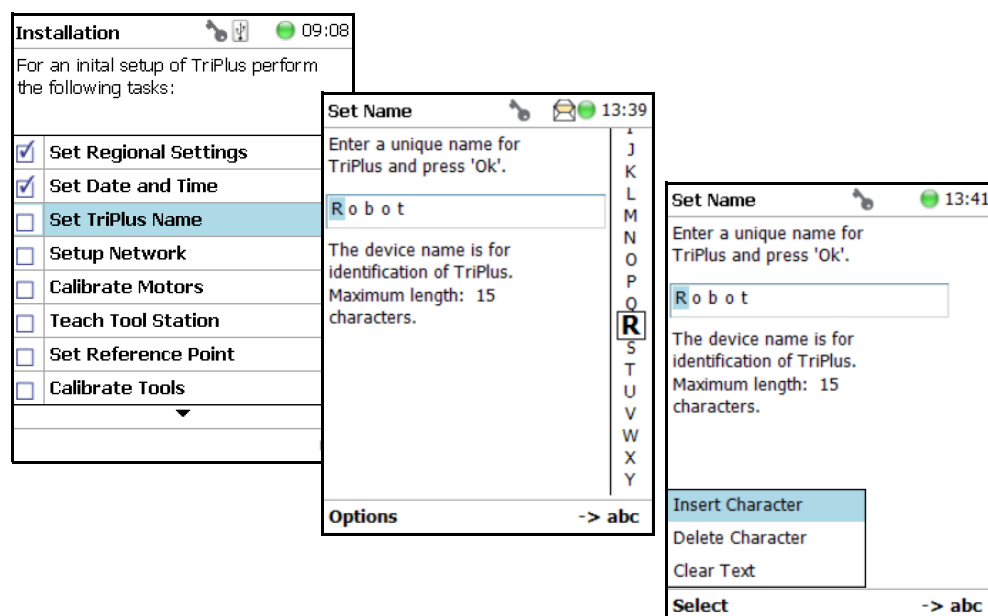


Set TriPlus RSH SMART Name

❖ To set TriPlus RSH SMART name

1. Select the wizard item **Set TriPlus Name** to set a name for the TriPlus RSH SMART for identification. See [Figure 154](#) and [Table 111](#).

Figure 154. Wizard Item Set TriPlus Name



2. Press **Enter** to receive the alphabetical selection of 15 characters maximum or press the **Default Action** button to change from capital to lower case characters or to numbers.

Note The name must start with an alphabetical character, and end with an alphanumerical character. Special characters or spaces cannot be used to start or end the name.

3. Press **Options** to access the list items **Insert**, or **Delete Character**, or **Clear Text**.
4. Press **Ok** when finished.

Table 111. Set TriPlus Name Parameter

Item	Description
Set TriPlus RSH Name	Set a unique name for the TriPlus RSH SMART. This name will be stored and is used for identification of the system.
Insert Character	Allows inserting a character. Press Enter to receive the selection of capital letters. Pressing the Default Action button will switch to lower case characters or to the alphanumeric selection.
Delete Character	Deletes the selected character.
Clear Text	Clears the full text.

Setup Network

❖ To perform Setup Network

1. Select the wizard item **Setup Network** to enable a network communication from the system to the computer, TCP/IP. See [Figure 155](#) and [Table 112](#).
2. Select either the mode **DHCP** or enter a unique fixed IP Address.
3. Press **Ok** when finished.

Figure 155. Wizard Item Setup Network

The figure consists of three screenshots of the TriPlus RSH SMART setup wizard interface.

Screenshot 1: Installation
Title: Installation
Time: 09:08
Text: For an initial setup of TriPlus perform the following tasks:
List of tasks:

- ☒ Set Regional Settings
- ☒ Set Date and Time
- ☒ Set TriPlus Name
- ☒ **Setup Network**
- ☐ Calibrate Motors
- ☐ Teach Tool Station
- ☐ Set Reference Point
- ☐ Calibrate Tools

An 'Ok' button is at the bottom right.

Screenshot 2: Setup Network
Title: Setup Network
Time: 09:10
Text: Press 'Enter' to edit a field and press 'Ok' when finished.

DHCP	<input checked="" type="checkbox"/>
IP Address	192.168.99.230
Subnet Mask	255.255.255.0
Default Gateway	255.255.255.255

An 'Ok' button is at the bottom right.

Screenshot 3: Enter IP Address
Title: Enter IP Address
Time: 09:10
Text: Press 'Enter' to edit a field and press 'Ok' when finished.

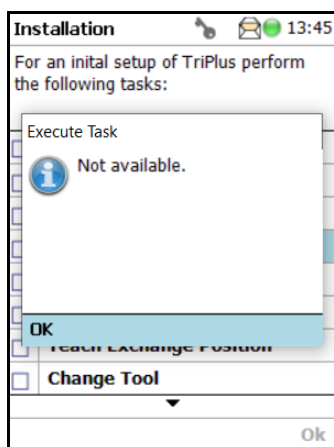
192 168 99 230

An 'Ok' button is at the bottom right.

Table 112. Setup Network Parameters

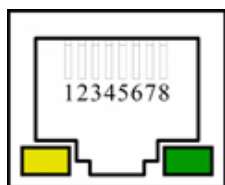
Item	Description
Setup Network	Defines the Network communication parameters.
DHCP	Dynamic Host Configuration Protocol. If activated, an IP Address is dynamically sought throughout the available network. It is advisable not to use the DHCP mode but to use a fixed IP Address.
IP Address	The IP Address is a fixed system address. The IP Address is often provided by the network administrator. Default address TriPlus RSH SMART is 192.168.99.230
Subnet Mask	The Subnet Mask is used for network configuration, it must be provided by the network administrator. Default address TriPlus RSH SMART is 255.255.255.0
Default Gateway	Gateway is used if independent networks must communicate interactively. Communication within the network is provided by a hub or switch, defined as the Gateway . Do not assign a Default Gateway address.

When the network cable is not connected, and a LAN communication is not established, the following screens will appear.



The system will recognize that no network communication is established or possible. A corresponding error message will appear.

1. Check the connections of the LAN cable. The default addresses is visible after reentering the **Setup Network** screen.
2. Check the LEDs on the Ethernet connector at the back of the TriPlus RSH SMART.



- **The LED on the left** — **Status LED**. Orange color indicates that the current is applied to the connector.
 - **The LED on the right** — Indicates the Ethernet communication status. Green blinking status indicates that the Ethernet communication is established.
3. When the settings have to be changed, select one Network parameter after the other, and enter the required numbers. The next examples show the default values.

Note When the LAN communication is not established, newly entered IP address numbers are not stored.

Setup Network 11:10

Press 'Enter' to edit a field and press 'Ok' when finished.

DHCP	<input type="checkbox"/>
IP Address	0.0.0.0
Subnet Mask	0.0.0.0
Default Gateway	255.255.255.255

Enter IP Address 11:11

Press 'Enter' to edit a field and press 'Ok' when finished.

192	168	99	230
-----	-----	----	-----

Ok

Setup Network 11:11

Press 'Enter' to edit a field and press 'Ok' when finished.

DHCP	<input type="checkbox"/>
IP Address	192.168.99.230
Subnet Mask	0.0.0.0
Default Gateway	255.255.255.255

Setup Network 09:10

Press 'Enter' to edit a field and press 'Ok' when finished.

DHCP	<input type="checkbox"/>
IP Address	192.168.99.230
Subnet Mask	255.255.255.0
Default Gateway	255.255.255.255

Ok

For more information refer to **Setting Up Network Interface** in the *TriPlus RSH SMART Hardware Manual*.

In order to select the required network setup according to the laboratory setting, the following possibilities are available:

- **Direct connection** (Peer-to-Peer) — The TriPlus RSH SMART is directly connected to the computer via the LAN cable. There is no corporate network or router connection.
 - IP Address TriPlus RSH SMART: 192.168.99.230
 - IP Address computer: 192.168.99.210
 - Subnet Mask: 255.255.255.0

- Default Gateway: not required, leave the field empty (if an address is entered, it will not be used)
- **Corporate Network with DHCP Protocol** — Ask the network administrator to verify and integrate the setup within the corporate network. Select the DHCP Protocol; the network will assign an IP Address and a Subnet Mask to the TriPlus RSH SMART.
- **Corporate Network with Fixed IP Address** — Ask the network administrator to provide the IP Address, Subnet Mask, and Default Gateway to configure the TriPlus RSH SMART within the corporate network.

Calibrate Motors

The calibration of the motors is basically a check to determine whether the mechanical stop points of the various axes can be found reliably. A clearance distance (offset) from the mechanical stop point is assigned and stored as the electronic stop point. This calibration of the axes is mandatory and ensures reliable performance.

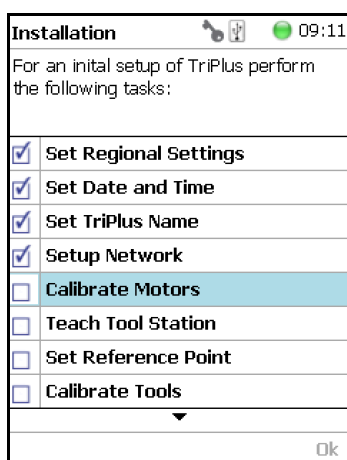
This step has been repeated when a motor has failed, has been replaced or when any other major error has occurred. This calibration task brings the TriPlus RSH SMART back to reliable operation.

Note Please do not confuse the terms and tasks for **Calibration Motors** as explained in this section with those for **Calibration Tools** as described in the section “[Calibrate Tools](#)” on [page 242](#). When starting the wizard **Calibrate Motors**, at least one Tool must be parked in a slot of the Tool Station.

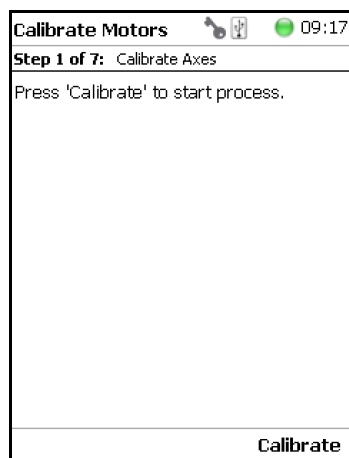
❖ To calibrate motors

1. Select the wizard item **Calibrate Motors** and follow the dialog. In the following example, the **Calibration Wizard** guides you from the steps 1 to 6. See [Figure 156](#).

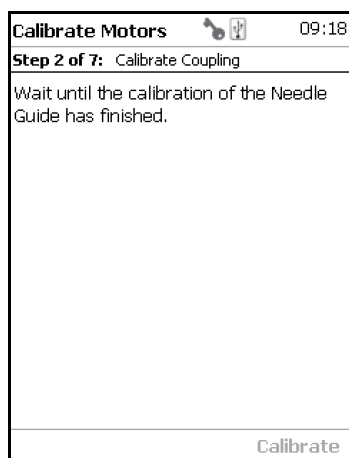
Figure 156. Wizard Item Calibrate Motors and Starting Calibration Wizard Step 1 of 6



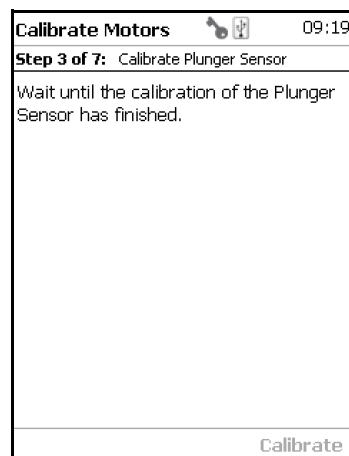
2. Press **Calibrate** to start the first step **Calibrate Axes**. All axes from the TriPlus RSH SMART are calibrated. Wait until the yellow light stops flashing and **Next** becomes available (Step 1).



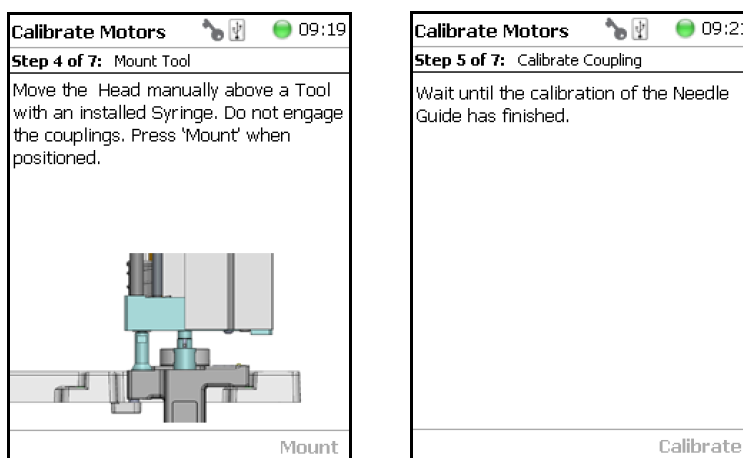
3. Press **Next** to continue with the **Calibrate Coupling** (Step 2).



4. When finished, press **Next** again to **Calibrate Plunger Sensor** (Step 3).

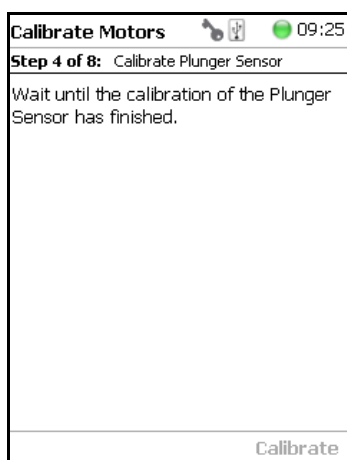


5. Step 4 calibrates the coupling of a Tool. The wizard text explains that the head must be moved above the **Coupling Pivots**.



Note Please note that the TriPlus RSH SMART Head has to be positioned such that the receiving holes of the **Z-Slider** are above the **Coupling Pivots** of the Tool but they must not be engaged.

Upon starting the wizard, the TriPlus RSH SMART automatically turns off the current to enable a manual movement of the TriPlus RSH SMART Head.

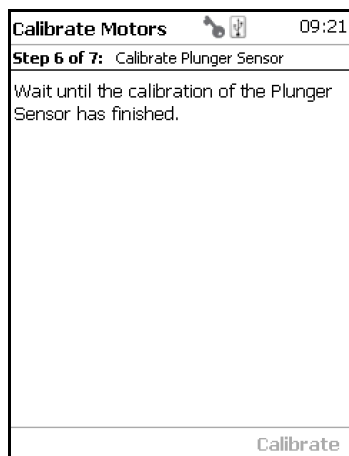


6. If the calibration step is activated with an installed Tool, the system dialog will ask you to move the Head first to an empty slot, and **Eject** the Tool first.

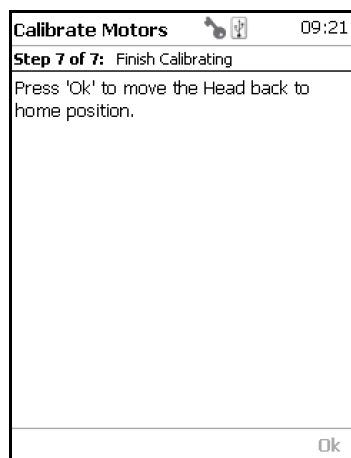
Note When the Tool ejection has been completed, the Tool is not installed in the head of the TriPlus RSH SMART. Continuing with **Calibrate Motors**, in the Installation Wizard will detect that the Tool is not mounted, and will adapt to this situation accordingly.

When Step 4 has been successfully completed, press **Next** to continue to Step 5 to calibrate the coupling.

7. In Step 6, the Sensor of the **Plunger motor** is calibrated. When finished, press **Next** to continue.



8. Step 7 completes the **Calibration Wizard**. The head of the TriPlus RSH SMART moves back to the Home position.



Teach Tool Station

This section describes the teaching of a ATC Station. The teaching of a TR Station uses the same steps.

CAUTION When a ATC Station is used in the configuration of the system, remove any other Tool from the slots before the wizard is started.

❖ To proceed with different types or configurations of the Tool station

The TriPlus RSH SMART system can be equipped with a TR Station or with one or two ATC Stations.

The following configurations are allowed:

- One TR Station
- One or two ATC Stations

The following configurations are prohibited:

- Two TR Stations
- The combination of a TR Station with a ATC Station

For the configuration with two ATC Stations see the following Caution **Exceptional Circumstances**.

CAUTION Exceptional Circumstances

To configure two ATC Stations see the following procedure:

1. Physically connect both ATC Stations at the desired position of the X-Axis.
2. Define which ATC Station shall be the **ATC Station #1**.
3. When the TriPlus RSH SMART is powered off, connect the supplied control cable from the rear side of ATC Station #1 to the connector marked Bus on the TriPlus RSH SMART control interface. If Bus connector is already occupied, connect the cable to another Active module with an open connector.
4. DO NOT connect the control cable from **ATC Station #2**.
5. Power-up the system. The software will assign the module address to **ATC station1**.
6. Turn off the system and connect the provided control cable to **ATC Station #2**.
7. Power-up the system again, the software will recognize the second ATC Station and will assign the address to **ATC Station2**.



After completing the steps to assign the addresses to the two ATC Stations, keep in mind the following points:

The slots in the two ATC Stations will be identically numbered from 1 - 3. The Address of the ATC Station will enable the system to distinguish between these slots.

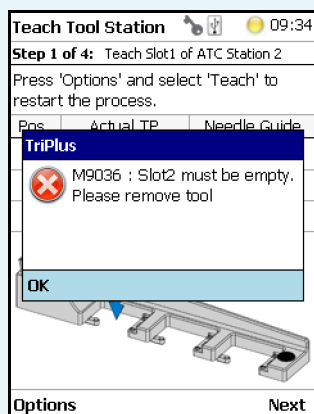
For example: ATC Station1; Slot1 | ATC Station2; Slot1.

- Following the **Service Wizard**, the second point after Teach Tool Station is the item **Set Reference Point**. It is advisable, but not mandatory, to set the reference point at ATC Station #1. It is more likely that the second ATC Station will be removed in the future, and not the first one. Removing the ATC Station to which the Reference Point has been assigned would result in the elimination of the Reference Point for the system.
- When the wizard for **Teach Tool Station** is started, the software will check if the Tool (coupled in the TriPlus RSH Head) is parked in the expected position. If the two ATC Stations are mixed up, an error message appears. Then, verify the identity of the ATC Station, the slot position, or both.

Wizard Teach Tool Station

The wizard procedure is identical for teaching a TR Station or an ATC Station. The difference is the number of slots to teach.

WARNING When an ATC Station is used in the configuration of the system, remove any other Tool from the slots before the wizard is started. If this is not observed, an error message will appear.

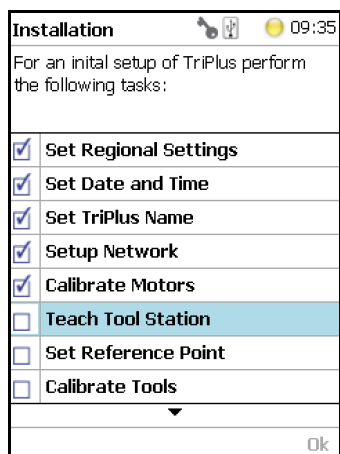


The wizard **Teach Tool Station** calibrates the position of the slot(-s). The height of the Tool, installed in the slot is calibrated against the TriPlus RSH SMART Injection Unit base plate to define the coupling distance.

❖ To calibrate the position of the slots

1. Select the wizard item **Teach Tool Station**. See [Figure 157](#).

Figure 157. Wizard Item Teach Tool Station

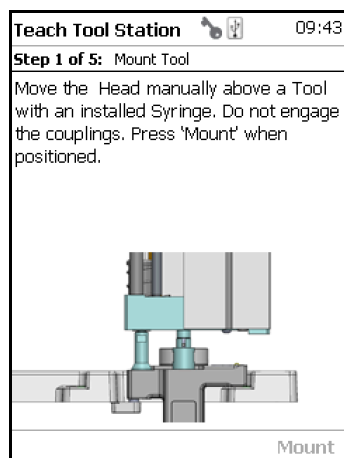


The wizard automatically turns off the current to the TriPlus RSH SMART to enable a manual movement of the TriPlus RSH SMART Injection Unit to the first Slot.

If you have performed the previous step “[Calibrate Motors](#)” on [page 231](#), a Tool should still be installed. If for any reason there is no installed Tool, the TriPlus RSH SMART will recognize the situation and will go through an intermediate step to mount a Tool.

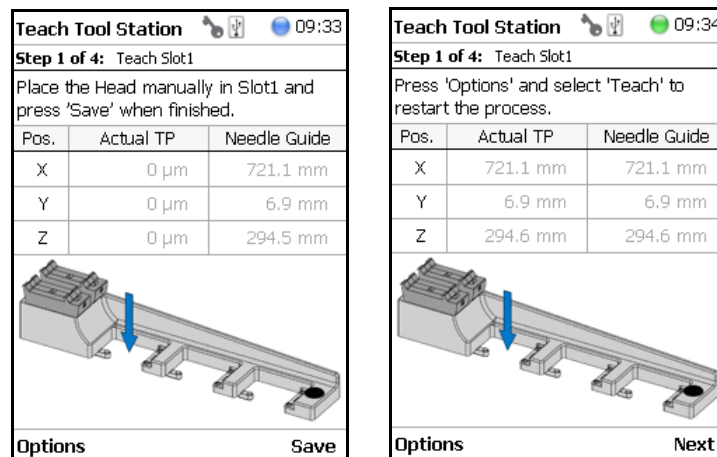
- Step 1 of 4 requests the installation of a Tool if one is not mounted to the Head.
See [Figure 158](#).

Figure 158. Mount a Tool



- When a Tool has already been installed, the wizard starts with Step 1. See [Figure 159](#).



Figure 159. Teach Slot 1



Step 1 asks you to place the TriPlus RSH SMART Injection Unit manually into the first slot. Ensure that the guiding pins engage well into the guiding holes of the ATC Station. When positioned well, press **Save** to store the X-, Y-, and Z-Axes positions.

- Repeat the previous steps to teach the positions for Slots 2 and 3. The last step moves the Head back to the **Home** Position. See [Figure 160](#).


Figure 160. Teach Slot 2 and Slot 3

Teach Tool Station   09:34



Step 2 of 4: Teach Slot2

Place the Head manually in Slot2 and press 'Save' when finished.

Pos.	Actual TP	Needle Guide
X	0 μ m	721.3 mm
Y	0 μ m	105.0 mm
Z	0 μ m	294.6 mm



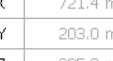
Options **Save**

Teach Tool Station   09:35



Step 3 of 4: Teach Slot3

Press 'Options' and select 'Teach' to restart the process.

Pos.	Actual TP	Needle Guide
X	721.4 mm	721.4 mm
Y	203.0 mm	203.0 mm
Z	295.2 mm	295.2 mm



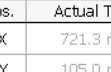
Options **Next**

Teach Tool Station   09:34



Step 2 of 4: Teach Slot2

Press 'Options' and select 'Teach' to restart the process.

Pos.	Actual TP	Needle Guide
X	721.3 mm	721.3 mm
Y	105.0 mm	105.0 mm
Z	294.6 mm	294.6 mm



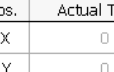
Options **Next**

Teach Tool Station   09:35

Step 3 of 4: Teach Slot3

Place the Head manually in Slot3 and press 'Save' when finished.

Pos.	Actual TP	Needle Guide
X	0 μ m	721.4 mm
Y	0 μ m	203.0 mm
Z	0 μ m	295.2 mm



Options **Save**

Note If the TriPlus RSH SMART configuration contains two ATC Stations, the wizard will continue with teaching ATCStation2 in the same logical order as described above.

Configure SPME Tool

Working with the SPME Tool requires two adjustments of the SPME Fiber. Configure SPME Tool parameters are described in [Table 113](#).

Table 113. Configure SPME Tool Parameters

Item	Description
Fiber Alignment	Fiber position is aligned with the needle tip.
Standby Position Offset	Fiber is inserted 2 mm into sheath metal needle. (2 mm retraction is a recommended value). When using very soft septa, adjust to 3.0 mm.

The last wizard point is Teach Tool Station. For this task, the Tool must be removed from the slots. After finishing the teaching task, the wizard will move to the next point, **Configure SPME Tool**. If the SPME Tool has not been positioned in a slot at the moment of activating this wizard point, the task will be grayed out.

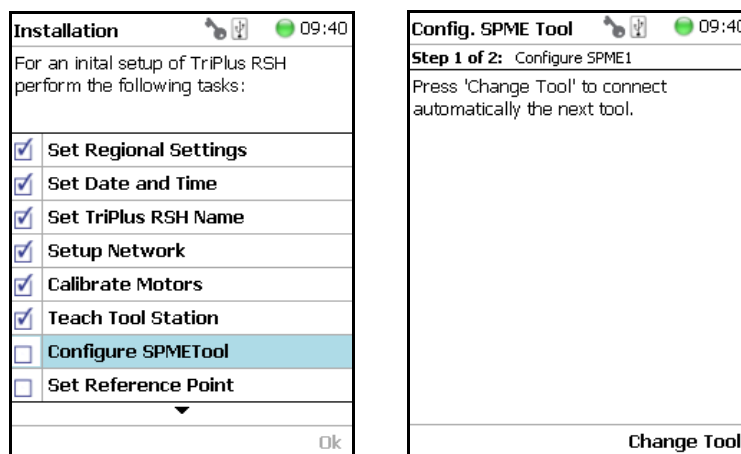
❖ To overcome the situation

1. Insert the SPME Tool manually in a slot.
2. Select the previous wizard point **Teach Tool Station** again. Wait until the first movements of the Z-Axes are finished.
3. Press **Back** and leave this wizard point without going through all the steps. Check if the wizard point **Configure SPME Tool** is active.

❖ To configure the SPME tool

1. Select the wizard item **Configure SPME Tool**. See [Figure 161](#).

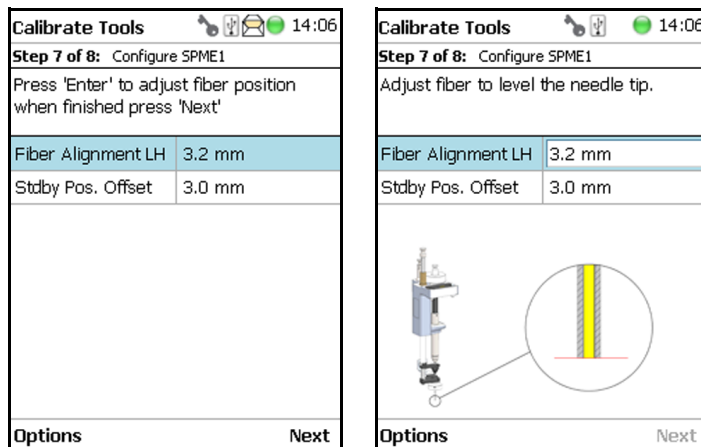
Figure 161. Wizard Item Configure SPME Tool



2. When a Tool other than the SPME Tool is installed in the TriPlus RSH SMART Injection Unit, the wizard asks for a Tool change.

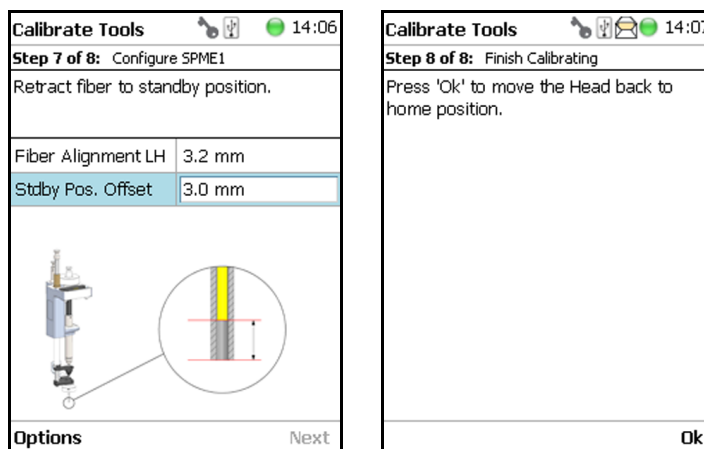
- Adjust the **Fiber Alignment**. Align the fiber tip with the needle tip as indicated in the figure of the handheld controller, or the virtual handheld controller. Turn the fiber downwards until it is clearly visible. Turn it back at the same level as the needle tip, then save this value. See [Figure 162](#).

Figure 162. SPME Fiber Alignment



- Adjust the **Standby Position**. Bring back the fiber by at least 2 mm into the needle (protection sheet), so the fiber does not touch the septum when penetrating through. The fiber could stick to the septum and be damaged or even lost. See [Figure 163](#).

Figure 163. SPME Fiber Standby Position



An approximate value for the parameter **Fiber Alignment** and the recommended value for the parameter **Fiber Standby Position** are given in [Table 114](#).

Table 114. Fiber Alignment and Fiber Standby Position

SPME Type	Fiber Alignment	Fiber Standby Position
SPME	10.8 mm	2.0 mm

Set Reference Point

Note The concept of **Referencing** and **Calibration** is explained in the chapter **TriPlus RSH SMART Defining Object Positions** in the *TriPlus RSH SMART Hardware Manual*.

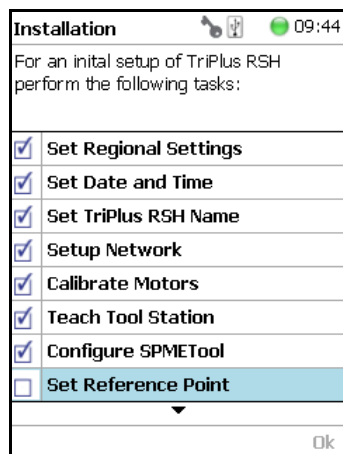
Note For the TriPlus RSH SMART Standard, you can set the Reference Point as any fixed position the autosampler head can reach. It is recommended to choose the Teaching Point of one of the Tray Holders as the Reference Point.

Follow the **Installation Wizard** for the referencing of the **Ideal Tool**. Select a Tool which is most frequently used and define it as the **Ideal Tool**. This Tool is used for referencing and all other Tools used in the TriPlus RSH SMART system configuration will be calibrated relative to this Tool.

❖ To set the Reference Point

1. Select the wizard item **Set Reference Point** and follow the dialog. See [Figure 164](#).

Figure 164. Wizard Item Set Reference Point



CAUTION It is advisable to hold with one hand the Y-Axis and with the second hand move the Tool body in a controlled manner until the Head reaches the teaching position. Do NOT hold the Needle Guide to move the Head. This part is mechanically flexible and could lead to misalignment.

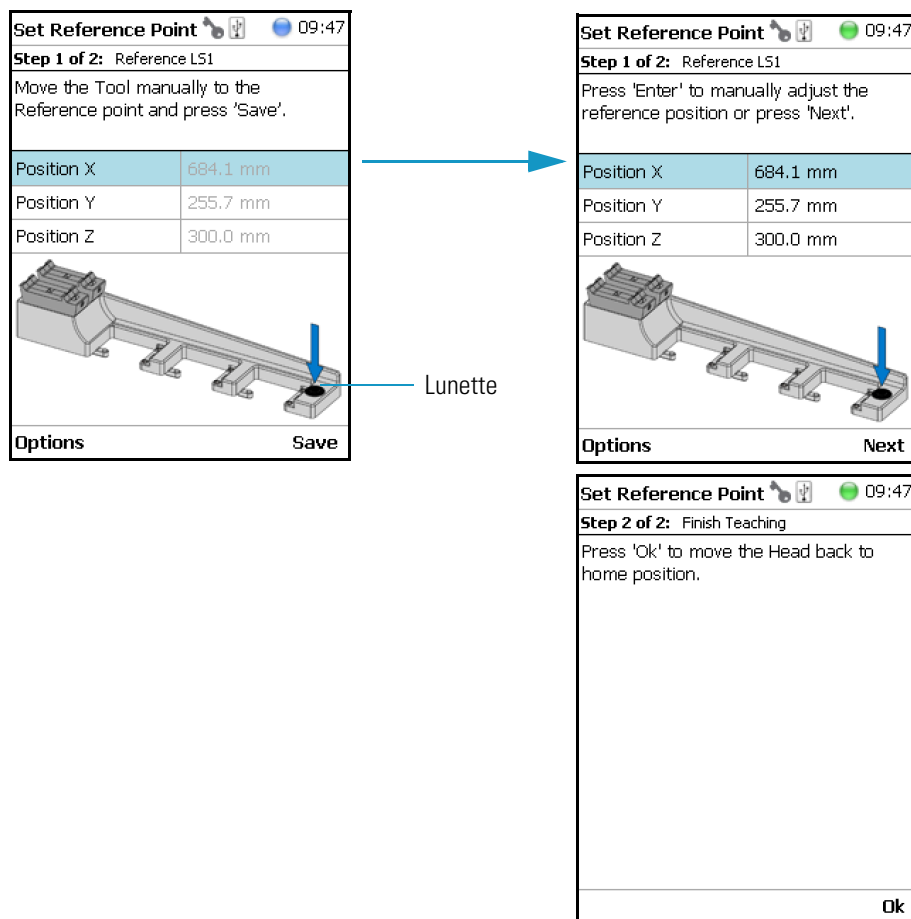


The TR Station or ATC Station should not change in their position and only calibrated Tools should be used. If the Station has moved its position, it is necessary to redefine the Reference Point, and recalibrate all the other Tools.

If for any reason, the referencing (Set Reference Point) has been repeated, it is mandatory to recalibrate all the Tools. Using the step **Set Reference Point** clears the calibration data for the individual Tools. A message will appear to inform the operator of the necessary steps. It is not important whether a TR or a ATC Station is used. The behavior during re-calibration will be identical.

2. Manually position the Head exactly within the guiding rings of the lunette. Store this value pressing **Save**. Now you the choice to fine tune the teaching by pressing Enter. This allows manually adjusting the three axes Y-, X-, and Z.
3. At the end pressing **OK** the Head move automatically back to the **Home Position**. See [Figure 165](#).

Figure 165. Set Reference Point and Finish Wizard



Calibrate Tools

Note The concept of **Referencing** and **Calibration** is explained in the chapter **TriPlus RSH SMART Defining Object Positions** in the *TriPlus RSH SMART Hardware Manual*.

The Tool which is most frequently used should be used for Calibration. This Tool can be considered as the **Ideal Tool**. All other Tools will be referenced with respect to the **Ideal Tool**. This step is not necessary when a single Tool Station, the TR Station, is used or if only one Tool is in use within the entire system.



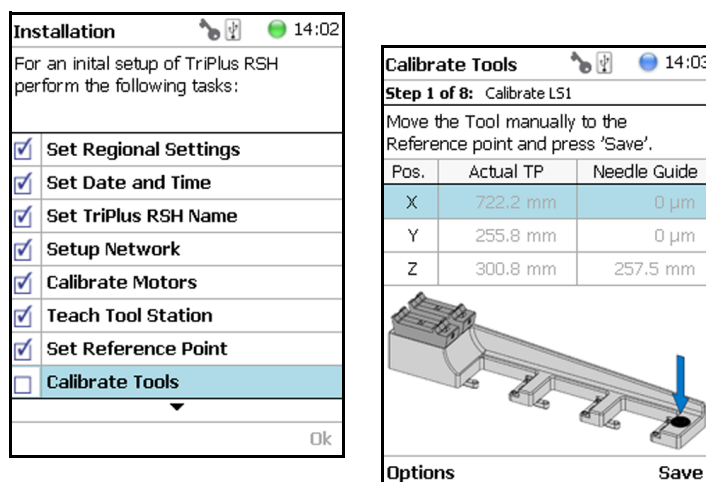
CAUTION It is advisable to hold with one hand the Y-Axis and with the second hand move the Tool body in a controlled manner until the Head reaches the teaching position. Do NOT hold the Needle Guide to move the Head. This part is mechanically flexible and could lead to misalignment.

The following example describes calibration of a Tool positioned in Slot 1, a second Tool positioned in Slot 2, and a third Tool positioned in Slot 3.

❖ **To calibrate the tools**

1. Select the wizard item **Calibrate Tools** and follow the dialog. See [Figure 166](#).

Figure 166. Wizard Item Calibrate Tools and Calibration of Ideal Tool



2. Press **Save** to continue in the wizard. The X-, Y-, and Z-positions will be stored. Select **Next** to open the window for assigning the Tool parameters.

The default value of the Tool Parameter is **Not Specified**. This means that the parameter has to be specified for the application. The definition can be made at this stage of installation or later on during routine work. You are able to change this parameter to adapt it for another application; note that the **Extended User Level** is required.

[Table 115](#) details the **Calibrate Tool Parameters**.

Table 115. Calibrate Tools Parameters (Sheet 1 of 2)

Item	Description
Not Specified	Prohibits the execution of a run.
Magn10or20mL	Magnetic Ring installed to enable the transport of 10 or 20 mL vials.
Magn2mL	Magnetic Ring not installed but Lower Needle Guide has Magnets installed to enable transport of a 2 mL vial.

Table 115. Calibrate Tools Parameters (Sheet 2 of 2)

Item	Description
Foil Cutter	Foil Cutter installed. The Foil Cutter pierces a sealing foil of a MTP or DW-Plate before the syringe needle penetrates the well.
NonMagn2mL	The lower Needle Guide has no magnets installed; a magnetic ring is not connected to it. Typically used for Microtiter Plates or for vials with a non-magnetic cap.

The parameter **Cap Type** in the class **Vial Type** has to correspond with the Tool Needle Guide Type.

Examples:

- Magnetic10/20 | Magnet Cap
- Magnetic 2mL | Magnetic Cap
- Foil Cutter | MTP Plates

Note If **Needle Guide Type** is defined as **Not Specified**, the execution of a sample run is prohibited even if the **Cap Type** is set to **No Cap** or **Non Magnetic Cap**.

- After the first step of **Tool Calibration**, the wizard will park the **Ideal** Tool and pick up the next Tool, starting with the Tool in **Slot 1** and consecutively to **Slot 2** and **Slot 3**. See [Figure 167](#) and [Figure 168](#).

Figure 167. Preparing Tool Change for Step 2, Check Tool and Pick Tool

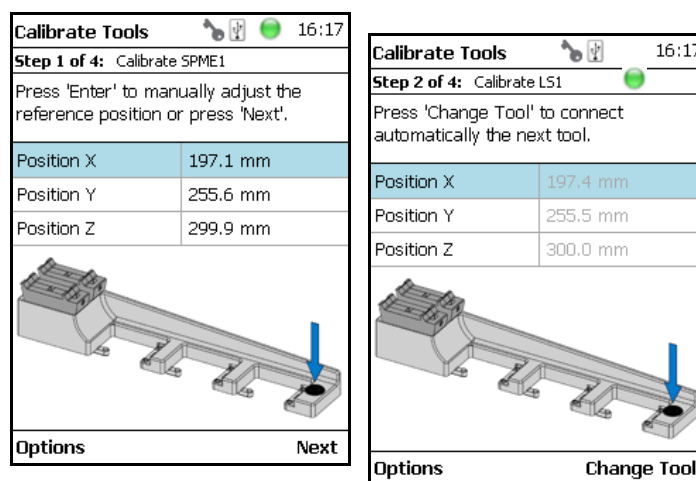
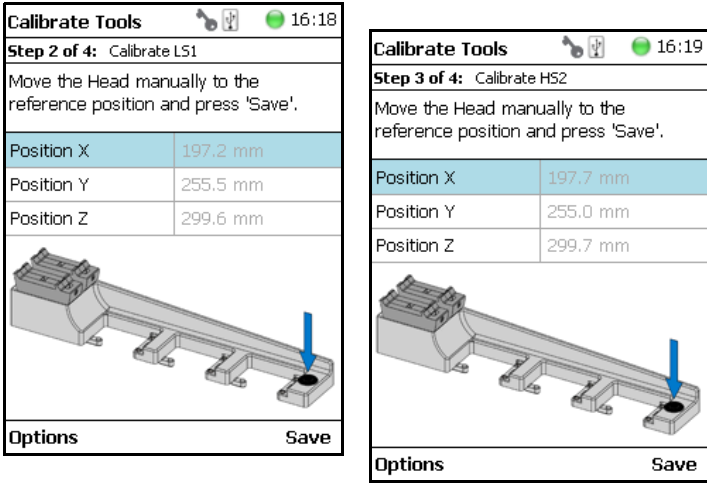


Figure 168. Tool Change to Prepare for Step 3 and Calibrating Tool



4. When finished, pressing **OK** the Head moves back to the **Home** position.



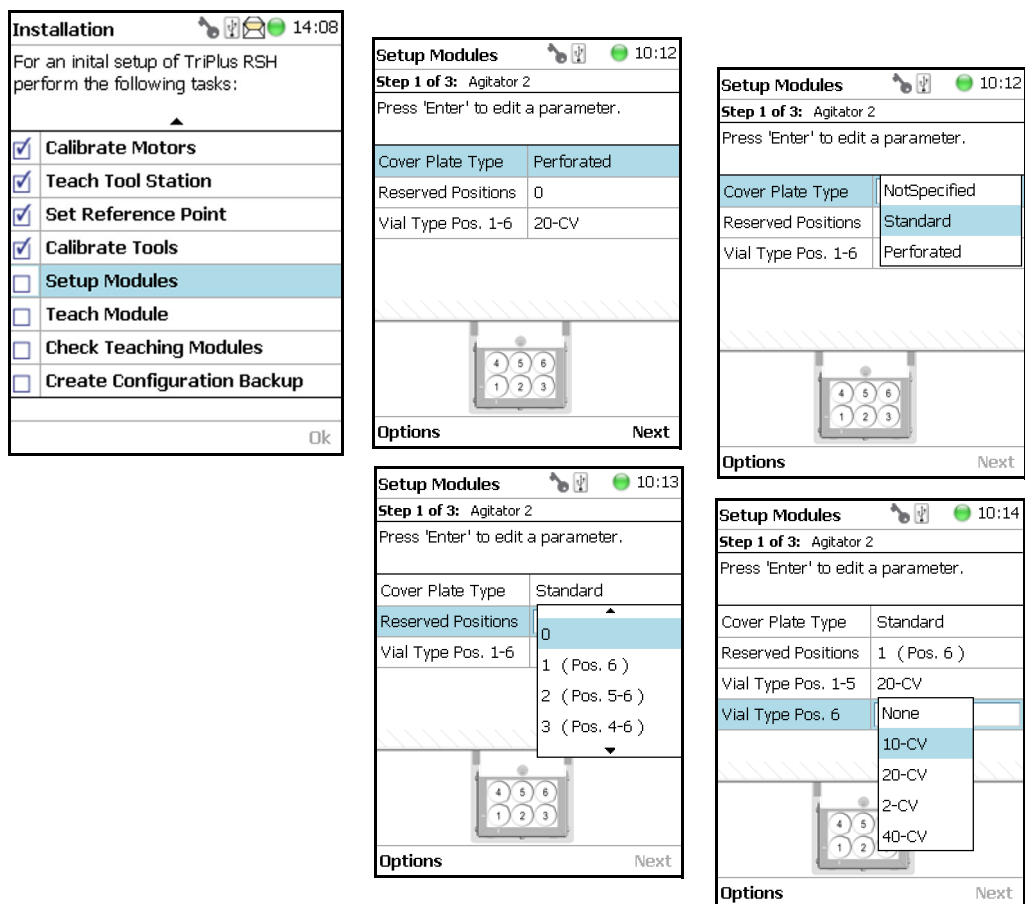
CAUTION TR Station or ATC Station should not change in the position. If the Station has moved its position, it is necessary to redefine the Reference Point, and recalibrate all the other Tools.

If for any reason, the referencing (Set Reference Point) has been repeated, it is mandatory to recalibrate all the Tools. Using the step **Set Reference Point** clears the calibration data for the individual Tools.

Setup Modules

This wizard item allows you to predefine the parameters from a module. Typically, this process is done once at first installation of the TriPlus RSH SMART. See [Figure 169](#).

Figure 169. Wizard Item Setup Module



❖ To setup a module

The example below shows the steps for defining the parameters for the **Agitator**:

1. Select the **Cover Plate Type** and the **Vial type** used for the Agitator.
 - **Not Specified** — Prohibits the execution of a run.
 - **Standard** — Cover without holes.
 - **Perforated** — Cover with 6 holes to enable Syringe Needle penetration through the cover into the vial inserted in the Agitator.
 - **Vial Type** — Select the type of vials used for the Agitator.

If the Vial Type has to be changed during routine application, this can be done at any time by going to the Start Screen, selecting the menu item **Agitator**, scrolling down to the list item **Vial Type** and selecting another Vial Type.

Teach Module

The term Teaching is used for the definition of the X-, Y-, and Z-Axis positions for each module. Refer to **TriPlus RSH SMART Defining Object Positions** in the *TriPlus RSH SMART Hardware Manual*.

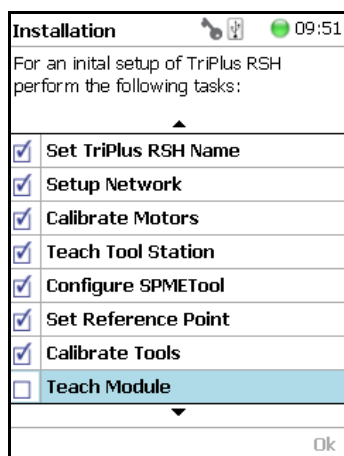
Note The difference between **Active** and **Passive** modules are:

- The **Active** modules are recognized automatically by the system when connected to the Bus and at the next restart of the system.
- The **Passive** modules are not automatically recognized; they have to be added to the configuration. The passive modules, such as Tray Holder, Wash Station, etc. have to be added first.

❖ To teach the module

1. Select the wizard item **Teach Module**. A dialog will guide the operator through this teaching wizard. Upon starting the wizard, the TriPlus RSH SMART automatically turns off the current to enable a manual movement of the Head to the various modules configured within the system. See [Figure 170](#).

Figure 170. Wizard Item Teach Module



2. If the wizard is started without an attached Tool, it first moves the TriPlus RSH SMART Injection Unit to the first slot of the ATC Station or TR Station, picks up the provided Tool, and waits for the next command.
3. The teaching order follows the order of the objects listed as shown in **Setup Modules** (pull-up menu Options). During the teaching process, it is always possible to demand a fine tuning or to go back to a previous position or module. See the various possibilities under the **Options** pull-up menu.



CAUTION It is advisable to hold the Y-Axis with one hand and with the other hand hold the Tool body to move the TriPlus RSH SMART Injection Unit in a controlled way to the teaching position.

CAUTION Do NOT hold the Needle Guide to move the TriPlus RSH SMART Injection Unit. This part is mechanically flexible and could lead to misalignment.

- When the wizard is started, the first module is displayed, an arrow indicates the teaching position. Follow the instructions given.

As a general description, move the TriPlus RSH SMART Injection Unit manually to the indicated teaching position, adjust the lower needle guide perfectly within the center of the lunette ring. Without the magnetic ring attached, use the inner ring for teaching.

- The **Lower Needle Guide** should be centered on the lunette with the bottom of the Lower Needle Guide lightly touching its surface.

For modules without a lunette, such as the Agitator, it is necessary to insert a vial (with the corresponding adapter if required), and use the vial cap surface as the reference for the Z-Axis value.


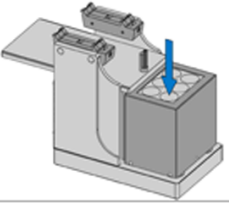
The teaching process for the active modules are described in chapter **TriPlus RSH SMART Defining Object Positions** in the *TriPlus RSH SMART Hardware Manual*.

- When you are satisfied with the teaching, press **Save** and continue by pressing **Next** to get to the following module. If in doubt, proceed with the fine tuning.


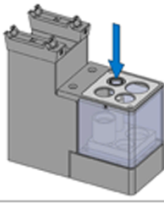
The Teach position of each module is reported in [Table 116](#).

Table 116. Teach Modules Steps (Sheet 1 of 4)


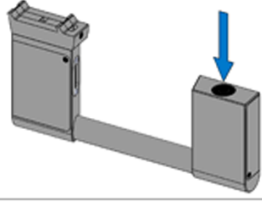
Steps

Teach Modules  14:12		
Step 1 of 20: Teach Agitator 1		
Press 'Enter' to manually adjust the position or press 'Next'.		
Pos.	Actual TP	Needle Guide
X	584.1 mm	584.1 mm
Y	29.6 mm	29.6 mm
Z	304.7 mm	304.7 mm
		
Options		Next

Agitator Teaching Position

Teach Modules  14:13		
Step 2 of 20: Teach Vortexer 1		
Press 'Enter' to manually adjust the position or press 'Next'.		
Pos.	Actual TP	Needle Guide
X	346.8 mm	346.8 mm
Y	18.6 mm	18.6 mm
Z	354.2 mm	354.2 mm
		
Options		Next

Vortexer Teaching Position

Teach Modules  14:13		
Step 3 of 20: Teach Barcode Reader 1		
Press 'Enter' to manually adjust the position or press 'Next'.		
Pos.	Actual TP	Needle Guide
X	404.0 mm	404.0 mm
Y	117.1 mm	117.1 mm
Z	273.7 mm	273.7 mm
		
Options		Next

Barcode Reader Teaching Position

Table 116. Teach Modules Steps (Sheet 2 of 4)

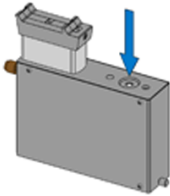
Steps

Teach Modules 14:13

Step 4 of 20: Teach SPME Cond Station 1

Press 'Enter' to manually adjust the position or press 'Next'.

Pos.	Actual TP	Needle Guide
X	351.7 mm	351.7 mm
Y	23.7 mm	23.7 mm
Z	322.1 mm	322.1 mm



Options Next

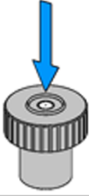
SPME Conditioning Station Teaching Position

Teach Modules 14:14

Step 5 of 20: Teach Injector SSL

Press 'Enter' to manually adjust the position or press 'Next'.

Pos.	Actual TP	Needle Guide
X	52.2 mm	52.2 mm
Y	34.6 mm	34.6 mm
Z	303.7 mm	303.7 mm



Options Next

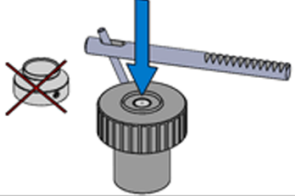
GC Injector Teaching Position

Teach Modules 14:14

Step 6 of 20: Teach OC Actuator 1

Press 'Enter' to manually adjust the position or press 'Next'.

Pos.	Actual TP	Needle Guide
X	52.2 mm	52.2 mm
Y	34.6 mm	34.6 mm
Z	303.8 mm	303.8 mm



Options Next

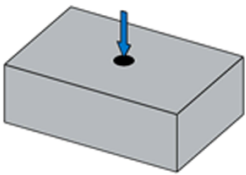
OC Actuator Teaching Position

Teach Modules 14:14

Step 7 of 20: Teach Obstacle OCI

Press 'Enter' to manually adjust the position or press 'Next'.

Pos.	Actual TP	Needle Guide
X	345.7 mm	345.7 mm
Y	44.5 mm	44.5 mm
Z	416.6 mm	416.6 mm



Options Next

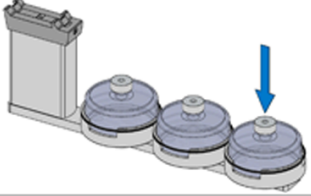
Obstacle Teaching Position

Teach Modules 14:15

Step 8 of 20: Teach Solvent 1

Press 'Enter' to manually adjust the position or press 'Next'.

Pos.	Actual TP	Needle Guide
X	52.6 mm	52.6 mm
Y	119.8 mm	119.8 mm
Z	303.7 mm	303.7 mm



Options Next

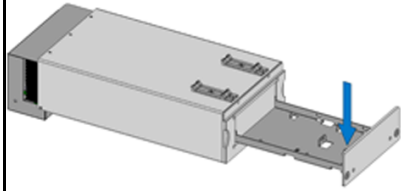
Large Solvent Station Teaching Position

Teach Modules 14:15

Step 9 of 20: Teach DrawerTempCtrl 1

Press 'Enter' to manually adjust the position or press 'Next'.

Pos.	Actual TP	Needle Guide
X	222.8 mm	222.8 mm
Y	136.9 mm	136.9 mm
Z	324.1 mm	324.1 mm



Options Next

Temperature Controlled Drawer St Teaching Position

Note Obstacle is a module from another device, for example the Thermo Conductivity Detector (TCD) from a GC system. If a module exceed a certain height, it could be get in the path way of the TriPlus RSH SMART. The dimension and the position of the obstacle can be defined. The TriPlus RSH SMART excludes this area from the allowed path way and bypasses it.

Table 116. Teach Modules Steps (Sheet 3 of 4)

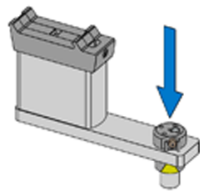
Steps

Teach Modules 14:15

Step 10 of 20: Teach MHE Station 1

Press 'Enter' to manually adjust the position or press 'Next'.

Pos.	Actual TP	Needle Guide
X	307.6 mm	307.6 mm
Y	36.3 mm	36.3 mm
Z	356.2 mm	356.2 mm



Options Next

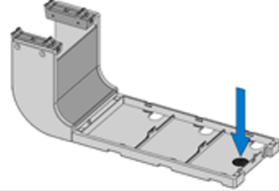
MHE Station Teaching Position

Teach Modules 14:15

Step 11 of 20: Teach Trayholder 1

Press 'Enter' to manually adjust the position or press 'Next'.

Pos.	Actual TP	Needle Guide
X	236.1 mm	236.1 mm
Y	223.2 mm	223.2 mm
Z	428.0 mm	428.0 mm



Options Next

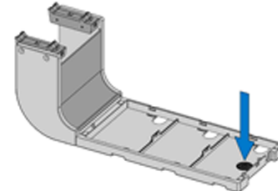
Tray Holder 1 Teaching Position

Teach Modules 14:15

Step 12 of 20: Teach Trayholder 2

Press 'Enter' to manually adjust the position or press 'Next'.

Pos.	Actual TP	Needle Guide
X	236.1 mm	236.1 mm
Y	223.2 mm	223.2 mm
Z	428.0 mm	428.0 mm



Options Next

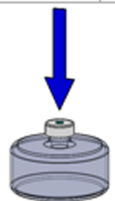
Tray Holder 2 Teaching Position

Teach Modules 14:16

Step 14 of 20: Teach Solvent Reservo

Press 'Enter' to manually adjust the position or press 'Next'.

Pos.	Actual TP	Needle Guide
X	49.2 mm	49.2 mm
Y	117.6 mm	117.6 mm
Z	304.1 mm	304.1 mm



Options Next

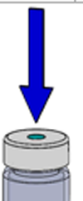
Solvent Reservoir Teaching Position

Teach Modules 14:16

Step 15 of 20: Teach Wash Vial 1

Press 'Enter' to manually adjust the position or press 'Next'.

Pos.	Actual TP	Needle Guide
X	49.2 mm	49.2 mm
Y	117.6 mm	117.6 mm
Z	304.1 mm	304.1 mm



Options Next

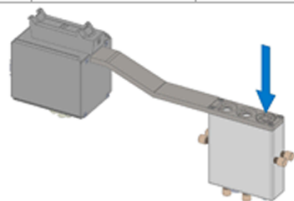
Wash Vial Teaching Position

Teach Modules 14:17

Step 17 of 20: Teach Fast Wash 1

Press 'Enter' to manually adjust the position or press 'Next'.

Pos.	Actual TP	Needle Guide
X	510.8 mm	510.8 mm
Y	146.8 mm	146.8 mm
Z	293.4 mm	293.4 mm



Options Next

Fast Wash Station Teaching Position

Table 116. Teach Modules Steps (Sheet 4 of 4)

Steps

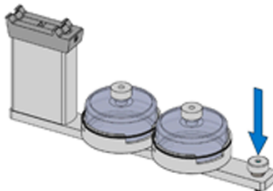
Teach Modules

14:17

Step 18 of 20: Teach Large Wash 1

Press 'Enter' to manually adjust the position or press 'Next'.

Pos.	Actual TP	Needle Guide
X	52.0 mm	52.0 mm
Y	117.5 mm	117.5 mm
Z	303.8 mm	303.8 mm



Options

Next

Large Wash Station Teaching Position

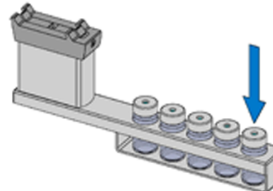
Teach Modules

14:17

Step 19 of 20: Teach Standard Wash 1

Press 'Enter' to manually adjust the position or press 'Next'.

Pos.	Actual TP	Needle Guide
X	52.0 mm	52.0 mm
Y	117.5 mm	117.5 mm
Z	303.8 mm	303.8 mm



Options

Next

Standard Wash Station Teaching Position

Teach Modules

10:24

Step 19 of 19: Finish Teaching

Press 'Ok' to move the Head back to home position.

Ok

Teaching Position

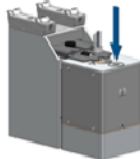
Teach Modules

11:45

Step 2 of 10: Teach Heatex Stirrer 1

Move the head to the teach point (TP) and press 'Save'.

Pos.	Actual TP	Needle Guide
X	691.5 mm	170.7 mm
Y	35.6 mm	144.6 mm
Z	297.4 mm	156.6 mm



Options

Save

Heatex Stirrer Teaching Position

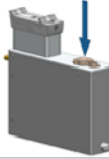
Teach Modules

11:53

Step 1 of 2: Teach SPMEArrowCond 1

Move the head to the teach point (TP) and press 'Save'.

Pos.	Actual TP	Needle Guide
X	97.2 mm	259.6 mm
Y	4.9 mm	755 µm
Z	298.1 mm	257.4 mm



Options

Save

SPME Arrow Conditioning Station Teaching Position

The list items specific to each module is provided opening **Options** pull-up menu.

The **Previous** pull-up menu moves one step back to the previous module and verifies the teaching position again.

Check Teaching Modules

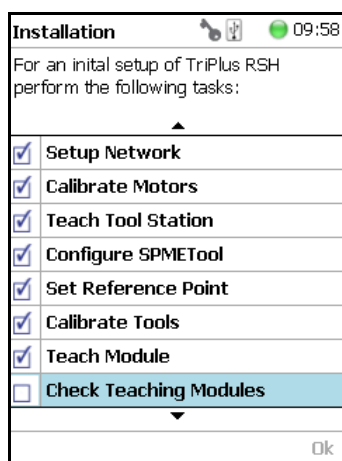
This section allows to check and verify the teaching positions of all the modules included into the system.

Note In this section a fine tuning is not foreseen. If a fine tuning is necessary, go either back in the section “[Teach Module](#)” on [page 247](#), or from the Start Screen activate the **Options** pull-up menu, then select **Setup > Modules**.

❖ To check the teaching modules

1. Select the wizard item **Check Teaching Modules**. See [Figure 171](#).

Figure 171. Wizard Item Check Teaching Modules



2. Press **Check** to activate the wizard. The Head moves to the first module in the list, positions itself at the Teaching Point, and waits for the next command. This gives the operator the chance to verify the position, and if necessary make some fine tuning and save the new settings.
3. Modules which have no direct access to the teaching point (lunette) such as the Agitator or the Vortexer are treated the same way as it would for a routine run. In other words, the cover of the Agitator is opened automatically or in combination with the MHE Adapter it moves the Head to the side to stripe off the magnetic adapter.

Note It is mandatory to insert a vial into the Agitator or the Vortexer to teach the X-, Y-, and Z-Axes positions. If the vial is not inserted, the Z-Axis value could be out of range, resulting in an error.

4. Press **Next** to continue within the wizard; the TriPlus RSH SMART Head moves to the next module.
5. The **Previous** pull-up menu moves one step back to the previous module and verifies the teaching position again.

Create a Backup File

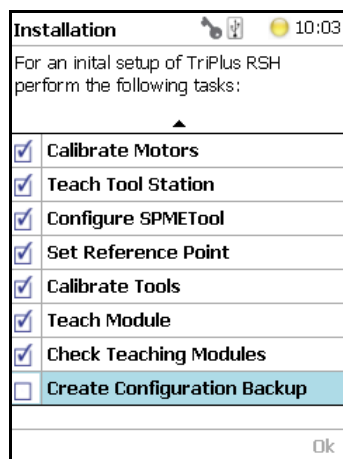
It is highly recommended to backup the configuration of system after completing the **Installation** wizard.

The functions Backup, Restore, and Updates are explained in chapter **Interfacing the TriPlus RSH SMART to Other Devices** in the *TriPlus RSH SMART Hardware Manual*.

❖ To create a configuration backup file

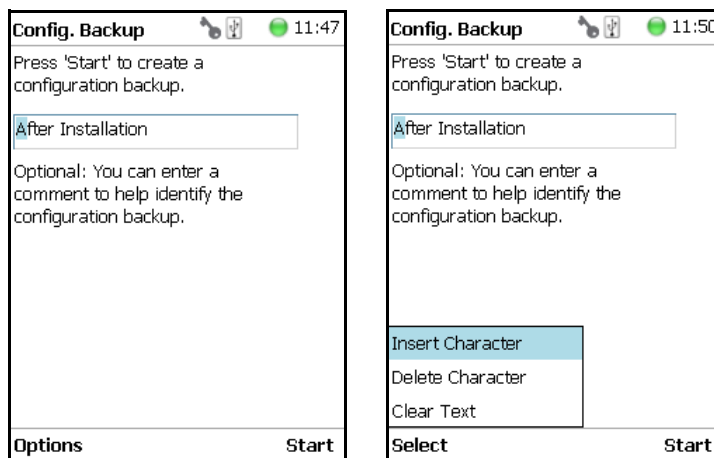
1. Select the wizard item **Create Configuration Backup** and follow the dialog. See [Figure 172](#).

Figure 172. Wizard Item Create a Backup File

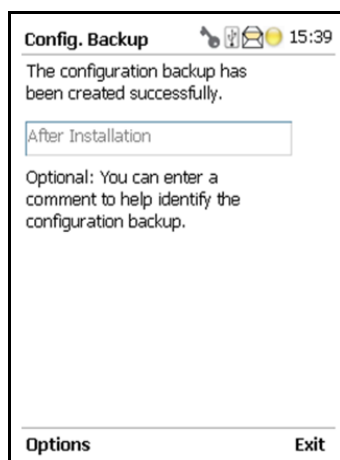


2. The proposed name for the backup file is **After Installation**. The file is tagged with the current date and time. The file name can be changed by the operator. Press the **Enter** button to open the alphanumeric characters or use the **Options** pull-up menu to insert or delete a character, see the examples in [Figure 173](#).

Figure 173. Creating a Backup File



3. After the file name definition, press **Start** to start the process. The blinking light indicates that the process has been executed. The progress of the backup is updated to inform the operator how many percent are completed.
4. This process only takes a few minutes. After completion, press **Exit** to finish the installation wizard.



Note The Backup file is stored in the SD card, which is installed on the Control Board.

This file can be saved on the USB Stick, see the chapter “[Setup Menu](#)” on [page 105](#).

The file can also be used to make a **Restore** of the Control Software. This option is only available with access level rights for the **Extended User**.

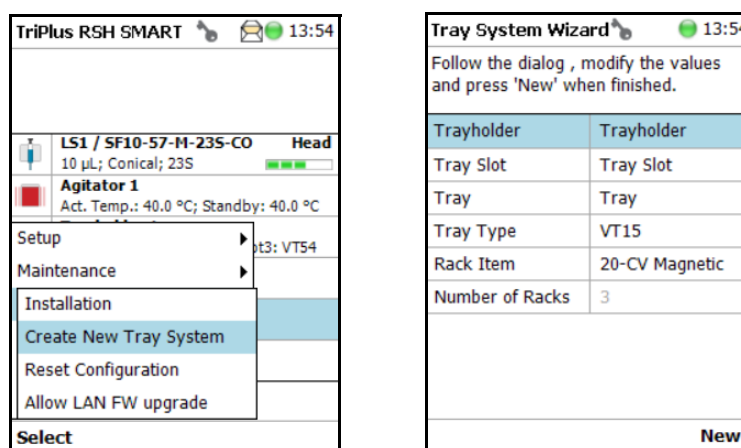
Create New Tray System Item

Selecting the menu item **Create New Tray System** enables you to define a combined system of a Tray Holder, Tray Type, and Vial Type. This task is mainly used when a custom specific Tray Holder will be used.

❖ To create a new tray system

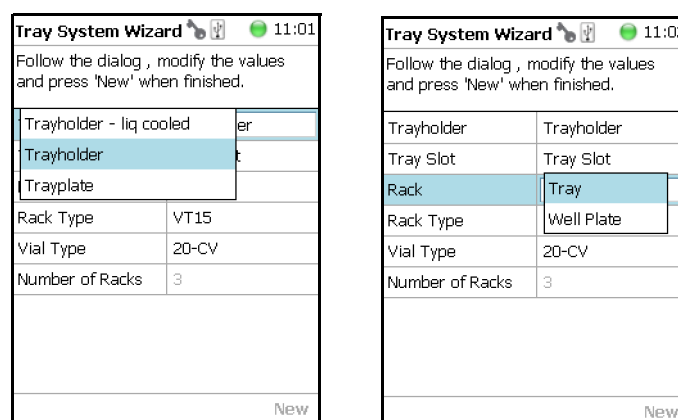
1. Select the menu item **Create New Tray System**. See [Figure 174](#).

Figure 174. Selecting Menu Item Create New Tray System



2. By opening the individual list items, the pre-selected parameters are available for use. See [Figure 175](#).

Figure 175. Tray Holder Choices



Note The Tray can be either a Tray or a Well Plate. Accordingly, the choices are pre-selected for Tray Type or a Well Plate Type.

3. Press **New** for creating the newly-defined Tray System, which is a complete setup of Tray Holder, Tray, Tray Type, and Vial Type.
4. The wizard closes, and the software returns to the Start Screen.

Table 117 lists the create New Tray Type parameters.

Table 117. Create New Tray Type Parameters

Item	Description
Tray Holder	Tray Holder Liquid Holder (passive module).
Tray Slot	Tray Slot, currently the only supported type.
Tray	Tray, currently the only supported type.
Tray Type	Tray 15, Tray 32, Tray 54, Tray 60, Tray 70. See the section “ Definition of Terms, Naming Conventions, and Start Screen Icons ” on page 3 for details.
Vial Type	1-CV, 2-CV, 10-CV, 20-CV Regular Vials. 2-SR, 10-SR. Vials combined with corresponding adapter, reservoir.
Number of Racks	Defines the numbers of sample trays that can be placed in the Tray Holder.

Teach Home Position

This task is not part of the **Service > Installation** wizard but it must be discussed with the user during the installation process.

Access to this task by entering the module **RobotArmLeft**.

The Home Position is the position the head is moved to at the end of a task, for example when it returns to standby. By default, this position is at the far left side of the X-Axis. It is highly recommended to optimize this position according to the final configuration of each system.

The Home Position optimization is performed for several reasons as:

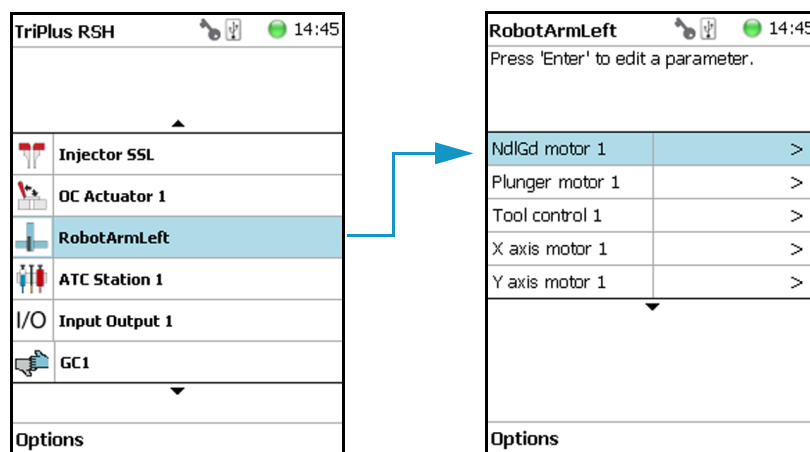
- For convenience, in order to have the head in a preferred standby position.
- To save time minimizing the movement of the head to a module.
- For avoiding the collision of the head and a module.

Changing Home Position

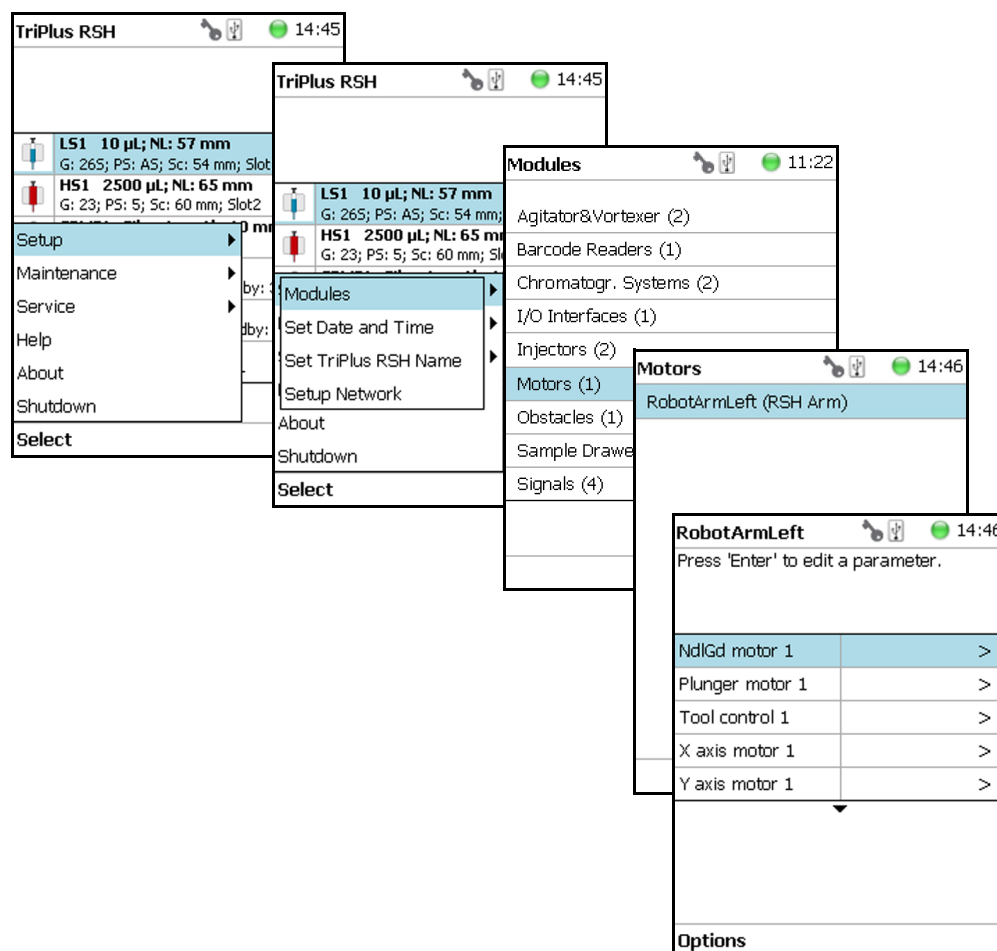
❖ To change a home position

There are two ways to get to the **Menu item > Teach Home Position**.

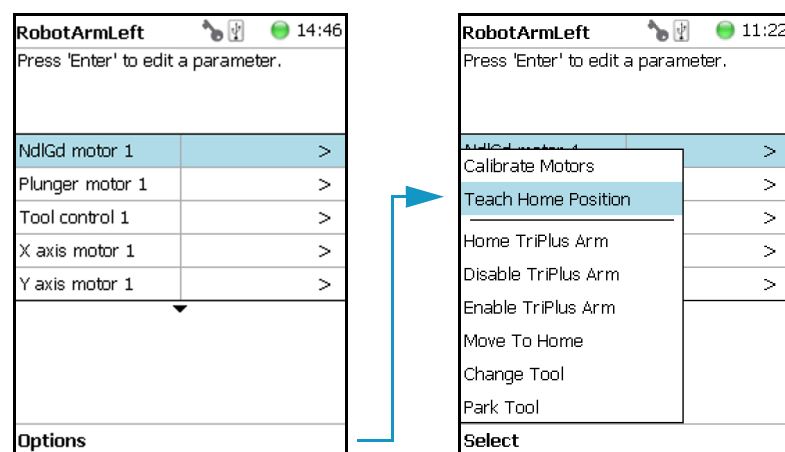
1. Use the short cut from the Start Screen with the menu item **RobotArmLeft**.




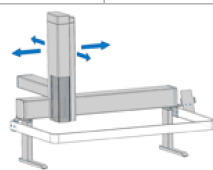
2. From the Start Screen select **Options > Setup** and continue with the modules. Several additional clicks are required to access the menu item **RobotArmLeft**. See the following example.


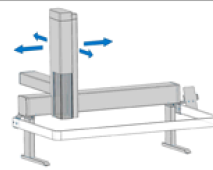


3. Under the screen **RobotArmLeft** select **Options** > **Teach Home Position** > **Select**.



4. Move the head to the required position and save the X-, Y-, Z- Axes Positions as the new Home Position. Press **Ok** to leave this wizard.

RobotArmLeft  11:23	
Step 1 of 1: Teach Home Position	
Move Head manually to the home position and press 'Save'.	
Position X	291 μm
Position Y	1.7 mm
Position Z	0 μm
	
<div>Options</div> <div style="text-align: right;">Save</div>	

RobotArmLeft  11:23	
Step 1 of 1: Teach Home Position	
Press 'Options' and select 'Teach' to restart the process.	
Position X	298 μm
Position Y	1.7 mm
Position Z	0 μm
	
<div>Options</div> <div style="text-align: right;">Ok</div>	

Analytical Troubleshooting

This chapter gives a quick overview of possible causes and recommended actions which can be taken to eliminate an erratic behavior.

Contents

- [General Points Regarding Chromatographic Effects](#)
- [Headspace Technique Points Regarding Chromatographic Effects](#)

This guide does not replace the troubleshooting guides for chromatographic techniques.

General Points Regarding Chromatographic Effects

This section provides general troubleshooting guidelines regarding the chromatographic effects. See [Table 118](#).

Table 118. General Points Regarding GC Effects - Troubleshooting Guideline (Sheet 1 of 3)

Symptom or Error Message	Possible Cause	Recommended Action
Very low or no detector signal is observed.	Clogged syringe.	Remove syringe and aspirate/dispense liquid manually. Clean syringe.
	Bent syringe needle or bent plunger.	Inspect the syringe. Replace it if necessary Note: Bottom Sensing using a long needle (85 mm) has a high risk of needle bending. How to remove a syringe with a bent needle or plunger is explained in the section Manually Removing a TriPlus RSH SMART Tool from the RSH Head of the <i>TriPlus RSH SMART Hardware Manual</i> .
	No sample liquid is injected.	Check, adjust, the needle penetration into sample vial.
	Sample volume too low.	Increase sample volume.
	Wrong setting of syringe needle penetration in GC injector.	Check Needle Penetration Depth settings and compare with GC manufacturer recommended parameters.
Syringe does not fill properly.	Air bubbles below syringe plunger. It is possible that air bubbles remain below the plunger after the first pull-up. If the plunger is moved up and down several times, these air bubbles are worked out.	Increase method parameter Def Fill Strokes Count (Fill Strokes). Check the method parameters Def Aspirate (Fill Speed) and Def Aspirate Delay (Pull-up Delay).
	Wrong type of syringe assigned to the Tool Holder.	Check the syringe parameters to ensure that the correct syringe type is assigned to the Tool Holder. Verify the Scale Length parameter.
	Syringe needle penetration depth in vial incorrect.	Check the syringe needle penetration depth in the sample vial.
	Syringe plunger polymer tip worn out.	Manually check the tightness of the polymer plunger tip. When in doubt, replace the plunger.
	Glass barrel cracked.	Check the integrity of the syringe. When in doubt, replace the syringe.

Table 118. General Points Regarding GC Effects - Troubleshooting Guideline (Sheet 2 of 3)

Symptom or Error Message	Possible Cause	Recommended Action
Sample peaks/responses are not reproducible.	Dirty syringe.	Increase PstClnSlv1/Slv2 values in method. Use PreClnSlv1/Slv2 and Pre Cln Spl .
	Syringe pressure difference.	Increase Def Aspirate Delay (Pull-up Delay) value.
	Vacuum created in sample vial.	Reduce Sample volume in sample vial. Use Pre Pressure Vial mode.
	Highly volatile solvent.	Use gas-tight syringe and sample tray cooling.
	Improperly crimped vials.	Check vial cap by attempting to rotate by hand. Loose caps might cause selective loss of volatile compounds from the sample. Adjust crimping tool correctly.
	Method Parameters.	Check recommended Method Parameters. The following parameters are crucial and must be verified first: <ul style="list-style-type: none"> • Def Aspirate Flow Rate (Fill Speed) • Def Aspirate Delay (Pull-up Delay) • Def Dispense Flow Rate (Injection speed) • Def Dispense Delay (Post Inj Delay) <p>Note that for dedicated cycles, certain parameters are locked.</p>
Excessive carryover between samples.	Dirty syringe.	Increase Pst InjSlv1/2 values in method. Use PreClnSlv1/Slv2 and PrClnSpl . Check and, if necessary, replace vial septa from Wash/Waste vials.
	Inappropriate wash solvent.	Use appropriate wash solvent.
	Wash Solvent and Waste vial septa too tight.	Check if the syringe fills completely when washing. If several cleaning cycles are programmed and many samples are processed, then vacuum in the Wash Solvent vials and overpressure in the Waste vials might build up. Cut away a segment of the solvent and Waste septa to ensure equalization of pressure.
	Wash solvent level too low.	Check the solvent volume in the Wash Vial and the syringe needle penetration in the vial.
	Solvent level in Waste vial too high.	Check the volume of the solvent in the Waste Vial . Check also the needle penetration into the waste vial. The needle must not touch the liquid at all.

Table 118. General Points Regarding GC Effects - Troubleshooting Guideline (Sheet 3 of 3)

Symptom or Error Message	Possible Cause	Recommended Action
Unexplained collisions of Head.	Object not defined correctly.	Define Object correctly. See Chapter 5 , TriPlus RSH SMART Defining Object Positions in the <i>TriPlus RSH SMART Hardware Manual</i> . Verify the position for all objects, including passive and active modules.
Object missed by Syringe Needle.	When several Tools are used from a ATC Station, have the Tools calibrated to compensate for any deviations.	Check the Tool calibration as described in Chapter 5, TriPlus RSH SMART Defining Object Positions in the <i>TriPlus RSH SMART Hardware Manual</i> .
Unexpected collision on Tray Holder.	Wrong Vial Type settings in Tray Type.	Check the settings in Tray Type (Rack Type).

Headspace Technique Points Regarding Chromatographic Effects

This section provides general troubleshooting guidelines regarding the Headspace technique.
See [Table 119](#).

Table 119. Headspace Technique Points Regarding GC Effects - Troubleshooting Guideline (Sheet 1 of 2)

Symptom or Error Message	Possible Cause	Recommended Action
Sample peaks or responses are not reproducible.	Dirty syringe.	Increase method value Syr Purge .
	Syringe pressure differences.	Increase Def Aspirate Delay (Pull-up Delay) value.
	Vacuum created in sample vials.	Reduce sample volume.
	Improperly crimped vials.	Check vial cap by attempting to rotate manually. Loose caps might cause selective loss of more volatile components from sample. Adjust crimping tool correctly.
	None or too low syringe purge gas pressure.	Check pressure at purge gas regulator (0.5 bar; 7.25 psig; 50 kPa) during the syringe purging period. Check gas flow at syringe needle tip.
	Method parameters.	Check recommended Method Parameters. The following parameters are crucial and must be verified first: <ul style="list-style-type: none"> • Def Aspirate Flow Rate (Fill Speed) • Def Aspirate Delay (Pull-up Delay) • Def Dispense Flow Rate (Injection speed) • Def Dispense Delay (Post Inj Delay)

Table 119. Headspace Technique Points Regarding GC Effects - Troubleshooting Guideline (Sheet 2 of 2)

Symptom or Error Message	Possible Cause	Recommended Action
Sample peaks or responses are not reproducible (<i>continued</i>)	Back pressure of GC column too high.	Check the back pressure of the GC column. If the pressure is too high the electronic flow control device (EPC or EFC) of the GC could get in overload at the moment of sample injection. This will lead to uncontrolled opening of the split valve until the pressure falls back into a controllable range.
Peak distortion or tailing.	Method Parameters.	See recommended previous actions.
	Needle penetration speed in GC Injector.	Check the parameter for injection technique. If all changes give no positive result, check the Injector Depenetration Speed .
	Solvent not suitable for application.	Check the boiling point of the solvent and try to change the solvent (when e.g. a high boiling point organic solvent is used as matrix).
	GC Injector liner not suitable.	Check the liner geometry.
	GC related parameters.	Any parameter such as the injector, oven or detector temperature can contribute to bad peak shape. Check the column type and connections (square cut connections).
Excessive carry-over between samples.	Dirty syringe.	Increase method value Syr Purge . Set the value of the method parameter Syringe Temp 10 °C above the Agitator temperature, Incubation Temp .
	None or too low Syringe Purge gas pressure.	Check pressure at purge gas regulator (0.5 bar; 7.25 psig; 50 kPa) during Syringe Purge period. Check gas purge flow at syringe needle tip.
Unexplained chromatographic peaks.	Dirty purge gas.	Check the purge gas supply for impurities.
Faulty temperature read-out. e.g. value: -99 °C.	HS-syringe cartridge (holder) temperature heater, over temperature fuse or sensor broken.	Contact your Thermo Fisher Scientific representative.
	Agitator temperature heater, over temperature fuse or sensor broken.	
	SPME/SPME Arrow Conditioning Module temperature heater or sensor broken.	
	ITEX syringe cartridge (holder) temperature heater, over temperature fuse or sensor broken.	
	ITEX Trap temperature heater or sensor broken.	

Multi Headspace Extraction (MHE)

This appendix describes the principles and the use of the Multi Headspace Extraction (MHE).

Contents

- [Introduction](#)
- [Principles of Multiple Headspace Extraction \(MHE\)](#)
- [MHE Cycle Step-by-Step](#)
- [Quantification from MHE Measurements](#)

Introduction

In a classical headspace technique, one sampling is performed per vial. Sample quantification can be inaccurate in the presence of interfering matrices or when a calibration standard cannot be made using a matrix composition identical to that of the sample.

See the section [“Principles of Multiple Headspace Extraction \(MHE\)”](#) on [page 268](#) for details.

The MHE station consists of a venting tool (MHE Adapter) combined with a MHE Adapter Holder. The MHE technique requires a series of sampling cycles using the same vial. First, the vial is pressurized to reach a specific pressure. The vial is then sampled and vented. The vial is re-pressurized and sampled again. This process is repeated multiple times to obtain the final results.

See the section [“MHE Cycle Step-by-Step”](#) on [page 273](#).

Principles of Multiple Headspace Extraction (MHE)

Introduction

The multiple headspace technique is used in instances where interfering matrices interact with the analyte, such as by partial adsorption, or if a solid analyte contains low concentrations of moisture. Whenever it is impossible to prepare the calibration standard using an identical matrix to that of the actual sample, single point calibration using the static headspace technique will fail.

The term multiple headspace extraction (MHE) is partially self-descriptive. To determine the quantity of an analyte, sampling is carried out by repeated extraction of gas from the same vial above a sample solution containing the analyte (known as the headspace).

The method thus approaches continuous gas extraction but is carried out in a stepwise fashion. In concept, the procedure is analogous to the multiple extraction of a sample from a simple elution column, where each passage of eluate through the column reduces the amount of analyte contained in a subsequent passage.

The peak area from any given extraction will be smaller than that of the previous extraction step. The sum of the peaks will be proportional to the total content of the analyte. A quantitative determination of the total amount of analyte present in a sample depends on the relationship between peak area and the amount of analyte. The sum of the amounts of analyte that are removed will eventually equal the total amount of analyte in the original sample if the extractions are continued to infinity.

Theoretically, summing up the peaks obtained from an infinite number of column extractions would allow the calculation of the absolute amount of analyte in a sample. In practice, it is sufficient to carry out a limited number of extractions, permitting a determination of the underlying exponential relationship between the measured area and the number of extractions, in turn allowing for the determination of the total amount of analyte in the sample. The effect of the sample matrix is eliminated by extracting the entire amount of the analyte. Contrary to the situation that exists in single-headspace extraction, it is therefore possible to use calibration standards that are *not* prepared with the same matrix as the actual samples. For MHE to provide meaningful results, the only prerequisite is that equilibrium must exist with respect to the analytes in terms of the distribution between the phases in the headspace vial.

Instrumentation in MHE

In normal extraction using headspace gas chromatographic technique with a gas-tight syringe, the following steps are employed in order to sample an aliquot of the headspace gas:

The vial is thermostatted in order for equilibrium to be established between the phases in the headspace vial.

The gas-tight syringe is used to introduce an aliquot of headspace gas to the GC.

Loop-injection headspace samplers use a pressurization step to start the headspace cycle. The vial is pressurized to a preselected value, usually using Helium gas, which is also often the carrier gas. The pressure is selected so that it is always greater than the pressure increase due to sample heating and vapor pressure of the sample.

The sample is introduced onto the GC column for analysis and the system is ready for the next sampling after cleaning.

In MHE, equilibrium must be reestablished in the headspace following each extraction. With a syringe-based system the following steps would normally be employed:

- The vial is thermostatted in order for the equilibrium to be established between the phases in the headspace vial.
- The vial is pressurized.
- The gas-tight syringe is used to introduce an aliquot of headspace gas to the GC.
- The vial is vented. This is accomplished by a specially designed venting tool that punctures the septum.
The pressurized headspace gas vents through the MHE Adapter needle (venting tool) to atmospheric pressure;
- Equilibrium is established again before the next analysis (Step 1).
- This procedure is repeated a number of times; typically three to five samplings are performed from a single vial (analytical sample and standard).
- The main steps are described in the section [“MHE Cycle Step-by-Step”](#) on [page 273](#).

Examples

In the following examples, we will briefly go through the basics of multiple headspace extraction (MHE).

We will look at four examples **situations** of equilibrium between the condensed (solid or liquid) phase and the gas phase (the headspace). The examples will be shown in increasing complexity with respect to the equilibrium distribution and removal of the headspace between subsequent extractions.

In each of the four cases described below, the complexity of the equilibrium distribution and of the removal of the headspace between subsequent extractions will be increased. The final conclusion is that the MHE method will work in most cases, with the only prerequisite that the distribution of the analyte between the gas and the condensed phases is actually governed by an equilibrium.

Situation 1

The equilibrium between the solid phase and the gas phase is assumed to be a 50/50-distribution. In the course of each extraction, **all** of the headspace is removed/exchanged.

The measured area of the analyte peak is **A**.

A(ref) — Area we would measure if all of the analyte were in the headspace (corresponding to the measured signal from a similar gas standard).

A(0) — Measured area of the analyte peak from the first extraction.

With 50% of the analyte present in the headspace, this amounts to:

$$A(0) = \frac{1}{2} * A(\text{ref})$$

The total area that is determined over a number of subsequent extractions is:

$$A(\text{tot}) = A(0) + \frac{1}{2} * A(0) + \frac{1}{4} * A(0) + \frac{1}{8} * A(0) + \dots, \text{ or}$$

$$A(\text{tot}) = A(0) / (1 - \frac{1}{2}) = 2 * A(0)$$

However, $A(0) = \frac{1}{2} * A(\text{ref})$ and therefore:

$$A(\text{tot}) = A(\text{ref})$$

Thus, it would be correct to determine the total amount of analyte by comparing the measured sum of analyte areas to a calibration measurement with data from a single determination of a gas standard.

Situation 2

The equilibrium between the condensed phase and the headspace is assumed to be 25/75 (with 75% in the gas phase). Furthermore, we assume that the entire headspace is exchanged during the course of each extraction step.

The measured area of the analyte peak is **A**.

A(ref) — Area that would be measured if all of the analyte were present in the headspace (again corresponding to the measured signal from a similar gas standard).

A(0) — Actual area measured from the first extraction with 75% of the analyte in the gas phase:

$$A(0) = \frac{3}{4} * A(\text{ref})$$

The total area determined by the MHE procedure is:

$$A(\text{tot}) = A(0) + \frac{1}{4} * A(0) + \frac{1}{16} * A(0) + \dots, \text{ or}$$

$$A(\text{tot}) = A(0) / (1 - \frac{1}{4}) = \frac{4}{3} * A(0)$$

However, $A(0) = \frac{3}{4} * A(\text{ref})$ and therefore:

$$A(\text{tot}) = A(\text{ref})$$

In this case, you also arrive at the correct value by determining the total amount of analyte by comparing the measured sum of analyte areas to a calibration measurement using data from a single determination of a gas standard.

The conclusion is: when in equilibrium, the relative ratio of the condensed phase versus the headspace plays no role in the amount of analyte content that is determined from an MHE-series. Furthermore, it can be concluded that quantification based on a single determination from a gas standard will, in this particular case, yield the correct result, assuming that the entire headspace is removed/exchanged during each extraction step.

Situation 3

The equilibrium between the condensed phase and the headspace is assumed to be 50/50.

Furthermore, we assume that only a part of the headspace is removed between each sampling. The relative amount of the headspace removed between each successive extraction constant and is denoted α .

The measured area of the analyte peak is **A**.

A(ref) — Area that would be measured if all of the analyte were present in the headspace (again corresponding to the measured signal from a similar gas standard).

A(0) — Actual area measured from the first extraction with 50% of the analyte in the gas phase:

$$A(0) = \frac{1}{2} * A(\text{ref})$$

The total area determined by MHE is:

$$A(\text{tot}) = A(0) + (1 - \alpha) * A(0) + (1 - \alpha)^2 * A(0) + \dots, \text{ or}$$

$$A(\text{tot}) = A(0) / (1 - \alpha) = A(0) * 2/\alpha$$

However, $A(0) = \frac{1}{2} * A(\text{ref})$ and thus:

$$A(\text{tot}) = \frac{1}{2} * A(\text{ref}) * 2/\alpha, \text{ or}$$

$$A(\text{tot}) = A(\text{ref})/\alpha$$

If $\alpha = 1$ (the entire headspace is exchanged between each extraction) then:

$$A(\text{tot}) = A(\text{ref})$$

If $\alpha = \frac{1}{2}$ (half of the headspace is exchanged between each extraction step) then:

$$A(\text{tot}) = 2 * A(\text{ref})$$

In this case $A(\text{tot})$ will be over-determined by a factor of two relative to $A(\text{ref})$. In other words, the content of analyte will be over-determined by a factor of two.

Situation 4

Similar to Situations 1 to 3 as described above, the general description for an equilibrium distribution with β being the relative amount of the analyte in the gas phase (in the headspace) and α being the relative amount of the headspace that is exchanged between each successive extraction, is given by:

$$A(\text{tot}) = \beta * A(\text{ref}) * (1 + (1-\alpha * \beta) + (1-\alpha * \beta)^2 + \dots)$$

Using the expression for the geometric sum yields:

$$A(\text{tot}) = \beta * A(\text{ref}) / (1 - (1 - \alpha * \beta)) = \beta * A(\text{ref}) * 1 / (\alpha * \beta)$$

or:

$$A(\text{tot}) = A(\text{ref}) / \alpha$$

That is: the total area, $A(\text{tot})$, will be over-determined by a factor of $1/\alpha$ relative to $A(\text{ref})$. In other words, the content of analyte will be over-determined by the factor $1/\alpha$. Thus the total area will depend on the amount of headspace removed during each successive extraction, but it will not depend on the position of the equilibrium (β).

Conclusion

If the headspace is only partially removed/exchanged between each extraction, the total area that results from the MHE determination will be greater than $A(\text{ref})$, where $A(\text{ref})$ denotes the area from a pure gas standard measured only once). Therefore, if MHE quantification is performed based on a singly-determined gas standard, the amount of analyte in the sample will be overestimated by a factor of $1/\alpha$, with α being the amount of the headspace that is removed/exchanged between each successive extraction. If the MHE quantification is based on gas standards that are subjected to the same MHE extraction sequences as the actual samples, there will be no overestimation. The amount calculated will be correct.

References

For more details, please refer to the corresponding publication on the static headspace technique and, in particular, on the MHE technique.

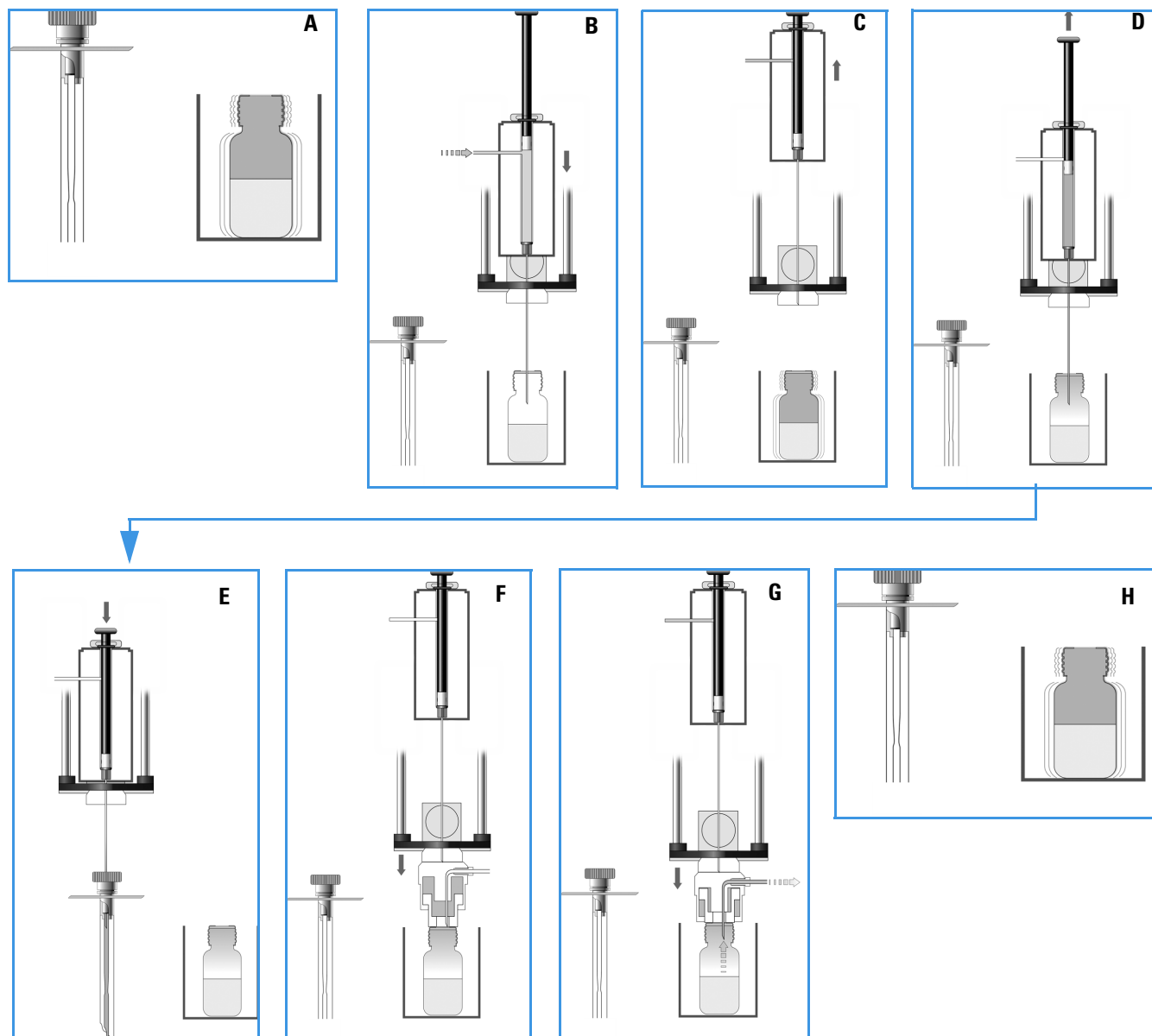
Title: 'Static Headspace-Gas Chromatography – Theory and Practice'
Authors: Bruno Kolb and Leslie S. Ettre, Second Edition.
Published by: John Wiley & Sons, Inc.

MHE Cycle Step-by-Step

This section details the basics steps for a routine operation of the MHE station.

1. The sample vial is placed into the Agitator and the equilibrium is established. Time and temperature are controlled. See **A** in [Figure 176](#).
2. The vial is pressurized by inserting the headspace syringe needle 22 mm into the vial. The purge gas is activated for a fixed time of 30 seconds. See **B** in [Figure 176](#).
3. The Headspace Syringe Needle is withdrawn from the vial. The gas purge valve is shut off after withdrawal. See **C** in [Figure 176](#).
4. A sample aliquot is taken up into the syringe according to the sample volume defined in the sample list. See **D** in [Figure 176](#).
5. The sample aliquot is injected into the GC. See **E** in [Figure 176](#).
6. The Injection Unit moves the MHE Adapter from the Adapter Holder to the sample vial in the Agitator. See **F** in [Figure 176](#).
7. The MHE Adapter needle is inserted into the vial (14 mm). The pressurized gas is vented to the atmosphere. See **G** in [Figure 176](#).
8. The MHE Adapter is removed from the sample vial and positioned back into the MHE Adapter Holder.
9. The sample vial will equilibrate to the same conditions as applied in Step 1. This cycle is repeated as often as defined by the MHE Counter method variable. See **H** in [Figure 176](#).
10. After this cycle has been completed, the sample vial is transported back to its original position in the Rack. The next sample is placed in the Agitator and the cycle will be repeated.

Figure 176. MHE Cycle Steps



Quantification from MHE Measurements

The raw data from analytical samples deriving from MHE measurements must be treated differently from those deriving from a classic, static headspace experiment. In general, software packages for chromatographic data handling are not designed to cope in an automated manner with MHE raw data. Raw data can be extracted from a chromatogram resulting from a single GC run into an Excel spreadsheet.

An example with explanations is given in the section [“Example of Quantitative Determination: Acetone and 2-Propanol in Granulate Samples”](#) on page 275.

Example of Quantitative Determination: Acetone and 2-Propanol in Granulate Samples

The determination of residual solvents, such as acetone and 2-propanol in granulates as used in the production of pharmaceutical products, is most often performed by headspace analysis.

Often the analysis is performed as a standard, single extraction determination with quantitation based on direct comparison to the response from gas standards. The drawback of this procedure is that it neglects any sample with matrix interaction. This can lead to the analyte not residing entirely in the gas phase (the headspace) in its distribution between the condensed phase and the headspace. In this case the analyte amount will be underestimated. In other words, the determined amount of analyte will be lower than the true value. In contrast, a true measure of the total content of the analyte can be obtained by applying multiple headspace extraction (MHE).

The following simple example briefly describes the practical steps involved in such an MHE-determination. The current example describes the procedure to determine the residual content of acetone and 2-propanol in samples of polyvinyl pyrrolidone-bound 5-amino salicylic acid (5-ASA) granulate. For simplicity, only the determination of the acetone content is discussed. The determination of the 2-propanol content is performed using a similar procedure. A three-level calibration curve (double determination at each level) is used for the quantitation – thus a total of six calibration samples are run. In this particular example, the calibration curve is used for determining the acetone content in one sample – in practice the number of samples will obviously be larger.

Procedure for Determining Acetone Content

The steps for determining the acetone content are outlined in the following example:

- **A** — Each of the six calibration standards is extracted five times for increasing the **quality** of the determination).
See [“A. Performing the Actual MHE Measurements”](#) on page 276.
- **B** — For each of the six calibration samples, the five areas from the five extractions are taken into account in determining the **total area**.
See [“B. Determination of the Total Area”](#) on page 276.

- **C** — An external standard calibration curve is established for acetone by plotting the calculated total area as a function of the amount of acetone in the standard. Remember that each of the **total areas** is a result of the MHE calculation for five extractions.
See “C. Construction of the Calibration Curve” on page 279.
- **D** — The **total area** is determined for any one of the real samples. The total content of the analyte is calculated from this value and the calibration curve.
See “D. Calculation of the Analyte Content in Real Samples” on page 279.

A. Performing the Actual MHE Measurements

The parameters of the actual MHE measurements, such as incubation time, incubation temperature, injection parameters, and so on, can be controlled using the MHE cycle that is part of the MHE kit.

B. Determination of the Total Area

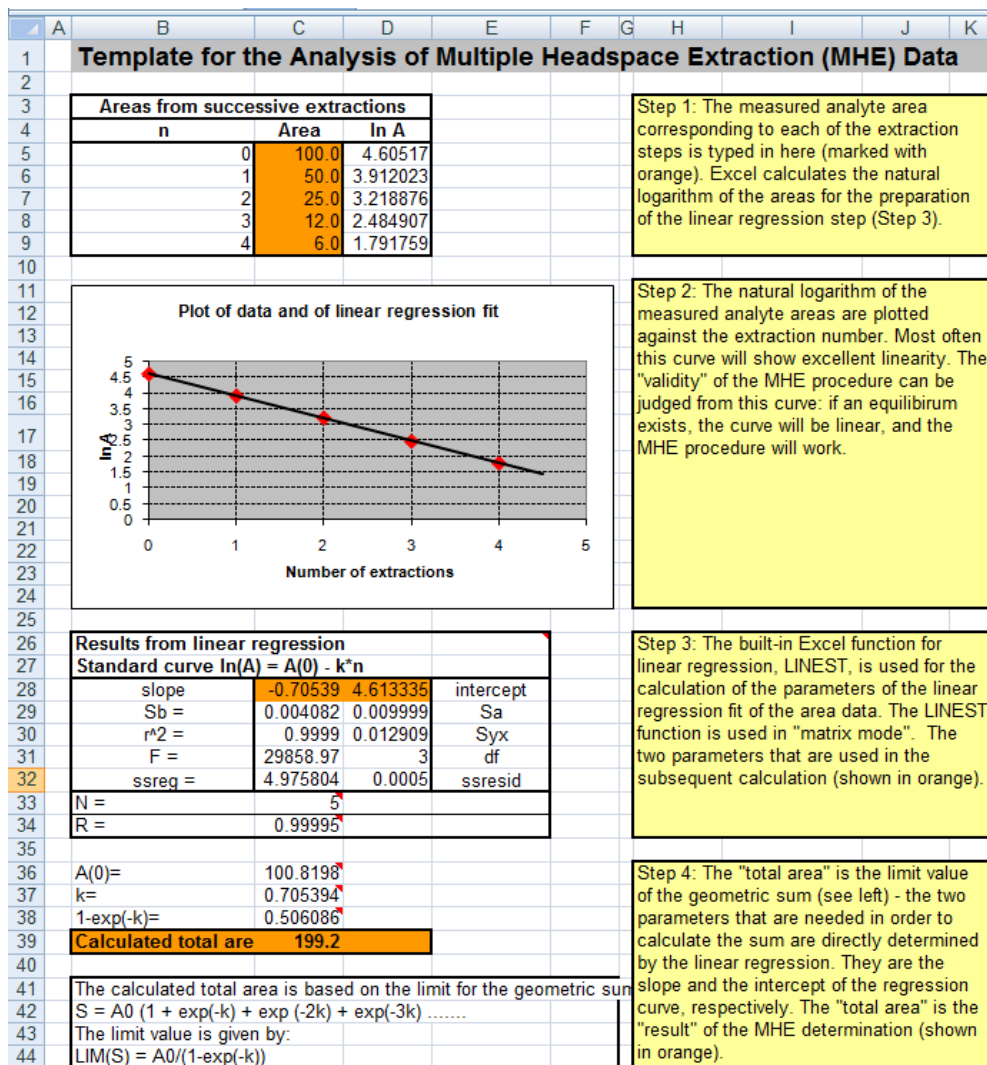
As you are performing a multiple headspace extraction to determine the total area, you can expect a functional relationship of the type. $A = A(0) * \exp(-k * n)$, where n is the extraction number

See [Step 1](#) and [Figure 177](#).

Therefore, by plotting the natural logarithm of the area as a function of the extraction number, you can expect a linear relationship, from which the constants $A(0)$ and k can be directly determined by means of the standard linear regression techniques. Finally, the **total area** can be determined as: $A = A(0)/(1-\exp(-k))$.

The linear regression determination of the constants can be easily performed using a simple Excel setup as well as the determination of the total area. The following Excel-sheet shows the MHE-data for one of the calibration samples. See [Figure 177](#).

Figure 177. Sample Excel Setup for MHE Quantitation



The following is an overview of each of the steps involved in completing and interpreting the data shown the Excel spreadsheet of [Figure 177](#).

Step 1

The measured analyte area corresponding to each of the extraction steps is typed here. See the orange field **Area** in [Figure 178](#).

Excel calculates the natural logarithm of the areas for the preparation of the linear regression step. See [Step 3](#).

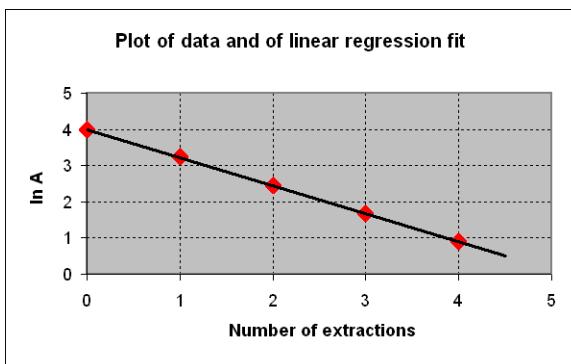
Figure 178. Entering Measured Areas of Calibration Standard Analyte

Areas from successive extractions		
n	Area	ln A
0	53,690	3,983227
1	25,480	3,237894
2	11,610	2,451867
3	5,400	1,686399
4	2,440	0,891998

Step 2

The natural logarithm of the measured analyte areas are plotted against the extraction number. Usually, this curve will show good linearity. The validity of the MHE procedure can be judged from this curve: if equilibrium exists, the curve will be linear, and the MHE procedure will work. See [Figure 179](#).

Figure 179. Linear Regression for Calibration Standard Analyte



Step 3

The built-in Excel function for linear regression LINEST is used for the calculation of the parameters of the linear regression fit of the area data. The LINEST function is used in **matrix mode**.

Note LINEST is the name of this function in the UK version of Excel. This name might be different in other language versions of Excel.

[Figure 180](#) shows the example of the **slope** and **intercept** parameters used in the subsequent calculation. [Calculation of Linear Regression for Calibration Standard Analyte](#)

Figure 180. Calculation of Linear Regression for Calibration Standard Analyte

Results from linear regression			
Standard curve $\ln(A) = A(0) - k \cdot n$			
slope	-0,7734	3,997067	intercept
Sb =	0,004542	0,011126	Sa
r^2 =	0,999897	0,014363	Syx
F =	28993,3	3	df
ssreg =	5,981402	0,000619	ssresid
N =	5		
R =	0,999948		

Step 4

The **total area** is the limit value of the geometric sum. The two parameters needed for the calculation of the sum are directly determined by the linear regression. They are the slope and the intercept of the regression curve, respectively. The **calculated total area** is the result of the MHE determination. See [Figure 181](#).

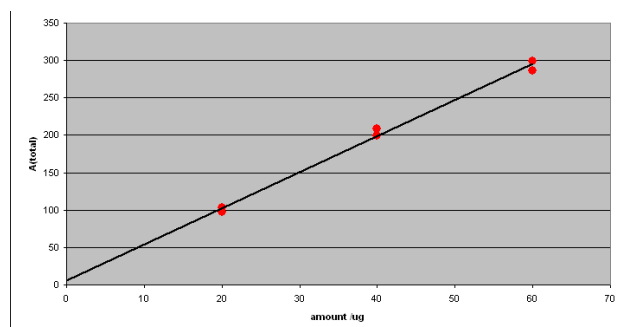
Figure 181. Calculation of Total Area of Calibration Standard Analyte

A(0)=	54.43827			
k=	0.773395			
1-exp(-k)=	0.538556			
Calculated total area	101.1			
The calculated total area is based on the limit for the geometric sum: $S = A_0 (1 + \exp(-k) + \exp(-2k) + \exp(-3k) + \dots)$ The limit value is given by: $LIM(S) = A_0 / (1 - \exp(-k))$				

C. Construction of the Calibration Curve

For each of the calibration samples the resulting total area, (determined according to the description above), is plotted against the amount of analyte.
In the following example we have three concentration levels of standards, each determined twice – thus the calibration curve comprises six points in total. See [Figure 182](#).

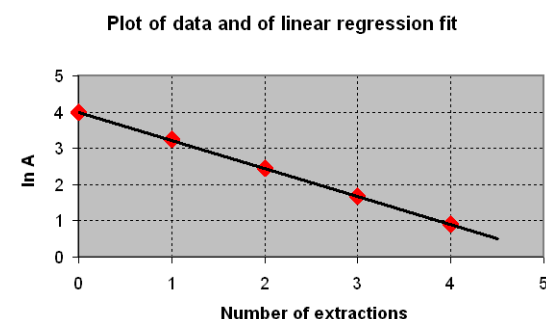
Figure 182. Calibration Curve: Total Area versus Amount of Acetone



D. Calculation of the Analyte Content in Real Samples

From the MHE measurements of each of the actual samples, an MHE plot is generated. A typical example yields an MHE curve as shown in [Figure 183](#).

Figure 183. MHE Plot of Analyte form an Analytical Sample



The **total area** is determined from the MHE-plot of [Figure 183](#).

Consequently, the acetone content can be determined as follows:

1. Calculate the total area using the Excel spreadsheet. In this example the total area is 101.1
2. Compare the total area against the calibration plot from which the amount can be determined as 19 µg. See [Figure 183](#).