TriPlus RSH

Robotic Sample Handling

Hardware Manual

Thermo
S C I E N T I F I C

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Reader's Survey

TriPlus RSH Hardware Manual, PN 31709640, Ninth 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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If not, please comment below. Attach additional sheets if necessary.

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Declaration

Manufacturer: **Thermo Fisher Scientific**

Thermo Fisher Scientific is the manufacturer of the instrument described in this manual and, as such, is responsible for the instrument safety, reliability and performance only if:
* installation
* re-calibration
* changes and repairs

have been carried out by authorized personnel and if:
* 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

Thermo Fisher Scientific is not liable for any damages derived from the non-compliance with the aforementioned recommendations.

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Regulatory Compliance

Thermo Fisher Scientific performs complete testing and evaluation of its products to ensure full compliance with applicable domestic and international regulations.

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* Low Voltage Directive:2006/95/EC
* EMC Directive:2004/108/EC
* Machinery Directive: 2006/42/EC
  … and conforms with the following product standards:

Safety

This device complies with:
* IEC61010-1:2010 3rd Edition | IEC/EN 61010-1 3rd Edition
* ANSI/UL 61010-1:2004 2nd Edition | CAN/CSA C22.2 No. 61010-1:2004 2nd Edition.
* EN 61010-2-010:2003 | EN 61010-2-051:2003 | EN 61010-2-081:2001+A1:2003 | EN 61010-2 101:2003

Electromagnetic Compatibility

This device complies with:
* IEC 61326-1:2nd Edition | EN 61326-1:2013 | CISPR 11:5th Edition
* EN 61000-6-2:2005 | IEC 61000-6-2:2nd Edition| IEC 61000-6-3:2nd Edition am1 | EN 61000-6-3:2007 + A1:2011
* Conducted Emission, Subpart B. FCC part 15, §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
- EN60825-1:1994 + A1:2002 + A2:2001
- IEC60825-1:1993 + A1:1997 + A2:2001

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 UNDESIRED 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.

Notice on Lifting and Handling of
Thermo Scientific Instruments

For your safety, and in compliance with international regulations, the physical handling of this Thermo Fisher Scientific instrument *requires a team effort* to lift and/or move the instrument. This instrument is too heavy and/or bulky for one person alone to handle safely.

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.

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WEEE Compliance

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2012/19/EU. It is marked with the following symbol:

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⚠️ **IMPORTANT**

The symbol indicates the product must not be disposed of with the normal household wastes. Correct disposal of this product prevents any potentially negative impact on the environmental and human health that could arise from any inappropriate handling of the product itself.

WEEE and RoHS rules, while laid down at European level, are put into national law at national level. When exporting to Europe, it is essential to comply with national law in each relevant country. The EU law simply serves as a template for national laws, which may differ considerably.

Each EU Member State has own regulations regarding the application of these directives. Please refer to the regulations in force in your country.

Contents

Preface

This manual details informations for installing, defining object, interfacing, maintaining, and troubleshooting the TriPlus RSH.

This manual is organized as follows:

- Chapter 1, "Specifications," provides general specifications of the TriPlus RSH.

- Chapter 2, "Installation of the TriPlus RSH System," provides informations for installing the TriPlus RSH System.

- Chapter 3, "TriPlus RSH Defining Object Positions," provides the instructions for defining the teaching position of he TriPlus RSH modules, the referencing position and the calibration of the tools. The definition of these terms, and the Row and Column sample positions, are also explained.

- Chapter 4, "TriPlus RSH Firmware," provides instructions for creating, copying, and restoring backup files, and for upgrading and downgrading the Control Software.

- Chapter 5, "Maintenance," provides guidelines for maintaining the TriPlus RSH and its modules.

- Chapter 6, "Troubleshooting," gives a quick overview of possible causes and recommended actions which can be taken to eliminate an erratic behavior.

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 may be impaired. If you maintain a system outside the specifications listed in this guide, failures of many types, including personal injury or death, may 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

Thermo Fisher Scientific provides comprehensive technical assistance worldwide and is dedicated to the quality of our customer relationships and services.

Use http://www.thermoscientific.com address for products information.address for products information.

Use http://www.gc-gcms-customersupport.com/WebPage/Share/Default.aspx address to contact your local Thermo Fisher Scientific office or affiliate GC-GC/MS Customer Support.

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 Preinstallation Requirements Guide*, PN 31709610

- *TriPlus RSH User Guide*, PN 31709620

- *TriPlus RSH Hardware Manual*, PN 31709640

To suggest ways we can improve the documentation, follow this link to complete our documentation 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 *will*, *could*, or *might* occur.
	BURN HAZARD: Alerts you to the presence of a hot surface that *could* or *might* cause burn injuries.
	ELECTRICAL SHOCK HAZARD: Indicates that an electrical shock *could* or *might* occur.
	FIRE HAZARD: Indicates a risk of fire or flammability *could* or *might* occur.
	EXPLOSION HAZARD. Indicates an explosion hazard. This symbol indicates this risk *could* or *might* 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 *could* or *might* cause physical injury.

	GLOVES REQUIRED: Indicates that you must wear gloves when performing a task or physical injury *could* or *might* occur.
	CLOTHING REQUIRED. Indicates that you should wear a work clothing when performing a task or else physical injury *could* or *might* occur.
	BOOTS REQUIRED. Indicates that you must wear boots when performing a task or else physical injury *could* or *might* 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 *could* or *might* occur.
	HARMFUL. Indicates that the presence of harmful material *will, could, or might* occur.
	INSTRUMENT DAMAGE: Indicates that damage to the instrument or component *might* occur. This damage might not be covered under the standard warranty.
	LIFTING HAZARD. Indicates that a physical injury *could* or *might* occur if two or more people do not lift an object.
	MATERIAL AND EYE HAZARD: Indicates that eye damage *could* or *might* 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 *could* or *might* put you at risk for a physical injury.
	TOXIC SUBSTANCES HAZARD: Indicates that exposure to a toxic substance could occur and that exposure *could* or *might* cause personal injury or death.
	LASER HAZARD. Indicates that exposure to a laser beam *will, could*, or *might* cause personal injury.
	RADIOACTIVE HAZARD. Indicates that the presence of radioactive material *could or might* 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 *could cause personal injury.*

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. See the asterisk.

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
*	I	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.
		Caution, risk of electric shock
*		Caution, hot surface
*		Caution, biohazard
*		Caution, Laser beam

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

	Symbol	Description
*		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

- EN60825-1:1994 + 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.

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 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.

Specifications

This section provides general specifications of the TriPlus RSH.

Contents

Electrical Specifications

The electrical specifications and the various protection classes are provided in Table 1 and Table 2.

Table 1. General Electrical Specifications

Parameter	Requirements
Voltage	36 VDC
Current	3.2 A
Fuse	T6.3 A/250 V

Table 2. Handheld Controller Power Supply

Parameter	Requirements
Input line voltage	Grounded AC, 100 V to 240 V
Input line frequency	50/60 Hz
Input power	4 A
Output voltage	36 VDC
Output current	5.55 A (total for two Outlets)

- **Protection Class I** — Describes the insulating scheme used in the instrument to protect the user from electrical shock. Class I identifies a single level of insulation between live parts (wires) and exposed conductive parts (metal panels), in which the exposed conductive parts are connected to a grounding system. In turn this grounding system is connected to the third pin (ground pin) on the electrical power plug.

- **Over Voltage Category II** — Pertains to instruments that receive their electrical power from a local level such as an electrical wall outlet.

- **Pollution Degree 2** — Measure of pollution on electrical circuits that may produce a reduction of the dielectric strength or surface resistivity. Degree 2 normally refers only to non-conductive pollution.Occasionally, however, a temporary conductivity caused by condensation is to be expected.

- **Moisture Protection** — Normal (IPXO) – PIXY means that there is NO Ingress Protection against any type of dripping or sprayed water. The X is a place holder to identify protection against dust, if applicable.

Physical Specifications

The physical specification for the TriPlus RSH with Standard are listed in Table 3.

Table 3.   Space and Load Requirements

Instrument	Depth (Y-axis)		Width (X-axis)		Height (Z-axis)		Mass	
	cm	in.	cm	in.	cm	in.	kg	lbs
TriPlus RSH standard X axis	46[1]	18[1]	85	33.5	54	21.3	13.3[4]	29.3[4]
TriPlus RSH extended X-axis	46[1]	18[1]	120.5	47	54	21.3	15.3[4]	33.7[4]
TriPlus RSH standard X axis (Working Range)	80[1]	31.5	99[2]	39[2]	53 (74)[3]	20.9 (29)[3]	25	55
TriPlus RSH extended X-axis (Working Range)	80[1]	31.5	135[2]	53[2]	53 (74)[3]	20.9 (29)[3]	27	60

[1] About 20 cm (about 8-in.) of the orthogonal crossrail (Y-axis) are protruding the back of the GC.

[2] Dimension of the entire working range including Handheld bracket

[3] Dimension including the support legs [about 22 cm (8.7 in.) height]

[4] Mass without accessories.

Operating and Environmental Specifications

These specifications are listed in Table 4.

Table 4.   Operating and Environmental Specifications

Parameter	Requirements
Operating temperature range	5 °C to 40 °C (41 °F to 104 °F)
Non-operating temperature range (transport or storage conditions)	-25 °C to +65 °C (-13 °F to + 149 °F)
Maximum relative humidity	80%, non-condensing
Work environment	Indoor use
Altitude	Up to 3000 m above sea level
Mains voltage variation	±10%
Bench space	At least 30 cm (12 in.) at the back.
Access to power switches and power cords.	Clean, level, and smooth surface.
Clean, level and smooth surface.	Solid bench plate.
Vibration	Negligible
Static electricity	Negligible

Sound Pressure Level

The sound pressure level is listed in Table 5.

Table 5. Sound Pressure Level

Parameter	Requirements
Sound Pressure Level	Measured value: • TriPlus RSH (basic unit): 64 dBA • TriPlus RSH with Agitator: 66 dBA • TriPlus RSH with Vortexer without sample vial: 67 dBA • TriPlus RSH with Vortexer with 20 ml sample vial inserted: 78 dBA. One meter from the equipment in the direction of maximum sound pressure level.
According to UL 610107A-1, 1st Edition, clause 12.5.	Limit < 85 dBA dBA = A weighted sound pressure level

Hardware and Software Requirements

This section details the hardware and software requirements.

Computer Hardware Requirements

The computer hardware minimal requirements depends on the Microsoft Windows Operating System and, if applicable, on the **MS.NET Framework software** used. See recommendations from Microsoft.
It is also important to consider the minimum requirements for the operation of the Chromatography Data System Software (CDS).

For operation of the TriPlus RSH, both an Ethernet (TCP/IP) and a USB communication port are required. The computer in use must be equipped accordingly: LAN or Ethernet IEEE 802.3 Industry Standard 10/100 Base-T. The network interface of the TriPlus RSH supports the Auto-MDI(X) protocol.

The USB Device/Client Type B communication port of the TriPlus RSH is currently not activated.

USB Stick (Memory Drive)

Use a commercially available standard USB memory stick with at least 100 MB memory size. No special formatting of the drive (stick) is necessary; on the contrary only one partition must be defined. If two partitions are defined, subsequent errors occur, and the access to the system is denied.

> **Note** Commercially available USB sticks with encrypting software installed, and secure USB drives, typically have two partitions. This type of USB drive cannot be utilized in combination with the TriPlus RSH system.

The following software types of the USB memory drive are compatible with the TriPlus RSH:

- FAT

- FAT32

- The software NTFS is **NOT** supported. If a USB Stick with this software is used, the stick will not be recognized by the RSH Firmware.

- Starting with Firmware version 1.5.0 a USB Stick with software version 3.0 can be operated. With Firmware versions lower than 1.5.0, USB sticks can be operated with software version 2.X.X only.

- It is recommended to adjust the **Allocation Unit Size** as large as possible. There is a dependency observed between the **Capacity Size** and the size of the **Allocation Unit**.

  Examples: USB Stick Capacity 4 GB with 4 MB Allocation Unit, or 16 GB Capacity with 64 MB Allocation Units. These combinations are valid; however a 16 GB Capacity with 8 MB Allocation Units is not working. The observed effect is that the USB Stick is not recognized within the 10 seconds time limit.

> **Note** The **Recognition Time** is time used from the moment the stick is connected to the TriPlus RSH System until the USB symbol is displayed on the handheld controller (terminal).
>
> Recognition Time of the USB Stick is:
> - Firmware version < 1.5.0:Time-out after 10 s.
> - Firmware version ≥ 1.5.0: Time-out after 30 s.

PC Software Requirements

All the software functionality such as Backup, Restore, or Update for the RSH Firmware are performed directly via USB interface using the USB stick. For these purposes, no specific software on a PC is required.

For the operation of the TriPlus RSH with a Thermo Scientific Chromatography Data System (CDS), for example: Chromeleon, Xcalibur, ChromQuest, or Chrom-Card, a software driver is used. The specific requirements for operation of the integrated TriPlus RSH System in the CDS are outlined by the supplier of the CDS software.

For the operation of the TriPlus RSH in combination with Sample Control, the software from Microsoft MS.net framework version 4.0 (or higher) is required.

Configuring Windows for Firmware and for the CDS

When configuring the Windows Operating software for the TriPlus RSH, it is important to note that the CDS to be used in conjunction with the TriPlus RSH might require specific settings as well. These settings have to be matched for reliable operation of the analytical system. See the corresponding sections in the installation manual of the specific CDS.

Firewall or Virus Scanner Settings

In order to reliably operate the TriPlus RSH and the selected Chromatography Data System (CDS), it is necessary to turn **OFF** any third party **Firewall** or **Virus Scanner** software.

If for any reason a firewall must be activated; the TCP Ports 80, 64000, 64001, and 8194 must be unlocked.

Screen Savers

It is highly recommended **NOT** to use any **Screen Savers**.

Disabling Power Management

Depending on the Windows Operating System version and the default settings, the computer may enter standby mode automatically after a specified time if no mouse or keyboard activity is detected. Using this **Power Save** mode in the environment with laboratory instruments where unattended operation day and night is expected, will likely result in loss of data, interruptions of specific functions, or whole operations.

❖ **To disable Windows power management**

1. Select the Windows **Control Panel**

2. Select **System and Security**

3. Select **Power Options**

4. From **Power Plan** select the menu item **Put the Computer to sleep: Never**

Note Depending on the Windows version, the path or wording may differ slightly. The example given above is based on Windows 7.

TriPlus RSH System Software Requirements

The TriPlus RSH Firmware is the collective term referring to all required software and data that complement one another and make up the complete TriPlus RSH Firmware. It consist mainly of:

- Operating System (OS)

- TriPlus RSH Application Software

- TriPlus RSH Configuration (persisted data)

- TriPlus RSH Device Firmware

When restoring a **TriPlus RSH Configuration Backup**, the software packages **TriPlus RSH Application** and **TriPlus RSH Configuration** are saved, under the file extension **.pac*. This file is always stored as an archive file.

The **Operating System** and TriPlus RSH device firmware are not stored in the configuration backup.

In case of a software update for the TriPlus RSH Firmware, a single archive file with the file extension **.cont* will be supplied.

The software supplied depends on the compatibility of all the software packages. In some cases, only the TriPlus RSH device firmware is necessary to complete the update. All other software packages remain untouched, and are compatible. If major changes are made to the operating systems, could also be necessary to adapt both the **TriPlus RSH Application**, and the **TriPlus RSH Configuration** software to provide full compatibility.

Note For detailed information see the Chapter 4, "TriPlus RSH Firmware."

Installation of the TriPlus RSH System

This chapter provides informations for installing the TriPlus RSH System.

Contents

Introduction

This chapter describes the installation of the TriPlus RSH and its modules. Referencing of the TriPlus RSH and teaching of the various modules are described in Chapter 3, "TriPlus RSH Defining Object Positions."

Who Performs the Installation

CAUTION The TriPlus RSH is installed by authorized Thermo Fisher Scientific technical personnel, who will check its correct operation. For more details, please contact Thermo Fisher Scientific local representatives. Should the instrument not be installed by Thermo Fisher Scientific personnel, please strictly adhere to the following instructions.

Space Requirements

Provide enough space around the instrument on which the TriPlus RSH must be installed making reference to the overall dimensions of the sampler described in the *TriPlus RSH Preinstallation Requirements Guide*.

WARNING Pay attention not to operate on the instrumental parts included in the work area of the sampler when this is in movement.

Electrical Requirements

The power line and the connections between the instruments must maintain good electrical grounding. Poor grounding represents a danger for the operator and may seriously affect the instrument performance.

CAUTION Do not connect the TriPlus RSH to lines feeding devices of a heavy duty nature, such as motors, UV lamps, refrigerators and other devices that can generate disturbances.

Pay attention not to leave any cable connecting the sampling unit and the chromatographic system or the power cord close to the GC hot air vents.

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

Sampler Supports

The TriPlus RSH is installed on the GC by using the two appropriate supports provided. Every support has a bar provided with holes for the fixing on the GC, and a vertical support leg provided with clamps for the correct hookup of the sampler.

Material Required for the Installation

To install the TriPlus RSH, and its modules, the following material is required:

- T6 Torxhead screwdriver
- T10 Torxhead screwdriver
- T20 Torxhead screwdriver
- T25 Torxhead screwdriver
- Two flat wrenches
- Flat-head screwdriver

Installation Quick Reference Guide

Table 6. Installation Quick Reference Guide (Sheet 1 of 2)

Step	Action	Reference
01	Prepare the working area and the GC System.	See the relevant **Preinstallation Requirements Guide** for the GC system and the TriPlus RSH.
02	Check if all components of the TriPlus RSH System are delivered.	See "Unpacking the Components" on page 12
03	Install the TriPlus RSH supports on the GC	See "Installing the TriPlus RSH Supports on the GC" on page 13
04	Install the TriPlus RSH on the GC.	See "Placing the TriPlus RSH on the Supports" on page 19
05	Connect all the Active and Passive modules, to complete the required system configuration.	See "Installation of the TriPlus RSH System" on page 20
06	Make all electrical connections, including for the Active modules	See "Installation of the TriPlus RSH System" on page 20
07	Prepare the tool(-s). Insert the required syringe(-s).	"Inserting a LS Syringe into the LS Tool" on page 53 or "Inserting a HS Syringe into the HS Tool" on page 55, or "Inserting a SPME Fiber Holder into the SPME Tool" on page 59 "Managing an ITEX Syringe and Trap Assemble" on page 61
08	Prepare the Computer with the required software:	Follow the recommendations and specifications from Thermo Fisher Scientific. See the section **Hardware and Software Requirements** in the *TriPlus RSH User Guide.*
09	Connect the TriPlus RSH to the Network environment. LAN cable provided with the system.	See "Combining the TriPlus RSH to Other Devices" on page 68.
10	Power up the system	See the section **How to Start the TriPlus RSH** in the *TriPlus RSH User Guide.*
11	When handheld controller is not part of the TriPlus RSH system: Establish LAN Communication and Start the Virtual handheld controller software under Xcalibur.	Follow the recommendations and specifications from Thermo Fisher Scientific.

Table 6. Installation Quick Reference Guide (Sheet 2 of 2)

Step	Action	Reference
12	Check the RSH Firmware Version.	Path from the Start Screen: Options | About. See the section **About Menu** in the *TriPlus RSH User Guide.*
	If the software version is lower than 1.4.0, perform an Update procedure at the beginning of the installation. The minimum software version should not be lower than 1.3.2.	See "Update the RSH Firmware" on page 121.
13	Change the Access Level to Extended User	See the section **Access Level** in the *TriPlus RSH User Guide.*
14	Press Options and select in the pull-up menu the item Setup | Modules. - Check availability of the Active modules. - Add all required Passive modules. - Check or add if necessary in following order: Signal, Input/Output Interface, Chromatograph System	See the chapter **Setup Menu Item** in the *TriPlus RSH User Guide.*
15	From the Start Screen select the required Tool, press Enter and select menu item Needle Guide Type. **Note**: The parameter **Cap Type** in the class Vial Type has to correspond with the Tool Needle Guide Type. Example: Magnetic10/20 | Magnetic Cap. Magnetic 2mL | Magnetic Cap Foil Cutter | MTP Plates. If **Needle Guide Type** is defined as **Not Specified**, a run is prohibited also when the **Cap Type** is set **No Cap** or Non **Magnetic Cap**.	Explanations for the different settings: Not Specified: Prohibits the execution of a run. Magnetic 2mL: Magnetic Transport for 2 mL vial (large magnetic ring not installed). Magn. 10/20 mL: Magnetic transport of 10 or 20 mL vials. Large magnetic ring installed. Foil Cutter: Foil Cutter for MicroTiter Plate foils installed.
16	Press Options and select in the pull-up menu the item Service | Installation. Follow step-by-step the installation wizard.	See the section **Service Menu - Installation Item** in the *TriPlus RSH User Guide.*
17	Make a Backup file	See the section **Maintenance Menu Item- Backup** in the *TriPlus RSH User Guide* and Chapter 4, "TriPlus RSH Firmware."

Unpacking the Components

A TriPlus RSH is shipped into two boxes. Depending on the configuration and optional modules, the entire system may be shipped in more than two boxes:

- The main box contains the TriPlus RSH base (X-,Y- axes assembly) and the standard modules such as the TriPlus RSH Handheld Controller, Power Module, Tray Holders, Trays, Wash Stations, and so on.

- The second box contains the TriPlus RSH Head (entire Z-axis). For shipping and protective reasons, the inner mechanical part is separated from the cover.

❖ **To unpack the instrument**

1. Open the boxes, remove the accessory boxes to compare the packing list, and check for completeness of the shipment

2. Carefully lift the TriPlus RSH base and remove it from the box.

CAUTION This operation must be performed by TWO persons who must stand each on one side of the X-axis and put their hands underneath it.

Hold the Y-axis in place while the assembly is being removed from the box. Set the TriPlus RSH base assembly on a bench.

3. Unpack the remaining box that includes the TriPlus RSH Head. If applicable, unpack the other boxes with any additional accessories included.

4. When placing the TriPlus RSH System onto a GC, make sure that no objects interfere with the Y-axis, or the TriPlus RSH Head, throughout the entire potential range of movement.

Installing the TriPlus RSH Supports on the GC

The TriPlus RSH supports are two vertical legs provided into a dedicated **GC Mounting Kit**.

To install the supports on your GC refer to the following procedures:

- "Installing the Supports on a Single GC" on page 14
- "Installing the Supports on a Double TRACE 1300/1310" on page 15
- "Installing the Supports on a TRACE 1300/1310 Coupled with a MS" on page 15
- "Installing the Supports on a Double TRACE GC Ultra" on page 15
- "Installing the Supports on a Double FOCUS GC" on page 16
- "Installing the Supports on a TRACE GC Ultra Coupled with a FOCUS GC" on page 17
- "Installing the Supports on a Double TRACE GC Ultra Coupled with a MS" on page 18
- "Installing the Supports on a TRACE GC Ultra and on a FOCUS GC Coupled with a MS" on page 18

Sampler Supports Assembling

❖ **To assemble the sampler support**

With reference to Figure 1, proceed as follows:

Figure 1. Support Assembling

1 = Support Bar
2 = Support Leg
3 = Mounting clamps
4 = Support Leg Holes
5 = Leg Fixing Screws
6 = Support Bar Fixing Holes for the GC
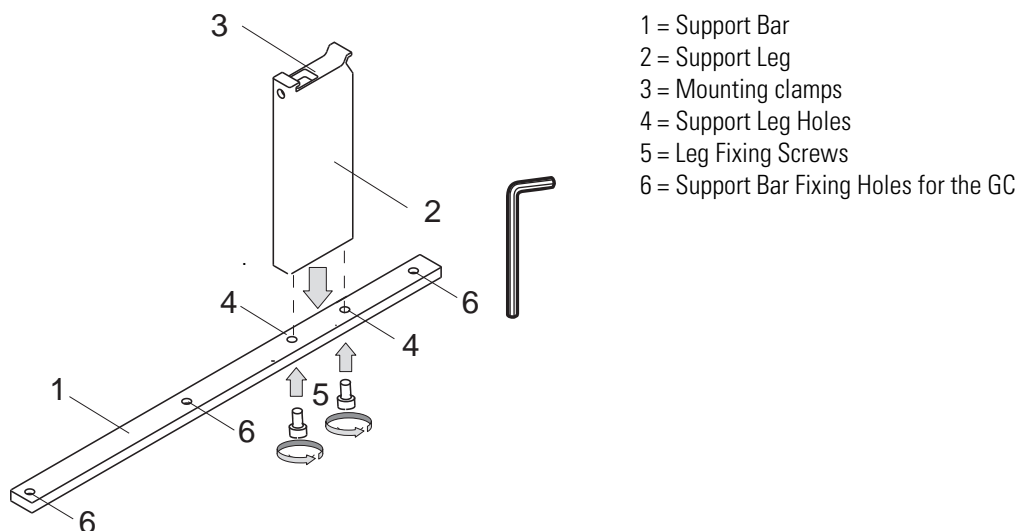
1. Insert the provided fixing screw into each hole present on the support bar.

2. Place the support leg on the support bar paying attention that the fixing screw of the leg is frontally turned.

3. Tighten the fixing screws.

Installing the Supports on a Single GC

❖ **To install the sampler supports on a GC**

1. From the GC upper cover remove the plastic caps covering the corresponding fixing holes.

2. Insert into each holes present on the support bar the provided fixing screw.

3. Mount each sampler support on the GC paying attention to have the support leg turned toward the back of the GC.

4. Guide the fixing screws into the corresponding fixing holes.

5. Tighten the fixing screws.

Installing the Supports on a Double TRACE 1300/1310

❖ **To install the support on a double TRACE 1300/1310 placed side by side**

⚠️ **CAUTION** Before proceeding, verify that the working area is large enough to accommodate two GC units and possible external devices.

1. Place the two TRACE 1300/1310 side by side.

1. From the upper cover of the GC placed on the right, remove the plastic caps covering the corresponding fixing holes.

2. Insert into each holes present on the support bar the provided fixing screw.

3. Mount each sampler support on the GC paying attention to have the support leg turned toward the back of the GC.

4. Guide the fixing screws into the corresponding fixing holes.

5. Tighten the fixing screws.

Installing the Supports on a TRACE 1300/1310 Coupled with a MS

❖ **To install the support on a TRACE 1300/1310 coupled with a mass spectrometer**

⚠️ **CAUTION** Before proceeding, verify that the working area is large enough to accommodate the GC, the MS detector and possible external devices.

1. From the GC upper cover remove the plastic caps covering the corresponding fixing holes.

2. Insert into each holes present on the support bar the provided fixing screw.

3. Mount each sampler support on the GC paying attention to have the support leg turned toward the back of the GC.

4. Guide the fixing screws into the corresponding fixing holes. Tighten the fixing screws.

Installing the Supports on a Double TRACE GC Ultra

❖ **To install the supports on a double TRACE GC Ultra placed side by side**

⚠️ **CAUTION** Before proceeding, verify that the working area is large enough to accommodate two GC units and possible external devices.

1. From both sides of the first GC upper cover remove the plastic caps covering the corresponding fixing holes.

2. Insert the provided fixing screw into each hole present on the support bar.

3. Mount each sampler support on the GC paying attention to have the support leg turned toward the back of the GC.

4. Guide the fixing screws into the corresponding fixing holes, then tighten the fixing screws.

5. Move the second GC beside the first one leaving a distance of about 90 mm between the two GC units.

6. From the left side of the second GC upper cover remove the plastic caps covering the corresponding fixing holes.

7. Insert the appropriate fixing screws into each hole present on the spacer plate provided.

8. Mount the spacer plate on the two GC units.

9. Guide the fixing screws into the corresponding fixing holes, then tighten the fixing screws.

Installing the Supports on a Double FOCUS GC

❖ **To install the sampler supports on two FOCUS GC Ultra units placed side by side,**

CAUTION Before proceeding, verify that the working area is large enough to accommodate two GC units and possible external devices.

1. Place the two FOCUS GC units side by side leaving a distance of about 130 mm between the two GC units.

2. From the **right** side of each of the FOCUS GC upper cover remove the plastic caps covering the corresponding fixing holes.

3. Insert the provided fixing screw into each hole present on the support bar.

4. Mount each sampler support on the GC units paying attention to ensure that the support leg is turned toward the back of the GC.

5. Guide the fixing screws into the corresponding fixing holes, then tighten the fixing screws.

6. From the **left** side of the second FOCUS GC upper cover remove the plastic caps covering the corresponding fixing holes.

7. Insert the appropriate fixing screws into each hole present on the spacer plate provided.

8. Mount the spacer plate on the two GC units.

9. Guide the fixing screws into the corresponding fixing holes, then tighten the fixing screws.

> ⚠️ **CAUTION** Before proceeding, verify that the working area is large enough to accommodate the GC units, the MS detector, and possible external devices.
> For this configuration the use of the TriPlus RSH extended X-axes is required.

1. From the **right** side of the TRACE GC Ultra and from the **left** side of the TRACE GC Ultra for MS upper cover remove the plastic caps covering the corresponding fixing holes.

2. Insert the provided fixing screw into each hole present on the support bar.

3. Mount each sampler support on the GC units paying attention to have the support leg turned toward the back of the GC.

4. Guide the fixing screws into the corresponding fixing holes, then tighten the fixing screws

5. Place the two GC units beside the MS detector.

Installing the Supports on a TRACE GC Ultra Coupled with a FOCUS GC

❖ **To install the sampler supports on a TRACE GC Ultra alongside a FOCUS GC**

> ⚠️ **CAUTION** Before proceeding, verify that the working area is large enough to accommodate two GC units and possible external devices.

1. Place the FOCUS GC on the **left** and the TRACE GC Ultra on the **right** leaving a distance of about 57 mm between the two GC units.

2. From **both** sides of the TRACE GC Ultra upper cover, remove the plastic caps covering the corresponding fixing holes.

> ⚠️ **CAUTION** One of the two supports must not be assembled. If the supports have already been assembled, one of them must be disassembled.

3. Disassemble one sampler support removing the support leg from the support bar unscrewing the two fixing screws.

4. Mount the support leg on the spacer plate provided and fix them by using the same fixing screws previously removed.

5. Insert the provided fixing screw into each hole present on the support bar.

6. Mount the alone support bar on the **left** side and the complete sampler support on the **right** side of the TRACE GC Ultra paying attention to have the support leg turned toward the back of the GC.

7. Guide the fixing screws into the corresponding fixing holes, then tighten the fixing screws.

8. From the **right** side of the FOCUS GC upper cover remove the plastic caps covering the corresponding fixing holes.

9. Insert the appropriate fixing screws into each hole present on the spacer plate assembled with the support leg.

10. Mount the spacer plate assembling on the two GC units.

11. Guide the fixing screws into the corresponding fixing holes, then tighten the fixing screws.

Installing the Supports on a Double TRACE GC Ultra Coupled with a MS

❖ **To install the sampler supports on two TRACE GC Ultra coupled with a mass spectrometer**

⚠ **CAUTION** Before proceeding, verify that the working area is large enough to accommodate the GC units, the MS detector, and possible external devices.
For this configuration the use of the TriPlus RSH extended X-axis is required.

1. From the **right** side of the TRACE GC Ultra and from the **left** side of the TRACE GC Ultra for MS upper cover remove the plastic caps covering the corresponding fixing holes.

2. Insert the provided fixing screw into each hole present on the support bar.

3. Mount each sampler support on the GC units. Pay attention that the support leg is turned toward the back of the GC.

4. Guide the fixing screws into the corresponding fixing holes, then tighten the fixing screws.

5. Place the two GC units beside the MS detector.

Installing the Supports on a TRACE GC Ultra and on a FOCUS GC Coupled with a MS

❖ **To install the sampler supports on a TRACE GC Ultra for MS and a FOCUS GC placed on the sides of a mass spectrometer**

⚠ **CAUTION** Before proceeding, verify that the working area is large enough to accommodate the GC units, the MS detector, and possible external devices.
For this configuration the use of the TriPlus RSH extended X-axis is required.

1. From the TRACE GC Ultra upper cover remove the plastic caps covering the corresponding fixing holes.

2. Insert the provided fixing screw into each holes present on the support bar.

3. Mount each sampler support on the TRACE GC Ultra Pay attention that the support leg is turned toward the back of the GC.

4. Guide the fixing screws into the corresponding fixing holes.

5. Tighten the fixing screws.

6. Place the two GC units beside the MS detector.

7. To mount the autosampler use the appropriate support and fixing it on the installation holes provided on the top of the GC.

8. For further details please refer to the *Operating Manual* of the sampling system in use.

Placing the TriPlus RSH on the Supports

❖ **To place the TriPlus RSH onto the supports (vertical legs)**
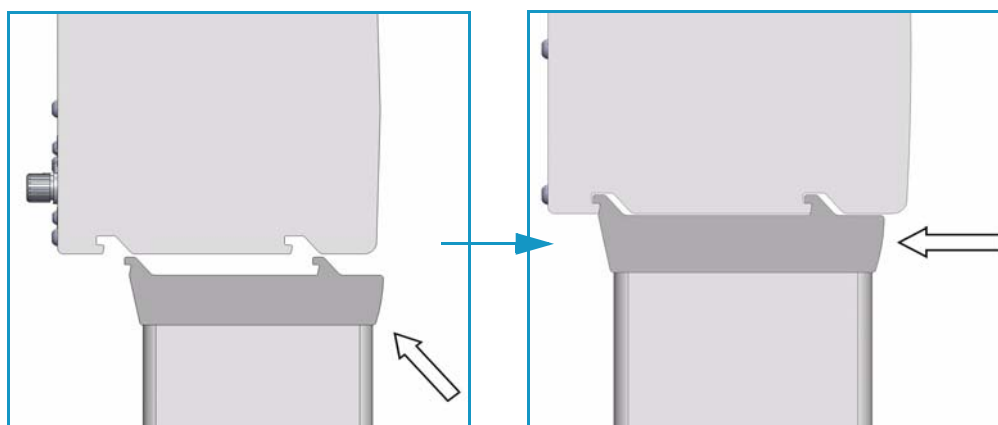
1. Loosen the two mounting clamps Torx screws of the vertical legs.

2. Place the TriPlus RSH base assembly on top and fit the legs into the groove in the X- axis.

CAUTION This operation must be performed by TWO persons who must stand each on one side of the X-axis and put their hands underneath it.

3. Be sure that the mounting clamps fit completely into the grooves. Alternately tighten the two Torx screws until the legs are firmly in place.

Figure 2.   Positioning and Fixing of the Mounting Clamps in the X-axis Grooves
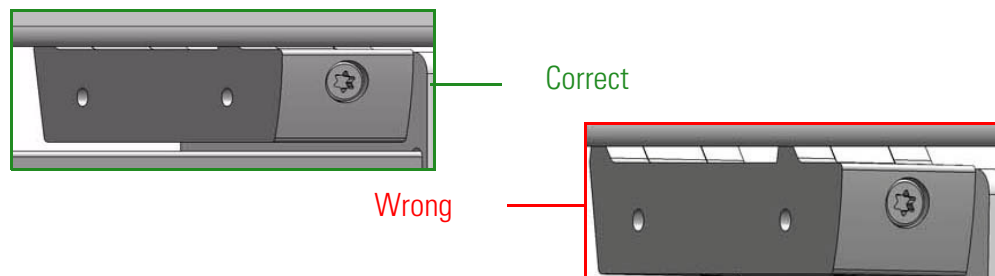

4. Be sure that the mounting clamps fit completely into the grooves. Alternately tighten the two Torx screws until the legs are firmly in place.

5. Double check if the leg mounting clamps are correctly hooked to the X-axis. See Figure 3.

Figure 3. Correct and Wrong Hooking of Mounting Clamps

Correct

Wrong

Installation of the TriPlus RSH System

This sections details the installation of the TriPlus RSH and its modules.

⚠️ **Note for Field Service Engineers** — Discuss with the customer the positions of the TriPlus RSH base and the TriPlus RSH modules hooked to the X-axis considering the GC configuration. Open zones should be easily accessible by the TriPlus RSH Head but placing a TriPlus RSH object above a heated zone could be dangerous, or at the very least influence the stability of the analytical sample. Consider the space availability in the lab and to adjacent instruments as well.

⚠️ **WARNING** Do not place a TriPlus RSH module, which might contain flammable solvents, directly above a heated zone. Special attention has to be paid to the Wash Station and its waste line (if applicable), and Tray Holders with sample vials inserted.

Figure 4 shows an example of TriPlus RSH system with its modules installed.

**Figure 4.** Example of TriPlus RSH System Modules
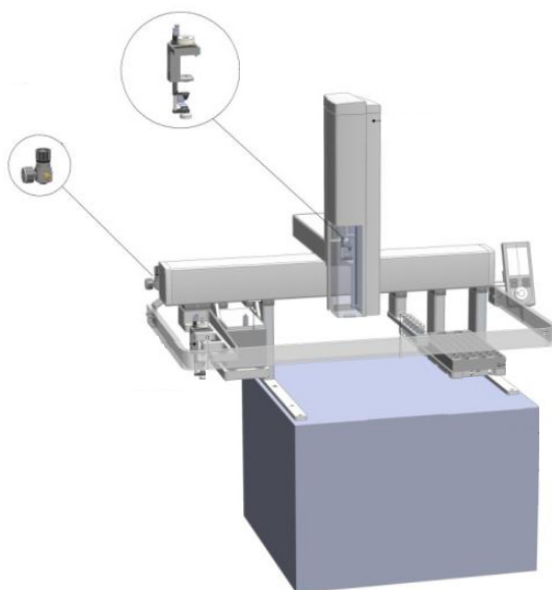
It is suggested to install the modules on the X-axis in the position more suitable, paying attention not to invade the injection zone. The installed components shall not prevent the Z-axis movements.

❖ **To Anchor the modules to the X-axis**

The module to be anchored has one or two clamps. In the second case, they must be alternately and progressively hooked. The hooking sequence is as follows:

1. Slightly tilt the component downwards in a way that the back hook of the clamp, present on the top, enter the proper grooves.

2. Straighten the component so that also the front hook of the clamp enters the proper slot parallel to the previous one.

3. Slightly push the component backwards in a way that the clamp hooks result perfectly anchored. See Figure 5.

Figure 5. Correct and Wrong Hooking of Module Mounting clamps
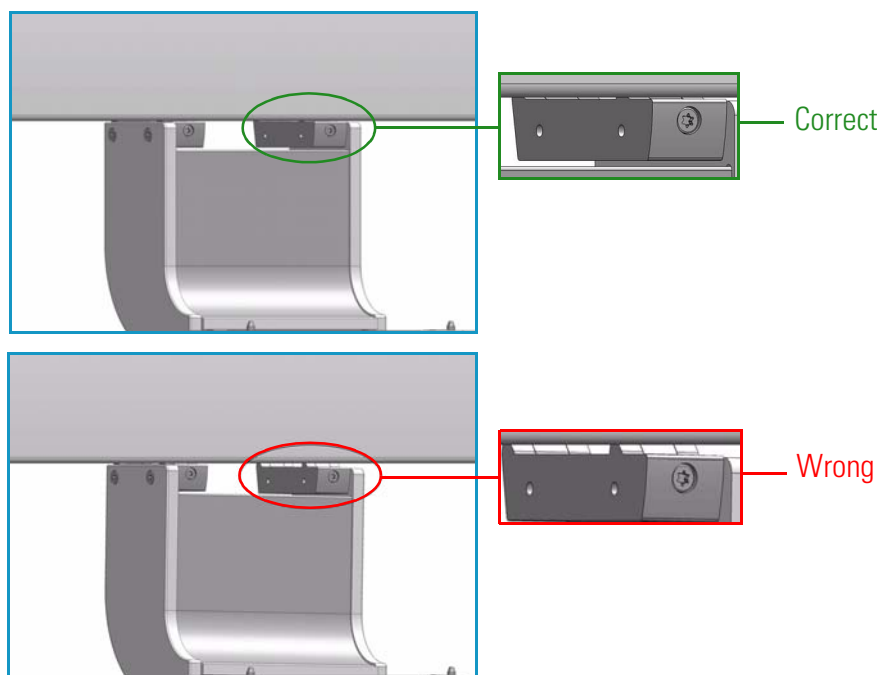
4. Tighten the fixing screw located behind the clamp.

For installing each single module refer to the following sections:

Installing the TriPlus RSH Head

> **Note** Installation of the TriPlus RSH Head (Z-axis) must be done carefully.
> When installing it for the first time, have someone hold it in place while the mounting
> screw is inserted.

> ⚠️ **IMPORTANT** The head is secured with a **Transport Locking Device** in order to prevent
> uncontrolled movement of the slider along the Z-Axis during the shipping. The locking
> device must be removed before installing the head to the base.

The TriPlus RSH Head is shipped disassembled. The cover is separated from the mechanical
part.

❖ **To install the TriPlus RSH head**

1. Locate the **Transport Locking Device** screw. Using a Torx T10 screwdriver remove the
   screw and the polymer spacer. See Figure 6.

Figure 6. Transport Locking Device
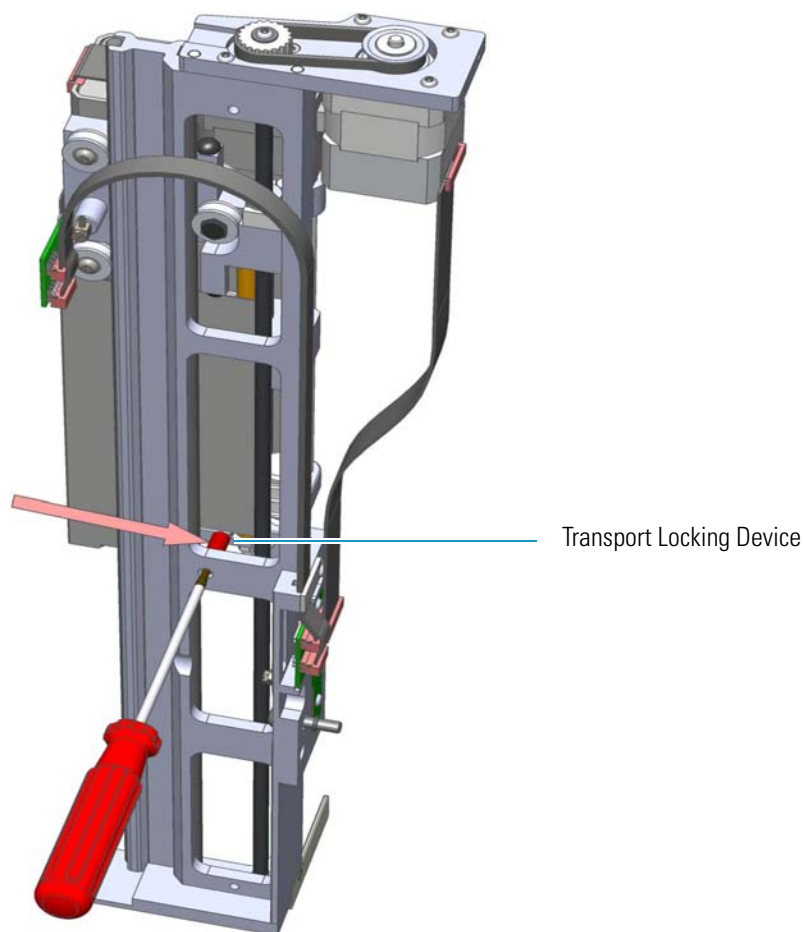
Transport Locking Device

2. Save the Transport Locking Device for future use. If for any reason the head unit has to be returned for inspection or repair, the Transport Locking Device must be reinstalled prior to shipping.

3. Locate the Torx mounting screw as shown in Figure 7.

Figure 7. TriPlus RSH Head Internal Mechanic Part and Cover
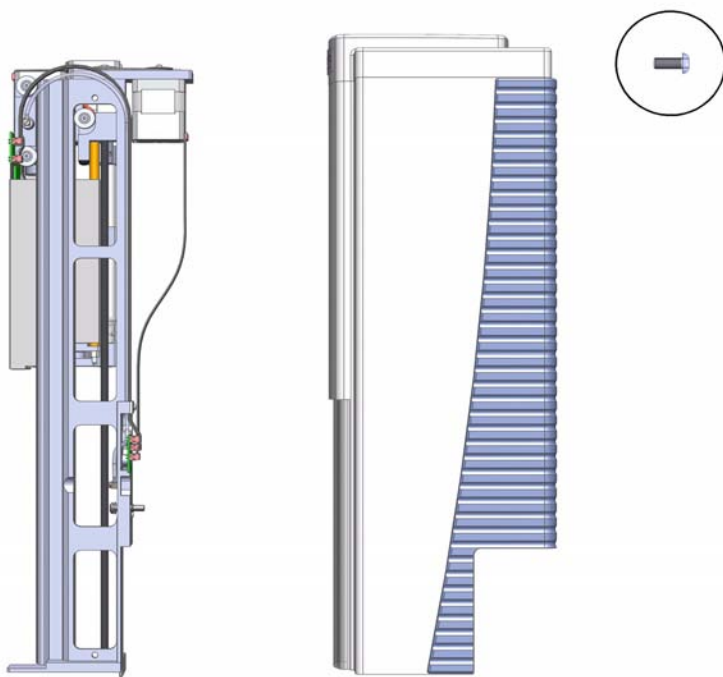
4. Hold the TriPlus RSH Head in place against the Y-axis. Make sure the two locating pins on the Y-axis fit into the two guide pin holes on the TriPlus RSH Head. See Figure 8 and Figure 9.

Figure 8. Head Mounting (1)

Locating Pins
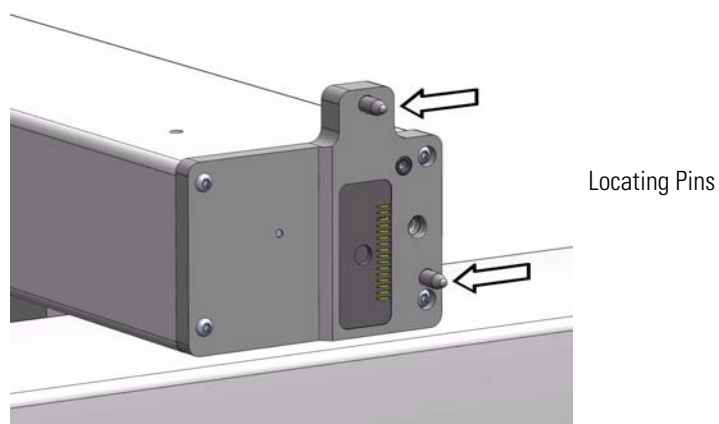
Figure 9.   Head Mounting (2)
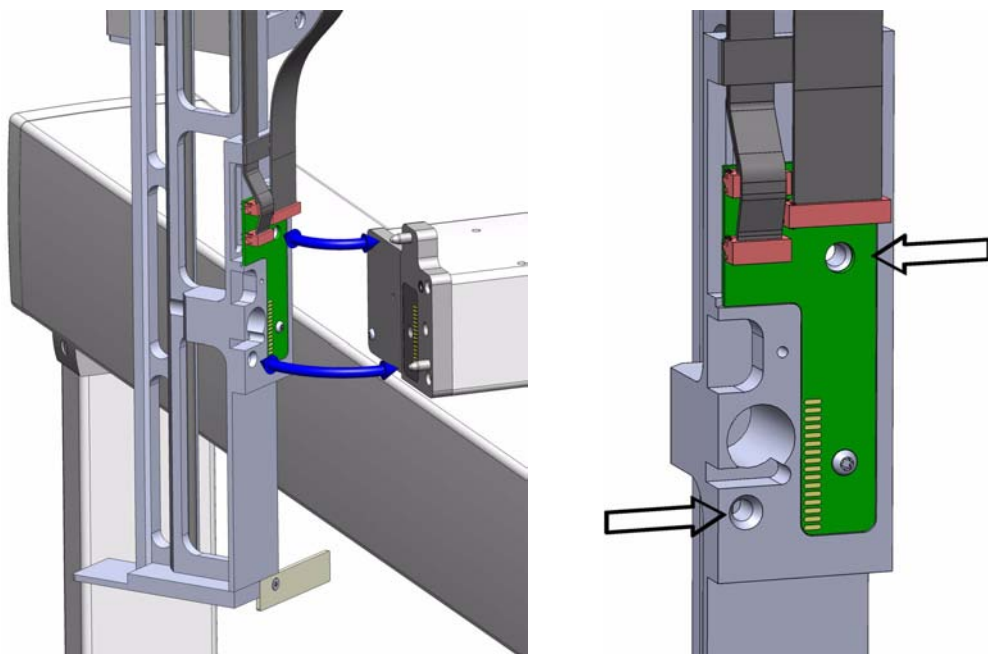
5. Place the provided Torx mounting screw into the hole from the front and securely tighten the screw by using the T25 Torx screwdriver provided. See Figure 10.

Figure 10.   Head Mounting (3)
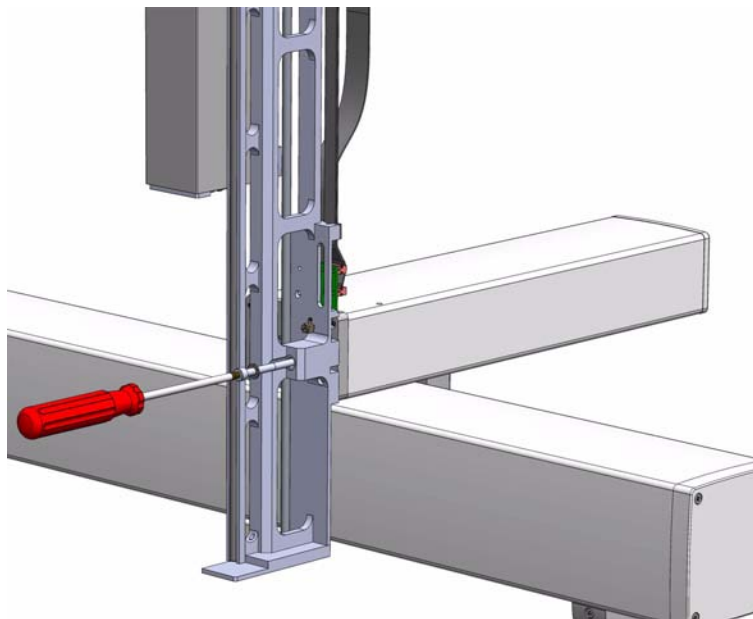
> **Note** The Ribbon Cables and the Gas Purge Line within the TriPlus RSH Head are already assembled and fixed. No installation of these parts is necessary. The Gas Purge Line connects the Y-axis, sealed by an O-ring, to the TriPlus RSH Head.

6. Locate the TriPlus RSH Head cover and put it over the mechanical construction of the Head very carefully to avoid any damage to a ribbon cable, motor connections and other critical parts.

7. Hold the cover in a perpendicular way and slide it over the mechanics of the Head. Avoid angling of the cover when attaching it to the mechanics. See Figure 11.

Figure 11. Head Mounting (4)
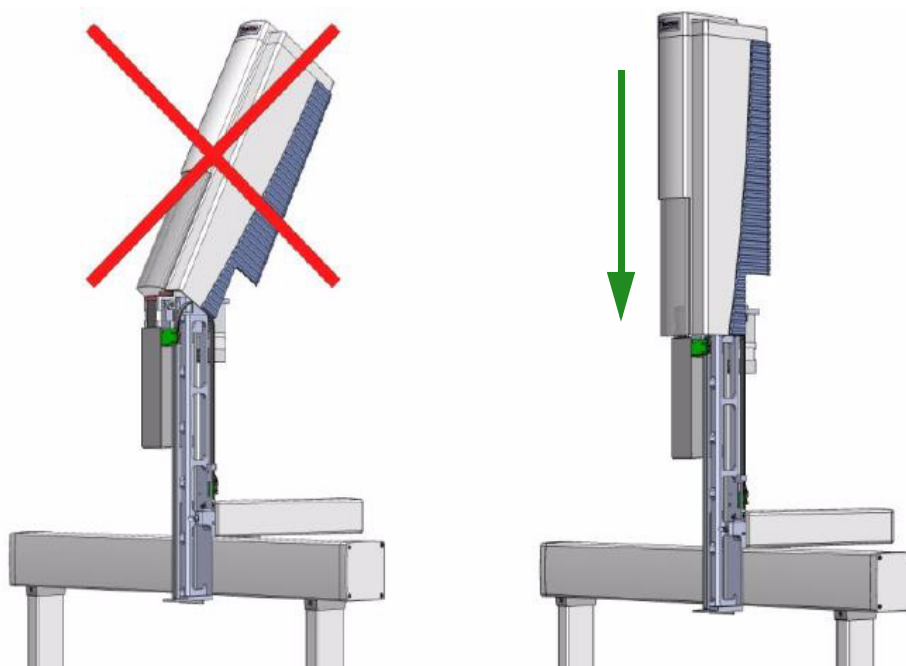
8. Put the Head cover over the mechanical construction from the top in perpendicular path. See Figure 12.

Figure 12. Head Mounting (5)
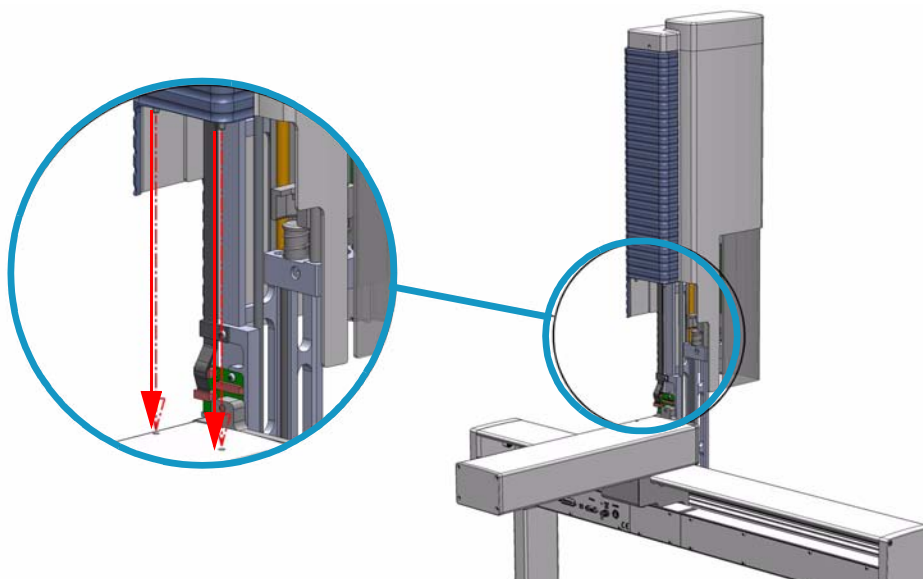
9. Tighten the screw at the backside of the cover to fix it to its mechanical part. See Figure 13.

Figure 13. Head Mounting (6)
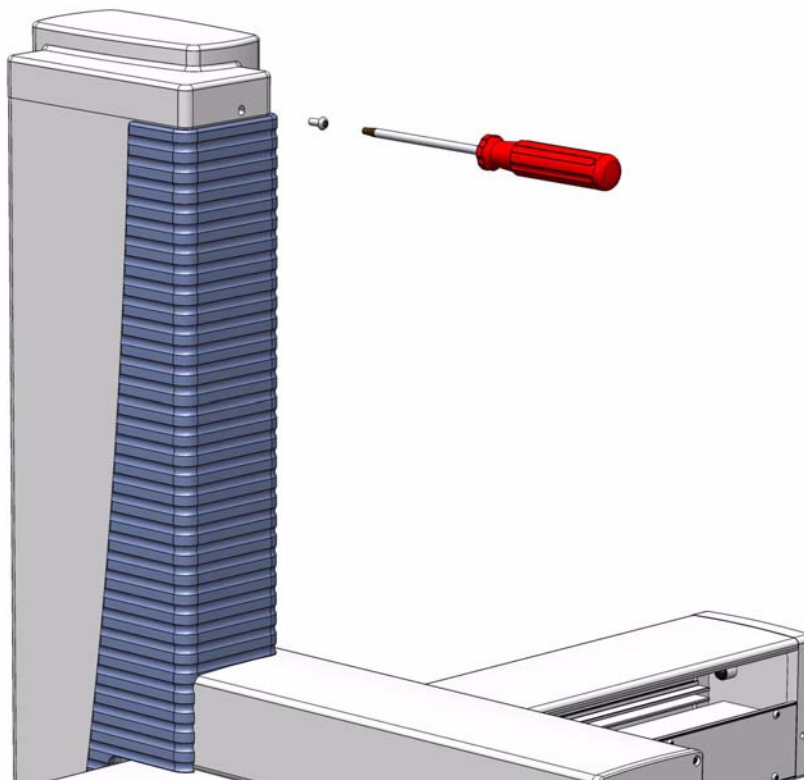
Installing the Handheld Controller and Safety Guard

The Handheld Controller is an optional module for the TriPlus RSH. If it is not part of the system configuration ordered, the TriPlus RSH can be controlled with the Virtual Handheld Controller software. See Figure 14.

> **Note** If the Handheld Controller is part of the configuration, it is advisable to install first all the other modules which are connectable to the X-axis.
>
> The Safety Guard can be installed at the end when everything else has been tested and completed.

Figure 14. Handheld Controller Installation
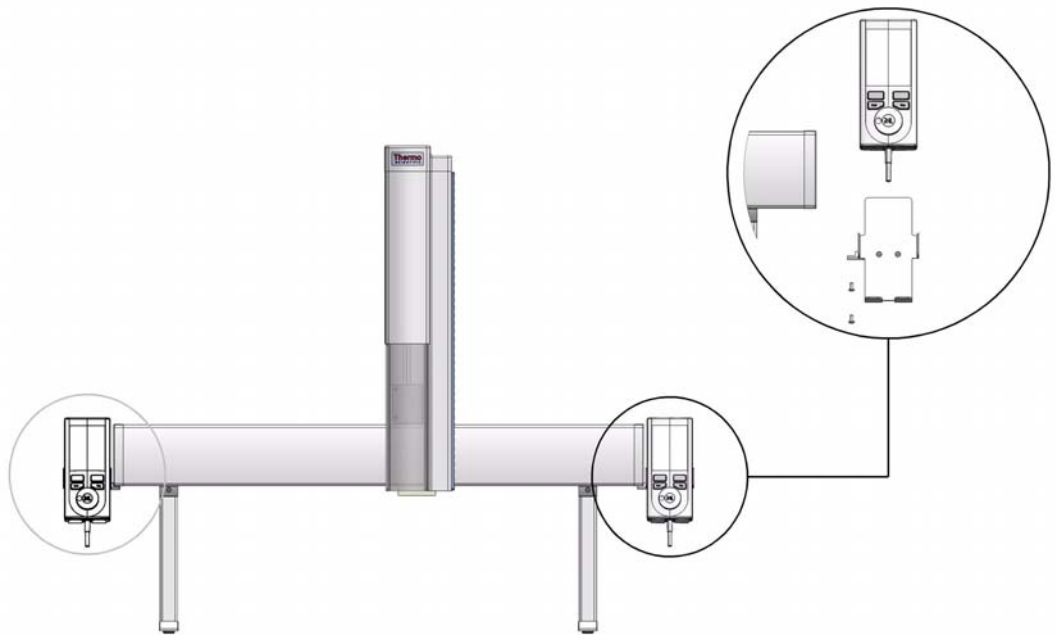
❖ **To install the safety guard and the handler controller**

1. Install the Safety Guard brackets on the left and right side to the of the X-axis.
   The brackets are installed underneath the Side Cover of the X-axis using the two holes at back side. The two front holes are reserved for the Handheld Controller mounting bracket. Do not completely tighten the screw to allow enough play to connect the Safety Guard. See Figure 15.

Figure 15. Safety Guard Installation
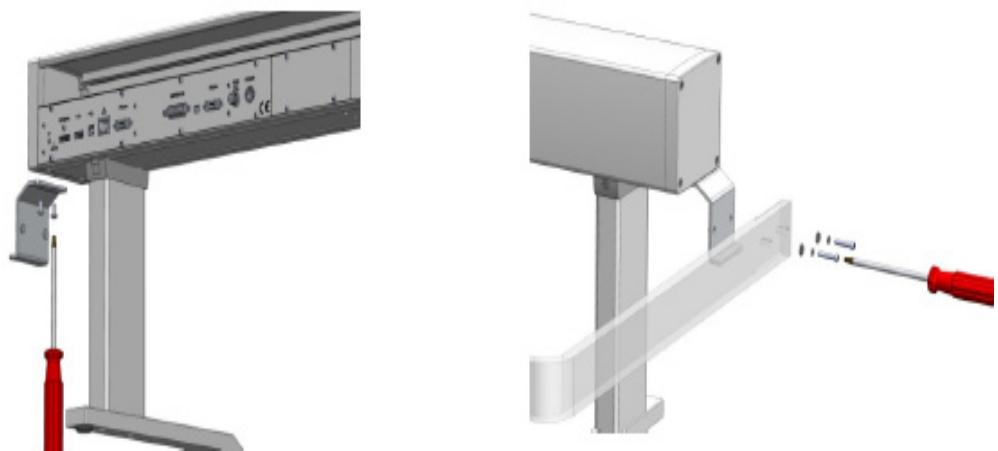
2. Connect the Safety Guard to the brackets by using the screws provided. Keep the Safety Guard in a square position and alternately tighten the screws from the brackets, and the guard on either side.

3. Install the Handheld Controller mounting bracket on either the right or left side of the X-axis. See Figure 16.

Figure 16. Handheld Control Bracket Installation
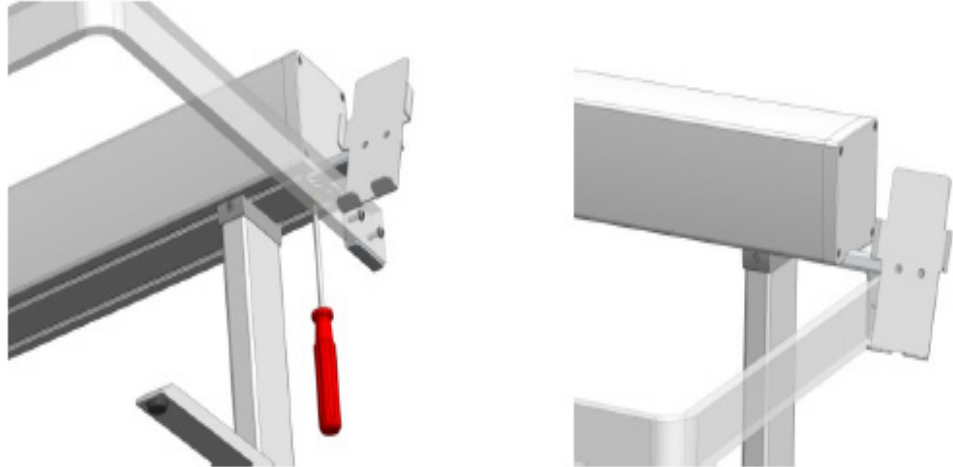
By default, the Handheld Controller bracket is assembled for the right hand installation. If the bracket is installed on the left hand side, remove the bracket from the holder, reverse it, and install it to the backside of the holder. See Figure 17.

Figure 17. Reversing Handheld Controller Bracket for Left Side Installation
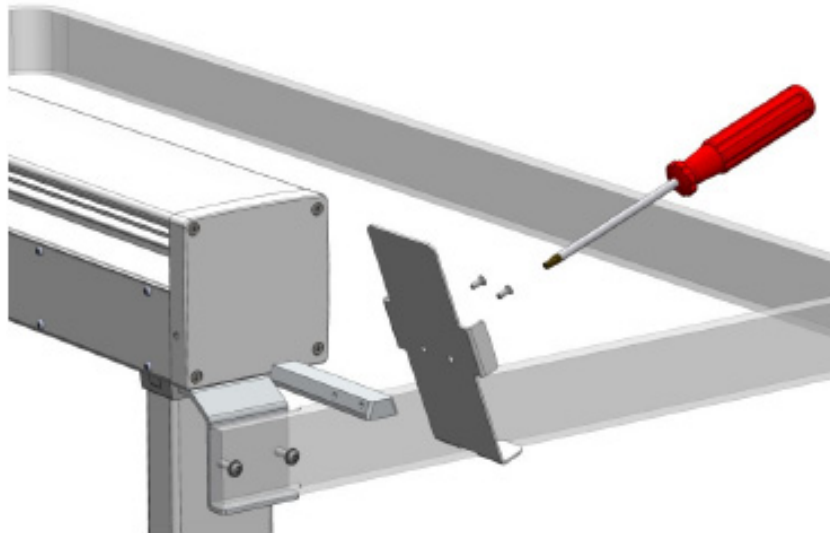
4. Connect the Handheld Controller cable to the TriPlus RSH Control Interface connector marked **Handheld Controller** on the back of the X-axis. See Figure 18.

Figure 18. Handheld Controller Connection
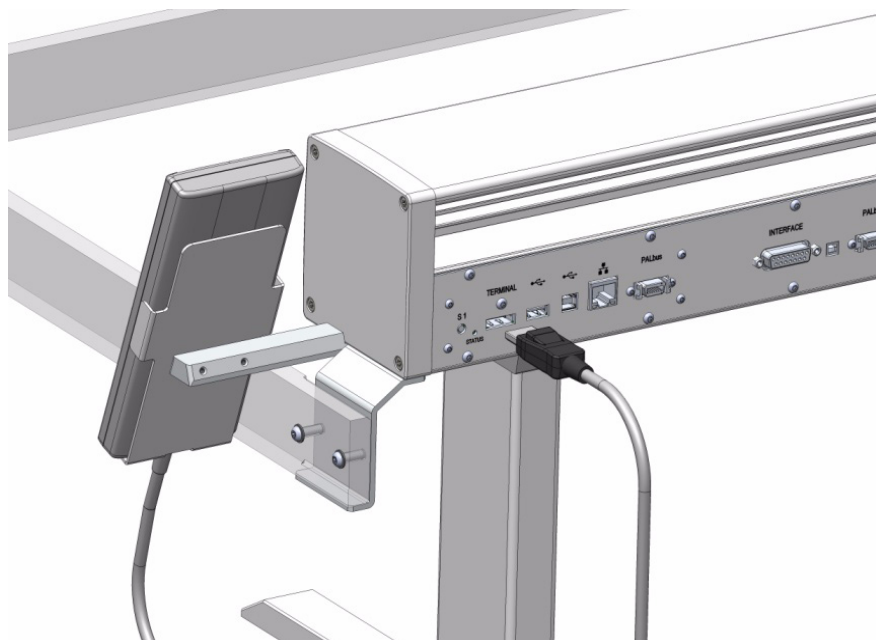
5. Place the Handheld Controller onto its mounting bracket. See Figure 19.

Figure 19. Handheld Controller Position
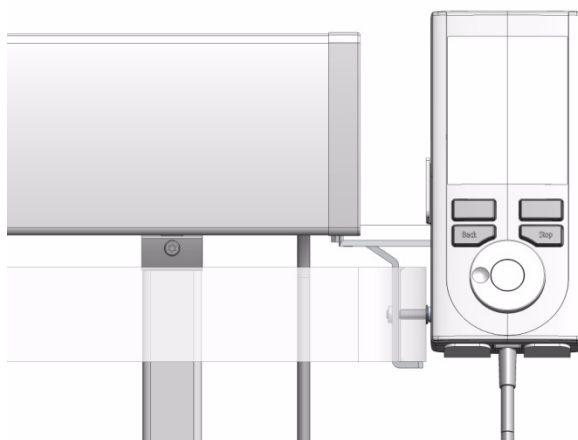
Installing the Purge Gas Pressure Regulator

⚠️ **WARNING** Use an inert gas, such as helium or nitrogen, as purge gas.

When working with the connections for the pressure regulator, it is mandatory to always use two flat wrenches as shown in Figure 20. Using only one wrench increases the chances of damaging or destroying the sealing gaskets.

Figure 20. Installation of the Purge Pressure Regulator (1)
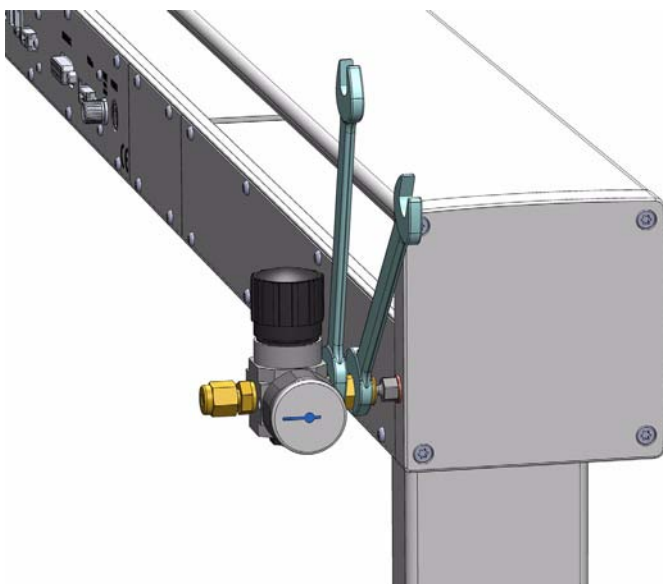
❖ **To install the purge gas pressure regulator**

1. Connect the OUT-side of the supplied pressure regulator at the back right side of the TriPlus RSH. See Figure 21.

Figure 21. Installation of the Purge Pressure Regulator (2)
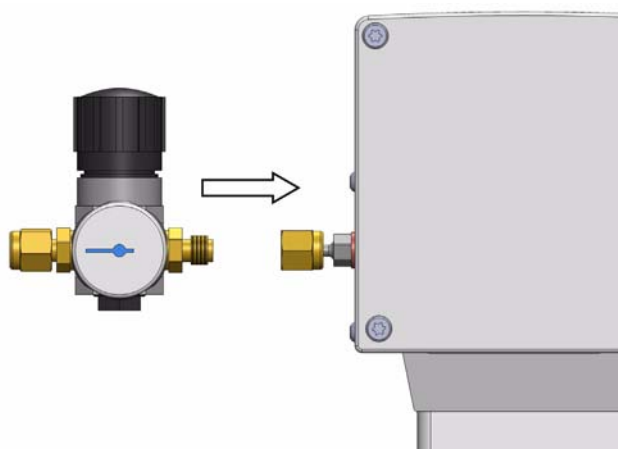
2. Connect a 1/8 inch clean gas supply line to the IN-side of the pressure regulator. Use a separate gas line to avoid any pressure drop that may affect the GC.

3. Adjust the pressure of the gas supply source to 1.0 – 1.5 bar (14.5 – 21.6 psig). If a gas line is teed-up from an installed gas chromatograph, the preset secondary pressure will be approximately 5 bar (72.5 psig).

4. Adjust the TriPlus RSH Autosampler gas pressure regulator to approximately 0.5 bar (7.25 psig).

> **Note** Pressures higher than 0.5 bar (7.25 psig) will not yield higher flow rates through the heated syringe. The syringe needle is the point of flow restriction in the gas flow system.
>
> The body of the pressure regulator can withstand up to 10 bar (145 psig).

5. Check the installed purge gas pressure regulator connections for leaks. Avoid any contamination of the pneumatic system, (gas flow), by using liquid soap or similar leak detection aids.

> **Note** The pressure of the purge gas should be verified during the flush period in a Headspace Cycle.

Installing the Tool Stations

The TriPlus RSH is equipped either with a TR Station, (Passive module), containing a single Slot, or the ATC Station, (Active module), containing three slots. The ATC Station allows the automatic change of the TriPlus RSH tools according to the specific requests.

To install the Tool Station you want, refer to:

Installing the TR Station

❖ **To install the TR station**

> **Note** Place the TR Station paying attention to keep enough clearance for the tool below it to not interfere with the GC devices.
> Do not place another module too close to the TR Station, keep approximately **20 mm** clearance on the left side. This space is needed for teaching the position.

1. Use the T20 Torxhead screwdriver to loosen the Torx screw on the TR Station mounting bracket.

2. Hook the TR Station to the X-axis.

Figure 22. TR Station Installation
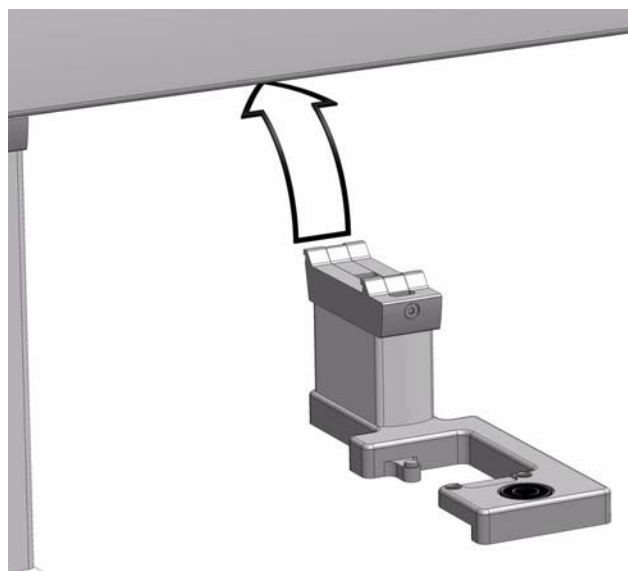
3. Be sure that the clamp fits completely into the grooves. Tighten the Torx screw until the mounting clamp is firmly in place. A square position of the module should be achieved.

Installing the ATC Station

❖ **To install the ATC station**

> **Note** Place the ATC Station paying attention to keep enough clearance for the tool below it to not interfere with the GC devices.
>
> Do not place another module too close to the ATC Station, keep approximately **20 mm** clearance on the left side. This space is needed for teaching the position.

1. Use the T20 Torxhead screwdriver to loosen the two Torx screws on the ATC Station mounting bracket.

2. Hook the ATC Station to the X-axis.

Figure 23. ATC Station Installation
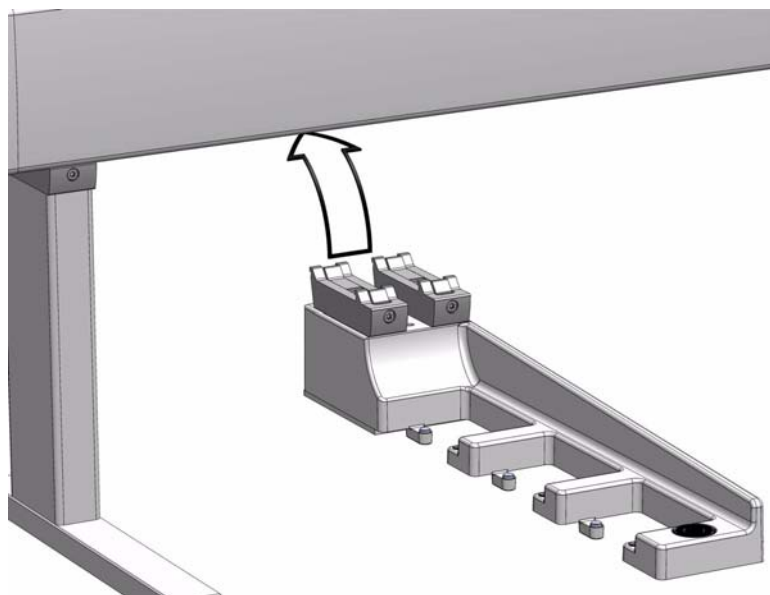
3. Be sure that the clamp fits completely into the grooves. Tighten alternately the two Torx screws until the mounting clamp is firmly in place; a square position of the module must be achieved.

4. Connect the supplied ATC Station control cable from the connector on the back side of the ATC Station to the Control Interface connector marked **BUS**. If BUS connector is already occupied, connect the cable to another Active module with an open connector.
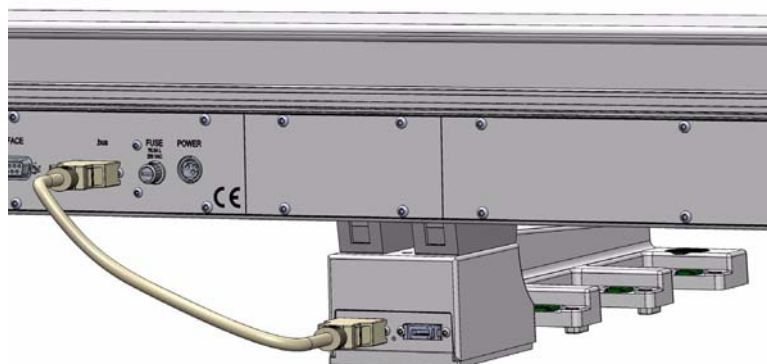
Note It is possible to install two ATC Stations on the same TriPlus RSH to enhance flexibility with various tools. See the following **CAUTION Exceptional Circumstances** and the Chapter 3, "TriPlus RSH Defining Object Positions."

> **CAUTION** Exceptional Circumstances
>
> To configure two ATC Stations follow the procedure described here:
>
> 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 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 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 station #1**.
>
> 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**.

Installing the Wash Stations

The TriPlus RSH Autosampler can be equipped with four different types of Wash Stations: **Standard**, **Large Volume**, **Solvents**, and **Fast**. For details see the following sections:

- "Installing the Standard Wash Station" on page 35
- "Installing the Large Volume Wash Station" on page 36
- "Installing the Solvents Station" on page 38
- "Installing the Fast Wash Station" on page 39

> **WARNING** Observe the safety measures if a Waste Line is installed in combination with a GC. Do not position the entire Wash Station above a heated zones. Pay special attention to the guidance of the Waste Line.
>
> For GC, often highly flammable wash solvents are used (organic solvents such as hexane, acetone, esters, and so on).

Installing the Standard Wash Station

❖ **To install the standard wash station**

1. Use the T20 Torxhead screwdriver to loosen the screw from the Wash Station mounting clamp.

2. Hook the Standard Wash Station assembly to the X-axis.

3. Tighten the mounting screw.

4. Convert the Standard Wash Station with the Drainage Adapter.

   a. Remove the Waste Vial in position 5.

   b. Insert the Drainage Adapter.
       The drainage adapter resembles a vial, and the material is PVDF (Polyvinylidene fluoride). The same polymer cap (with septum inserted), used for the Wash vials, can be used for this adapter. The drainage adapter has a stainless steel nipple connected to the bottom. A waste tubing must be connected.

Installing the Large Volume Wash Station

❖ **To install the large volume wash station**

1. Use the T20 Torxhead screwdriver to loosen the screw from the Wash Station mounting clamp.

2. Hook the Large Volume Wash Station assembly to the X-axis.

Figure 24. Large Volume Wash Station
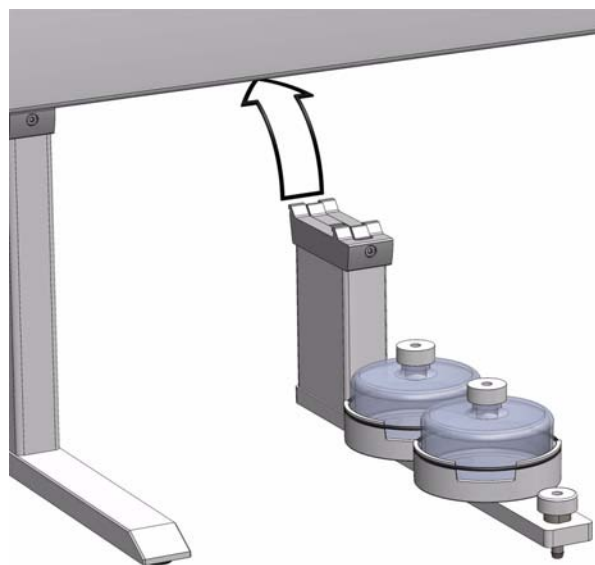
3. Tighten the mounting screw.

4. Place the solvent reservoir bottles onto their holders.

5. Connect one end of the supplied polyethylene waste tubing to the Waste port. Place the other end of the tubing into the waste reservoir (not supplied).
Stretch the PE tubing to make sure that no used wash solvent is trapped before the Waste reservoir.
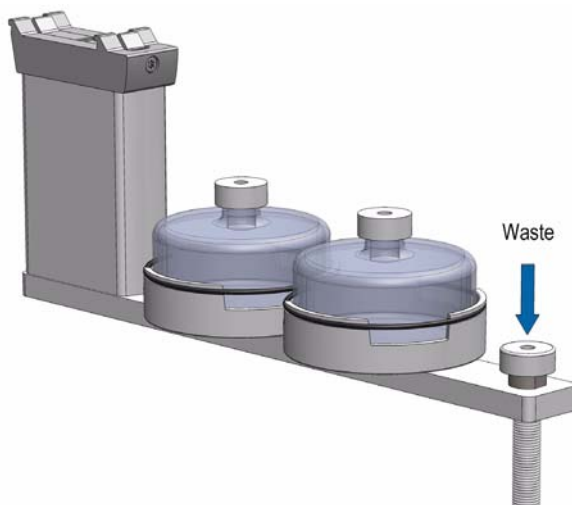
⚠️ **WARNING** The Waste reservoir MUST be placed in a lower position than the Large Volume Wash Station assembly.
Make sure that the waste liquid flows into the container without restriction.
For safety reasons, place the waste container into a collection pan.

Installing the Solvents Station

❖ **To install the solvents station**

1. Use the T20 Torxhead screwdriver to loosen the screw from the Wash Station mounting clamp.

2. Hook the Solvents Station assembly to the X-axis.

Figure 25. Solvent Station
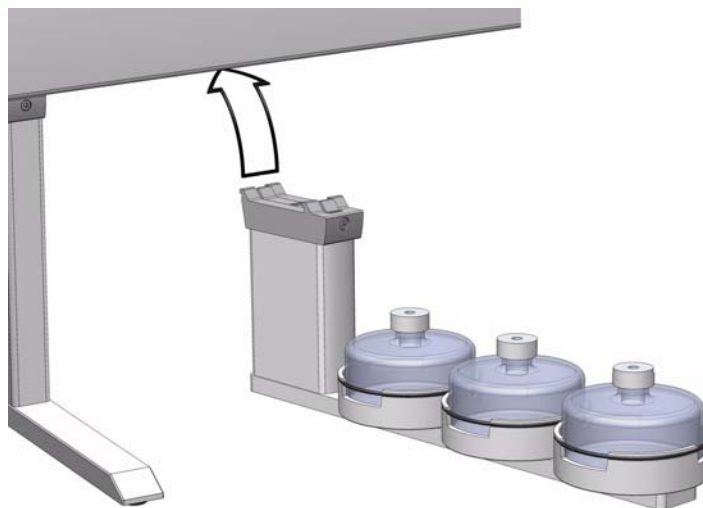
3. Tighten the mounting screw.

4. Place the solvent reservoir bottles onto their holders.
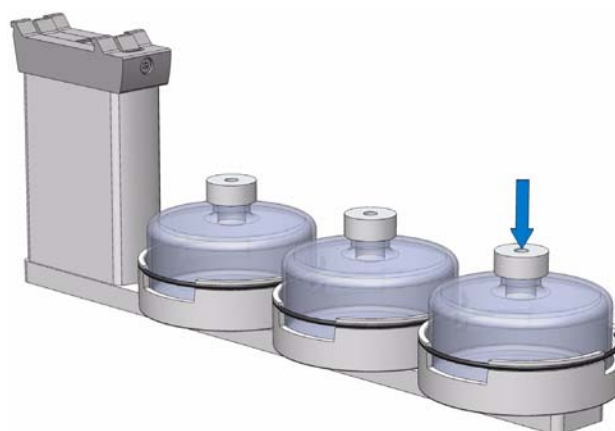
WARNING The Waste reservoir MUST be placed in a lower position than the Solvents Station assembly.
Make sure that the waste liquid flows into the container without restriction.
For safety reasons, place the waste container into a collection pan.

Installing the Fast Wash Station

The Fast Wash Station is shipped in a box separate from the system. The box also includes the Solvent Reservoir Kit (two 1000 mL glass bottles, and a Tubing Kit).

CAUTION Do not place the station and specifically the waste line above a heated zone. Tightly secure the waste line using a cable binder or similar item.

❖ **To install the fast wash station**

1. Connect the solvent lines from the **Solvent Reservoir Kit** to the Inlet connectors of the micro pump.

2. Loosen the two Torx screw on the mounting bracket for the module.

3. Hook the Fast Wash Station assembly to the X-axis.

4. Be sure that the clamp fits completely into the grooves. Alternately tighten the two Torx screws until the mounting clamp is firmly in place.

5. Double check whether the Fast Wash Station clamp is correctly attached to the X-Axis.

Figure 26. Fast Wash Station
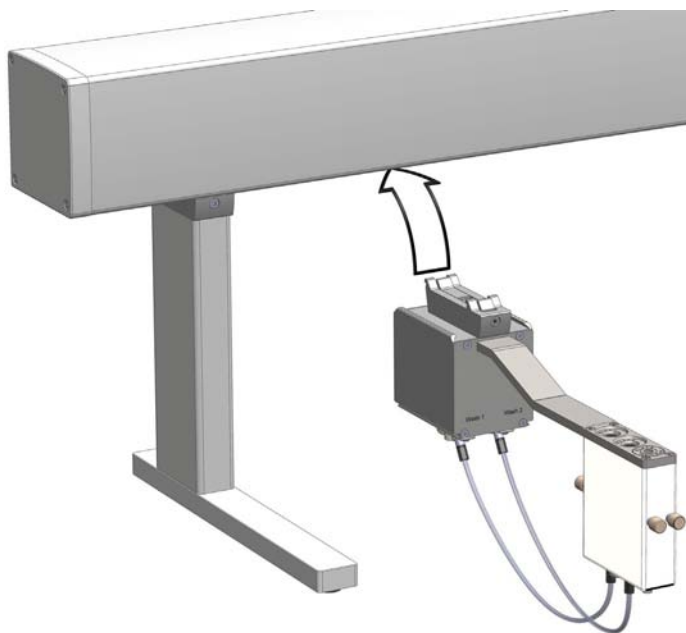
6. Connect the supplied control cable from the connector on the back side of the Fast Wash Station to the Control Interface connector marked **BUS**. If BUS connector is already occupied, connect the cable to another Active module with an open connector. For details see Figure 27.

Figure 27. Fast Wash Station Connections
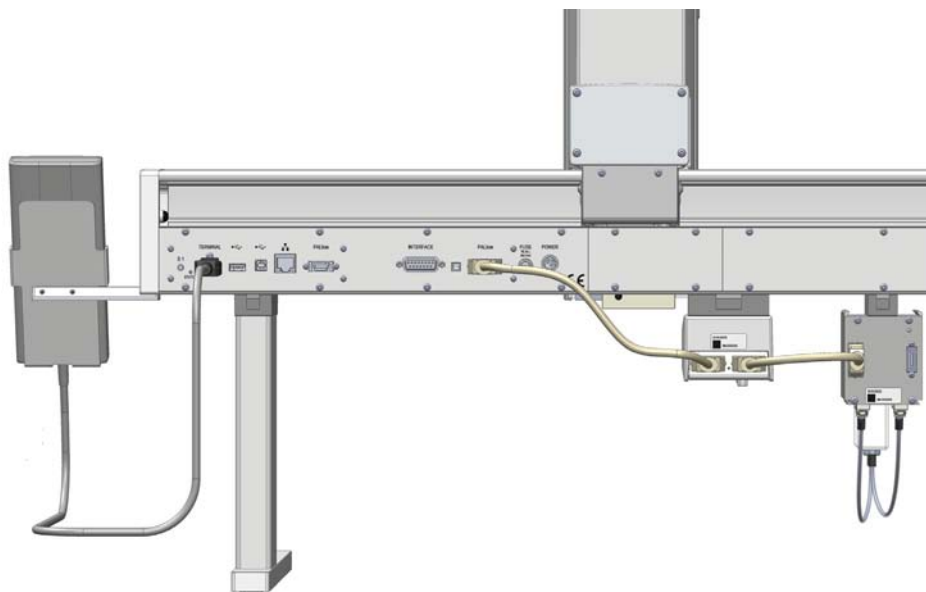
Installing a Tray Holder

❖ **To install the tray holder**

1. Use the T20 Torxhead screwdriver to loosen the two Torx screws on the two mounting clamps.

2. Install the Tray Holder with the mounting clamp teeth fitting into the grooves on the bottom of the X-axis.

Figure 28. Tray Holder Installation
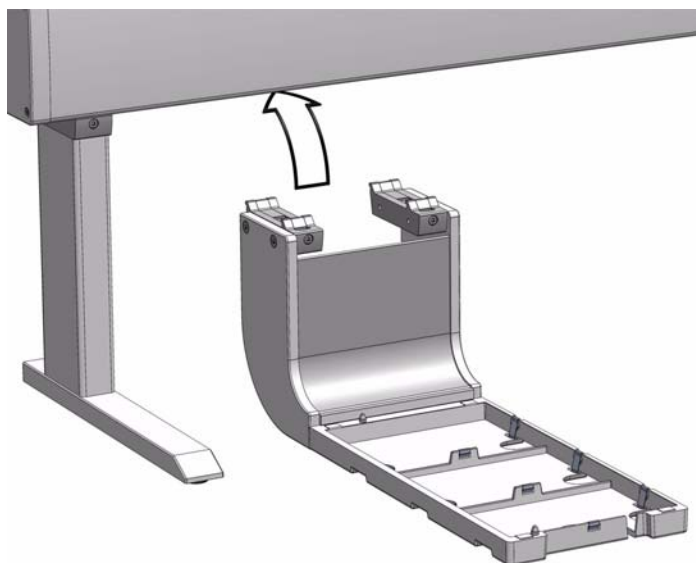
3. Alternately tighten the two Torx screws until the two mounting clamps are firmly in place.

4. Double check if the two clamps are correctly hooked to the X-axis.

Installing an Agitator

❖   **To install the agitator**

1. Loosen the two Torx screws on the two Agitator mounting clamps.

   Figure 29.   Installing the Agitator
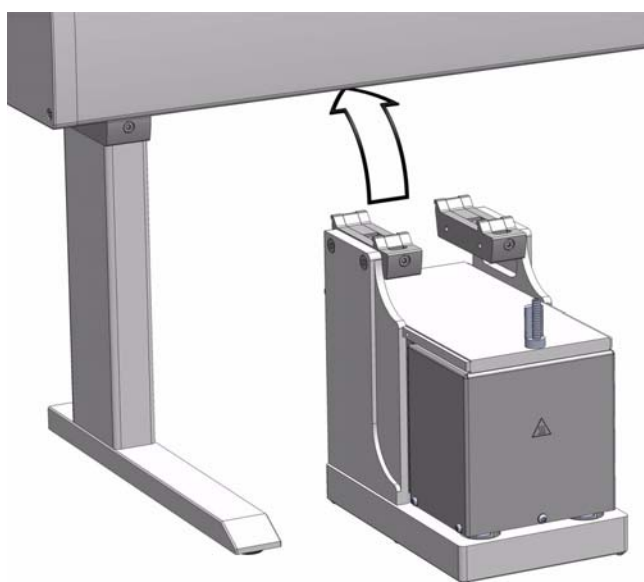
2. Be sure that the clamps fit completely into the grooves. Alternately tighten the two Torx screws until the two mounting clamps are firmly in place.

3. Double check if the Agitator clamps are correctly hooked to the X-axis.

4. Connect the supplied control cable (daisy chain cable) from the connector on the back side of the Agitator to the Control Interface connector marked **BUS**.
   If BUS connector is already occupied, connect the cable to another Active module with an open connector. For details see Figure 30.

Figure 30. Agitator Electrical Connections
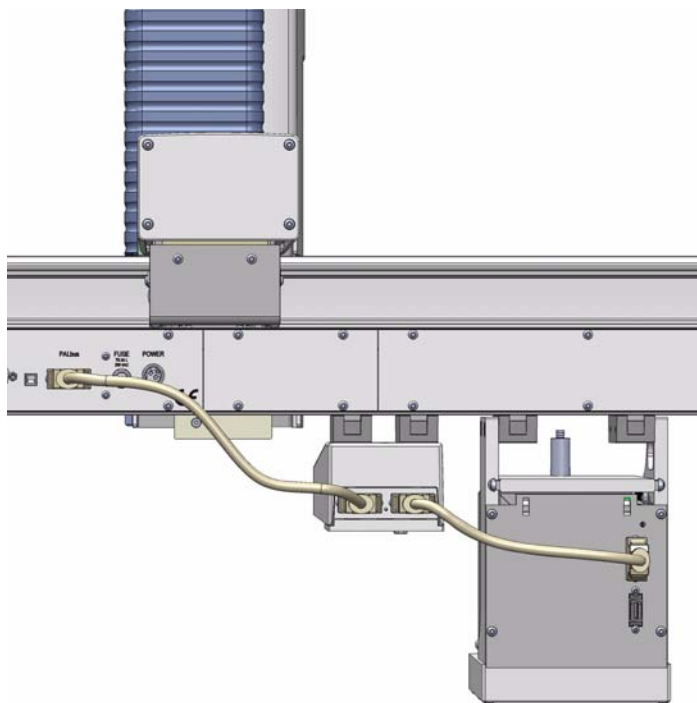
Installing a Vortexer

❖ **To install the vortexer**

1. Loosen the two Torx screws on the two Vortex Mixer mounting clamps.

Figure 31. Installing a Vortexer Module
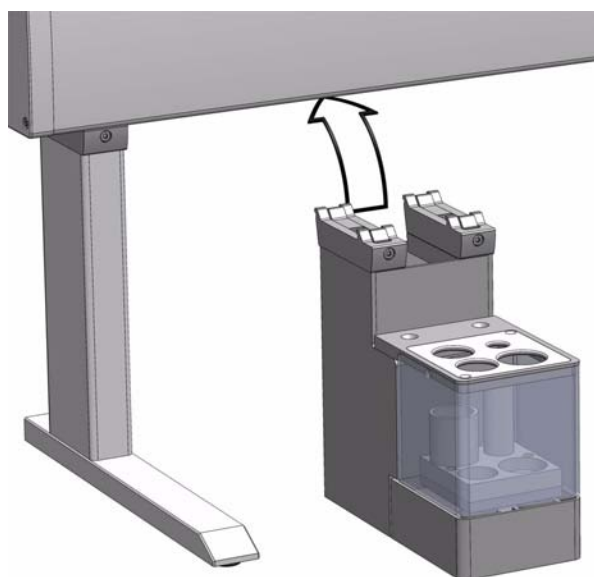
2. Be sure that the clamps fit completely into the grooves. Alternately tighten the two Torx screws until the two mounting clamps are firmly in place.

3. Double check if the Vortexer clamps are correctly hooked to the X-axis.

4. Connect the supplied control cable (daisy chain cable) from the connector on the back side of the module to the Control Interface connector marked **BUS**. If BUS connector is already occupied, connect the cable to another Active module with an open connector. For details see the Figure 32.

Figure 32. Vortexer Electrical Connections
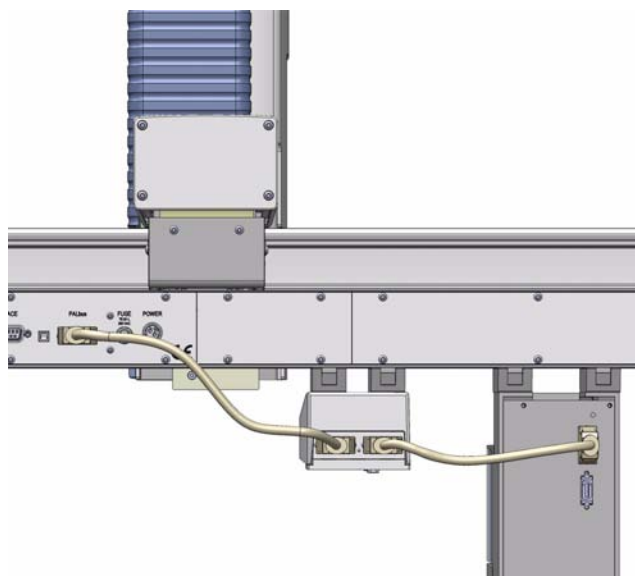
Installing a MHE Station

Before starting the installation process, determine the approximate position for the MHE Adapter Holder.

The recommended position is directly next to the Agitator keeping about 40 mm distance. If the Agitator is located at the far right side of the X-Axis, the MHE Adapter Holder should be placed to the left side of the Agitator, or inside the path of travel.
Likewise, if the Agitator is located at the far left, the MHE Adapter Holder should be placed to the right of the Agitator.

> **Note** If a venting tube is installed, the MHE Adapter Holder must be installed as close as possible to the Agitator (or any other position where the venting of the vial is performed) to prevent the venting tube from catching on the hardware module.

❖ **To install the MHE station**

1. Loosen the Torx screw on the mounting clamps located on the top side of the Fiber Conditioning Station.

2. Be sure that the clamps fit entirely into the grooves. Tighten the Torx screw until the mounting clamps are firmly in place.

3. Double check if the MHE Adapter Holder clamp is correctly hooked to the X-axis.

Figure 33. MHE Station
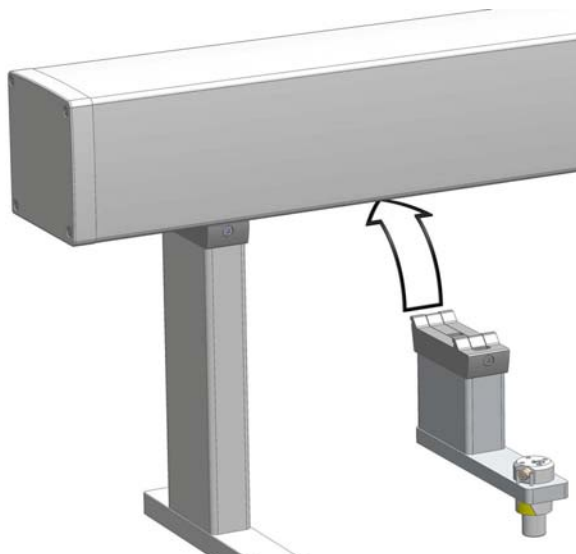
4. If the application requires the waste tube, connect one end of the waste tube to the MHE Adapter. Insert the other end into an appropriate waste container, or into an appropriate laboratory venting system, such as a fume hood.

5. The MHE Adapter is already pre-assembled. If a venting tube is required, insert the tube and tighten with the provided nut. A tube flange connection or a flangeless ferrule (flat bottom) is recommended.

6. Place the MHE Adapter into the Adapter Holder, making sure that the vent outlet is positioned within the two pins of the Adapter Holder.

7. Insert the red magnetic ring in the Injection Unit.

Figure 34. Magnet Transport Ring
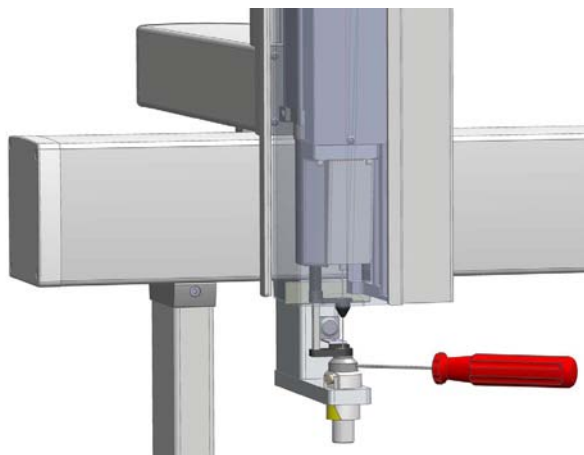
Installing a SPME Conditioning Station

To install the SPME Conditioning Station, proceed as follows:

> **Note** Before starting, determine approximately where the SPME Conditioning Station must be located.
>
> The TriPlus RSH Head has a longer path in the Z-axis, allowing a 20 mL vial to be completely inserted into the unit, and avoiding any collisions.
>
> If there is not enough space between the X-axis of the TriPlus RSH and the GC top cover, consider installing the module outside of the GC frame to the far left or far right side.
>
> If the SPME Conditioning Station is installed with an existing TriPlus RSH, another module might require to be shifted. Remember to re-position the modules accordingly.

❖ **To install the SPME conditioning station**

1. Loosen the Torx screw on the mounting clamps located on the top side of the Fiber Conditioning Station.

   Figure 35. Installing the SPME Conditioning Station
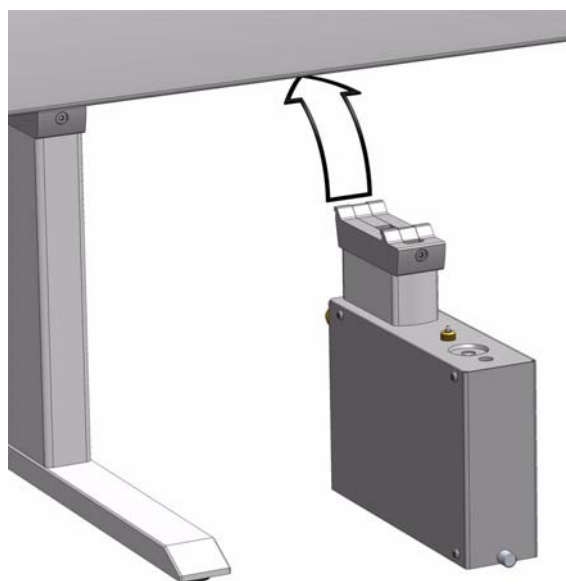
2. Be sure that the clamps fit entirely into the grooves. Tighten the Torx screw until the mounting clamps are firmly in place.

3. Double check if the SPME Conditioning Station clamp is correctly hooked to the X-axis.

4. Connect the supplied control cable (daisy chain cable) from the connector on the back side of the module to the TriPlus RSH Control Interface connector marked **BUS**.
   If BUS connector is already occupied, connect the cable to another Active module with an open connector. For details see Figure 36.

Figure 36. SPME Conditioning Station Electrical and Gas Connections
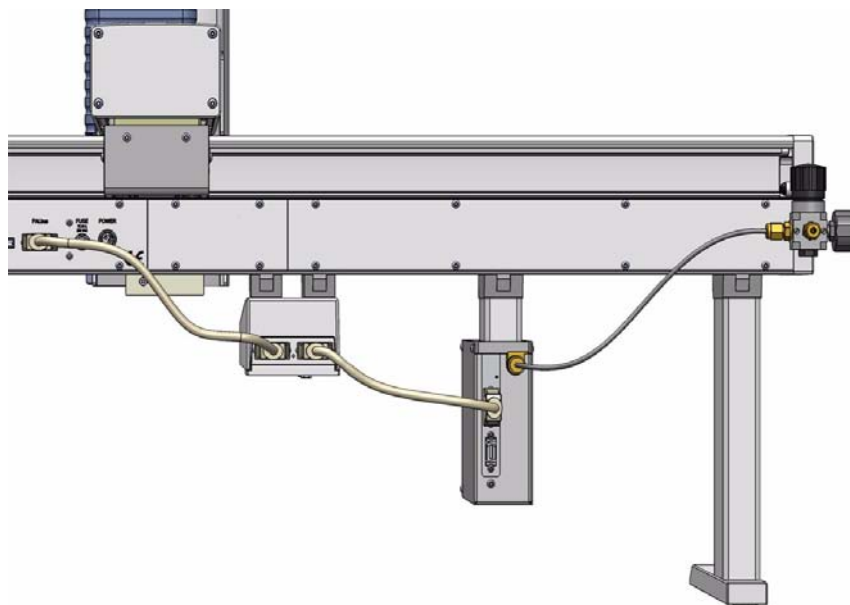
5. Connect the Gas Line

⚠️ **WARNING** Do not use hydrogen or any other explosive gas or gas mixtures for the SPME Conditioning Station. Recommended gases are helium or nitrogen.

  a. One end of the supplied black gas tube is connected to the gas purge regulator supplied with the TriPlus RSH. See "Installing the Purge Gas Pressure Regulator" on page 31.

  b. Remove the blind-plug at the gas purge regulator and connect the corresponding reducing union supplied with the installation kit. The other side of the gas tube is connected with a 1/8 inch Swagelok nut to the SPME Conditioning Station. The installation of this second gas line is shown in Figure 37.

Figure 37. Gas Tube Connection from Pressure Regulator to SPME Conditioning Station
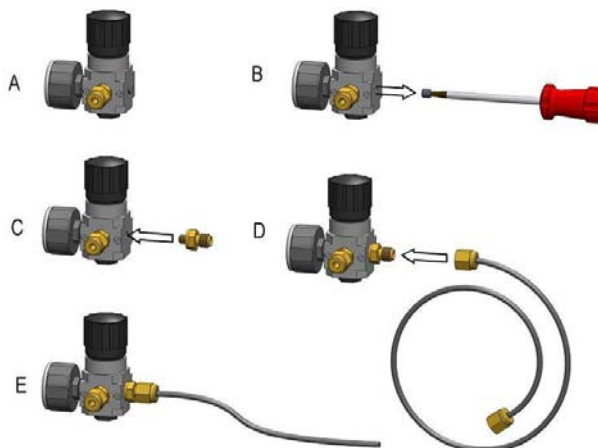
6. Set the Gas Flow

   a. The gas flow is regulated by the Purge Gas Pressure Regulator. The setting of the secondary regulator is approximately 0.5 bar as for Headspace analysis.

      The SPME Conditioning Station has a built-in, internal flow restriction. The typical flow rate yields about 6 mL/min if only the back position is used. If both positions are used (front and back), the flow is divided approximately in half.

      The gas flow for the two positions is pneumatically separated. Both channels can be used independently of one other.

      The restriction is a frit installed in the Swagelok union at the conditioning station housing (connection to the gas tube). In case of blockage, clean the frit with an intense flow of gas from the reverse side or wash it in an ultrasonic bath with an appropriate solvent. As a good starting point, an aqueous mixture of an alcohol is recommended for washing.

      The Head needle guide, with the installed Stack Drawer Magnet and SPME Adapter, is "sit "on the spring-loaded gas valve. At this point, the gas flow is activated. Leaving this position will close the gas valve, minimizing gas consumption.

Installing a Barcode Reader

❖ **To install the barcode reader**

1. Loosen the two Torx screws on the two Barcode Reader mounting clamps.

Figure 38. Installing the Barcode Reader
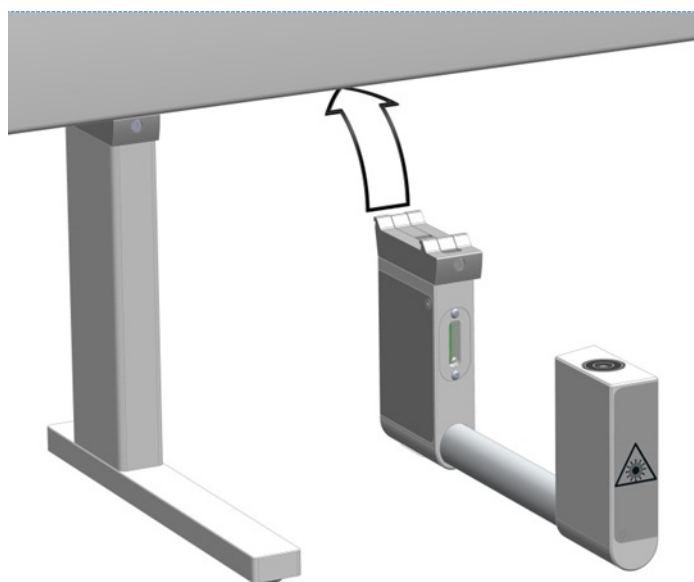
2. Be sure that the clamps fit completely into the grooves. Alternately, tighten the two Torx screws until the two mounting clamps are firmly in place.

3. Double check if the Barcode Reader clamps are correctly hooked to the X-axis.

4. Connect the supplied control cable (daisy chain cable) from the connector on the back side of the Barcode Reader module to the TriPlus RSH Control Interface connector marked **BUS**. If BUS connector is already occupied, connect the cable to another Active module with an open connector. For details see Figure 39.

Figure 39. Barcode Reader Electrical Connections
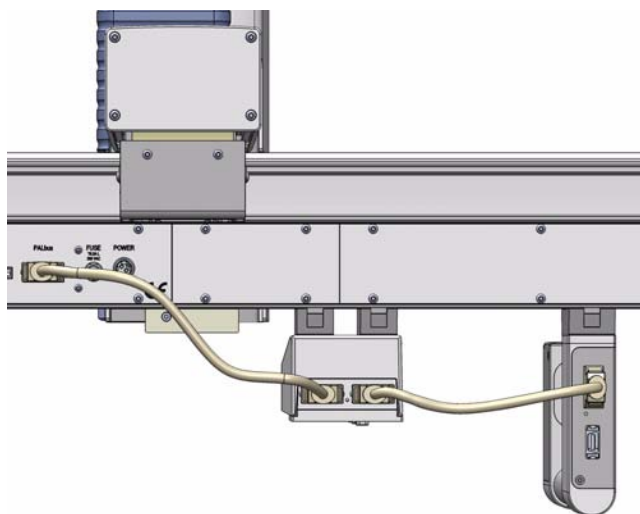
Installing a Liquid Cooled Tray Holder

❖ **To install the liquid cooled Tray holder**

1. Loosen the two Torx screws on the two module mounting clamps.

Figure 40. Installing the Liquid Cooled Tray Holder Module
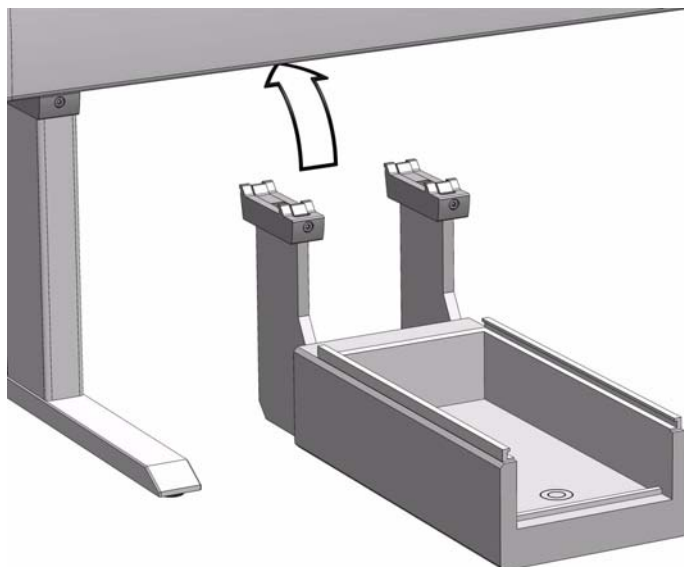
2. Be sure that the clamps fit completely into the grooves. Alternately tighten the two Torx screws until the two mounting clamps are firmly in place.

3. Double check if the Liquid Cooled Tray Holder clamps are correctly hooked to the X-axis.

4. Connect the hoses from the liquid circulation bath, tighten securely using pipe clamp.

5. Select the liquid medium for temperature control according to the application requirements.

6. Ensure the quality of the hose, connections and consider the compatibility with the liquid medium being circulated. Avoid any leaks or spill to prevent physical injury caused by the coolant or possible fire.

Installing a Temperature Controlled Drawer

❖ **To install the temperature controlled drawer**

1. Loosen the two Torx screws on the two module mounting clamps.

Figure 41. Installing the Temperature Controlled Drawer
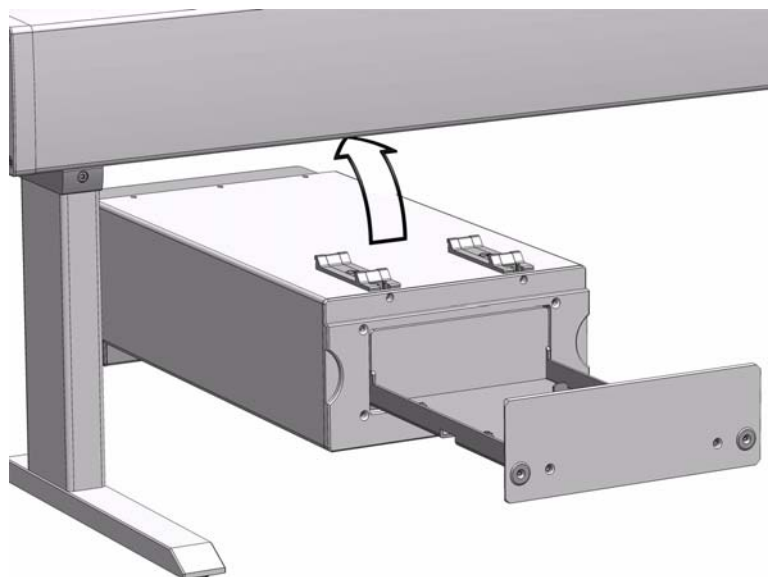
2. Be sure that the clamps fit completely into the grooves. Alternately tighten the two Torx screws until the two mounting clamps are firmly in place.

3. Double check if the Temperature Controlled Drawer clamps are correctly hooked to the X-axis.

4. Power off the TriPlus RSH before making any electrical connections.

5. Connect the supplied control cable (daisy chain cable) from the connector on the back side of the module to the TriPlus RSH Control Interface connector marked **BUS**.

If BUS connector is already occupied, connect the cable to another Active module with an open connector. For details see Figure 42.

Figure 42. Electrical Connections of Temperature Controlled Drawer
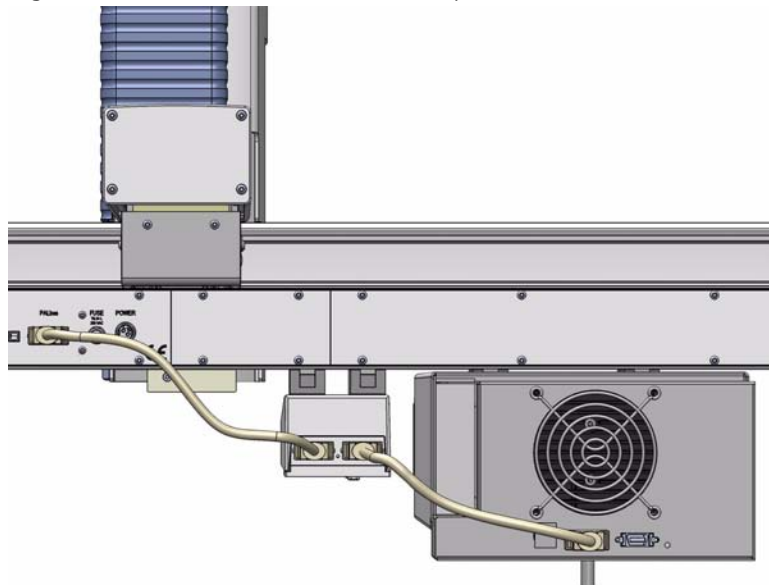
6. Connect the cable provided to the connector **OUT** of the Power Module (Power Supply) marked **TriPlus RSH**.

7. Connect the other side of the cable to the Temperature Controlled Drawer at the back of the module.

Figure 43. Correct Electrical Connections to Two Power Supply Module
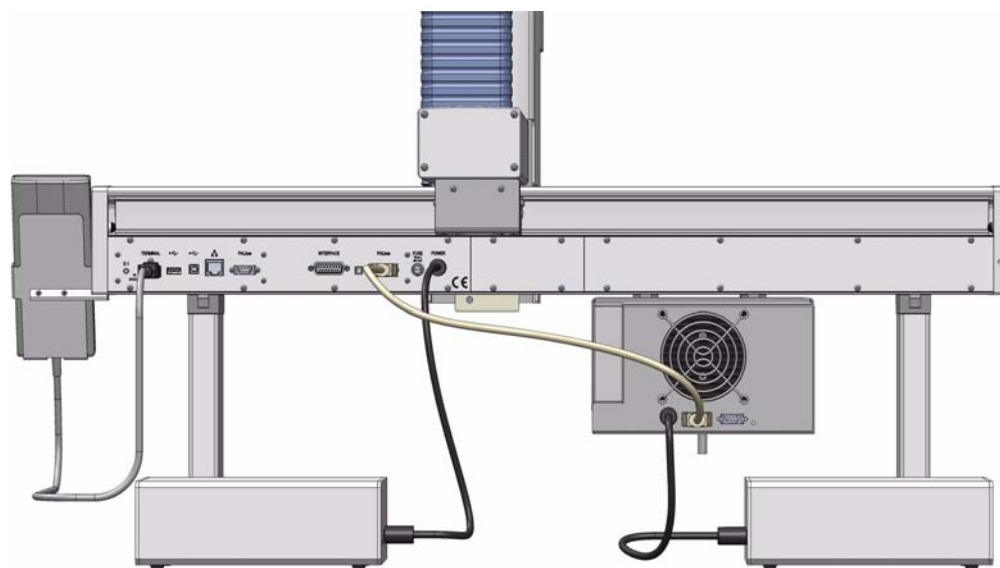
> ⚠ **WARNING** It is mandatory to use the supplied Power Module to connect the Temperature Controlled Drawer also if the second connector marked **Aux** of the Power Module used for the TriPlus RSH is not occupied.
> The electrical demands of the entire system are too high to be covered by a single Power Module.

Figure 44. Forbidden Electrical Connection to a SINGLE Power Supply
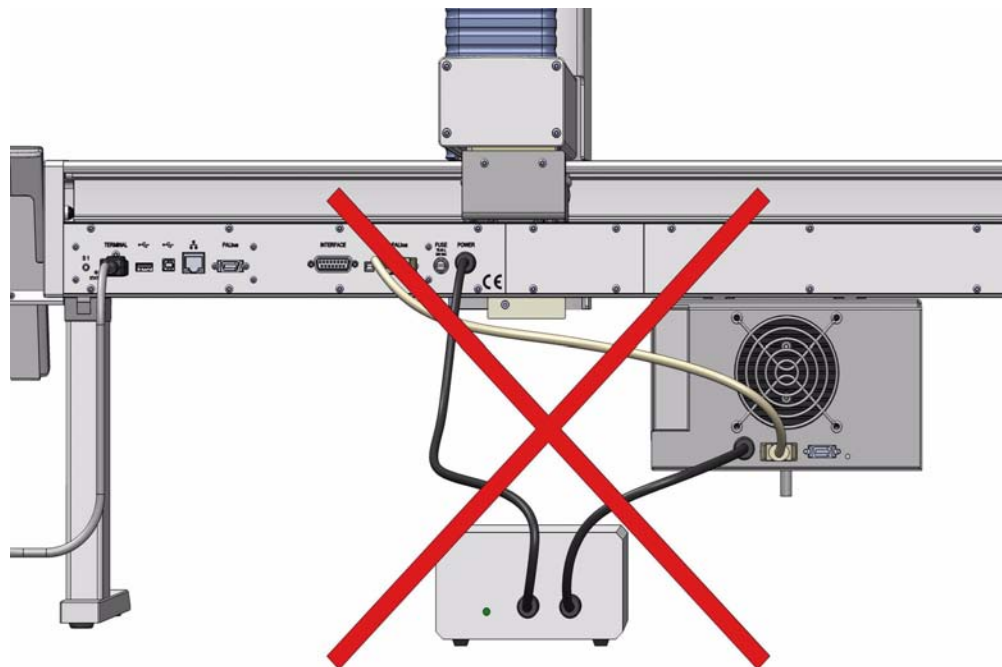
8. Connect the power cable from the power connector built into the switch to the wall outlet.

Installing an OC Injector Module

❖ **To install the OC injector module**

1. Locate the OC Injector Box and the BUS daisy chain cable.

2. Locate the cable which is connected to the OC Adapter and should be ready to hand at the backside of the GC unit.

3. Place the OC Electronic Box preferable to the backside of the GC frame. Use a cable strap for fixation.

4. Connect the supplied control cable (daisy chain cable) from the connector of the OC Electronic Box to the TriPlus RSH Control Interface connector marked **BUS**.
   If BUS connector is already occupied, connect the cable to another Active module with an open connector. For details see Figure 45.

Figure 45. Connecting the OC Electronic Box
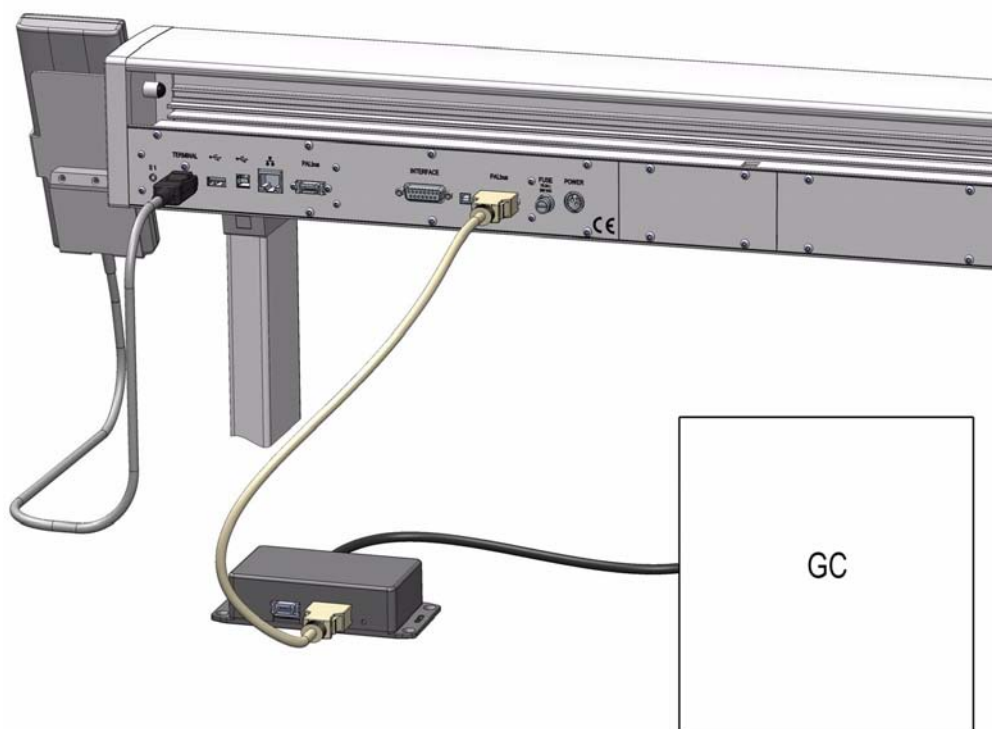
5. Connect the cable from the OC Adapter to the OC Electronic Box.

Inserting a LS Syringe into the LS Tool

❖ **To insert a LS syringe into the LS tool**

1. Remove the retaining nut from the LS Tool, then insert the syringe such that the flat side of the flange matches with the cut-out of the upper part of the holder. See Figure 46.

Figure 46. Syringe Insertion into LS Tool
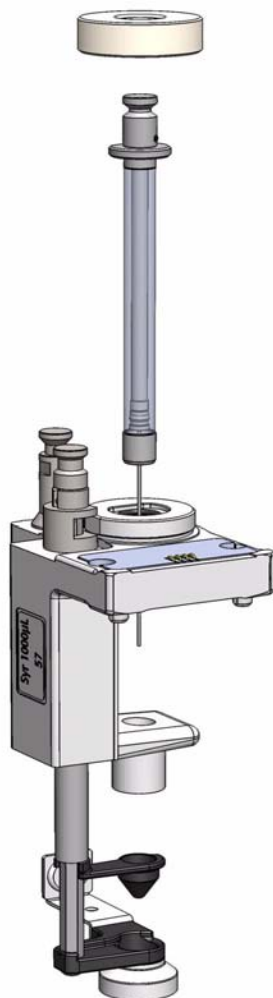
2. Carefully insert the syringe body guiding the needle tip into the upper and the lower needle guide. Press the syringe flange firmly into the tool holder.

Figure 47. Syringe Alignment and Front View

O-Ring
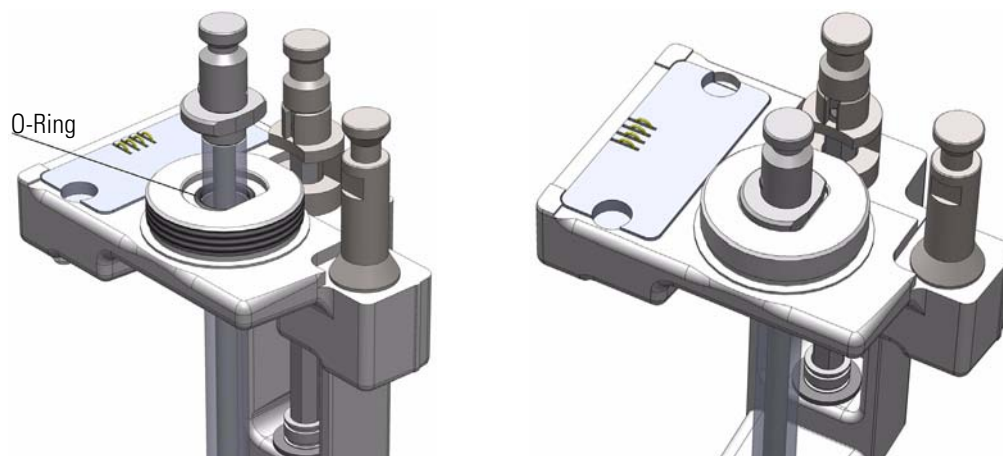
3. Tighten the retaining nut.

4. Check for the correct installation. It is important that the needle tip is not visible outside of the lower needle guide. See Figure 48.

Figure 48. Correct and Incorrect Position of the Syringe Needle Tip

Inserting a HS Syringe into the HS Tool

❖ **To insert a HS syringe into the HS tool**

1. Remove the retaining nut from the HS Tool, locate the O-ring, and put it over the syringe glass barrel up to the flange. This is a protection for the glass flange. See Figure 49.

Figure 49. Preparing HS-Syringe for Installation
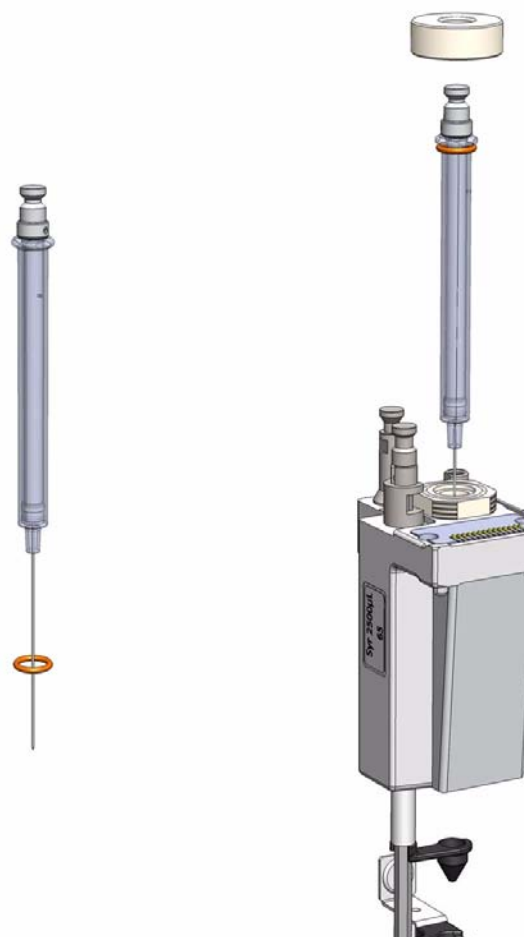
2. Insert the HS syringe into the HS Tool. Carefully insert the syringe body guiding the needle tip into the upper and lower needle guide.

3. Press the syringe firmly into position, and tighten the syringe flange with the retaining nut until a resistance is felt. The plunger is inserted in the syringe barrel.

Note It is not necessary to pay attention to the position of the syringe barrel side hole. The heater design with the O-ring sealing allows a circular purge gas flow.

4. Check for correct installation. It is important that the needle tip is not visible outside of the lower needle guide. See Figure 50.

Figure 50. Correct and Incorrect Position of the Syringe Needle Tip

Purge Gas Adapter

The purge gas adapter, mounted on the HS Tool, couples with the adapter from the TriPlus RSH Head. See Figure 51 and Figure 52. The coupling is sealed through an O-ring installed in the HS Tool Purge Gas Adapter.

Figure 51. HS Tool Gas Adapter
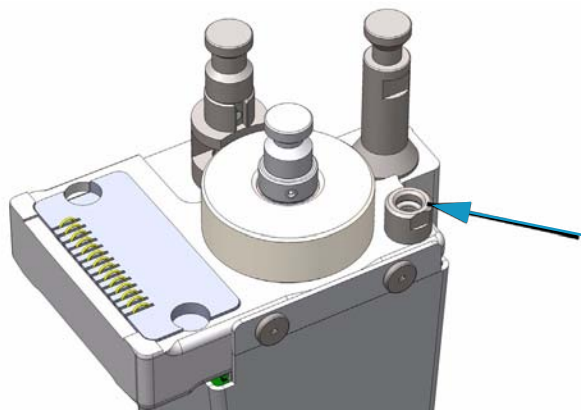
Figure 52. Purge Gas Coupling of HS Tool and TriPlus RSH Head
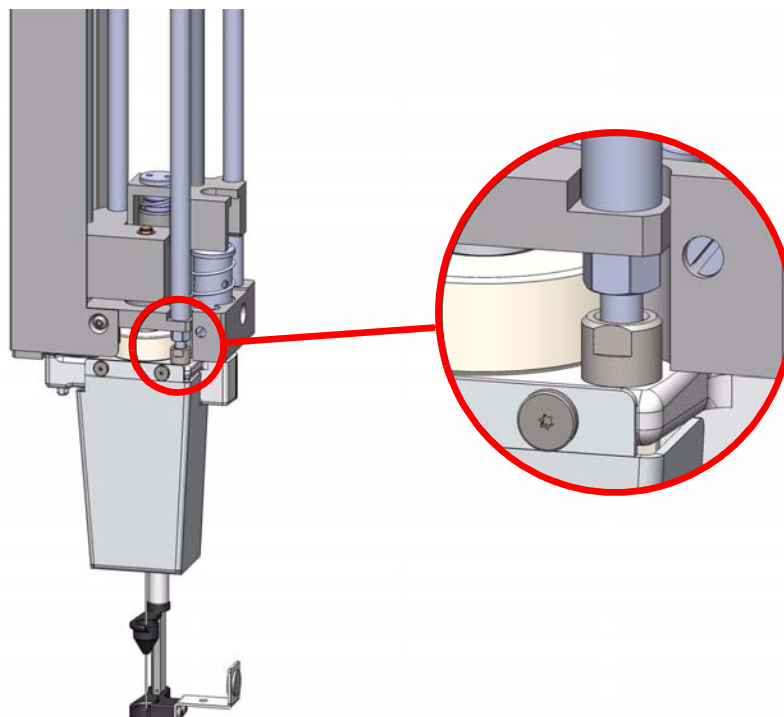
Installing the SPME Fiber Protector

The installation of the SPME fiber protector is only valid for the tool SPME and Fiber Holder supplied by Supelco™.
Using the tool SPME 2 the fiber protector not necessary. Returning the SPME 2 Tool into the Park Station is the SPME Fiber not exposed anymore at the moment of decoupling the tool.

CAUTION When a ATC Station is used, it is mandatory to install the SPME Tool and the SPME Fiber Protector in Slot position # 1.
This limitation is due to the automated return of a tool if it must exchanged.

The TriPlus RSH always searches for the first available Slot to park the connected tool.

When the SPME Tool is originally positioned in Slot position #1, this position is available when the SPME Tool is returned.

It is important to pay attention to the installation procedure of the SPME Protector.
Any misalignment between SPME Tool and Protection Adapter can cause Fiber breaking.

❖ **To install the SPME fiber protector**

Install the SPME fiber Protector as shown in Figure 53 and Figure 54.

Figure 53. SPME Fiber Protector
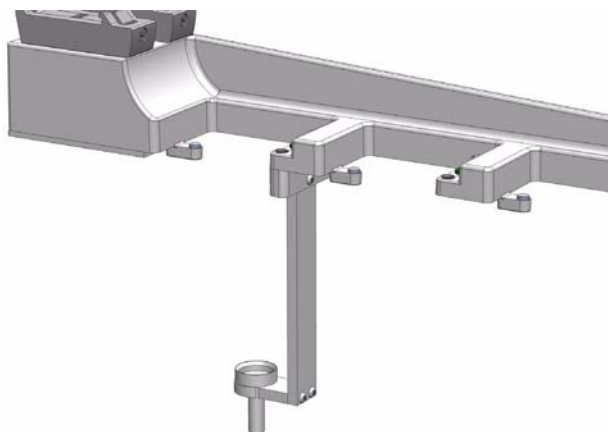
Figure 54. Alignment of SPME Fiber Protector
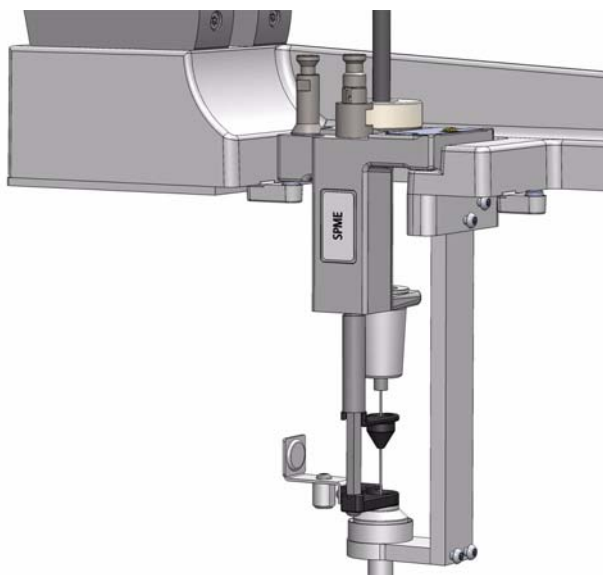
> ⚠️ **IMPORTANT** It is recommended to install the SPME Fiber Protector before mounting the TR Station or the ATC Station on the TriPlus RSH.

1. Connect the upper part of the Fiber Protector to the bottom side of the TR Station or in Slot position #1 when a ATC Station is used. Do not tighten the screw completely allowing a play for the alignment.

2. Insert the SPME Tool into the Slot position. The magnetic ring has to collapse into the guiding ring of the protection adapter.

3. Very carefully, tighten the screws of the adapter ensuring that the alignment is not lost.

4. Very carefully, manually check the fiber fits perfectly into the Protection Adapter. If not, repeat step 3 and 4.

5. Install the TR Station or the ATC Station on the TriPlus RSH as described in the section "Installing the Tool Stations" on page 32.

6. Manually, check again the fiber matches with the Protector.

Inserting a SPME Fiber Holder into the SPME Tool

❖ **To insert a SPME fiber holder into the SPME tool**

> **Note** The standby position of the **SPME Fiber Holder** is reversed compared to a syringe. If the plunger is in the uppermost position, the fiber is pulled back into the sheet needle. This is the protected position for the fiber.

1. Remove the retaining nut and the SPME Tool Adapter. Insert the SPME Fiber Holder, making sure the fiber is also inserted.

2. Insert the SPME Tool Adapter such that it sits on the metallic part of the SPME Fiber Holder. See Figure 55 and Figure 56.

Figure 55. Inserting Fiber Holder

SPME 1   SPME2
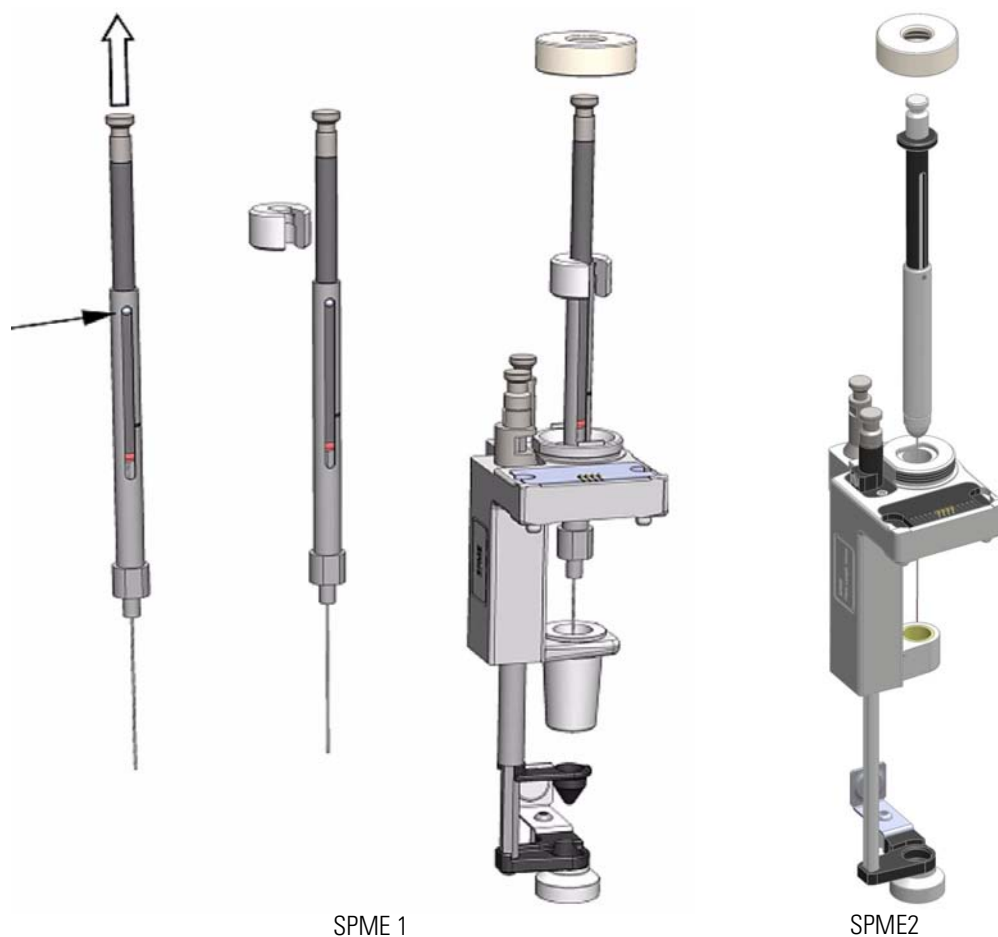
Figure 56. SPME Fiber Holder Inserted in SPME and SPME2 Tools
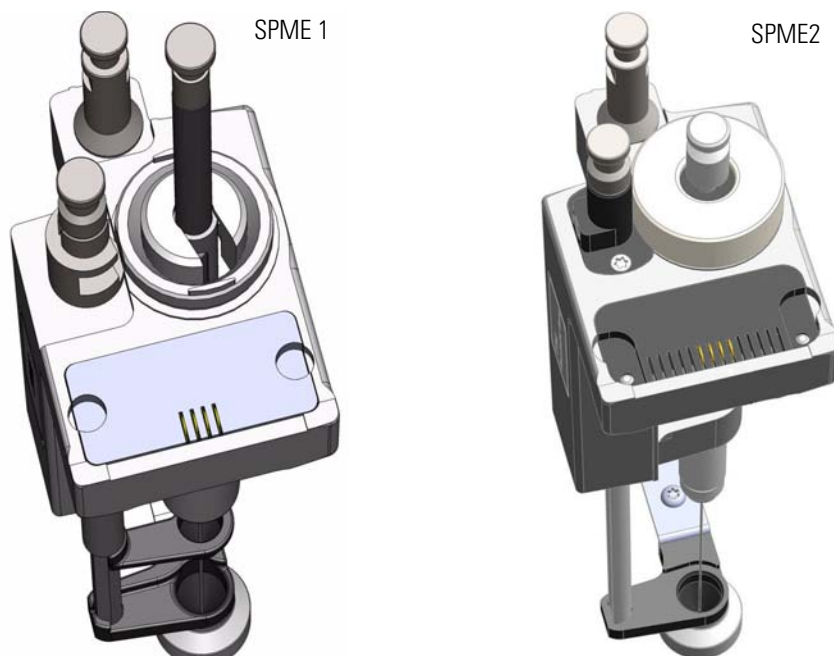
3. Place the holder such that the shaft of the moving part is visible from the front. Note that this point is for convenience only.

4. Tighten the retaining nut to the mechanical stop. Use normal force, do not overtighten the nut.

5. Check for correct installation. It is important that the needle tip is not visible outside of the lower needle guide. Avoid moving the SPME plunger, the fiber could become damaged. See Figure 57.

Figure 57. Correct and Incorrect Position of the SPME Needle Tip

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

Managing an ITEX Syringe and Trap Assemble

This section provides information for installing the ITEX syringe and trap into the ITEX Tool, for removing the HS syringe from the ITEX tool, for setting the flush gas pressure.

See the related topic:

- "Installing the ITEX Syringe and Trap into the ITEX Tool" on page 61
- "Removing the HS syringe from the ITEX Tool" on page 63
- "Flush Gas Considerations" on page 63

Installing the ITEX Syringe and Trap into the ITEX Tool

❖ **To install an ITEX syringe and trap into the ITEX tool**

1. Assemble the ITEX Syringe with trap/needle following the order shows in Figure 58.

Figure 58. ITEX Syringe and Trap Assembling
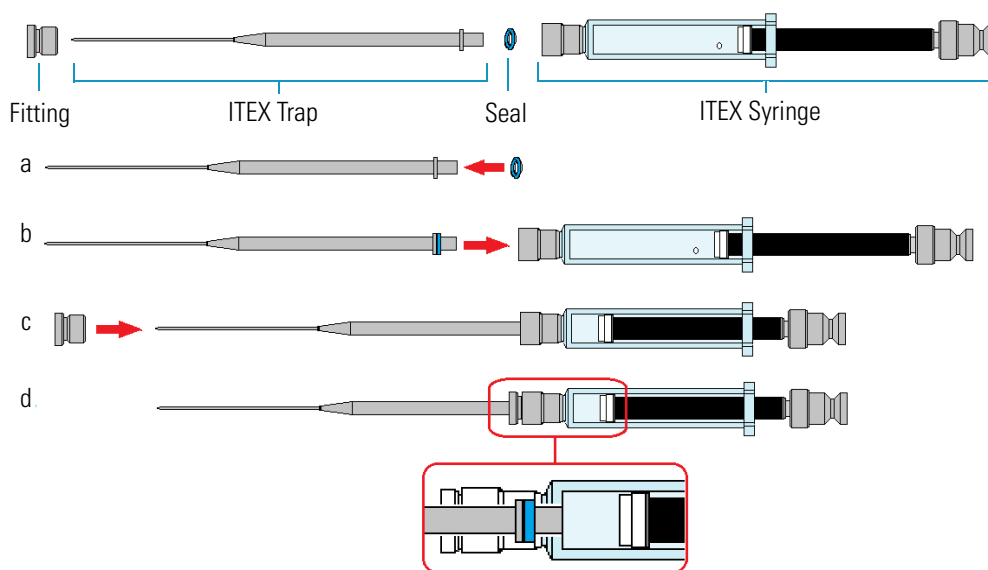
a. Slide the seal provided with the ITEX trap on the bottom of the trap up to reach the stopper.

b. Carefully insert the ITEX trap into the ITEX syringe as far as goes.

c. Slide the fitting on the ITEX trap up to reach the tip of the syringe, then secure the assemble by screwing the manually fitting into the syringe without overtightening.

d. Internal view of the assemble where the ITEX trap is coupled with the ITEX syringe.

2. Remove the retaining nut from the tool, locate the O-ring and put it over the syringe glass barrel up to the flange. This is a protection for the glass flange. See Figure 59.

Figure 59. Syringe Insertion into the ITEX Tool
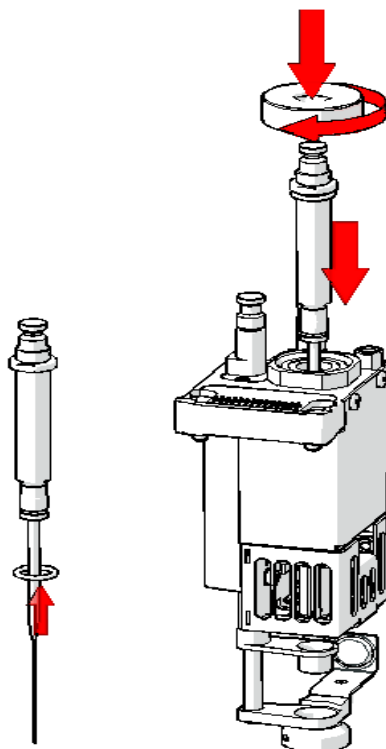
3. Insert the ITEX syringe into the ITEX Tool. Lower the syringe body carefully to guide the needle tip into the upper and lower needle guide.

4. Press the syringe firmly into position and tighten the syringe flange with the Retaining Nut until resistance is felt. The plunger is inserted in the syringe barrel.

> **Note** It is not necessary to pay attention to the position of the syringe barrel side hole. The heater design with the O-ring sealing allows a circular purge gas flow.

5. Check for correct installation. It is important that the needle tip is not visible outside of the lower needle guide. See Figure 60.

Figure 60. Correct and Incorrect Position of the ITEX Syringe Needle Tip
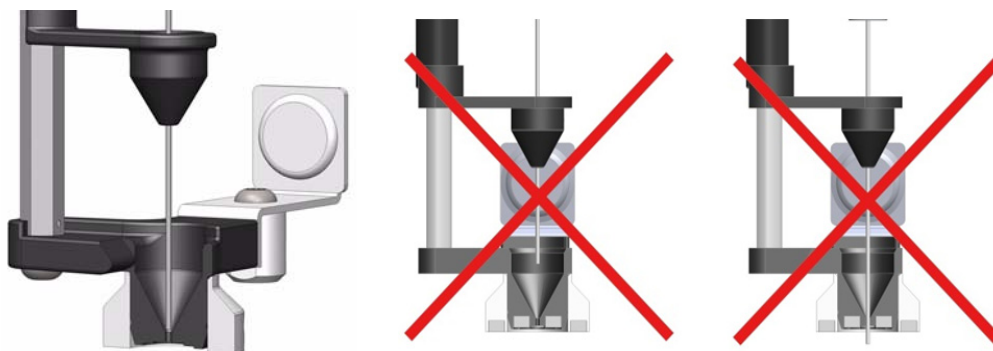
Removing the HS syringe from the ITEX Tool

❖ **To remove the HS syringe from the ITEX tool**

1. Remove the retaining nut from the tool. See Figure 61.

    Figure 61. HS Syringe Removal
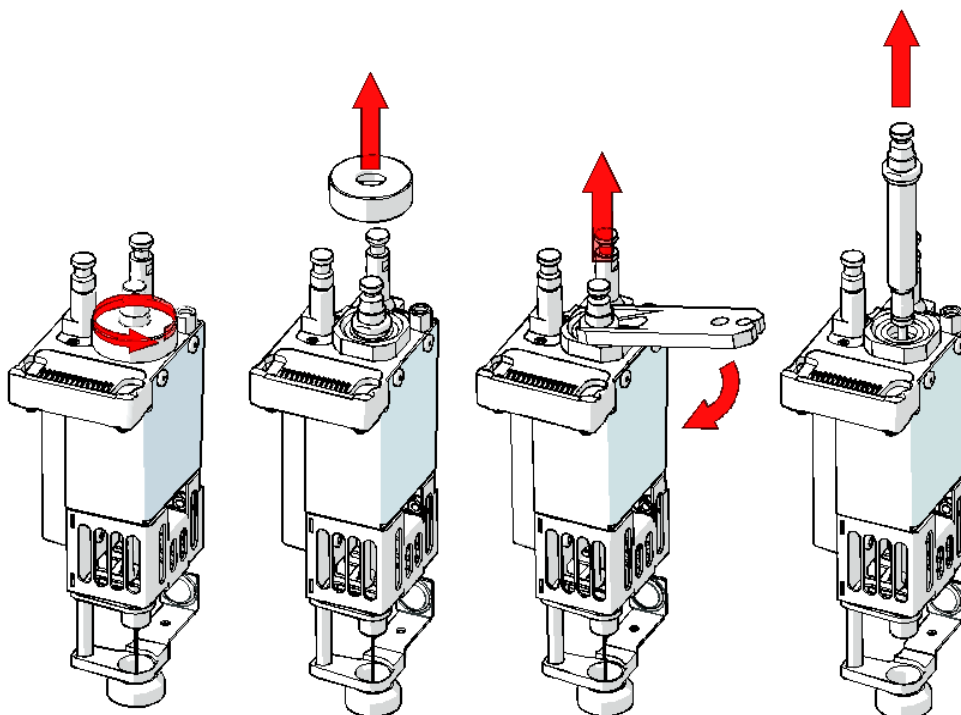
2. Carefully slide the ITEX Syringe Removal tool under the syringe flange and pull the syringe out of the ITEX tool.

Flush Gas Considerations

A gas flow level greater than 6 mL/min can destroy the bed of the trap, which will result in non-reproducible trapping efficiency.

Setting Flush Gas Pressure

A gas flow restrictor union for the pressure regulator is integrated within the PAL3-ITEX Tool. This restriction allows a flow of approximately 7 mL/min helium or approximately 5 mL/min nitrogen at a pressure setting of 0.5 bar at room temperature.

> **Note** If you already have installed a pressure regulator in the pressure regulator body, it is necessary to remove this and replace it with the original adapter without a built-in flow restriction frit, otherwise the gas flow will be too low. See Figure 62.

Figure 62. Replacing Flow-restricted Adapter at the Pressure Regulator with the Original Adapter
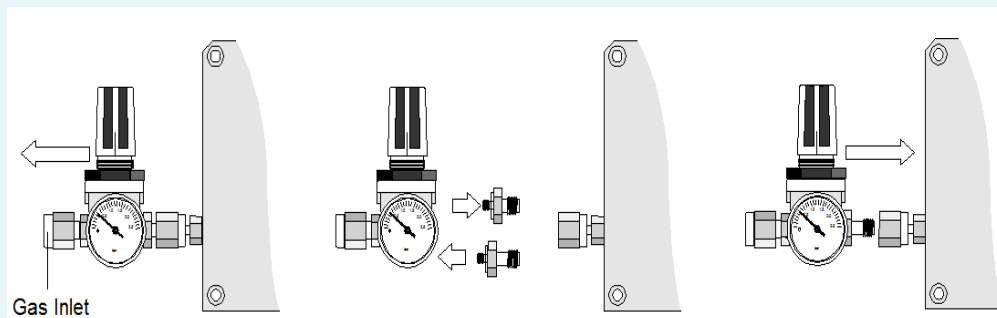
Adjusting Gas Flow

If your system was previously used for static headspace techniques, you must adjust the gas flow to ITEX technique requirements. If the original adapter for Headspace (without flow restriction) is in place, it is likely that the pressure setting of 0.5 bar needs to be lowered.

Adjust the gas flow to approximately 4 mL/min ±1 mL/min.

This flow of gas will not damage the bed of the trap, but the entire system is flushed about three times per minute. Standard flush time is two minutes. This means that the ITEX device is flushed six times with gas for cleaning purposes.

Gas flow adjustment without an installed restrictor can be done. See "To adjust the gas flow" on page 64.

❖ **To adjust the gas flow**

This procedure is necessary in case the ITEX Kit is installed, if the restriction frit was not provided, or if it has been lost or is clogged.

1. Release the pressure entirely from the pressure regulator. Use a liquid (e.g. n-hexane) to check whether any bubbles form.

2. Turn the pressure on very slowly and check for bubble formation in the liquid again. If a good stream of bubbles is visible, measure the gas flow.

Flush Gas Type

For gas chromatographic technique, three different carrier gases are typically used: nitrogen, helium, and hydrogen.

Nitrogen and helium are inert gases and therefore can be safely used as flush gases for the ITEX technique.

Because of a slightly lower solubility in water, the preferred gas for headspace analysis is helium. Whenever possible, helium should be used for the ITEX technique. If helium is used as a carrier gas, the carrier gas line can be divided and teed-up for a carrier and a flush gas. Activating the flush gas valve should not result in irregularities in the GC detector baseline.

WARNING Hydrogen, widely used as a carrier gas for GC capillary techniques, is a flammable, explosive gas. For safety reasons do not use hydrogen as a flush gas for the ITEX technique.

Flush Gas Quality

The minimum quality level is grade 55 (99.9995% purity).

Grade 59 (99.9999% purity) or Grade 60 (99.99990% purity) are preferable.

Good laboratory practice is to install a charcoal and a moisture filter to ensure that a high quality of gas is supplied to the GC system.

Connecting the Power Module

> ⚠️ **WARNING** Always switch the TriPlus RSH Power Module OFF before connecting or disconnecting any TriPlus RSH accessories cables.

❖ **To connect the power module**

1. Locate the power supply module.

2. Connect the provided cable to the connector **OUT** of the Power Module.

   Figure 63. Power Supply Connection
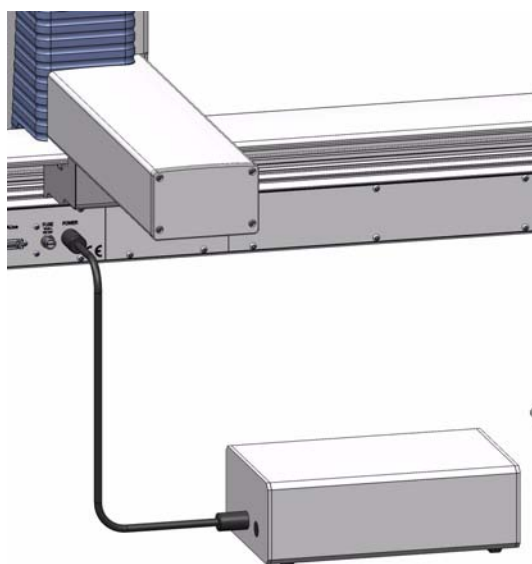
> **Note** The second outlet marked AUX of the Power Module is identical to the TriPlus RSH outlet, including connector size and pins, and outlet voltage.

3. Connect the other side of the cable to the connector marked **Power** at the backside of the TriPlus RSH.

4. Connect the power cable from the power connector built into the switch to the wall outlet.

5. Make sure that the cable from Handheld Controller is correctly connected to the control board.

6. Make sure that all the active modules are linked together (daisy chaining) and that the first module, for example the ATC Station, is connected to the connector marked **BUS** as shown in Figure 64.

Figure 64. Modules Electrical Connection
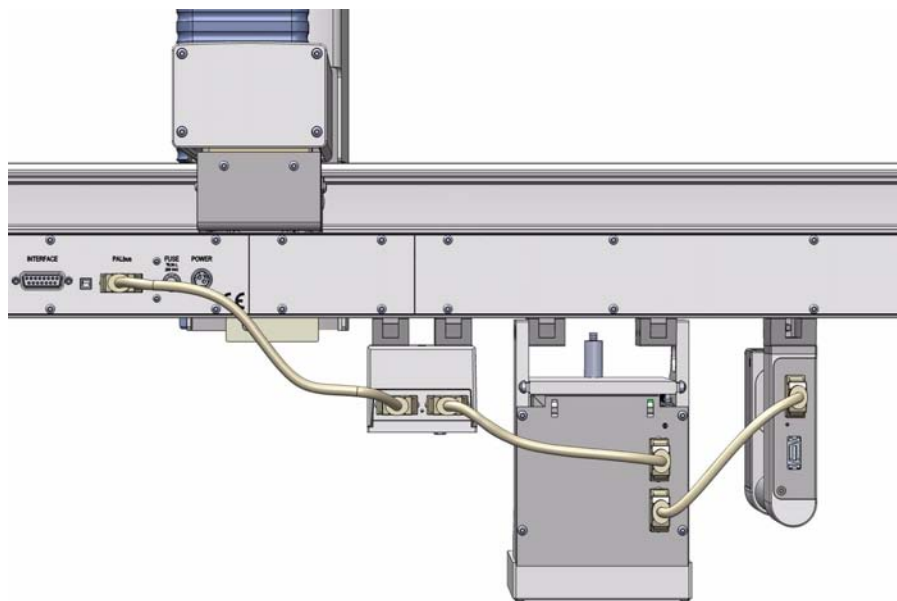
Combining the TriPlus RSH to Other Devices

Combining the TriPlus RSH with a GC requires synchronization of a Ready-Signal and a relay contact output signal.
This section explains the available input and output signals, the pin allocations of the external connectors, and provides information enabling you to copy the default signals and add, for example, a second output signal if required.

Synchronization and Output Signals

Synchronization signals are inputs that inform the TriPlus RSH to wait or to proceed with a sample-processing step.
Output signals are sent from the TriPlus RSH to the external devices, such as the GC, to indicate the status or the completion of the processing steps.

❖   **To setup the synchronization signals**

The synchronization signals from the system to the GC must be set step-by step.

1. Assign an **Input** and an **Output** signal, and establish the type of contact required to receive or send a signal. Type of contacts are a TTL (Transistor-Transistor Logic), a relays contact, an Opto-coupler or another type.
   The required parameters such as **Pulse Duration** and **Blocking Time** must be added.

2. An output signal is required to send a start signal to the GC. Typically the **Switch Out Signal 1 (SWOut1)** is used for this task.
   The assigned signals must be matched with the pin allocation of the synchronization cable.

   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 to the GCs. 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.

   Synchronize the signal parameters with the GC System.
   Refer to the section **Input/Output Interface** and to the section **Signal** in the *TriPlus RSH User Guide*. The **Ready** signal is usually sent from the GC to the system; a TTL-In signal is used to receive the **Ready** signal. Depending on the GC settings, the signal is set to **active high** or **active low**.

3. Bundle the required **Input Signal** and **Output Signals** for the GC System. The bundle can be configured and tested in the combination of the system, and the other device. The bundling is described in the section **Chromatograph System** in the *TriPlus RSH User Guide* as the last step in setting up signals.

For details refer to the section **TriPlus Basic Information** and to the section **Setup Menu Item** in the *TriPlus RSH User Guide*.

External Connectors

The external connectors of the control interface are shown in Figure 65.

Figure 65. Control Interface Connectors
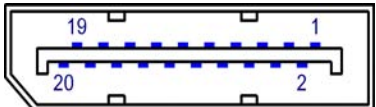
The connectors are the follows:

- Handheld Controller Connector

- USB Host Connector

- USB Device/Client Connector

- Ethernet Connector

- Bus Connector

- Interface Connector

- Fuse Port

- Power Connector

Handheld Controller Connector

The pin-out of the Handheld Controller 20-pin display port connector, marked HANDHELD CONTROLLER is list in Table 7.

Table 7. Handheld Controller Connector Pin-out

Connector Layout	Pin	Signal Name
	1	TxOut0-
	2	Term_nPresent
	3	TxOut0+
	4	TxOut1-
	5	GND
	6	TxOut1+
	7	TxOut2-
	8	GND
	9	TxOut2+
	10	TxClkOut-
	11	GND
	12	TxClkOut+
	13	+3.3 VDC
	14	GND
	15	+3.3 VDC
	16	GND
	17	Term_RxExt
	18	+3.3 VDC
	19	GND
	20	Not connected

USB Host Connector
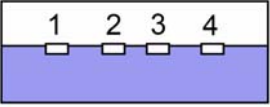
The pin-out of the 4-pin USB Type A connector, marked ⟵ is list in Table 8.
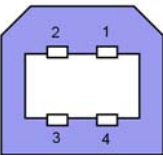
Table 8. USB Host Connector Pin-out

Connector Layout	Pin	Signal Name
1 2 3 4	1	+5VDC
	2	Data-
	3	Data+
	4	GND

USB Device/Client Connector

The pin-out of the 4-pin USB Type B connector, marked ⟵ is list in Table 9.

Table 9. USB Device/Client Connector Pin-out

Connector Layout	Pin	Signal Name
2 1 3 4	1	VCC
	2	Data-
	3	Data+
	4	GND

Ethernet Connector
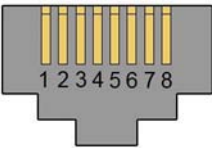
The pin-out of the 8-pin RJ45 connector, marked is list in Table 10. Currently this connector is not active.

Table 10. Ethernet Connector Pin-out

Connector Layout	Pin	Signal Name
1 2 3 4 5 6 7 8	1	TX+
	2	TX-
	3	RX+
	4	NC
	5	NC
	6	RX-
	7	NC
	8	NC

Bus Connector

The pin-out of the Bus 14-pin Mini Delta Ribbon connector, marked BUS is list in Table 11.

Table 11. BUS Connector Pin-out

Connector Layout	Pin	Signal Name
	1	TXD
	2	NC
	3	+36VDC
	4	+36VDC
	5	+36VDC
	6	+36VDC
	7	+36VDC
	8	RXD
	9	nAlarm
	10	GND
	11	GND
	12	GND
	13	GND
	14	GND

Interface Connector

The pin-out of the Interface 15-pin DSUB female connector, marked INTERFACE is list in Table 12.

Table 12. Interface Connector Pin-out (Sheet 1 of 2)
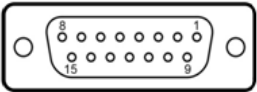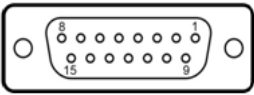
Connector Layout	Pin	Signal Name
	1	TTLOut1
	2	TTLOut3
	3	Relais1A
	4	Relais1B
	5	Relais2B
	6	OptoIn+
	7	TTLIn1
	8	GND

Table 12. Interface Connector Pin-out (Sheet 2 of 2)

Connector Layout	Pin	Signal Name
	9	TTLOut2
	10	GND
	11	TTLIn2
	12	Relais2A
	13	TTLIn3
	14	OptoIn-
	15	+5VDC

Fuse Port

In the control interface a T6.3A; 250 V; 5 x 20 mm fuse is installed.

Power Connector

The pin-out of the 3-pin KYcon KPJX-3S-S connector, marked POWER is list in Table 13.

Table 13. Power Connector Pin-out

	Pin	Signal Name
	1	VCC
	2	Data-
	3	Data+

Establishing Communication with the Computer

This section provides instruction for establishing communication between the TriPlus RSH and the computer.

Connecting the TriPlus RSH with Factory Settings

In order to select the required network setup best suited for the your's laboratory setting, the following possibilities are available:

- **Direct connection** — The TriPlus RSH 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 a corporate network.
  Select the DHCP Protocol, the network assignees 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, the Subnet Mask, and the Default Gateway to configure the TriPlus RSH within the corporate network.

To establish communication to the computer, please see to the following sections:

Setting Up the Direct Connection

⚠️ **CAUTION** The following description assumes that an Ethernet cable is connected directly from the TriPlus RSH to a computer and not integrated within a customer network. If this is the case, consult your System Administrator for support. The same is true as soon as the DHCP Mode is activated.

This description is also valid for use with the Virtual Handheld Controller.

The System is pre-configured to use a static IP Address. To set the initial Ethernet settings, prepare a network computer in the same IP Subnet:

❖ **To setup the direct connection**

1. If the computer is already part of your network, record its TCP/IP configuration settings.

Figure 66. Setting IP Properties in the Computer
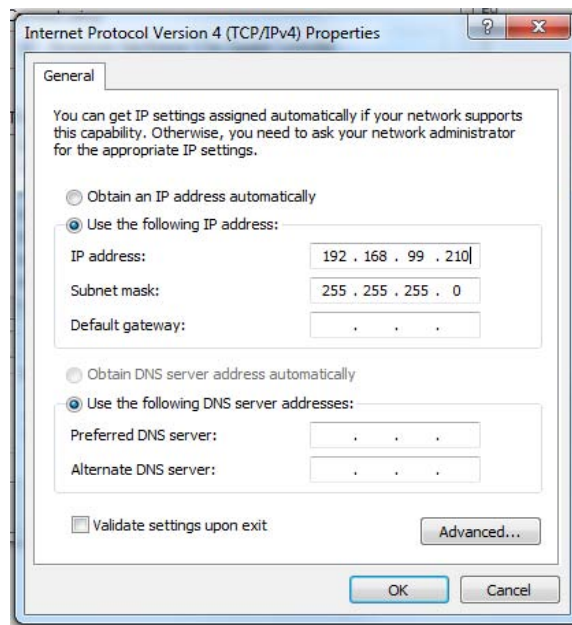
2. Configure the computer with a static IP Address **192.168.99.230**, and a Subnet Mask **255.255.255.0**. Do not enter a **Default Gateway** address.

Note Use the proposed IP Address number as shown in Figure 66.
If a deviation is required, do not use the following numbers of the last address package:

- 192.168.99.0 is reserved for Net address
  192.168.99.255 is reserved for Broadcast address
  192.168.99.230 is reserved for TriPlus RSH

3. Connect the Ethernet cable from the control board of the TriPlus RSH to the computer, and verify that the LAN control LED lights when connected to a powered-on computer. See Figure 67.

Figure 67. LAN Cable Connection to the PC
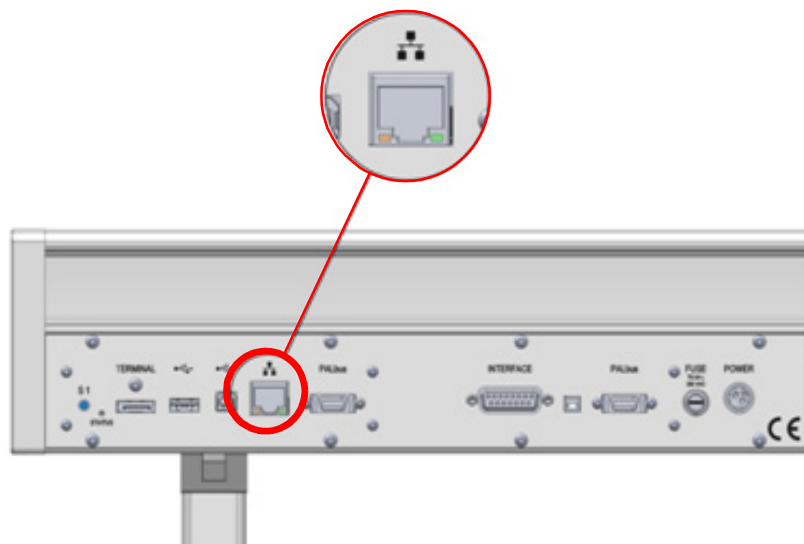
> **Note** If the communication is not established, use a **Cross Adapter** for the LAN cable. The adapter can be connected on either side.

Setting up the Network Interface

❖ **To configure the ethernet port of the computer for LAN access**

1. Establish a LAN connection from the computer to the TriPlus RSH by opening a browser, and entering **http://192.168.99.230** in the address field.

2. Configure the IP Address settings as shown in Figure 68.

Figure 68. LAN Communication Settings

3. Click **Apply** to confirm the changes, and activate the new network settings.

4. When the setup steps are completed, you can deploy the TriPlus RSH in your network. If needed, you can now reconfigure your computer back to its original TCP/IP settings.

5. If your computer is connected to a factory network, configure the IP Address settings appropriate for your network. Consult your System Administrator for the correct settings.

For further details see also the section **Service Menu Item-Installation** in the *TriPlus RSH User Guide*.

Setting up the Network Interface by using the Handheld Controller

Setting up the network by using the Handheld Controller, follow the instructions as described in the section **Service Menu Item-Installation** in the *TriPlus RSH User Guide*.

The computer settings must be accurate.

The TriPlus RSH Network default settings are shown in Figure 69.

Figure 69. TriPlus RSH Network Settings

Do not use the DHCP mode nor an entry in the Default Gateway field.

Restoring Factory Default Network Settings

It is sometimes desirable to restore the TriPlus RSH factory default network settings if you moved the TriPlus RSH to a new network or lost the IP Address of the robot.

To restore the factory default settings, without knowing the IP Address, you must use the **Reset** button marked **S1** on the back panel.

Figure 70.   Reset Button S1
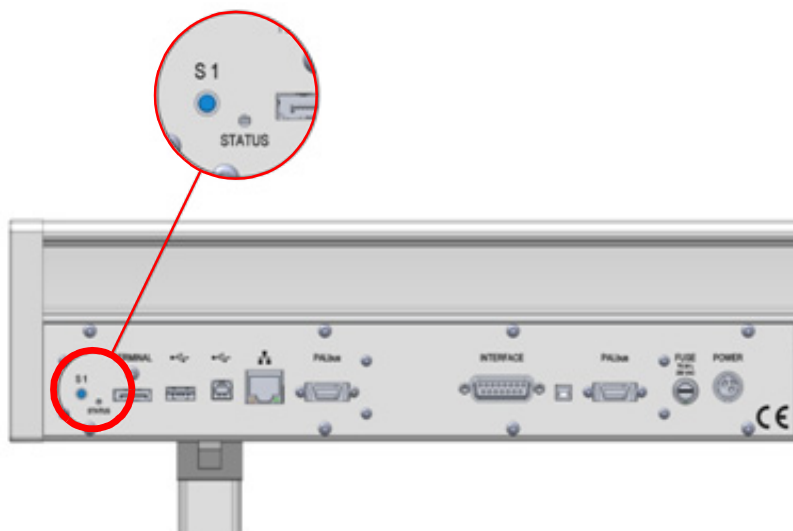
❖   **To reset the TriPlus RSH**

1. Power OFF the TriPlus RSH.

2. Press the **Reset** button **S1** by using an appropriate tool.

3. Power ON the TriPlus RSH with the Reset button pressed, and hold it pressed for at least 10 to 15 seconds. The LED starts blinking for a short time. Keep the button pressed for another five seconds.

4. The LED starts blinking eight times within one or two seconds. A second rush of blinking of the LED after this indicates that the system has been reset to factory default settings.

5. Release the button, and follow the steps in the section "Connecting the TriPlus RSH with Factory Settings" on page 74 to setup the Ethernet port with factory settings.

Setting up a Corporate Network

Setup within a corporate network requires the support of the system administrator who has local administrator privileges for Windows, and network setup.

Installing the TriPlus RSH as part of an analytical system into a corporate network does not require any special precautions. Use the state-of-the-art technique available.

For operation of the TriPlus RSH, an Ethernet (TCP/IP) is required.
The computer in use has to be equipped accordingly. LAN or Ethernet IEEE 802.3 Industry Standard 10/100 Base-T.
The network interface of the TriPlus RSH supports network connections Auto-MDI(X) of a switch which follows the protocol 1000Base-T standard.

The RSH Firmware accepts a moderate latency time, however if in a network the latency time clearly exceeds 500 ms, it must be inspected closely.

> **IMPORTANT** For the LAN communication, the following ports must be kept open:
>
> **64001** = Integration driver routing port
> **64000** = TriPlus RSH Communication
> **8194** = Data subscription
> **80** = Web interface

For further details see the section '"Hardware and Software Requirements" on page 4.

For the LAN communication troubleshooting, see Chapter 6, "Troubleshooting."

TriPlus RSH Defining Object Positions

This chapter provides the instructions for defining the teaching position of he TriPlus RSH modules, the referencing position and the calibration of the tools. The definition of these terms, and the row and column sample positions, are also explained.

Contents

Definitions of Teaching, Referencing, and Calibration

The term **Teaching** is used for define the X-, Y-, and Z- axis positions for each module.

The teaching process is activated by moving the TriPlus RSH Head to the **Teach Point**. Figure 71 and Figure 72 show examples of teaching position for a Temperature Controlled Drawer, and for a Tray Holder.

Figure 71. Temperature Controlled Drawer Teaching Position
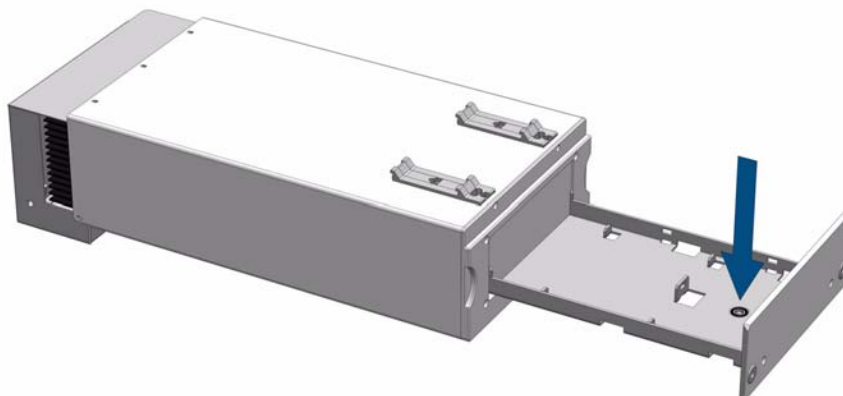
Figure 72. Tray Holder Teaching Position
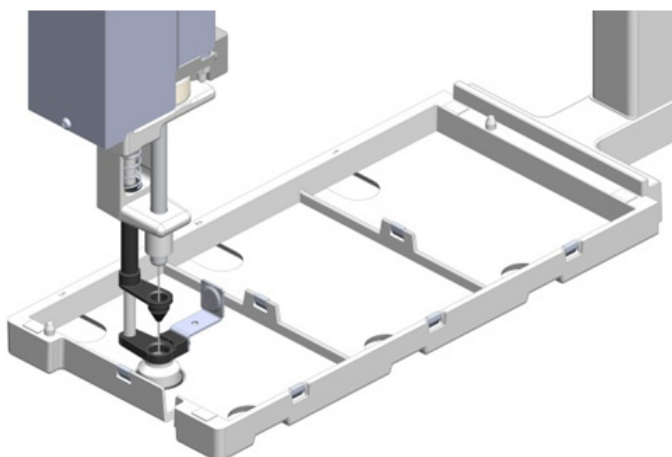
The Tool is not part of the TriPlus RSH Head (Z-axis). Initially the Tool is parked either in the TR Station or in the ATC Station. The Tool will be picked up from the station, and can be automatically changed during a cycle if required by the application.

The positions teaching of the TR Station or ATC Station is done by teaching the Slot positions and not the position marked by the disc with two concentric rings conventionally named **"lunette"**. The disk is used as a **Reference Point**.
If more than one Tool is used with the TriPlus RSH, it is required to **Reference** and **Calibrate** the tools. This operation is necessary to compensate for minor deviations between one Tool and another.
See the section "TriPlus RSH Tool Referencing and Calibration" on page 101 for details.

A Tool is defined as **Reference Tool** while all the other Tools are **Calibrated** in function of the **Reference Tool**. Possible deviations are stored with the Reference Tool. This step is important, for example, to enable reliable grasping of a Tool from a Slot in the ATC Station and to return it.

As a first step, define the Reference Point. Since the TriPlus RSH will always be equipped with either the TR Station or the ATC Station, use the Reference Point of one of the available stations as a Reference Point as the **TriPlus RSH Tool Referencing**. Figure 73 and Figure 74 illustrate the Reference Points for the two stations.

Figure 73. Reference Point at TR Station

Concentric Rings - Lunette
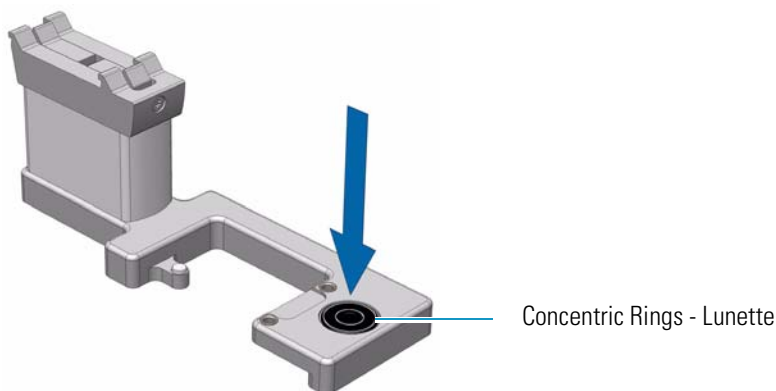
Figure 74. Reference Point at ATC Station
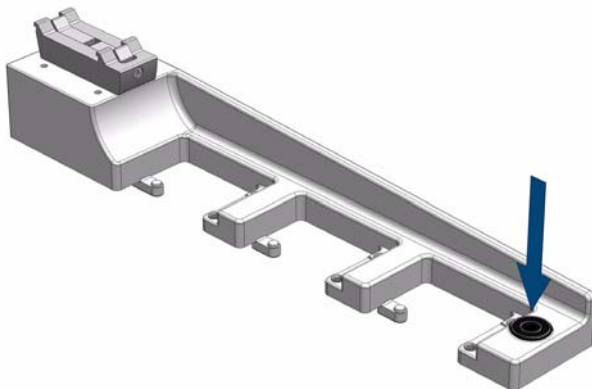
The Reference Point is defined by moving the TriPlus RSH Head to this point and the X-, Y-, and Z-axis Positions are stored. It is important that all other TriPlus RSH Tools are calibrated against the Reference Tool.

> **CAUTION** The **Reference Point** of the TR Station or ATC Station should not be confused with the **Teaching Point**.
>
> The installed **lunette** with the two concentric rings could mislead you. A teach position for the TR Station and ATC Station is not the **lunette** (disc with two concentric rings; Reference Point) but the actual slots for the tools, which are individually taught.

Slot Positions

A **Slot** is defined as a position within a TriPlus RSH module which can be occupied by a sample tray such as Tray 60, or a Well Plate.

Slots are used for Tray Holders and for Temperature Controlled Drawer. The numbering for Slots is defined from the TriPlus RSH X-axis to the front.

- Figure 75 illustrates the example of a Tray Holder including the Slots with spaces for installing up to three trays.

Figure 75. Tray Holder with Two Trays Installed
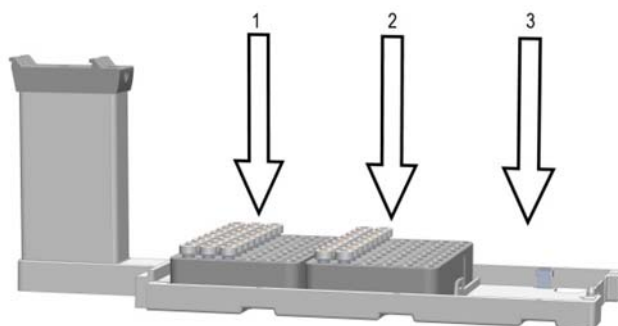
- Figure 76 shows the same Tray Holder but with a Tray 60 installed, which spreads over the three slot positions. In this example, the Tray Holder is defined as holder with a single Slot.

Figure 76. Tray Holder with a Single Tray Installed
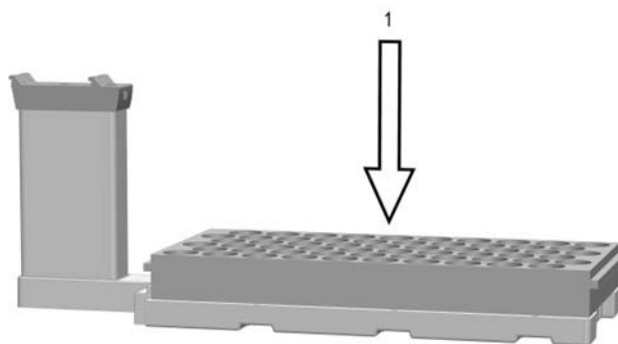
The term **Slot** is also used for both the ATC Station and TR Station.

In the ATC Station three positions **Slots** are available, while for the TR Station a single position is provided as holding position of a Tool.
For consistent terminology, this position is also defined as **Slot**.

The numbering concept is kept the same, from the back to the front. See Figure 77.

Figure 77. TC Station with 3 Slots for TriPlus RSH Tools and TR Station with Single Slot

ATC Station Slots

TR Station Slot
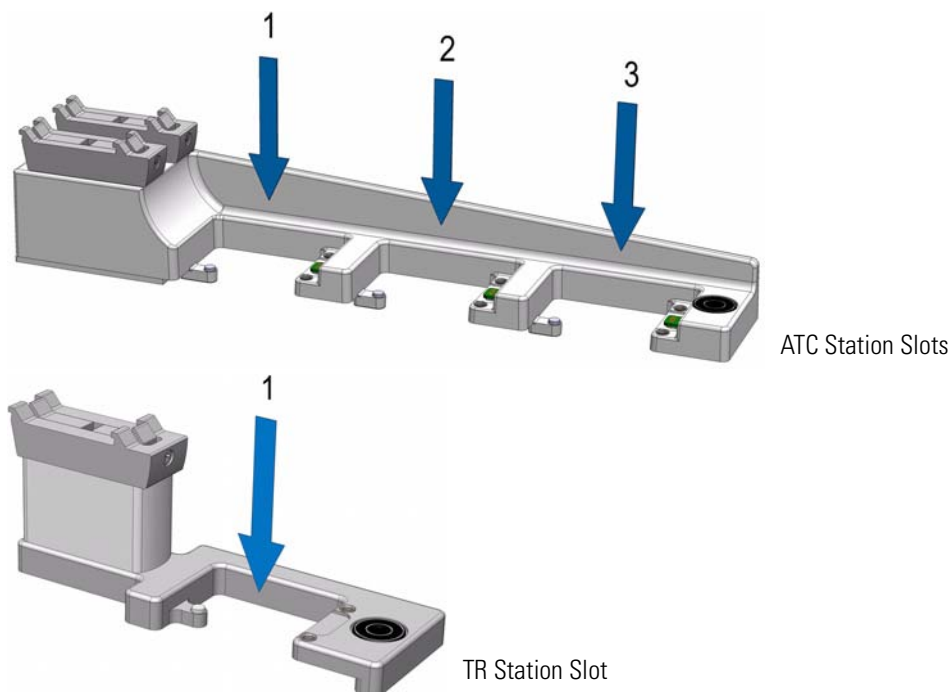
Definition of Row and Column

The TriPlus RSH uses a constant pattern for the definition of **Column** and **Row**. The concept is identically as used in spreadsheet programs, for example Excel.

The **Column** is always in the direction of the Y-axis and independent of the sample order. The definition is shown in Figure 78 with the Tray 60 and the Tray 54 (which has the same footprint as Well Plate).

A **Row** is not associated with an X-axis or Y-axis.

Figure 78. Trays R32 and VT54
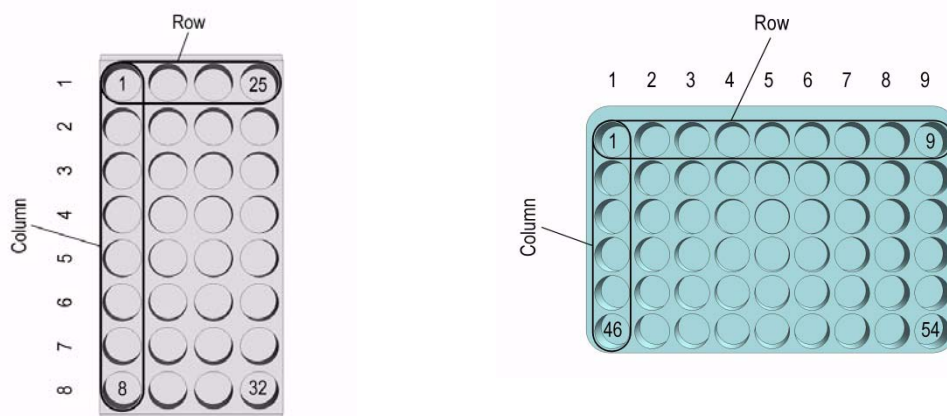
Definition of Vial or Well Position Pattern

The definition of **Pattern** is only required for Trays and Well Plates.
The arrangement of vial or well positions in a tray or well plate can be in a **regular** or what is often referred to as a **staggered** pattern. A staggered pattern can take two forms:

- **Staggered+** — The second row is offset by **+x (mm)** of the hole pattern

- **Staggered-** —The second row is offset by **–x (mm)** of the hole pattern

See the following examples:

Pattern Type Regular

The vial or well positions are equally distributed.
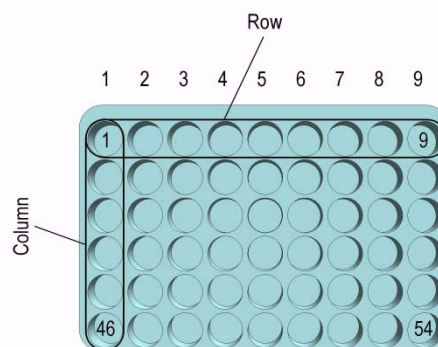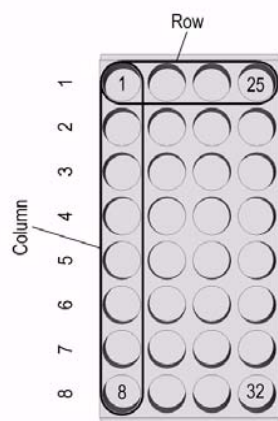
Pattern Type Staggered+

The vial or well positions are arranged in a staggered pattern.

Example: The offset of the second Row is shifted by **+50%** of the hole pattern.
The offset value is selectable (in mm).
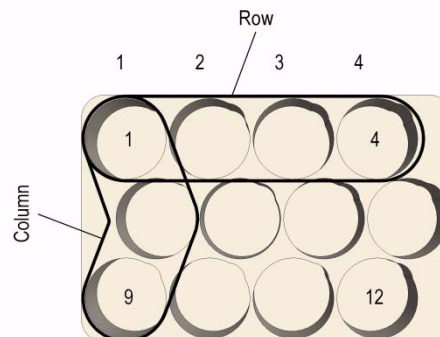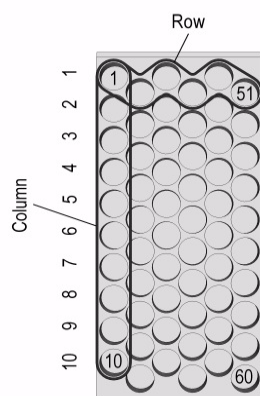
Pattern Type Staggered-

The vial or well positions are arranged in a staggered pattern.

Example: The offset of the second Row is shifted by **-50%** of the hole pattern.
The offset value is selectable in mm.
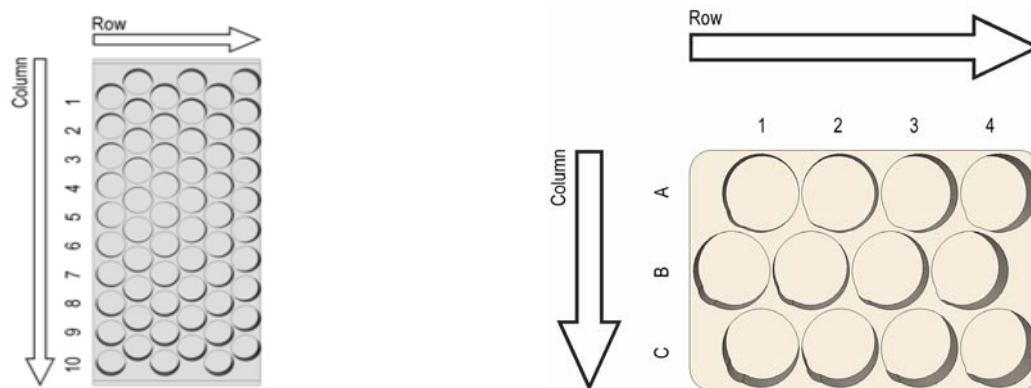
Definition of Inclination

If the Tray surface is not exactly horizontal and planar but inclined in one or more axes, you can perform a correction through the RSH Firmware. A dialog window appears when a Tray has been checked-out at the corners, asking to verify vial positions and heights.
How to correct a possible inclination is shown in the example of Figure 79.

Figure 79. Inclination correction
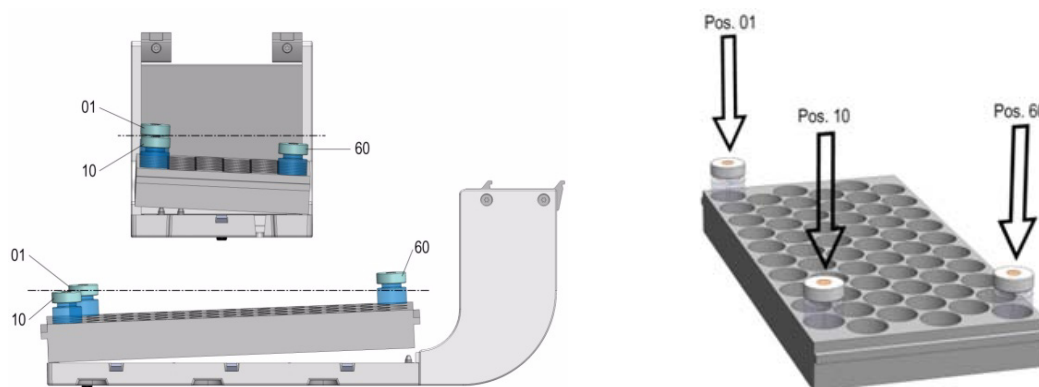
The values for the **3-Corner** calibration are assigned to the Tray linked to the Tray Holder. It is important that the X-, Y-, and Z-positions of the Tray Holder are determined first. If for any reason the X-, Y-, and Z-positions of the Tray Holder are taught again, the 3-Corner values for each related Tray are lost.

The 3-Corner calibration has to be repeated again for each Tray related to the Tray Holder The reason of this behavior is the direct relationship of the Tray Holder to the Tray, considered as parent-child dependency, as expressed in computer programming.

TriPlus RSH Modules Teaching

The objective is defining all Teach Points for all the modules installed.

For details see the following sections:

- "Introduction" on page 88
- "TriPlus RSH Tool Referencing and Calibration" on page 101

Introduction

According to the configuration of your TriPlus RSH, make sure that all the stations and the modules are properly mounted on the TriPlus RSH X-axis.

Before starting the procedure "TriPlus RSH Tool Referencing and Calibration" on page 101, see to the following sections for an overview of the teach point of each station and module:

- "Teaching TR Station Position" on page 89
- "Teaching ATC Station Position" on page 89
- "Teaching Standard Wash Station Position" on page 90
- "Teaching Large Volume Wash Station Position" on page 91
- "Teaching Solvents Station Position" on page 91
- "Teaching Fast Wash Station Position" on page 92
- "Teaching Tray Holder Position" on page 93
- "Teaching GC Injector Position" on page 94
- "Teaching Agitator Position" on page 94
- "Teaching Vortexer Position" on page 95
- "Teaching MHE Station Position" on page 96
- "Teaching SPME Conditioning Station Position" on page 97
- "Teaching Liquid Cooled Tray Holder Position" on page 99
- "Teaching Temperature Controlled Drawer Position" on page 100

To perform step by step the module teaching procedure, see the section "Modules Teaching Step-by-Step Procedure" on page 104.

Teaching TR Station Position

Manually insert the required Tool into the TR Station as shown in Figure 80.

Figure 80. TR Station
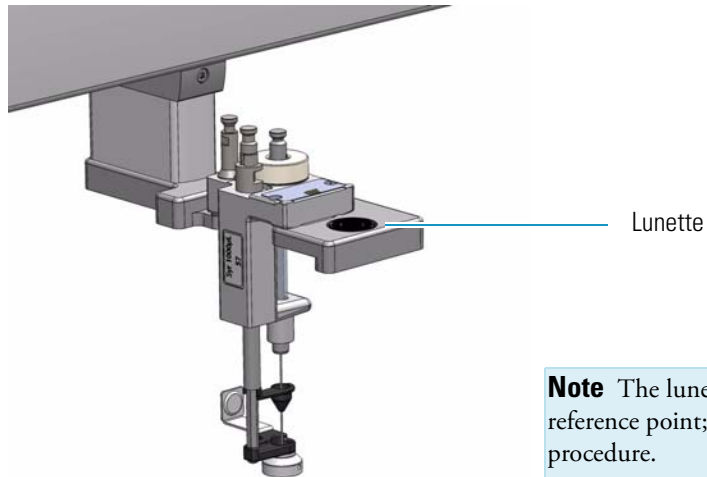
Lunette

Note The lunette at front of the station is the reference point; it is not used for the teaching procedure.

The teaching of the TR Station is based on the position of the Slot and not on the position of the lunette.

Teaching ATC Station Position

Manually Insert the required Tool into the ATC Station as shown in Figure 81.

Figure 81. Manually inserting the Tool to the ATC Station
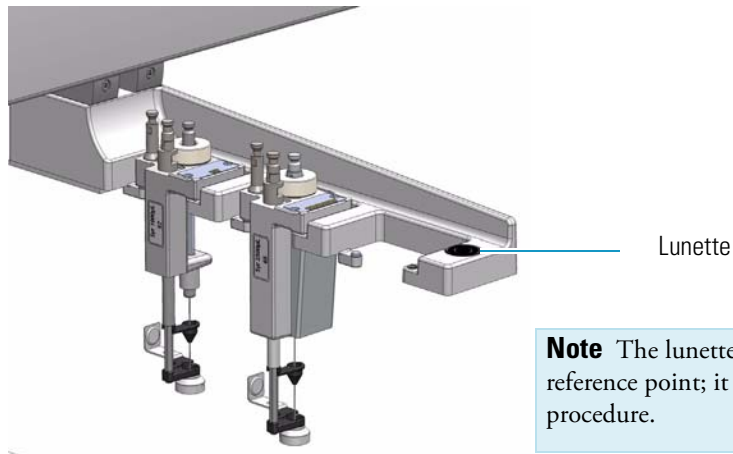
Lunette

Note The lunette at front of the station is the reference point; it is not used for the teaching procedure.

The teaching of the ATC Station position is based on position of the three Slots and not on the position of the lunette.

Teaching Standard Wash Station Position

The teach position for the Standard Wash Station is the front vial (#5).
The Lower Needle Guide should be centered in these holes with the bottom of the lower needle guide lightly touching the surface of the caps.

Figure 82. Teaching Position for Standard Wash Station and Fine-tuning of Vial #1
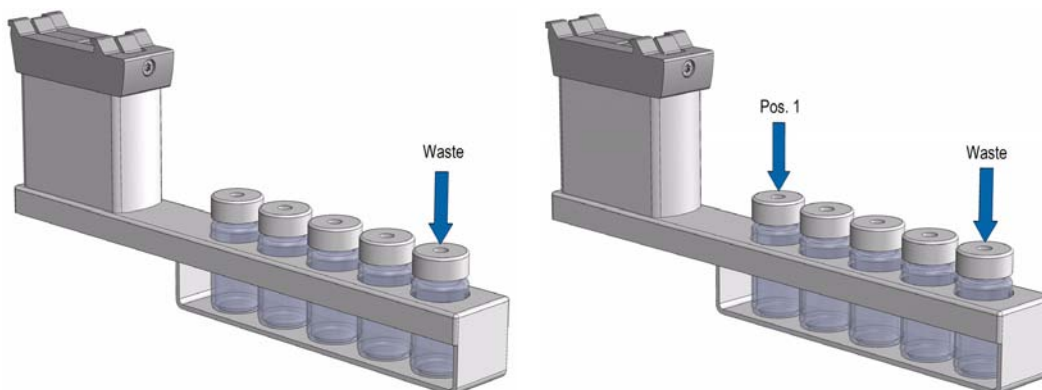
For the Standard Wash Station it is sufficient to teach position **# 5** only. As long as the station is mounted in square way, this approach is sufficient.
When in doubt, check each position individually. Select each position of the Standard Wash Station, position **#1** to position **#5**, and check the teach position. If a deviation is found, do the necessary fine-tuning.
The teaching process for the Standard Wash Station with an inserted Waste Line Adapter does not differ from the standard module. See Figure 83.

Figure 83. Teaching of Waste Positions with inserted Drainage Adapter
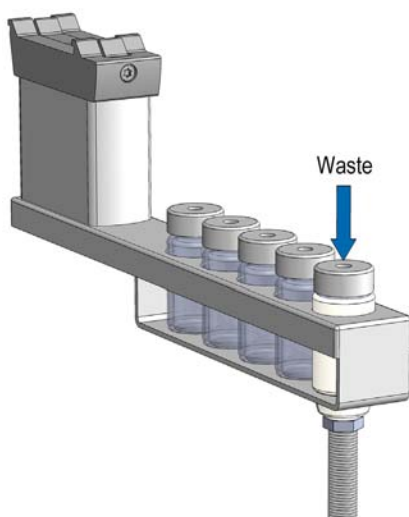
⚠ **WARNING** Observe safety measures if a waste line is installed in combination with a gas chromatograph. Do not place the waste line above a heated zone.

Teaching Large Volume Wash Station Position

The teaching position for the Large Volume Wash Station is the **Waste**.
The lower needle guide should be centered in these holes with the bottom of the Lower Needle Guide slightly touching the surface of the Station assembly.

For the Large Volume Wash Station it is sufficient to teach the position **Waste** only. As long as the module is mounted in square way, this approach is sufficient.

When in doubt, check each position individually. Select each position of the Large Volume Wash Station, position **#1** and position **#2**, and check the teach position. If a deviation is found, do the necessary fine-tuning.

Figure 84. Teaching Position for Large Volume Wash Station and Fine-tuning.
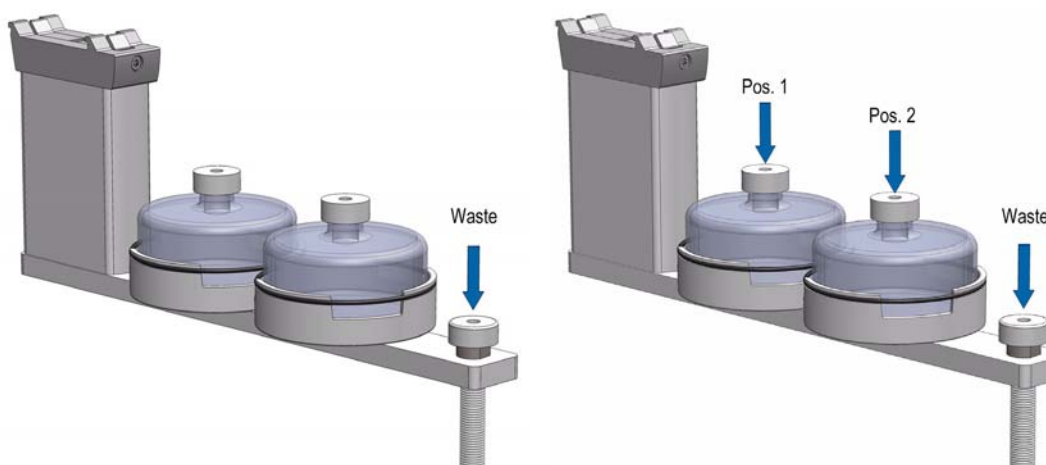
WARNING Observe safety measures if a waste line is installed in combination with a gas chromatograph. Do not position the waste line above a heated zone.

Teaching Solvents Station Position

The teaching position for the Solvents Station is the **third position**.

The lower needle guide should be centered in these holes with the bottom of the Lower Needle Guide slightly touching the surface of the reservoir bottle cap.

For the Solvent Station it is sufficient to teach position **#3** only. As long as the module is mounted in square way, this approach is sufficient.

When in doubt, check each position individually. Select each position of the Solvents Station, position **#1** and position **#2**, and check the teach position. If a deviation is found, do the necessary fine-tuning.

Figure 85. Teach Points for Three Solvent Reservoir and Position 1 to 3
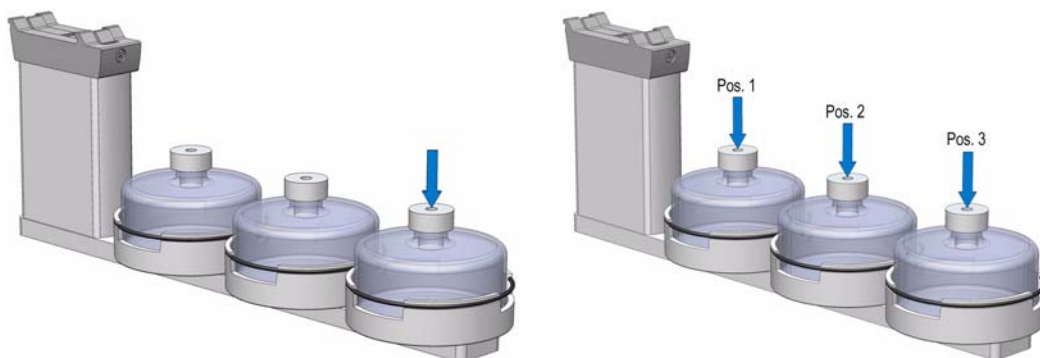
Teaching Fast Wash Station Position

The teach position of a Fast Wash Station is the **lunette** at the front of the module. See Figure 86.

Figure 86. Teach Points for Fast Wash Station
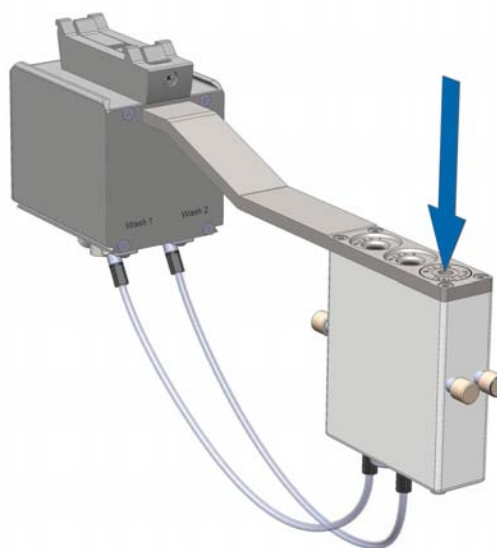
❖ **To define the position of the fast wash station**

1. Select the access **Extended User Level**.

2. From the **Options** pull-up menu, select the item **Setup | Modules | Wash Stations | Fast Wash**.

3. If required by the application, attach the magnetic vial transport ring to the lower needle guide.

4. Define the X-, Y-, and Z- positions common to all objects. The teach position is located at the front of the upper drawer. The lower needle guide should be centered in the Lunette.

Teaching Tray Holder Position

The teach position of a Tray Holder is the **lunette** at the front of the module. See Figure 87.

The Lower Needle Guide should be centered in the inner ring with the bottom of the Lower Needle Guide slightly touching the surface.

If the Magnet Adapter Ring is installed, the magnet ring should match with the outer ring of the lunette.

Figure 87. Teach Position for Tray Holder
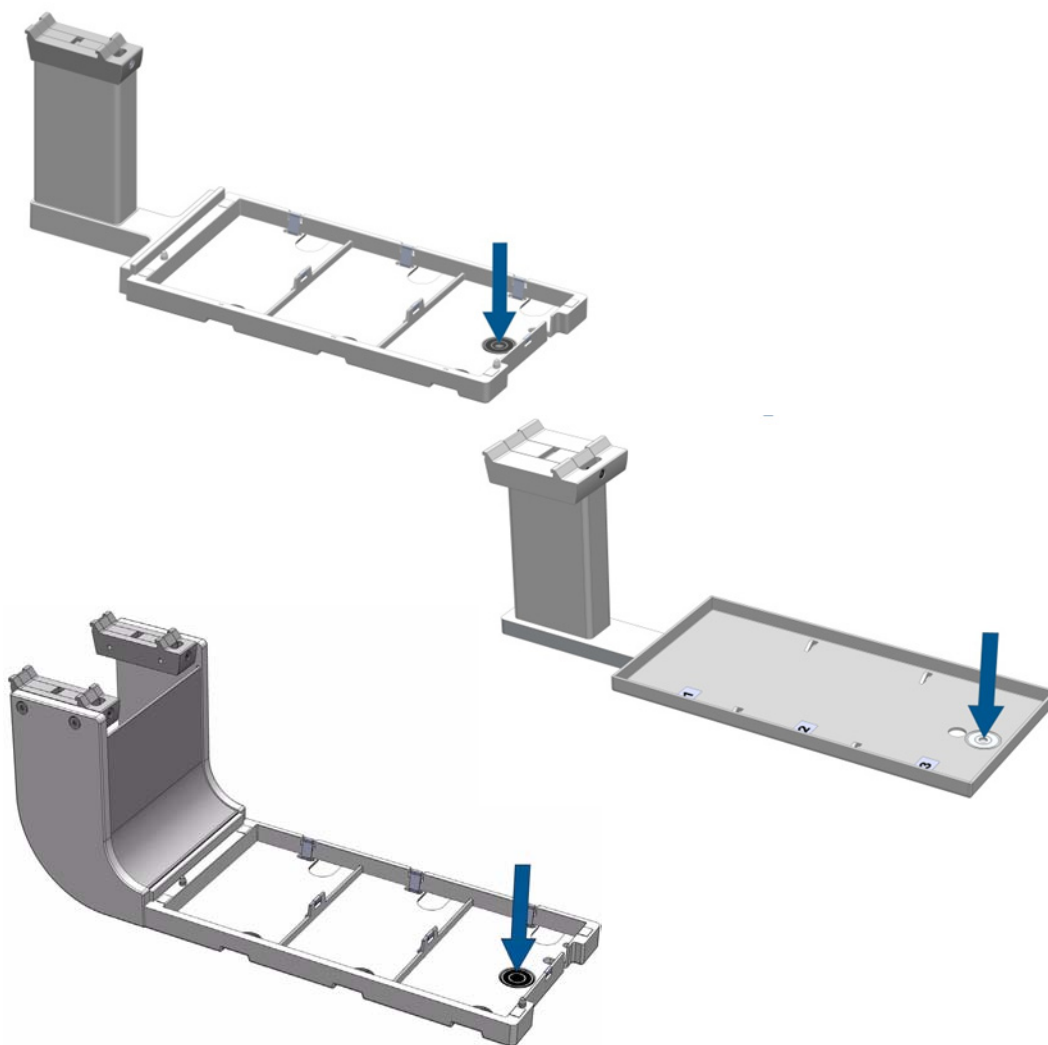
Teaching GC Injector Position

For certain GC models, centering rings are provided with the GC mounting kit.

If a centering ring is available, it should not only be used for teaching the injector position, but also for routine work. The ring stabilizes the needle guide of the TriPlus RSH Head at the moment of needle penetration. It acts as a guide tool and prevents needle bending.

For the GC Inj1 (GC Inj2), the teaching position is the appropriate GC Injection port. The lower needle guide should be centered on the port with the bottom of the lower needle guide lightly touching its surface.

Figure 88. GC Injector (GC Inj1) Teaching Point
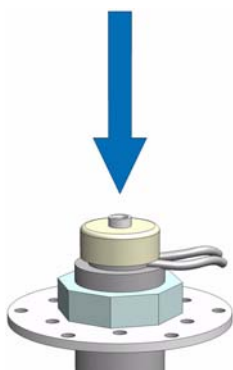
Teaching Agitator Position

The Agitator teaching position is located as indicated in Figure 89.

Figure 89. Teaching Position for Agitator
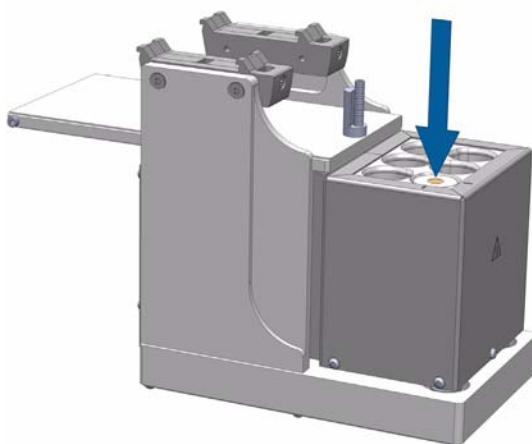
❖ **To define the position of the agitator**

1. Select the access **Extended User Level**.

2. From the **Options** pull-up menu select the item **Setup | Modules | Agitator & Vortexer**.

3. From the **Options** pull-up menu select the item **Teach Module**.

4. Open the white Agitator cover manually and block it open by using a screwdriver, fitting it into the side of the cover.

5. Insert a 20 mL vial in sample position #1.

6. Connect the large vial transport ring to the lower needle guide.

7. Define the X-, Y-, Z- positions common to all objects as described in the section "TriPlus RSH Tool Referencing and Calibration" on page 101.
   The teach position is located at the hole in the steel vial cap. The Lower Needle Guide should be centered on the vial cap and should touch the cap.

> **Note** Teach the position very carefully when using the Perforated Cover of the Agitator. Any deviation may cause needle or fiber breaking.

8. Remove the screwdriver and close the Agitator cover.

> **Note** It is recommended that you create a configuration backup before a module is added or shifted in the system.

Teaching Vortexer Position

The Vortexer teaching position is located as indicated in Figure 90 A.

Figure 90. Vortexer Teaching Position
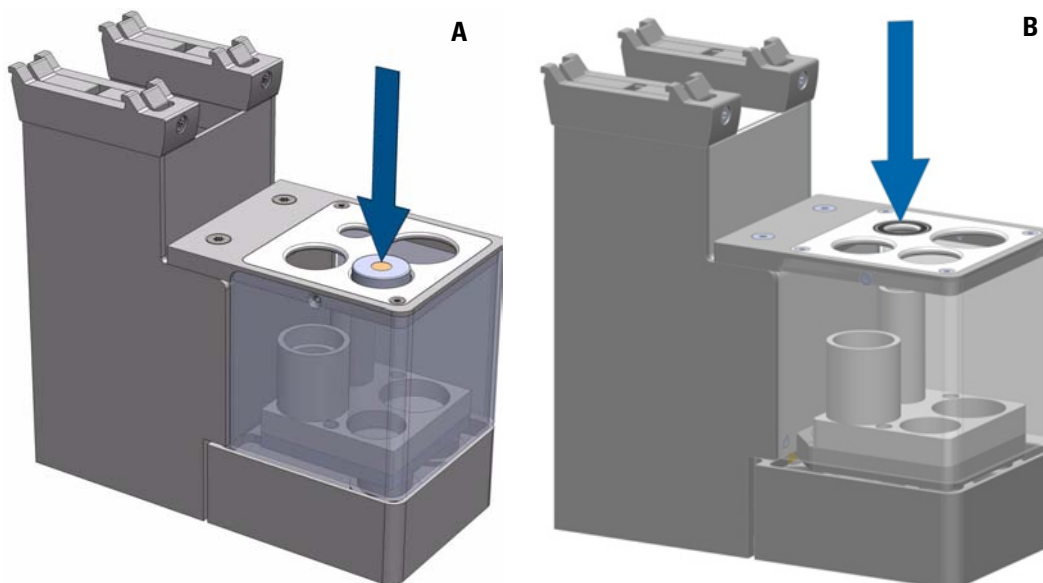
> **Note** Using the RSH Firmware version 1.4.0 or higher the teaching position for the Vortexer is defined at the rear position at right hand side as shown in Figure 90 B.

❖ **To define the position of the vortexer**

1. Select the access **Extended User Level**.

2. From the **Options** pull-up menu select the item **Setup | Modules | Agitator & Vortexer**.

3. From the **Options** pull-up menu select the item **Teach Module**.

4. Insert a vial with corresponding size in sample position as indicated according the used RSH Firmware version as described above.

5. Connect the large vial transport ring to the lower needle guide.

6. Define the X-, Y-, Z- positions common to all objects as described in the section "TriPlus RSH Tool Referencing and Calibration" on page 101.
The teach position is located at the hole in the steel vial cap. The Lower Needle Guide should be centered on the vial cap and should touch the cap.

Note It is recommended that you create a configuration backup before a module is added or shifted in the system.

Teaching MHE Station Position

The teach position of a MHE Station is shown in Figure 91.

Figure 91. Teach Points for MHE Station
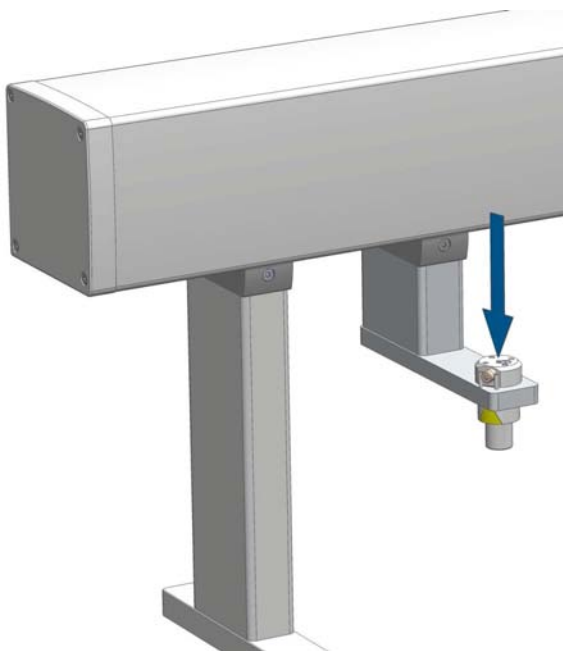
❖ **To define the position of the MHE station**

1. Select the access **Extended User Level**.

2. From the **Options** pull-up menu, select the item **Setup | Modules | Tool Adapter | MHE Station**.

3. When the head has been positioned on the Adapter, which is placed in the MHE Adapter Holder, the vent outlet should be placed in between the two pins.

4. Loosen the screw of the magnetic transport ring for aligning the magnetic transport ring to the magnets of the MHE Adapter.

5. Define the X-, Y-, and Z- positions common to all objects.
The teach position is located at the front of the upper drawer.
The lower needle guide should be centered in the Lunette.

Teaching SPME Conditioning Station Position

The SPME Conditioning Station teaching position is located as indicated in Figure 92.

Figure 92. Teaching Position for SPME Conditioning Station
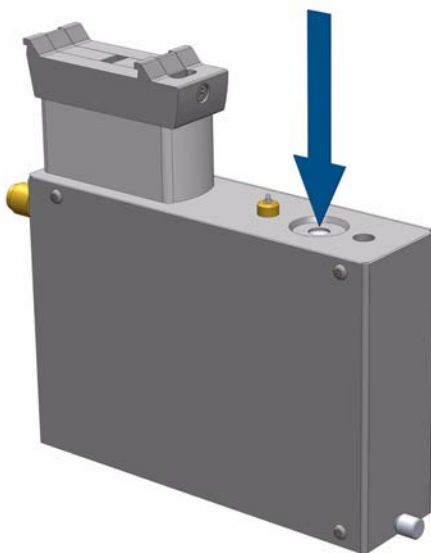
❖ **To define the position of the SPME conditioning station**

1. Select the access **Extended User Level**.

2. From the **Options** pull-up menu select the item **Setup | Modules | SPME Conditioning Station**.

3. Select SPME Conditioning Station.

4. From the **Options** pull-up menu select the item **Teach Module**.

5. Connect the large vial transport ring to the lower needle guide.

6. Define the X-, Y-, Z- positions common to all objects as described in the section "TriPlus RSH Tool Referencing and Calibration" on page 101.
The teach position is located at the larger hole (back position) on top of the module.
The Lower Needle Guide should be centered in the hole.
Make sure that the SPME Adapter attached to the Stack Drawer Magnet presses the spring loaded valve completely down.

Note It is recommended that you create a configuration backup before a module is added or shifted in the system.

Teaching a Barcode Reader Position

The Barcode Reader teaching position is located as indicated in Figure 93.

Figure 93. Teaching Position for Barcode Reader
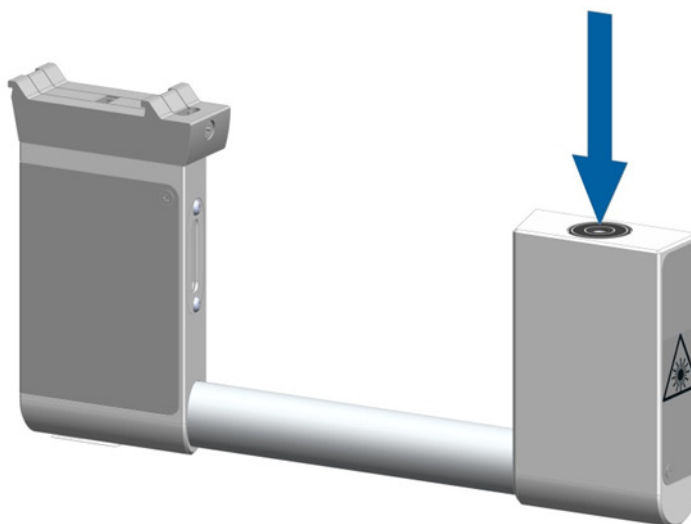
❖ **To define the position of the barcode reader**

1. Select the access **Extended User Level**.

2. From the **Options** pull-up menu select the item **Setup | Modules | Barcode Reader**.

3. Select Barcode Reader.

4. From the **Options** pull-up menu select the item **Teach Module**.

5. Define the X-, Y-, Z-positions common to all objects as described in the section "TriPlus RSH Tool Referencing and Calibration" on page 101.
The teach positions is located on top of the front module.
The Lower Needle Guide should be centered on the lunette.

Note It is recommended that you create a configuration backup before a module is added or shifted in the system.

Teaching Liquid Cooled Tray Holder Position

The Liquid Cooled Tray Holder teaching position is located as indicated in Figure 94.

Figure 94. Teaching Position for Liquid Cooled Tray Holder
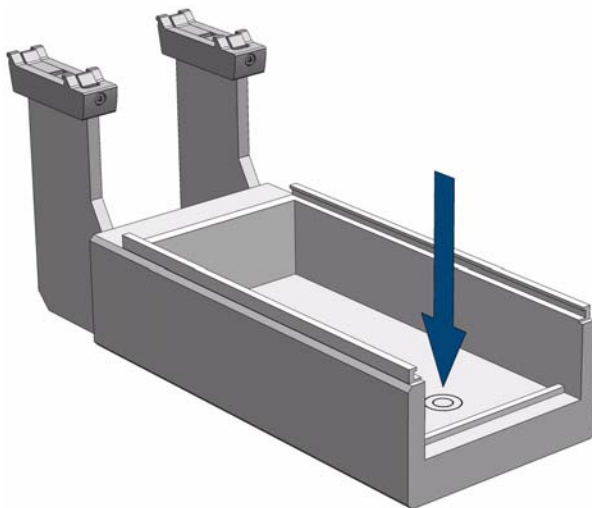
❖ **To define the position of the liquid cooled tray holder**

1. Select the access **Extended User Level**.

2. From the **Options** pull-up menu select the item **Setup | Modules | Tray Holders**.

3. Select **Liq Tray Holder**.

4. If required by the application, connect the large vial transport ring to the Lower Needle Guide.

5. From the **Options** pull-up menu select the item **Teach Module**.

6. Define the X-, Y-, Z- positions common to all objects as described in the section "TriPlus RSH Tool Referencing and Calibration" on page 101.
The teach position is located at the bottom of the module.
The Lower Needle Guide should be centered on the lunette.

> **Note** It is recommended that you create a configuration backup before a module is added or shifted in the system.

Teaching Temperature Controlled Drawer Position

The Temperature Controlled Drawer teaching position is located as indicated in Figure 94.

Figure 95. Teach Position for Temperature Controlled Drawer
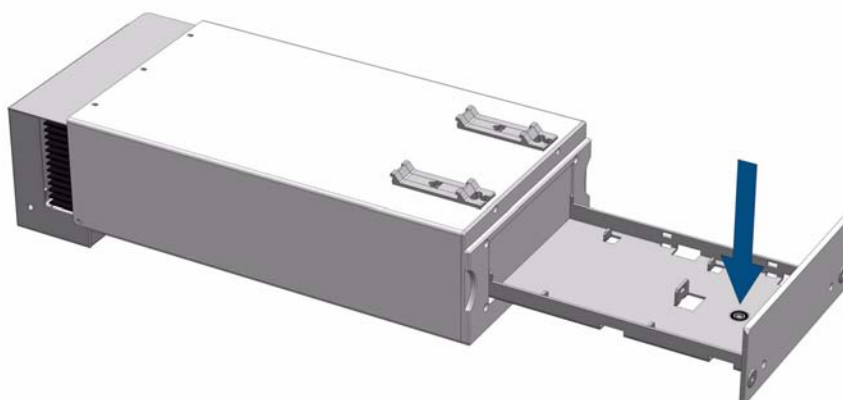
❖ **To define the position of the temperature controlled drawer**

1. Select the access level **Extended User**.

2. From the **Options** pull-up menu select the item **Setup | Modules | Sample Drawers**.

3. Select Sample Drawer.

4. If required by the application, connect the large vial transport ring to the Lower Needle Guide.

5. From the **Options** pull-up menu select the item **Teach Module**.

6. Define the X-, Y-, Z- positions common to all objects as described in the section "TriPlus RSH Tool Referencing and Calibration" on page 101.
   The teach position is located at the front of the drawer.
   The Lower Needle Guide should be centered on the lunette.

> **Note** It is recommended that you create a configuration backup before a module is added or shifted in the system.

TriPlus RSH Tool Referencing and Calibration

ATTENTION It is important removing the syringe from the Tool holder. See Chapter 5, "Maintenance," for details. This measure prevents any accidental syringe damage.

The only exception is the SPME Tool. The SPME Fiber Holder must be installed, but the fiber should be removed for protection and safe handling because the SPME Plunger is referenced at its topmost position. The RSH Firmware will trigger an error message if the SPME Plunger is not sensed.

Introduction

Only one TriPlus RSH Tool is used as a **Reference Tool** while all the other tools, used within the same TriPlus RSH, must be calibrated relative to the Reference Tool.

This process is necessary only if more than one TriPlus RSH Tool is used within the same system. It is advisable to follow this process when a tool is most often used more that the others (for example a LS Tool is most often used but sometimes a HS Tool or a SPME Tool is required for other applications).
If the **Reference** and **Calibration** process is done at the installation, the system will be prepared for a fast turnaround of various applications, as well as for automated tool changes within a cycle.

The TR Station or ATC Station must not change position, and only calibrated TriPlus RSH Tools should be used. If the Station in object has changed position, it is necessary to define the Reference Point again, and re-calibrate all the other TriPlus RSH Tools, and re-teach all the modules.

If the Reference Tool is accidently slightly damaged (for example, the lower needle guide assembly is slightly bent), but still functioning, it is possible to re-calibrate the Reference Tool, and the deviation in the original **Reference Point** is stored for further use.

For details refer to:

- "TriPlus RSH Tool Referencing" on page 102
- "TriPlus RSH Tool Calibration" on page 103

TriPlus RSH Tool Referencing

Follow the **Installation** for the referencing of the **reference tool**. Select the TriPlus RSH Tool which is most used, and define it as the **ideal tool**. This Tool is used for referencing, and the other Tools are calibrated relative to this tool.

❖ **To define the reference tool**

1. Select the **Options | Service | Installation** and choose the Wizard List Item **Set Reference Point**.
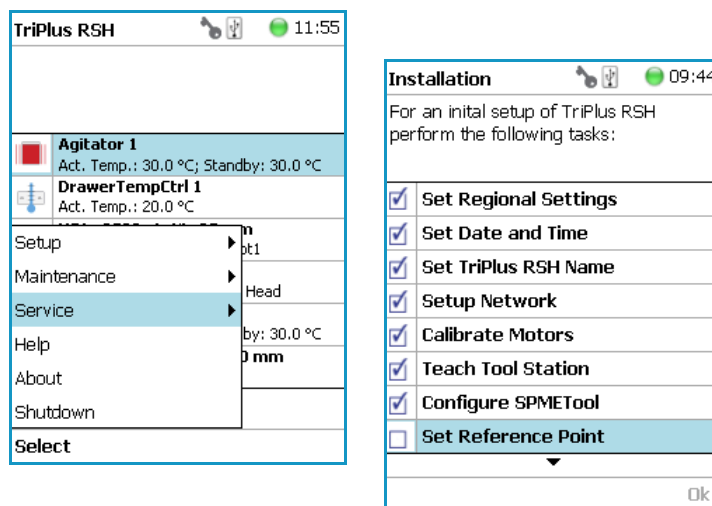
> **Note** Installing the system, you must follow the **Installation Wizard** step-by-step.

2. Activating this wizard section will turn off the current to the TriPlus RSH devices. You can manually move the TriPlus RSH Head to any position.

   The following message is displayed: **Move the TriPlus RSH Head to the teach point and press Save when finished.**

> **CAUTION** To move the TriPlus RSH Head in a controlled way to the teaching position, it is advisable to hold the Y-axis with one hand, and with your other hand hold the Tool body.
>
> Do NOT hold the Needle Guide to move the TriPlus RSH Head. This part is mechanically flexible and could lead to misalignment.

3. After pressing **Save** the operator has the choice to fine tune the teaching by pressing **Enter**. You can manually adjust the Y-, X-, and Z-axes.

4. Finishing the wizard by pressing **Ok** moves the TriPlus RSH Head automatically back to the **Home** Position.

TriPlus RSH Tool Calibration

Follow the Installation Wizard for the **Calibration** of the other used TriPlus RSH Tools.

> **Note** A TriPlus RSH Tool which has not been calibrated cannot be used within the system. When a new TriPlus RSH Tool is added to the system, its **Calibration** is mandatory.

❖ **To calibrate a tool**

1. Select the **Options | Service | Installation** and choose the Wizard List Item **Calibrate Tools**.
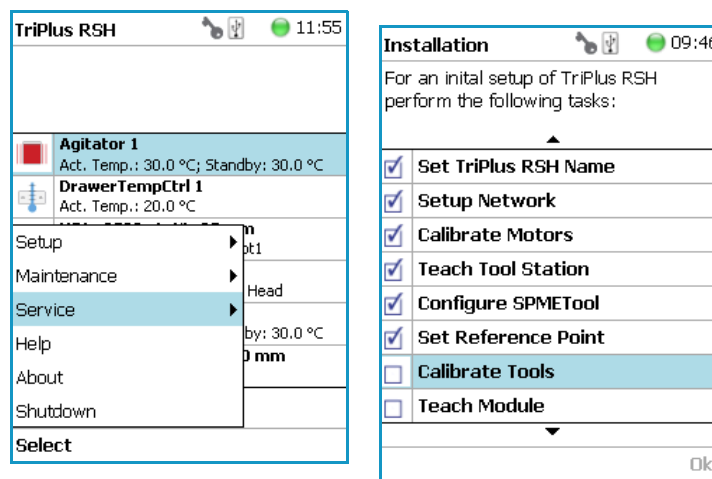
> **Note** At the moment of installing the system it is mandatory to follow the **Installation** step-by-step.

2. Activating this wizard section will turn off the current to the TriPlus RSH devices. You can manually move the TriPlus RSH Head to any position.
   The following message is displayed: **Move the TriPlus RSH Head to the teach point and press Save when finished.**

> **CAUTION** To move the TriPlus RSH Head in a controlled way to the teaching position, it is advisable to hold the Y-axis with one hand, and with your other hand hold the Tool body.
> Do NOT hold the Needle Guide to move the TriPlus RSH Head. This part is mechanically flexible and could lead to misalignment.

3. After pressing **Save** the operator has the choice to fine tune the teaching by pressing **Enter**. You can manually adjust the Y-, X-, and Z-axes.

4. Press **Change Tool**, the wizard moves the TriPlus RSH Head back to the original Slot, the tool is ejected, and the next TriPlus RSH Tool is picked up for calibration. Repeat the steps 3 and 4 for the third tool, if installed.

5. Finish by pressing **Ok**, the TriPlus RSH Head automatically moves back to the **Home** Position.

Modules Teaching Step-by-Step Procedure

Apply this procedure to define all the Teach Points for all the modules installed.
Make sure that the TR Station or ATC Station, the Tray Holder, Agitator, Wash Module, and any other module which is part of the configuration are properly mounted to the X-axis of the TriPlus RSH.

❖ **To teach a module**

The following description is an example of how to teach the X-, Y-, and Z-Positions for a Tray Holder. The procedure is the same for all the modules.

> ⚠️ **IMPORTANT** For the teaching of the X-, Y-, Z-Positions is it necessary to activate the **Extended User** Access Level.

To teach the positions several paths are available. At the moment of the installation the logical path to choose is **Options | Service | Installation**.

> **Note** Ensure all non-active modules are loaded prior to the installation, and they will be added to the teaching section automatically.

When the system is already setup and a position of a module is changed, you can select the path **Options | Setup | Modules**.

1. Switch On the TriPlus RSH. The sampler goes through the boot-up procedure and finally displays the TriPlus RSH Start Screen. See Figure 96.

Figure 96. Start Screen
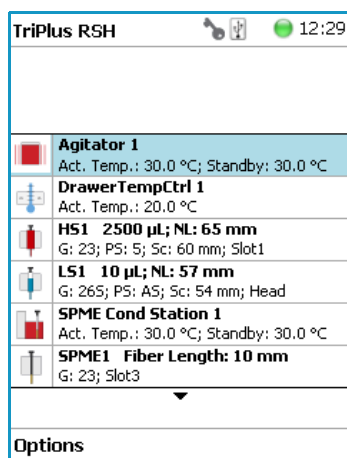
> **Note** If an error appears during the boot-up procedure, an envelope will appears in the Status Line indicating a **Pending Message**.
>
>
>
> Envelop
>
> Find the source of the problem verifying all the connections. After the corrective measures, restart the system.
>
> For detail, see the Chapter 6, "Troubleshooting," and refer to the section **Starting the TriPlus RSH** in the *TriPlus RSH User Guide*.
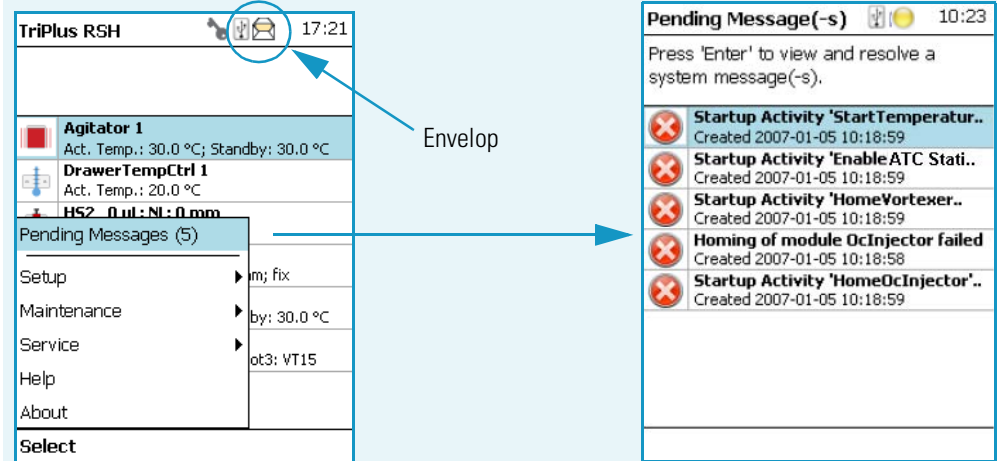
2. From the **Options** pull-up menu, select the Item menu **Service**, and the list item **Installation**.
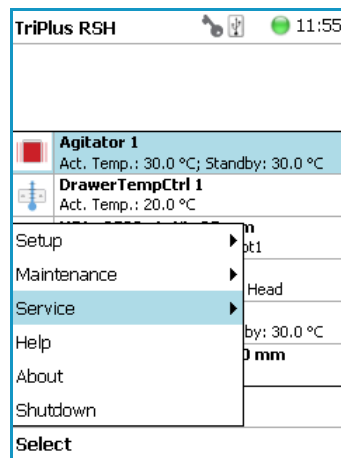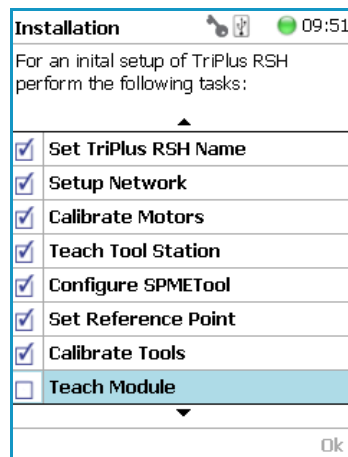
> **Note** When installing the system it is mandatory following the **Installation** wizard step-by-step.

3. Follow the **Installation** wizard step-by-step until the point **Teach Module** appears. Activating this wizard section will turn off the current to the TriPlus RSH devices. You may now move the TriPlus RSH manually to any position.

The following message is displayed: **Move the TriPlus RSH Head to the teach point and press Save when finished**.

An illustration of the module with an arrow indicating the teach position appears on the display; it does helps you to understand the step.

CAUTION To move the TriPlus RSH Head in a controlled way to the teaching position, it is advisable to hold the Y-axis with one hand and with your other hand hold the Tool body.
Do NOT hold the Needle Guide moving the TriPlus RSH Head. This part is mechanically flexible and could lead to misalignment.

4. After pressing **Save**, fine tune the teaching by pressing **Enter** button. Perform the manual adjustment of the Y-, X-, and Z-axes.

5. When the teaching of the X-, Y-, Z-Positions is completed, press **Next**. The wizard moves automatically to the next module.

6. Repeat the steps 4 to 6 for each module listed in the configuration of the system.

7. After teaching the position of the individual module it is not necessary to request a Check Position. Verify each position at the moment of the set up for avoiding the risk of losing a step during the teaching process.

   The new control concept of the TriPlus RSH with its Servo Drives provides the added security of knowing each position at any time. Therefore, checking the teaching position is no longer necessary.

   This saves time for the operator. However, the check can be requested by activating Check Teaching modules.

8. After finishing the teaching of all active and passive modules, you can verify all positions by calling up the wizard step **Check Teaching Modules**.

Installation	🔑 📶	🟢 09:58

For an inital setup of TriPlus RSH
perform the following tasks:

▲

☑	Setup Network
☑	Calibrate Motors
☑	Teach Tool Station
☑	Configure SPMETool
☑	Set Reference Point
☑	Calibrate Tools
☑	Teach Module
☐	Check Teaching Modules

▼

Ok

TriPlus RSH Firmware

This chapter provides instructions for creating, copying, and restoring backup files, and for upgrading and downgrading the RSH Firmware.

Contents

- The RSH Firmware
- Create Diagnostic Backup File
- Create Configuration Backup File
- Restore Backup File
- Update and Downgrade Functions
- Update the RSH Firmware
- Downgrade the RSH Firmware

⚠️ **WARNING** All the operations described in this chapter must be carried out only by authorized and trained Thermo Fisher Scientific technical personnel,

The RSH Firmware

This section introduces the RSH Firmware and its structure.

> **Note** Starting with the software version 2.0 the software has been renamed from
> **Control Software** to **RSH Firmware**.
> Please note that this term is valid for the entire software package, file extension *.**cont**.
> The **Device Firmware**, which is part of the entire package, will be named specifically
> **Device Firmware** to avoid any misunderstanding.

> **WARNING** During any of the operations described in this section, it is mandatory that
> the TriPlus RSH is connected to the power supply. If the power supply is interrupted
> during a process, the booting commands may become corrupted and the TriPlus RSH can
> no longer be started. In such a case the control board must be returned in the factory in
> order for the boot loader to be reconfigured.

Introduction

The RSH Firmware is the product name for all the software and the persisted data located on
the control or on the devices. It consists mainly of:

- **Operating System (OS)**

- **Application Software**

- **Configuration** — Persisted data

- **Device Firmware** — Firmware of all active modules which are part of the specific TriPlus
  RSH configuration

- **Presets** — The presets define a model configuration such as liquid injection or liquid and
  headspace injection technique, and so on.

  > **Note** The file extension for the RSH Firmware is *.**cont**

Two different backup types are available: **Configuration Backup**, and **Diagnostic Backup**.
The configuration backup can be used to restore the RSH Firmware. Therefore, both backup
file types can be used to restore the RSH Firmware.

It is important to differentiate between **Restore** and **Update**:

- The **Restore** file originated from the configuration backup with the extension *.**pack**.

- The **Update** file is provided by Thermo Fisher Scientific for software updating. An
  Update package always contains the Operating System (OS), the Device Firmware, the
  Application Software, and the Presets.

  The Update file is again an encapsulated archive file with the file extension *.**cont**.
  The Update file has to be included in a directory named **Autorun**.

IMPORTANT You must spell **Autorun** correctly. Only one file with the extension *****.cont** can be stored in the directory Autorun.

The directory **Autorun** must be loaded onto the USB Stick. Inserting the USB Stick into the control board when the system is powered off, followed by turning on the power, the process of loading the *****.cont** file to the flash memory starts.

The Operating System (OS) software package must be installed for any process. The OS is part of the RSH Firmware package, included in a *****.cont** file only.

The installation of the software packages depends on the function **Update** or **Downgrade**.

RSH Firmware Filename Structure

The structure of the filename is:

OEM/VAR Name - Product Name - Product Version - Software Version - TFS ChangeSetID.cont

Examples: **TMO-TriPlus RSH-1.4.1-1.4.12071.1101.7662.cont**

The RSH Firmware file name is clearly structured and contains the following informations:

- **Product Name** — Product name of the TriPlus RSH System.

- **Product Version** — Identifies the software. The Product Version is an alphanumerical code, which can contain an add-on such as Beta. A released version is always numerical, without add-on.

- **Software Version** — Contains always the first two numbers of the release version; the timestamp when the software was created is automatically added.

- **TFS Change Set-ID** — This identification is related to the software source code. The ID is important for the software developer only.

- *****.cont** — Extension for the RSH Firmware (mandatory).

The Rules are:

- The individual parts of the file name are separated by the minus symbol (-).
  As a consequence, this symbol is not allowed within the actual parts of the file name.

- The following characters are forbidden: **\ / : * ? " < > | |**
  However, the space character is allowed.

Overview of the Backup and Restore Function

The **Backup** and **Restore** functions are available through the handheld controller menu.

It is important to understand the difference between **Restore** and **Update**:

- The term **Update** is solely used for a file provided by Thermo Fisher Scientific to upgrade or update the RSH Firmware version.

  The file extension for **Update/Downgrade** file is *.**cont**.

  The file extension for **Restore** file is *.**pack**.

  The difference between **Restore** and **Update** functions is the following:

  – The **Restore** process always originates from a known backup file from the same TriPlus RSH, which means that the Application Software and the key encryption will match, and the Configuration of the TriPlus RSH is known.

  – The **Update** process is not carried out through the handheld controller menu dialog.

- The option **Backup** creates a backup file of the TriPlus RSH in its current status. This backup file is stored on the SD card, installed on the control board.

Backup of the RSH Firmware

Two different types of backup files are provided:

- **Configuration Backup** — Used for a **Restore** procedure. See also the chapter **Maintenance Menu Items** in the *TriPlus RSH User Manual*, and "Create Configuration Backup File" on page 115.

- **Diagnostic Backup** — Supports and troubleshoots a TriPlus RSH system. For this purpose you must send the file by e-mail to the Thermo Fisher Scientific technical support center: gc.gcms.customersupport@thermofisher.com, with the file description, and providing as well the RSH Firmware version used.
  The Diagnostic Backup file can also be used for a **Restore** procedure.

The differences of the two backup files are summarized in Table 14:

Table 14. Backup Files Differences (Sheet 1 of 2)

Item	Configuration Backup	Diagnostic Backup
RSH Firmware packages included in Backup file		
Operating system (OS)	No	No
Application Software	No	Yes
Configuration (Persistent Data, Data Base)	Yes	Yes
Device Firmware	No	Yes
Presets	No	Yes

Table 14. Backup Files Differences (Sheet 2 of 2)

Item	Configuration Backup	Diagnostic Backup
File Details		
File Extension	*.pack	*.pack
File Size (approximately)	Up to 4 MB	Up to 24 MB
Time required to save Backup File	Up to 5 min.	Up to 15 min.
Availability in Access Level	• User • Extended User • Service	• --- • Extended User • Service
Purpose of use	Restore	(Restore) Diagnostics Troubleshooting

CAUTION This operation for the content of the Backup file is valid for RSH Firmware versions 1.3.1/1.3.2, and 1.4.0, or higher. With the RSH Firmware Version 1.3.0, the Operating Software (OS) and the Application Software have been stored additionally.

CAUTION During any of the next operations, the TriPlus RSH must be connected to the power supply.
CAUTION If the power supply is interrupted during a process, the booting commands might become corrupted, then the system cannot longer be started. In this case return the control board to the factory, in order for re-configuring the boot loader.

Create Diagnostic Backup File

This option creates a diagnostic backup file of the TriPlus RSH in its current status. The configuration backup is stored on the SD card installed on the control board.

ATTENTION 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. See "Copy a Diagnostic Backup File" on page 114.

❖ **To create a Diagnostic Backup file**

1. Select Access Level **Extended User**.

2. Select from the **Options** pull-up menu the list item **Maintenance**.

3. Select the item **Create Diagnostic Backup**.
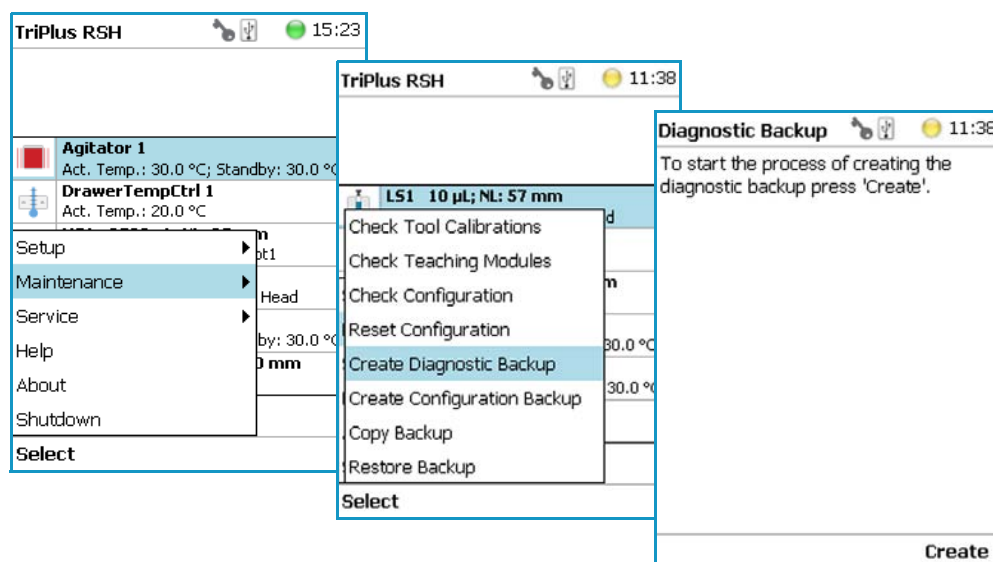
4. Press **Create** to start the process, the blue LED blinks signaling the execution mode.

5. This process takes several minutes.

6. At the end of the process the message **backup has been created successfully** appears.

Copy a Diagnostic Backup File

It is good practice to store the backup file in a safe place, if possible on a net worked-server. We recommend keep an authorized configuration backup outside of the premises.

❖ **To copy a diagnostic backup file from the SD card to the USB stick**

1. Insert the **USB Stick** into the connector **USB Host**.

2. Select the item **Copy Backup**, and follow the dialog.
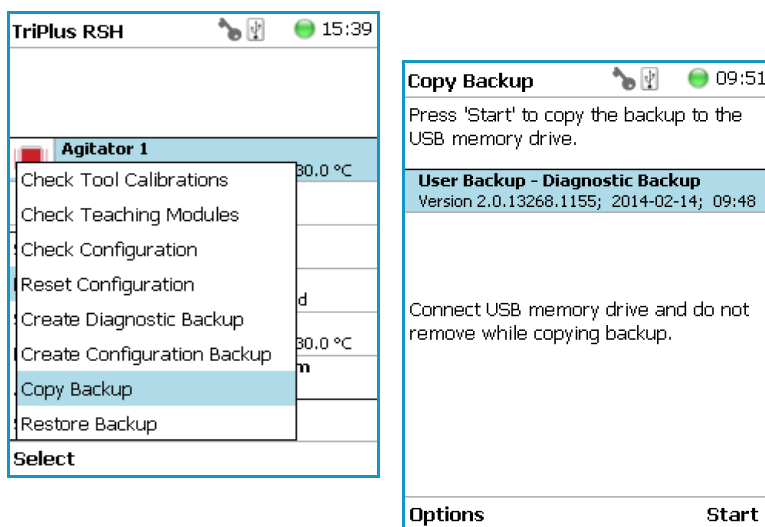
3. Press **Start** to copy the file to the USB memory devise.

4. At the end of the process the message **backup has been created successfully** appears.

5. Remove the USB Stick.

The backup file has the following name convention:
Diagnosticbackup_Date_Time_Number.pack

The system creates a directory on the USB Stick, named **Backup**. The configuration backup is stored as a single archive file with the extension **.pack*.

Backup		▾ ↔	*Search Backup*
folder			▤ ▾
Name	Date modified	Type	Size
🗎 DiagnosticsBackup_20140214_0948_000.pack	14.02.2014 09:49	PACK File	22'955 KB
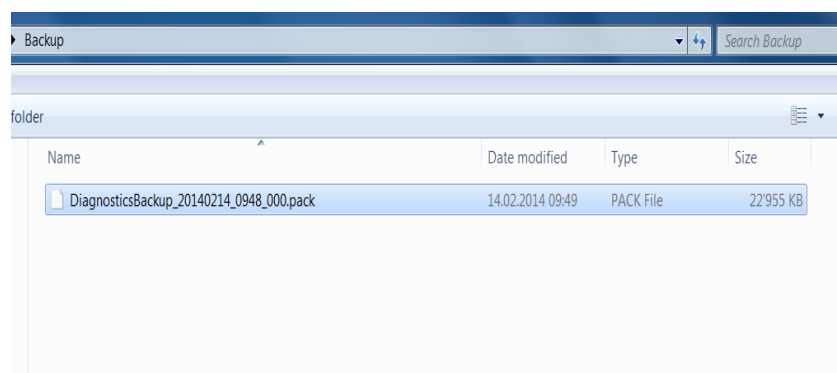
Create Configuration Backup File

This option creates a configuration backup file of the TriPlus RSH in its current status. The configuration backup is stored on the SD card installed on the control board.

> ⚠ **IMPORTANT** 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. See the section "Copy a Configuration Backup File" on page 116.

❖ **To create a configuration backup file**

1. Select from the **Options** pull-up menu the list item **Maintenance**.

2. Select the item **Create Configuration Backup**.
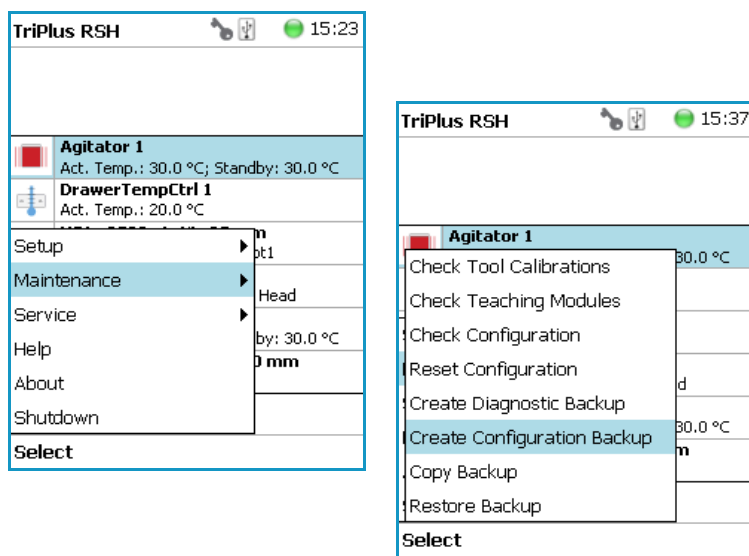
3. Enter a comment to help identify this configuration backup, if you want.

   a. Press **Enter** to open the alphanumeric selection of characters.
   The pull-up menu **Options** provides the possibilities to **Insert** or **Delete** a character
   or **Clear a Text**.

4. Press **Start** to begin the process; the **blue** LED blinks, signaling the execution mode.
   This process takes several minutes.

5. At the end of the process the message **backup has been created successfully** appears.

Copy a Configuration Backup File

It is good practice to store the backup file in a safe place, if possible on a net worked-server.
We recommend keep an authorized configuration backup outside of the premises.

❖ **To copy a configuration backup from the SD card to the USB stick**

1. Insert the **USB Stick** into the connector **USB Host**.

2. Select the item **Copy Backup**, and follow the dialog.
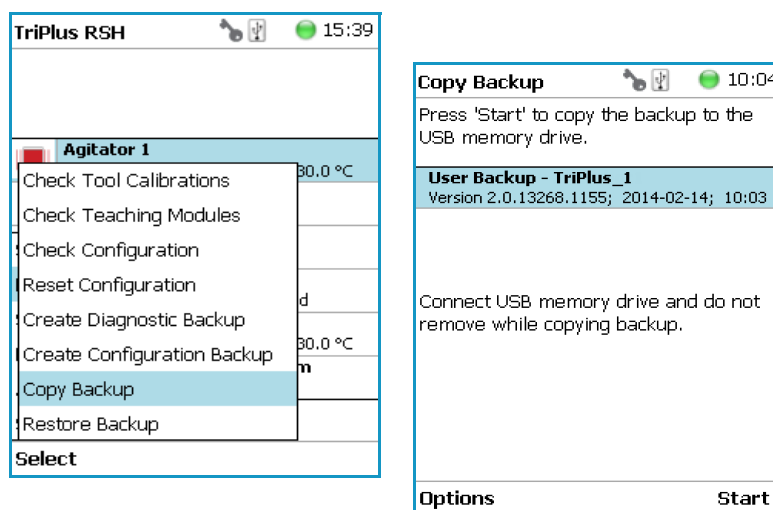
3. Press **Start** to copy the file to the USB memory devise.

4. At the end of the process the message **backup has been created successfully** appears.

5. Remove the USB Stick.

The backup file has the following name convention:
ConfigurationBackup_Date_Time_Number.pack

The system creates a directory on the USB Stick, named **Backup**. The configuration backup is stored as a single archive file with the extension *** .pack**.
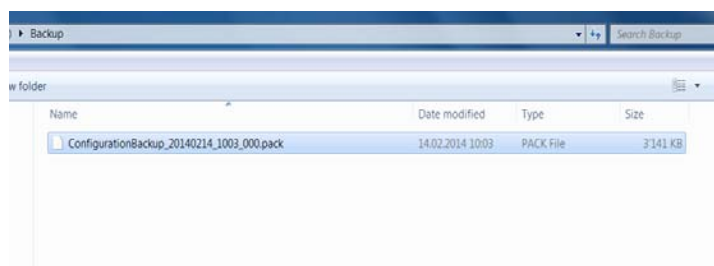
Restore Backup File

The function **Restore** loads a **Backup** file saved from the same TriPlus RSH 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 have to match.

> ⚠️ **CAUTION** The following **Restore Backup File** process is a general description. Please read through these points first before starting the process. Be aware that an older backup file may contain a Configuration which is no longer compatible.
> See also the section Update and Downgrade Functions.

❖ **To restore a backup file:**

Restore function is only available in the **Extended User Level**.

1. Select from the **Options** pull-up menu the list item **Maintenance**.

2. Select the menu item **Restore** to load a backup to the system.
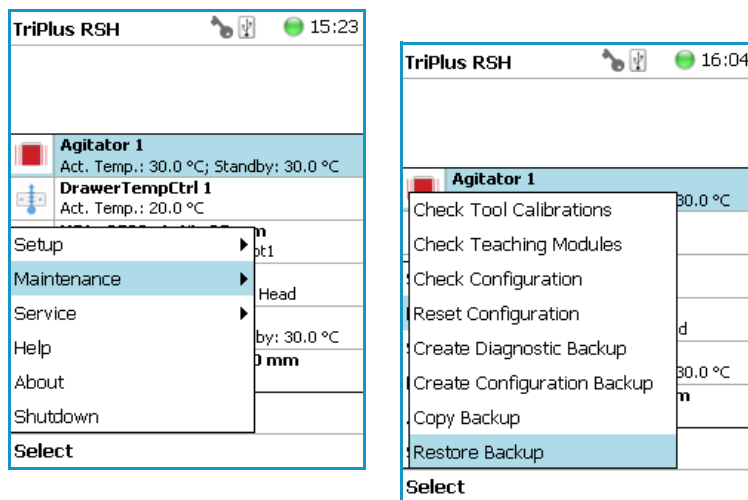
3. Press **Restore Backup** to start the process; the following steps are automatically carried out:

> ⚠️ **ATTENTION** The backup file has to be placed in the folder **Autorun**. You must spell **Autorun** correctly. The system software searches only for files embedded in the folder.

a. The dialog window shows all available backup files which are stored either on the SD card, or on the USB Stick.

> **Note** The file can be located on the SD card or on the USB Stick. The file named **User Backup – TriPlus RSH1** is the file stored on the SD card.
>
> The other files named **Copied Backup File** are the files which have been copied from the TriPlus RSH (SD card) to the USB. The system will search for the available files.

b. Select the required backup file, and press **Restore**. to start the process. The file named **Copied Backup** is the file that has been copied from the TriPlus RSH (SD card) to the USB device.

c. When finished, a pop-up window appears with the message: **In order to complete the restore, TriPlus RSH must be restarted. Restart now? Yes/No**. Select **Yes** to restart the system.

> **WARNING** The two points mentioned are important:
>
> - **Remove first the USB Stick** — The process of updating/downgrading would be started automatically if the USB drive would remain connected to the TriPlus RSH, and a software file for update/downgrade (***.cont** file) would be detected after rebooting the TriPlus RSH system.
>
> - **TriPlus RSH must be restarted** — When selected, does the power down and the software will be rebooted automatically. It is not necessary to turn off the main power switch at the power supply. The new software configuration will be activated after the next restart of the TriPlus RSH.

4. After a system restart, check under **About to verify** that the software version has been loaded and activated.

5. Create a User Backup file after successfully restoring the software, calibrating the motors, and teaching of the X-,Y-,Z-axes.

Special Cases and Error Message

TriPlus RSH generates a **Backup** file from the current configuration, and stores this file on the SD card. The file is named **Before Installation**. This file is a security backup to give you the choice to reload the previous configuration.
This automated saving of the current system configuration is obsolete beginning with RSH Firmware version 1.3.1/1.3.2. When an upgrade from software version 1.3.0 to a higher level is made, in this case is the file **Before Installation** generated the very last time.

At the start of the Restore process the **compatibility of the selected Restore file** is checked against the Application and the installed key of the TriPlus RSH. If an incompatibility is detected, the process of restoring is aborted, and the error message is displayed.

> **CAUTION** Be aware that an older backup file may contain a software version which is no longer compatible with the installed device firmware of an active module.

After Completion of the Restore Process

When the correct file is re-loaded to the corresponding TriPlus RSH system, it is not necessary to run the **Installation Wizard** again. However, it is recommended to **Check Configuration** if a Pending Message or a Service Issue signals any inconsistency. Access level **Extended User** is required.
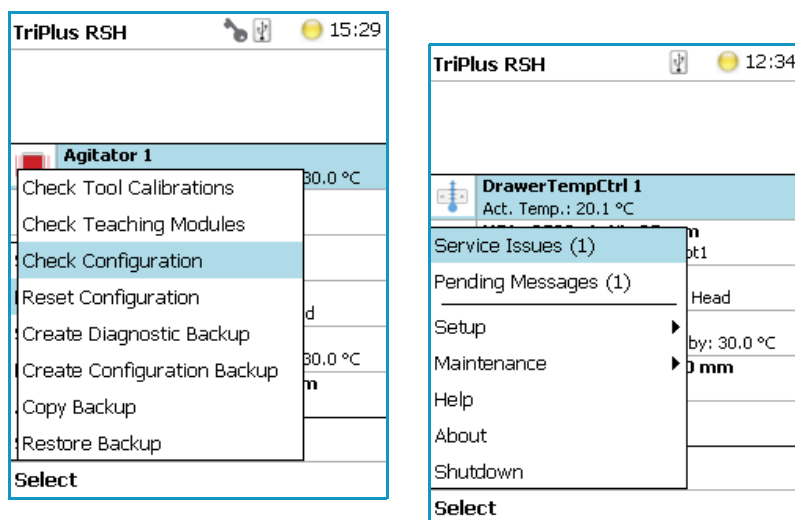
Update and Downgrade Functions

The term **Update** is solely used for a file provided by Thermo Fisher Scientific to upgrade or update the RSH Firmware version.

The difference between the **Restore** and **Update** functions is that the **Restore** process always originates from a known backup file from the same TriPlus RSH. This means that the Configuration Software and the key encryption will match.

The **Update** function is defined as a process to upgrade the entire RSH Firmware, or parts of it.
To correctly upgrade the software, you must have a fully compatible software package. Fully compatible means that the device firmware matches the Application and the Operating System (OS).

Thermo Fisher Scientific provides one file with the extension ***.cont**. Different software packages (***.pack**) can be integrated, these individual packages are matched for compatibility.

Table 15 illustrates the possible paths for Update/Downgrade the RSH Firmware:

Table 15. Update/Downgrade Path (Sheet 1 of 2)

Software Version Start Situation	Software Version to go for	Compatibility
1.4.1	1.5.0	Update Possible
1.5.0	1.4.1	Downgrade possible
1.4.1 | 1.5.0	2.0.0	Update possible
2.0.0	1.4.1 | 1.5.0	Downgrade possible
1.4.1 | 1.5.0	2.1.1	Upgrade possible

Table 15. Update/Downgrade Path (Sheet 2 of 2)

Software Version Start Situation	Software Version to go for	Compatibility
2.1.1	1.4.1 | 1.5.0	Downgrade possible
2.0.0	2.1.1	Upgrade possible
2.1.1	2.0.0	Downgrade possible
2.1.1	2.2.X	Upgrade possible
2.2.X	2.1.1 | 2.0.0	Downgrade possible

> **Note** Older firmware versions:
>
> The older software versions are not considered in Table 15.
> The first released Software version for the TriPlus RSH system was 1.3.0. It is important to understand the special case of a tool in use with a lower Device Firmware version.
> In order to downgrade a TriPlus RSH system the compatibility of the existing device Firmware with the Firmware version must be considered. The conclusion is that an update from software version 1.3.0 to a higher version is possible, but for downgrading the lowest possible software version that can be reached is the version 1.3.2 (recommended).

You can upgrade from software version 1.3.0 to a higher version. Thermo Fisher Scientific does not recommend downgrading software version lower than 1.3.2.

For details about updating and downgrading the RSH Firmware see the following sections:

Update the RSH Firmware

The prerequisites for a successful **Update** process are the follows:

- Check the required update path is possible according to the Table 15 on page 120.

- Confirm that the Configuration or Diagnostic Backup File from the current software version is available. This is a safety measure to maintain the possibility of returning back to the original state. The backup file should be stored on the USB Stick (not in the directory Autorun), or on any other safe drive outside of the TriPlus RSH.

- Use a RSH Firmware package as provided by Thermo Fisher Scientific.
  Important: The must be a file with the extension *.cont.

- The RSH Firmware package has to match with the key.

- If the software file is not already included in the directory **Autorun**, create the directory Autorun, and load the file *.cont into it. You must spell **Autorun** correctly.

- Load this directory Autorun onto the USB Stick.

> **Note** Ensure that only one *.**cont** file is placed in the folder Autorun.
> The text file **force.txt** is not required for an Update Process but it is essential for the
> Downgrade Process.

Updating Process

The **Update** process is not performed through the handheld controller menu dialog.

An Update package always contains the device Firmware, the Application Software, and the
Operating System (OS). A neutralized data bank for the Configuration is also included in the
package.

Beginning with RSH Firmware version 1.4.0, a software set of **Presets** is part of the *.**cont**
file. These presets contain the Input/Output Signals, the I/O Interface settings, and so on.

The Update file is an encapsulated archive file with the file extension *.**cont**.

❖ **To update the RSH Firmware**

1. If the software file is not already included in the directory Autorun, create the directory
   Autorun, and load the file *.**cont** into it.

   > **Note** Important: You must correctly spell **Autorun**.

2. Load the directory **Autorun** onto the USB Stick.

3. Turn off the power from the TriPlus RSH.

4. Insert the USB Stick in the USB connector from the control board, on the back of the
   TriPlus RSH.

5. Power up the TriPlus RSH.

6. Start the automated execution of the Update process:

   Loading such a file to the TriPlus RSH from the USB Stick will store the file in the flash
   memory, SDcard. Next, the various software files are installed in TriPlus RSH, and those
   provided by the new *.**cont** file compared. If a newer version is detected, the older version
   will be replaced.

7. After the Update process has been successfully completed, check the **Menu Item About**
   to confirm that the software version has been installed and activated.

   > **Note** The USB Symbol in the status bar of the screen indicates that a USB device is
   > connected.

8. Remove the USB Stick. This avoids another software installation after a reboot of the
   TriPlus RSH.

9. Select the **Maintenance** menu item, then **Reset Configuration**. Select the dedicated configuration for the TriPlus RSH.
   This task loads the **Presets** including the neutralized data base. This provides the software with a well-defined starting position. This menu item is available beginning with RSH Firmware version 1.4.0.

10. The Status Bar of the handheld controller (or virtual handheld controller), displays an envelope icon for Pending Messages, Service Issues, or both.

   The reason for this message is that in step the data base has been neutralized. This means that you must calibrate the TriPlus RSH, and teach all positions of the X-, Y-, and Z-axes.

   Select the access level **Extended User**. Follow the installation wizard using the path **Options | Service | Installation**.

11. After successful installation setup and testing of the TriPlus RSH, we recommend creating a **Configuration Backup** (last wizard item).

12. Copy the **Backup File** directly onto the USB Stick. Path: **Options | Maintenance | Copy Backup**.

   > This step is recommended because only one backup file is stored on the SD card. Creating another backup file will overwrite the first version.

   It is good practice to store the configuration backup in a safe place, if possible on a network-server. You should to keep an authorized configuration backup outside of your premises.

   To copy a configuration backup from the SD card, insert the USB Stick into the jack **USB Host**. **Type A** at the control, on the back of the TriPlus RSH. Select the process **Copy Backup** and follow the dialog.

   > **Note** It is mandatory that the used USB Stick that you use has one partition only. If you define two partitions, subsequent errors will occur. The access to the TriPlus RSH will be denied.

> **CAUTION** The RSH Firmware **Update** package (*.**cont** file) has to be compatible with the key installed. When a mismatch is found, the update routine will either stall or the TriPlus RSH will power up without going through the upgrade. Always check under About to verify that the software version has been installed.

Downgrade the RSH Firmware

It is possible to safely downgrade the RSH Firmware when considering the following points. Downgrading from a specific software version to a lower one has to be thought through carefully.

The prerequisites for a successful **Downgrade** process are the follows:

- Check according to Table 15 on page 120 if the required downgrading path is possible.

- Confirm that the Configuration or Diagnostic Backup File from the current software version is available.
  This is a safety measure to maintain the possibility of returning back to original state. The backup file should be stored on the USB Stick (not in the directory Autorun), or on any other safe drive outside of the TriPlus RSH.

- Confirm that the Backup File from this particular TriPlus RSH System lower level software version is available.

- Confirm that the Backup File matches the key and whether it is a Thermo Fisher Scientific key or OEM specific key.

- Use a RSH Firmware package as provided by Thermo Fisher Scientific.
  Important: The file must be a file with the extension *.cont**.

- The RSH Firmware package has to match with the key.

- If the software file is not already included in the directory **Autorun**, create the directory Autorun, and load the file *.cont** into it. You must spell **Autorun** correctly.

- Load this directory Autorun onto the USB Stick.

Downgrading Process

Note The **Downgrade** process is not carried out through the handheld controller menu dialog.

WARNING **Downgrading using a Backup or a Restore Backup File**
It is not possible and strictly prohibited by the software to perform a **Downgrade** through the use of a **Backup** or a **Restore Backup** file created from a previous version of the TriPlus RSH. If a downgrade is necessary, it has to be performed step-by-step following the appropriate procedure:
- **Step1**: Downgrade first by using an original file **RSH Firmware** package with the extension *.cont**.
- **Step2**: Use a **Backup** or a **Restore Backup** file of the TriPlus RSH, previously made using the same software version as the downgrade.

A Restore Process is not possible if the key is not identical or has been switched.

WARNING Starting with RSH Firmware version 2.0.0, the **Needle Guide Type NonMagn2mL** is available. Pay attention when downgrading the RSH Firmware because a firmware version lower than 2.0.0 does recognize the new Needle Guide Type. The tool using the type **NonMagn2mL** will not be active after the downgrade. To overcome this possible problem, before starting the downgrading process it is mandatory to change the Needle Guide Type to a type which is known by the lower firmware version.

Use the file with the required software version as provided by Thermo Fisher Scientific, and follow the following step:

❖ **To downgrade the RSH Firmware**

1. If the software file is not already included in the directory Autorun, create the directory Autorun, and load the file *****.cont** into it.

> **Note** Important: You must correctly spell **Autorun**.

2. Add the text file **force.txt** to the directory Autorun to force a downgrade of the Operating System (OS) software. This suppresses the comparison of the files, and performs installation of the replacement.

> **Note** The file force.tx has also to be present if the key has been changed or replaced.

To create the **Text File Force.txt** proceed as follows:

a. Open the Window Explorer or the Windows Desktop.

b. From the context menu, select **New > Text Document**. Save it as **force**.

The text document does not require any content, but its presence in the directory Autorun is mandatory.

> **CAUTION** If the **force** command does not show any effect, check if the name has been typed as force.txt and the windows Software does add the extension *****.txt** afterward. This would name the file **force.txt.txt**. This software cannot recognized this filename will ignore it.

> **Note** The text file **force.txt** will be deleted in the directory **Autorun** on the USB Stick before the *****.cont** file is transferred to the SD card. The reason for erasing the file is to avoid an endless loop if the USB Stick is left in the USB connector of the control board.

> Note that the file **force.txt** must be added again into the directory **Autorun** in case the downgrade process has to be repeated.

3. Load the directory Autorun onto the USB Stick.

4. Turn **OFF** the power from the TriPlus RSH.

5. Insert the USB Stick in the USB connector from the control board (on the back of the TriPlus RSH).

6. Power **UP** the TriPlus RSH.

7. Start the automated execution of the **Downgrade** process:

Loading such a file to the TriPlus from the USB Stick will cause the file be stored in the flash memory, SD card. In the next step, the various software packages are checked for compatibility and if they are compatible, the new packages will be installed.

If a newer version is detected, the older version will be replaced.

8. The text file **force.txt** will be deleted in the directory Autorun on the USB Stick before the *.cont file is transferred to the SD card. The reason for erasing the file is to avoid an endless loop if the USB Stick is left in the USB connector of the control board.

> **Note** You must add the file **force.txt** to the directory Autorun again if you must repeat the downgrade process.

9. The TriPlus RSH is booted automatically after installing the software. Remove the USB Stick. This avoids another software installation after a reboot of the TriPlus RSH.

10. After the Downgrade process has been successfully completed, check the Menu Item **About** to confirm that the RSH Firmware version has been installed and activated.

> **Note** The USB Symbol in the status bar of the screen indicates that a USB device is connected.

11. Select the **Maintenance** menu item, then **Reset Configuration**. Select the dedicated configuration for the TriPlus RSH. This task loads the **Presets** including the neutralized data base. This provides the software with a well-defined starting position. This menu item is available beginning with RSH Firmware version 1.4.0.

> **Note** This task is only possible on version 1.4.0 or higher. If downgrading from software version 1.4.0 to 1.3.2 use a backup instead.

If a Backup file of the lower-level software version is available, you must load this file by using the backup procedure as described above.

Important: The backup file must have been originally created by the same TriPlus RSH. The backup file contains the Configuration software, which includes the data bank for the configuration. Calibration of the drives and X-, Y-, and Z-axes position values are stored in the data bank and are available.

> ⚠️ **CAUTION** Only perform this step if you know with certainty the source of the backup and that the configuration of the TriPlus RSH has not been altered in the meantime.

12. The Status Bar of the handheld controller (or virtual handheld controller), displays an envelope icon for Pending Messages, Service Issues, or both.

The reason for this message is that in step the data base has been neutralized. This means that you must recalibrate the TriPlus RSH, and teach all positions of the X-, Y-, and Z-axes.

Select the access level **Extended User**. Follow the installation wizard with the path: **Options | Service | Installation**.

13. After successful installation setup and testing of the TriPlus RSH, it is highly recommended that you create a Configuration Backup (last wizard item) and copy the file directly onto the USB Stick. Use the path **Options | Maintenance | Copy Backup**.

> This step is recommended because only one backup file is stored on the SD card. Creating another backup file overwrites the previous version.

It is good practice to store the configuration backup in a safe place, if possible on a network-server. You should to keep an authorized configuration backup outside of your premises.
To copy a configuration backup from the SD card, insert the USB Stick into the jack **USB Host**. **Type A** at the control, on the back of the TriPlus RSH. Select the process **Copy Backup** and follow the dialog.

> **Note** It is mandatory that the USB Stick used has only one partition. The Autorun function checks for Disk1. If two partitions are defined, will occur. The access to the TriPlus RSH will be denied.
>
> **Note** The USB Symbol in the status bar of the screen indicates that a USB device is connected.

After Completion of an Update or a Downgrade Process

It is important to understand that the **Data Base** will be neutralized by using the *****.cont** file for both processes. As a consequence, it is mandatory to run the **Installation Wizard** to Calibrate Motors, Set Reference Point, and so on.

Beginning with RSH Firmware version 1.4.0, the software package **Presets** is part of the RSH Firmware. The **Presets** defines a model configuration such as liquid injection, or liquid and headspace injection technique, and so on.

By using the **Maintenance** menu item **Reset Configuration** resets the configuration to that of a standard application package, the length of the standard or extended X-axis, and the predefined I/O signal settings.

When updating the software version 1.4.0 (or higher), it is highly recommended that you use the **Presets** function as a first step.

After a successful Update or Downgrade of the RSH Firmware, when the final update version is 1.4.0 or higher, perform the next procedure:

❖ **To reset the configuration after completing an update or a downgrade process**

The access level **Extended User** Level is required.

1. From **Maintenance** item select the menu item **Reset Configuration**.

2. Press **Options** and from the pull-up menu select the item **Setup | Modules**:

- Check the availability of the active modules.

- Add all required passive modules.

- Check or add if necessary in the following order:

- Signals

- I/O Interface

- Chromatograph System

3. From the start screen select the required tool, press **Enter**, and select menu item **Needle Guide Type**.

4. **Press Options**, and from the pull-up menu select the item **Service | Installation**, and follow step-by-step the **Installation Wizard**.

5. Make a **backup file**, and copy the created file onto the USB Stick.

Maintenance

This chapter provides guidelines for maintaining the TriPlus RSH and its modules.

Routine Maintenance

Regular maintenance procedures help to ensure the accuracy and precision of the TriPlus RSH system. Suggested intervals of maintenance procedures are included to ensure uninterrupted operations.

If you use the system extensively (for example, nights and weekends), or if you use corrosive solvents, you must to perform the maintenance procedures more frequently.

Table 16. Maintenance Steps (Sheet 1 of 2)

Maintenance Step	Interval
Cleaning the TriPlus RSH including the surfaces of all modules. Use only a soft lint-free cloth dampened with mild soap and water.	Weekly or as needed.
Clean syringe.	Daily or as needed.
Replace the syringe plunger.	The Syringe Plunger for a liquid syringe (Metal Plunger sealing against glass) should be cleaned on a regular basis with an aqueous alcohol solution. Be aware that this plunger type should not be used for samples with a high amount of matrices or for clinical or residue analysis. A polymer plunger tip would be more suitable. The Syringe Plunger for a gas tight syringe (polymer tip) has to be replaced on a regular basis. The interval is highly dependent on the application, throughput, quality of sample solution (particles, and so on), and type of washing solvent. It is advisable to check the tightness of the plunger on a regular basis to gain experience with the application.
Wash and Waste Solvent reservoirs (Standard or Large Wash Module)	Weekly or as needed. Replace the septum to avoid carry-over.

Table 16. Maintenance Steps (Sheet 2 of 2)

Maintenance Step	Interval
Wash and Waste Solvent reservoirs (Fast Wash Module)	Weekly or as needed. • Check the solvent frit for contamination or biological growth in the solvent reservoir bottle. • Check solvent lines and connectors for integrity. • Check glass liners in the wash block for integrity and ensure free flow in the wash block. • Check waste line for blockage.
Cleaning the TriPlus RSH when working with hazardous material.	For regular cleaning and maintenance or after a spill. See "Working with Hazardous Material and Decontamination" on page 132.

Preventative Maintenance

Planned Preventative Maintenance (PM) is a procedure to protect and maintain the operating performance of the TriPlus RSH. The objective of the PM document is to define Preventative Maintenance (PM) requirements and acceptance criteria for the System.

A Preventative Maintenance check must always precede the annual Qualifications Test. This measure reduces the risk of failing the Qualifications Test.

Successful completion of this Preventative Maintenance check provides assurance that the TriPlus RSH is still running according to Thermo Fisher Scientific specifications. Failure to implement the PM check can compromise the reliability of the TriPlus RSH over the long term.

The PM check is not a substitute for a specific repair or hardware upgrades, and does not serve as part of a general overhaul. It is considered an initial, preparatory step for any OQ/testing that may follow.

Contact your Thermo Fisher Scientific representative to perform an annual preventative maintenance on the TriPlus RSH.

IMPORTANT There are no operator-serviceable or replaceable parts inside the Power Module of the TriPlus RSH. In case of a failure, contact your Thermo Fisher Scientific representative.

Working with Hazardous Material and Decontamination

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

When working with hazardous materials such as radioactivity, 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.

Sampler Removal from the GC

WARNING This operation must be performed by TWO persons who must stand each on one side of the X-axis.

❖ **To remove the sampler from the GC**

1. Switch Off the power module that supplies the instrument, then disconnect the power cable.

2. Disconnect the cable from the connector marked **Power** at the backside of the TriPlus RSH.

3. Unscrew and remove the screws that are fixing the two support bars on the GC cover.

4. Put your hands under the X-axis, then carefully lift the sampler.

5. Place the sampler over an appropriate flat surface.

6. Reassemble the sampler on the GC, performing the inverse sequence.

Emptying of the Waste Container

⚠️ **WARNING** Before using dangerous substances (toxic, harmful, and so on), read the hazard indications and information reported in the Safety Sheet supplied by the manufacturer referring to the relevant CAS (Chemical Abstract Service) number.

❖ **To empty the waste container**

1. If necessary, move the head to have free access to the washing and waste tray.

2. Take out the container, and remove the cap and empty the container.

3. Put on the cap again and reposition the container into its seat.

External Cleaning of the Sampler

⚠️ **WARNING** The external cleaning must be performed with the instrument off and the power cord disconnected. Avoid using solvents and spraying on electrical parts.

For the removal of possible dangerous substances (toxic, harmful, and so on), read the hazard indications and information reported in the Safety Sheet supplied by the manufacturer referring to the relevant CAS (Chemical Abstract Service) number. Use proper protective gloves.

❖ **To clean externally the sampler**

1. Clean the instrument on the outside with a water and soap solution or with a household non abrasive product. Pay special attention when cleaning the back side of the sampling unit. Do not spray, but clean using a cloth imbued with the same substance.

2. Dry with a clean cloth.

In case you suspect that any substance used for cleaning or submitted to analysis may have entered the instrument, though it is very unlikely, you shall immediately switch off the instrument and call the authorized Technical Service for proper action.

Cleaning the interior of the Head

⚠️ **CAUTION** DO NOT use a silicon spray to clean any spindle. Use dry, lint-free wipes or cloths to clean a spindle.

DO NOT use grease for all spindles built-in the head. The guiding bushings have Teflon coating inside to ensure smooth movement.

Cleaning of the LS/HS Syringe

The syringe cleaning is advisable every 100-200 samples, particularly if the sample analyzed contains solids in suspension, or if poorly lubricant solvents are used, such as water and methanol.

❖ **To clean the LS/HS syringe**

1. Remove the syringe from the LS/HS tool.

2. Completely take out the syringe plunger and clean it gently using a soft cloth or a paper tissue.

3. Reintroduce the syringe plunger and gently move it repeatedly along its whole travel drawing an organic solvent (for example Hexane).

4. Reinstall the syringe in to the tool.

Cleaning the ITEX Trap

WARNING - BURN HAZARD Do not touch the surface of the Trap Heater during operation to avoid burns. The surface temperature can reach potentially harmful levels when operated at high desorbing or cleaning temperatures.   The trap surface can reach about 270 °C if operated at the maximum trap temperature of 350 °C.

❖ **To clean the ITEX trap**

1. Clean a trap initially to eliminate all volatile contaminants.   A practical check is to run a blank injection, monitor the detector baseline to check for sufficient cleanness of the trap.

Maintaining a Fast Wash Station

WARNING Before any maintenance step is initiated, power down the TriPlus RSH.

Maintenance Step	Interval
Cleaning the outside of the Fast Wash Station: Use only a soft lint-free cloth dampened with mild soap and water.	Weekly or as needed.
Check the integrity of the lines and connections.	Daily or as needed.

Maintenance Step	Interval
Check the flow of the solvent and check for any blockage.	Daily or as needed.
Check the cleanliness of the solvent frit in the solvent reservoir bottle.	Daily or as needed.

Maintaining an Agitator

> **WARNING** Before any maintenance step is initiated, power down the TriPlus RSH and ensure that the temperature inside the unit is below 50 °C to avoid any burns.

Maintenance Step	Interval
Cleaning the outside of the Agitator: Use only a soft lint-free cloth dampened with mild soap and water.	Weekly or as needed.
Check opening and closing of the lid. Move the lid manually back and forth to ensure smooth movement.	Weekly or as needed.

As a standard procedure, the replacement of the agitator belt is recommended.

Maintaining a Vortexer

> **WARNING** Before any maintenance step is initiated, power down the TriPlus RSH and ensure that the temperature inside the unit is below 50 °C to avoid any burns.

Maintenance Step	Interval
Cleaning the outside of the Vortexer: Use only a soft lint-free cloth dampened with mild soap and water.	Weekly or as needed.

As a standard procedure, the replacement of the toothed motor belt is recommended.

Maintaining a MHE Station

> ⚠️ **WARNING** Before any maintenance step is initiated, power down the TriPlus RSH.

Maintenance Step	Interval
Cleaning the outside of the MHE Station: Use only a soft lint-free cloth dampened with mild soap and water.	Weekly or as needed.
Check the functionality of the spring-loaded needle	Monthly or as needed.
Check the magnetic transport of the MHE Adapter. Check the picking up and returning of the Adapter into the Holder.	Monthly or as needed.
Check the Vent tubing for integrity.	As required

Maintaining a SPME Conditioning Station

> ⚠️ **WARNING** Before any maintenance step is initiated, power down the TriPlus RSH. To avoid any burns be careful when touching the module or parts which have been inserted into the unit, such as the thermocouple.

Maintenance Step	Interval
Cleaning the outside of the SPME Conditioning Station: Use only a soft lint-free cloth dampened with mild soap and water.	Weekly or as needed.
Check opening and closing of the gas purge valve.	Weekly or as needed.
Check purge gas flow.	Monthly or as needed

Maintaining a Barcode Reader

> ⚠️ **WARNING** Before any maintenance step is initiated, power down the TriPlus RSH and ensure that the temperature inside the unit is below 50 °C to avoid any burns.

Maintenance Step	Interval
Cleaning the outside of the Barcode Reader: Use only a soft lint-free cloth dampened with mild soap and water.	Weekly or as needed.

It is recommended to perform the Preventive Maintenance test at least after a year.
The major point tested for the Barcode Reader is the successful reading, and interpretation of a barcode label. The general cleanliness and condition of the module are also verified.

Maintaining a Liquid Cooler Tray Holder

Condensation build-up is directly related to the temperature and relative humidity in the ambient air (dew point). Long term tests showed very little build-up of condensation in an environment of relative humidity up to 60% and 22 °C ± 2 °C ambient temperature.
If condensation is observed, clean the compartment on a regular basis as needed.
Drainage for condensation is not available, the compartment is a closed system.

CAUTION Before any maintenance step is initiated, power off the TriPlus RSH.

Maintenance Step	Interval
Cleaning the outside of the Liquid Cooled Tray Holder: Use only a soft lint-free cloth dampened with mild soap and water.	Weekly or as needed.
Clean and dry the inside of the compartment. Moisture build-up.	Daily or as needed.
Check condition of hose and connections.	Monthly or as needed.

It is recommended to perform the Preventive Maintenance test at least after a year. The major point tested for the Liquid Cooled Tray Holder is its general cleanliness and conditions.

Maintaining a Temperature Controlled Drawer

Condensation build-up is directly related to the temperature and relative humidity in the ambient air (dew point). Long term tests have shown very little build-up of condensation in an environment with relative humidity up to 60% and ambient temperatures of 22 °C ± 2 °C.
If condensation is observed, clean the compartment on a regular basis as needed.

⚠️ **CAUTION** Before any maintenance step is initiated, power down the TriPlus RSH.

Maintenance Step	Interval
Clean the outside of the instrument. Use only a soft, lint-free cloth dampened with mild soap and water.	Weekly or as needed.
Clean and dry the inside of the instrument if necessary, including compartments, rolls and rails. Use only a soft, lint-free cloth.	Daily or as needed.
Clean and grease the rolls and the rails*. *Recommended Grease • Grease: AL Lub Kit: approximately 8 g grease and brush • Grease Temperature Range: -130 °C to +150/+200 °C	After a year, if the system is not exposed to acidic vapor. If acids are used for the sample solution and the Stack Cooler is exposed to the vapor, cleaning should be done more frequently, as required. A positive stream of inert gas, such as nitrogen, clean and dry air or helium, can prevent corrosion, Condensation Build-up.
Verify the position and condition of the stopper and holding magnet of the drawer(-s).	Monthly or as needed.

Maintaining a OC Injector Actuator

Condensation build-up is directly related to the temperature and relative humidity in the ambient air (dew point). Long term tests have shown very little build-up of condensation in an environment with relative humidity up to 60% and ambient temperatures of 22 °C ± 2 °C. If condensation is observed, clean the compartment on a regular basis as needed.

⚠️ **CAUTION** Before any maintenance step is initiated, power down the TriPlus RSH.

Maintenance Step	Interval
Verify the homing position of the OC Actuator.	Weekly or as needed.
For further maintenance steps, refer to the relevant GC's manual.	As required.

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 Related to TriPlus RSH

Table 17 provides general troubleshooting guidelines regarding the TriPlus RSH:

Table 17. General Points Related to TriPlus RSH - Troubleshooting Guideline (Sheet 1 of 3)

Symptom or Error Message	Possible Cause	Recommended Action
Active module not recognized, not visible on Handheld Controller or Virtual Handheld Controller.	Cable from active module to BUS connector not connected or defective. Software.	Check the cable and the connections from the active module in question to the BUS connector, or to another active module. Restart the TriPlus RSH, if still not recognized, restore the RSH Firmware.
	Device firmware not loaded or not on current level to match with RSH Firmware version.	Restore the configuration backup. Reload a complete new RSH Firmware package.
Tool not recognized or mismatch with syringe.	Syringe diameter mismatch with Tool Holder.	Check the syringe diameter with the Tool Holder specifications. Refer to the section **Handheld Controller** in the *TriPlus RSH User Guide* for reference value tables. Repeat the syringe wizard as described in the section **TriPlus Basic Information** in the *TriPlus RSH User Guide*.
	Needle Guide Length does not match with inserted syringe needle length.	Check the syringe needle length. If a mismatch is observed change the TriPlus RSH tool or the syringe type. Repeat the syringe wizard as described in **TriPlus Basic Information** in the *TriPlus RSH User Guide*.
	Wrong Tool Holder for syringe type.	Check the specs for the Tool Holder and compare data with the syringe used. Repeat the syringe wizard as described in the section **TriPlus Basic Information** in the *TriPlus RSH User Guide*.
	PCB from tool Holder or from Park Station defective.	Check the integrity of the PCB and the contacts. When in doubt, contact your Thermo Fisher Scientific representative for technical assistance.
Liquid Syringe wears out rapidly.	Liquid syringe not primed.	Do not insert a liquid syringe without priming with the solvent which will be used by the application.
Headspace syringe contaminated with organic solvents.	Headspace syringe.	To avoid saturation of the polymer plunger tip with an organic solvent it is highly recommended not to prime a headspace syringe at all. Possible traces of organic solvents can cause ghost peaks in the next analysis.

Table 17. General Points Related to TriPlus RSH - Troubleshooting Guideline (Sheet 2 of 3)

Symptom or Error Message	Possible Cause	Recommended Action
SPME Fiber disintegrates quickly.	Fiber heated without gas protection.	The SPME fiber has to be thermally cleaned after each analysis. Keeping the fiber without gas protection destroys the polymer coating. Ensure that the fiber is always heated in an environment under gas protection. An inert gas of high purity is required, typically nitrogen or helium.
Homing Failed	TriPlus RSH Tool not listed in software	If a tool is physically mounted, but not listed in the handheld controller: the instrument requires to be homed (home Head). If homing did not help, check physical contacts or tool is corrupt.
Start-up Error	Error Message displayed	If after startup errors are displayed (message on the handheld controller) check if park station is enabled (parameter **Tool Eeprom Access** in ATC Station).
Plunger cannot be coupled.	Plunger Coupling Device in closed position.	The Plunger Coupling Device has to be opened manually. Turn OFF the power from the TriPlus RSH system and follow the instructions described in the section "Manually Removing a Tool from the Head" on page 151. After receiving free access to the Plunger and Needle Guide Coupling Blocks make following steps: • Remove the inserted tool manually. • Press the Plunger Coupling Device upwards. The device spring has to engage in OPEN position.
Tool cannot be ejected	Plunger bent	If the instrument ejected (unmounted) a tool automatically, but the plunger still sticks in the coupling, check the plunger.
Time and Date wrong	Low Battery on the control PCB.	Ask the representative of Thermo Fisher Scientific for a service. If battery voltage is lower than 3 V the battery is suspect, and if lower than 2 V the battery must be replaced.

Table 17. General Points Related to TriPlus RSH - Troubleshooting Guideline (Sheet 3 of 3)

Symptom or Error Message	Possible Cause	Recommended Action
Head misses a position (Module, Vial, and so on)	X-,Y-, and Z-axes positions are off	Check teaching positions. Note, in case of Thermo Trace Injectors it is necessary to check the positions again after the GC system has reached the operating temperature.
		Check configuration for a possible mismatch with specified Tray Holder, Tray (Rack Type or Well Plate Type), and Vial Type and Needle Guide Type.
	Reference Point of the Tool Station has been changed.	When a Tool Station (TR or ATC Station) is shifted in the X-Position, or if for any reason the process Set Reference Point has been repeated, it is mandatory to recalibrate the all the tools which are used with the TriPlus RSH.
Guide Rollers are not moving (sticky).	The TriPlus RSH system or part of it has been stored at lower temperature, typically for transport reasons. The grease has a high viscosity.	Allow the system to warm up time to adjust to ambient temperature (approx. 20 °C). If the system has been stored below -25 °C (-13 °F) it may be necessary to clean all parts from grease and re-apply grease again.

RSH Firmware Related Points

Table 18 provides troubleshooting guidelines regarding the RSH Firmware.

Table 18. RSH Firmware - Troubleshooting Guideline

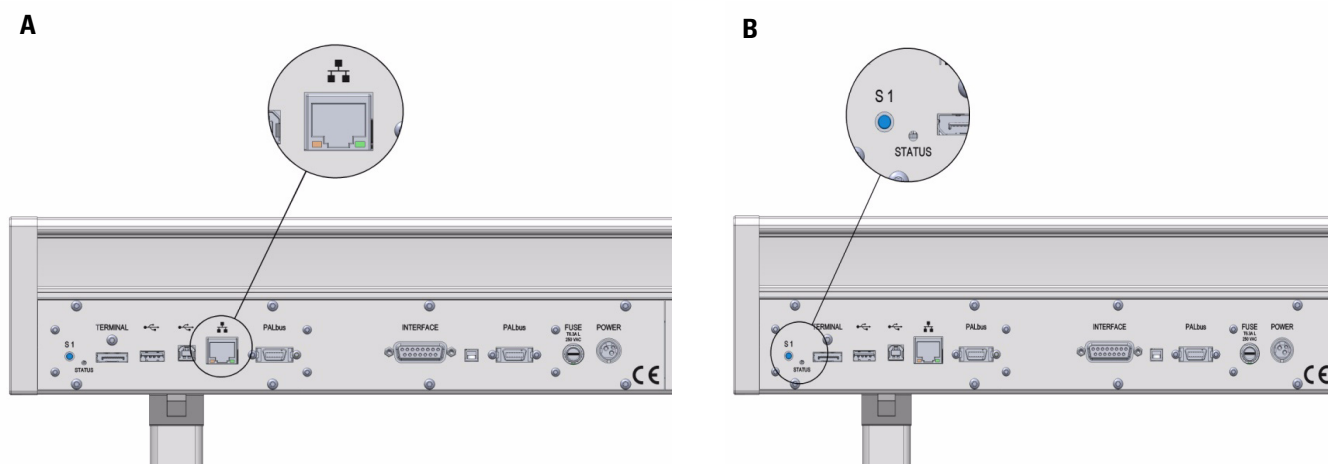| Symptom or Error Message	Possible Cause	Recommended Action
Backup/Restore not possible	Use of handheld controller and virtual handheld controller in parallel during backup/restore	Do not use handheld controller and virtual handheld controller in parallel during backup/restore
Update, Downgrade, or both processes are not possible.	Key does not match with file to update or downgrade.	Carefully see the Chapter 4, "TriPlus RSH Firmware," to find any source of mismatch.
	*.**pack** file used instead of *.**cont** file.	If not successful:
	*.**cont** not in File directory **Autorun**.	Check for any **Pending Message** or **Service Issue**.
	Force.txt file not used for downgrading.	Create a **Diagnostics File**, and send it for evaluation to your representative from Thermo Fisher Scientific.
	USB Stick with more than one partition used.	
Red LED at Control Board is blinking continuously.	- Firmware update error	Reboot the autosampler.
	- Hardware error	Reinstall the firmware.
Error Message: An error stops the program. Please reboot. Application is corrupt.	Key changed or replaced.	When the key of the system is changed or replaced, it is mandatory use the text file **Force.txt** to install RSH Firmware. This is true for **Updates** or **Downgrading**.

LAN Communication Problems using Direct Connection

Table 19 provides troubleshooting guidelines regarding the LAN direct connection.

Table 19. LAN Direct Connections Troubleshooting Guideline

Symptom or Error Message	Possible Cause	Recommended Action
LAN communication See "Establishing Communication with the Computer" on page 74 for details.	Network cable may not be plugged into: TriPlus RSH, Company network or PC	Check if the network cable is plugged into the autosampler and the local company network or PC. Ask your local Network administrator for assistance with TCP/IP settings.
	Verify that the IP Address is correct.	Check the IP Address settings in the computer and in the system. Is DHCP mode active?
	Verify that the Basic Communication is possible.	Check the status of the LED. See Figure 97 A.
		Use the ping command to verify the communication. Details are described in the section Corporate Network.
Red LED at Control Board is blinking continuously. STATUS LED	Firmware update error. Hardware error.	Reboot the autosampler. Reinstall the firmware. See Figure 97 B.

Figure 97. LAN Communication, Detail LED, Reset Button, and Status LED

LAN Communication Problems within Corporate Network

Table 20 provides troubleshooting guidelines regarding the LAN Corporate Network.

Table 20. LAN Corporate Network Troubleshooting Guideline

Symptom or Error Message	Possible Cause	Recommended Action
Red LED at Control Board is blinking continuously.	Firmware update error.	Reboot the autosampler.
	Hardware error.	Reinstall the firmware.
LAN communication	Network cable may not be plugged into:	Check if the network cable is plugged into the autosampler and the local company network or PC.
	TriPlus RSH, or Company network, or PC	Ask your local Network administrator for assistance with TCP/IP settings.
	Verify the correctness of: • IP Address • Subnet Mask • Default Gateway	Check the settings in the computer and in the TriPlus RSH. **Note:** The Default Gateway setting is required in a corporate network. The network administrator has to be contacted for support.
	If DHCP mode is used, check settings.	Check DHCP settings.
	Verify that the Basic Communication is possible.	Check the status of the LED. See Figure 97 B.
		Use the **ping** command to verify the communication. See Table 20.
	Communication problem related corporate network.	Check LAN cables.
		Reboot the Switch (hub if used).
		Simplify the setup by making the direct connection as described in section "Setting Up the Direct Connection" on page 75. Be aware that the IP settings in the computer and TriPlus RSH have to be changed accordingly.
		If direct connection is not successful: • replace the LAN cables • replace the workstation (computer) • reload the RSH Firmware • replace the control PCB
		If direct connection is successful: • replace the switch (hub if used) • ask network administrator for support.
	Latency time in network.	The RSH Firmware accepts a rather high latency time. However if the latency time within a network is above 500 ms it should be evaluated.

LAN Communication Problems Related to Network Interface Card (NIC)

A network interface controller (also known as a network interface card, network adapter, LAN adapter and by similar terms) is a computer hardware component that connects a computer to a computer network. It is called here in short form NIC.

Table 21 provides troubleshooting guidelines regarding the LAN Network Interface Card.

Table 21. LAN Network Interface Card Troubleshooting Guideline 1 (Sheet 1 of 2)

Symptom or Error Message	Possible Cause	Recommended Action
No LAN communication.	Network cable not plugged in.	Check connections.
	Network cable plugged in into the wrong NIC.	It is possible that more than one NIC is present on the PC. Select network connections settings on the computer, plug in the cable, and check if the status changes from **unplugged** to **connected**.
	IP address setting in the TriPlus RSH wrongly assigned.	Check the IP address entered on the Handheld Controller (or Virtual Handheld Controller.
	IP address setting in the CDS software wrongly assigned.	Check the IP address entered on the CDS software.
	Subnet Mask wrongly assigned.	Ask network administrator for details.
	Default Gateway wrongly set.	Ask network administrator for details.
	IP address on PC NIC not valid.	The IP address has to be in the correct range such that both the instrument and the PC are in the same network and subnetwork.
	Wrong LAN cable.	Straight wired Cat. 5 LAN cable is used for most setups. The only exception is if a direct connection from PC to instrument is used and the NIC does not have Auto-negotiation or Auto-sensing (the possibility to detect the correct transmission parameters and set them accordingly between NICs). The network administrator may support and check: MDI-X Auto MDI(X) Ports are used within the network.Check if straight or crossed wired cable (vice-versa) solves the problems, or work with a corresponding LAN adapter (MDI) to test the communication.

Table 21. LAN Network Interface Card Troubleshooting Guideline 1 (Sheet 2 of 2)

Symptom or Error Message	Possible Cause	Recommended Action
No LAN communication. (*Continued*)		Check the communication by using the |Ping command.
		Ping is a command used in the command prompt of Windows. Start the program CMD and a black window will appear. Type in ping [IP-Address of the TriPlus RSH] and press enter.
		Figure 98 shows a successful communication with the TriPlus RSH and confirms that the Network requirements for communication are fulfilled.

Figure 98. Ping Command

|		
LAN Communication interrupted or unstable.	Firewall or Virus Scanner activated.	Check for any installed firewall or virus scanner software which may cause interferences.
		For details see the section "Hardware and Software Requirements" on page 4.
	Screen Saver activated.	Check for any monitor screen saver which may cause interferences. The best screen saver is turning off the monitor.
		For details see the section "Hardware and Software Requirements" on page 4.
	Computer hard disk power management activated.	Check if the power management option is turned off.
		For details see the section "Hardware and Software Requirements" on page 4.

Troubleshooting Check for LAN Communication

When the network cable is not connected and a LAN communication is not established, the previously entered network settings are maintained. The system will recognize that no network communication is established or possible.

❖ **To check Lan Communication**

1. Check the connections of the LAN cable. The default addresses or the last addresses to be defined and stored should be visible after reentering the **Setup Network** screen;

2. Check the LEDs on the Ethernet connector at the back of the TriPlus RSH.

Figure 99. LAN Communication LEDs
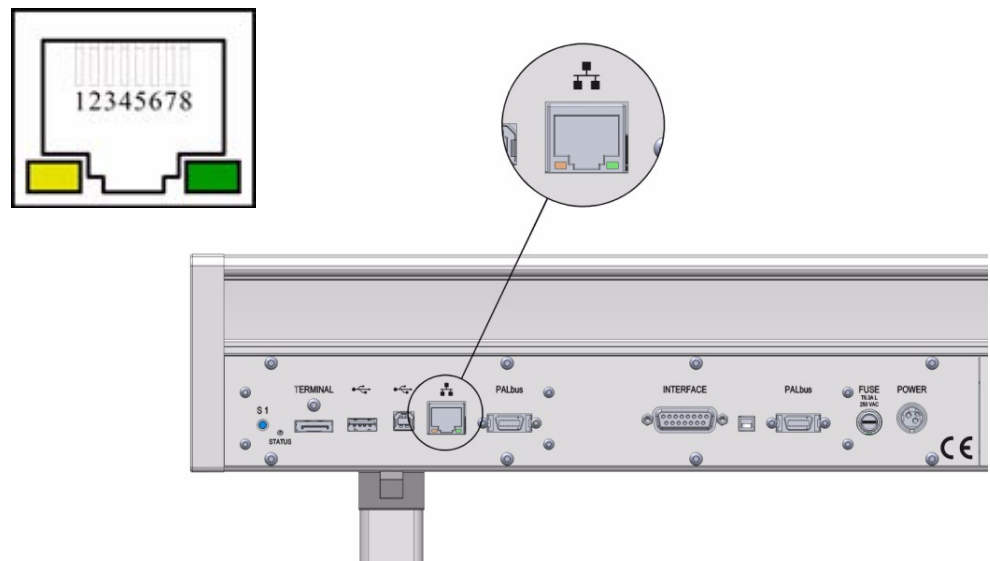
- **The LED on the left** — Status LED. Orange color indicates that the current is applied to the connector.

- **The LED on the right** — Indicates the Ethernet communication status. Green blinking status indicates that the Ethernet communication is established.

System Status LED at Status Bar or at X-Axis Side Cover

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 Figure 100.

Figure 100. Side Cover Status LED
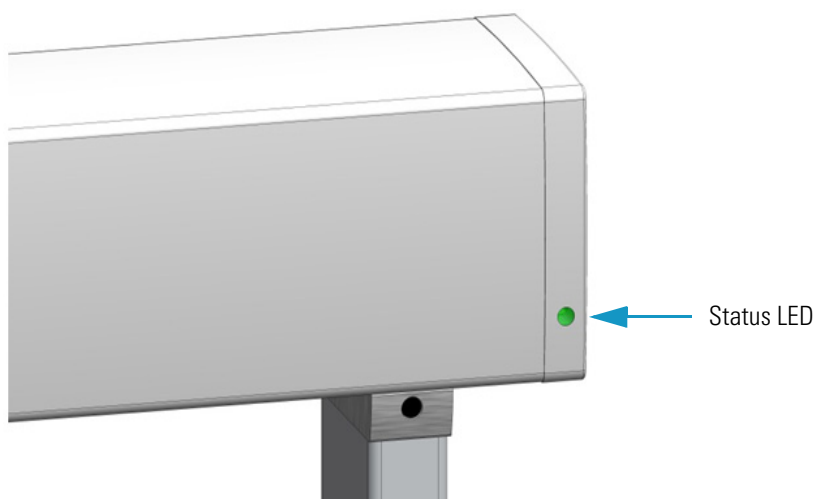
Table 22 lists the different LED statuses and the corresponding tasks or errors.

Table 22. LED Status (Sheet 1 of 2)

TriPlus RSH Status	LED Color	LED Status
Successful Booting Process		
Power Off	Off	Off
System booting	🟡	Blinking fast
Updating Software	🔵	Blinking fast
Start loading application software	🟡	Blinking normal
Application working	🟢	Blinking normal
Application Ready	🟢	Solid On
Errors during Booting Process		
Software failed to start application	🟡	Solid On
Application software is not installed	🟡	Solid On
Fatal error	🟡	Solid On

Table 22. LED Status (Sheet 2 of 2)

TriPlus RSH Status	LED Color	LED Status
LED Status during Operation		
Configuration error	🟡	Blinking normal
Activity execution error	🟡	Solid On
Backup / Restore executed	🔵	Blinking normal
Manual operation (waiting for inputs)	🔵	Solid On
System working	🟢	Blinking normal
System Ready / Idle	🟢	Solid On
Fatal error	🟡	Solid On

LED Status at Control Board

The status LED at the back of the TriPlus RSH has limited functionality. See Figure 101.

Figure 101. Control Status LED and Reset Button
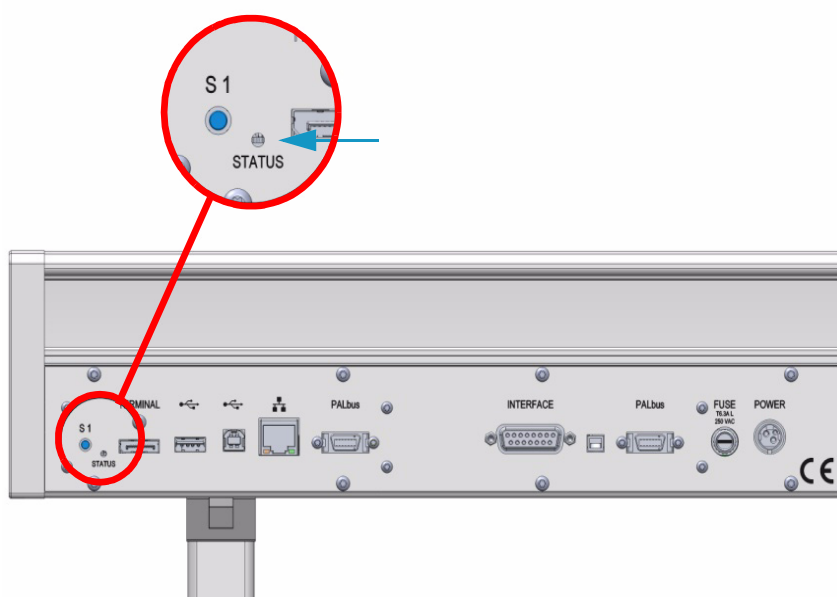
During the booting-up process, the following status changes can be observed in Table 23.

Table 23. LED Status

TriPlus RSH Status	LED Color	LED Status
Successful Booting Process		
Power Off	Off	Off
System booting	🔴	Solid On
Software OS Initialized	🔴	Blinking fast
Application Software Initialized	🟢	Blinking normal
System Ready	🟢	Solid On

Observing the status of the control LED is also important when restoring the network settings to factory default.See the section "Restoring Factory Default Network Settings" on page 77.

Manually Removing a Tool from the Head

When a syringe plunger or needle is bent during an automated procedure, it is likely that the tool can no longer be parked in the Tool Station.

The de-coupling mechanisms can be blocked by the distorted part of the syringe.
In such situations it is important that you can manually remove the Tool from the Head.

⚠️ **WARNING** Turn off the power to the TriPlus RSH before any repair steps are taken.

❖ **To remove a tool from the head of the TriPlus RSH**

1. Turn Off the power to the TriPlus RSH system.

2. Move the Head manually in a position where it is easily accessible, preferably to an empty slot of the Tool Station. Manually pull down the Z-axis to gain easy access to the lower part.

3. Remove the front cover by loosening the screw at bottom of the cover. See Figure 102.

Figure 102. Front Cover Removal
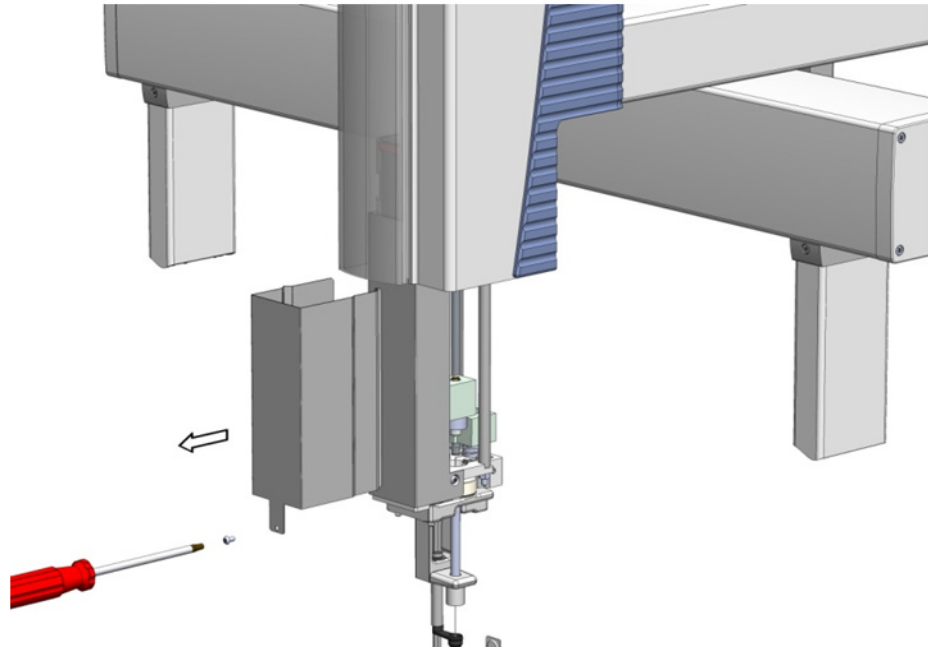
4. Locate the **Plunger Coupling Block** (left side of the Head) and move the block manually approximately 50 mm up. See Figure 103.

Figure 103. Move the Plunger Coupling Block up

Plunger Coupling Block

Damaged Plunger
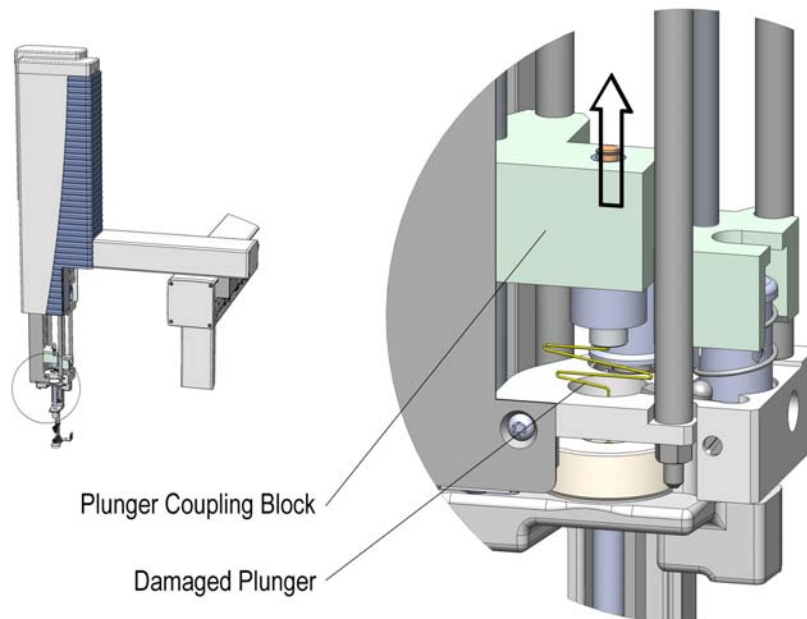
5. Locate the **Plunger Coupling Device** underneath the block; push it up to decouple the plunger adapter. See Figure 104.

Figure 104. Push up the Plunger Coupling Device
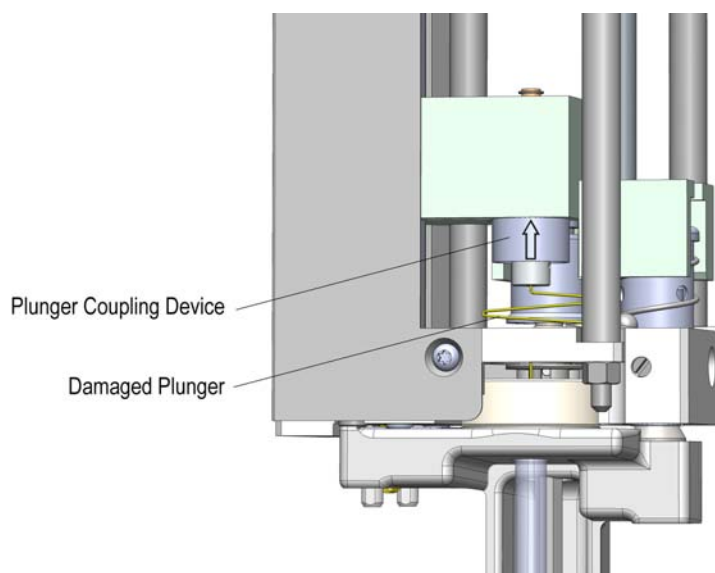
6. Locate the **Tool Coupling Block** (spring loaded device), best accessible from the backside of the Head. Press the Tool Guide Coupling Block downwards, this decouples the Needle Guide and the Tool Coupling at the same time. See Figure 105.

Figure 105. Pressing the Tool Coupling Block Downwards to Decouple Tool and Needle Guide Couplers
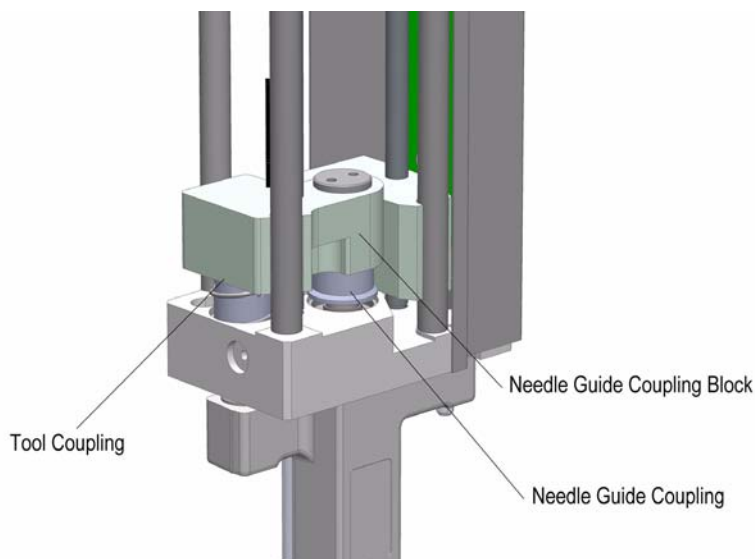
Note If the Head is not parked in a Slot, hold the tool with one hand before the Tool Coupling Button is pressed.

7. Reinstall the previously removed front cover.

Note For safety reasons, do NOT operate the TriPlus RSH system before reinstalling the outer cover.

Fast Wash Station Troubleshooting

This section lists the most important points to overcome a faulty or problematic situation.

CAUTION Before starting any repair step, power off the TriPlus RSH.

Observation	Recommended Action
Syringe Needle bending.	• Check the teaching position for X-, Y-, and Z-Axes.
Solvent flow not sufficient.	• Check the position of the solvent reservoir bottles. Level should not be lower than 50 cm from the Micro Pump of the station. • Check the cleanliness of the solvent frits.
Air bubbles in solvent lines.	• Check the solvent levels in the reservoir bottles. • Check the position of the solvent reservoir bottles. Level should not be lower than 50 cm from the Micro Pump of the station. • Check the cleanliness of the solvent frits. • Check the flow by using the task **Prime Wash Liner**.
Solvent flow blocked.	• Check the electrical connections from the station to the Bus, or daisy chaining to the next module. • Check the position of the solvent reservoir bottles (see the point above). • Check the solvent level in the reservoir bottles. • Check the cleanliness of the solvent frits. Activate the priming function (path described above) and check for the blockage.
Waste line blocked.	• Check the position of the Waste line in the waste container. Is the end of the line within the liquid or above it? • Check for any particles which may hinder free flow of the solvent.
Wash Block leaking.	• Check the composition of the wash solvents. Be aware of the material used for the various parts of the Fast Wash Station.

Agitator Troubleshooting

This section lists the most important points to overcome a faulty or problematic situation.

CAUTION Before starting any repair step, power off the TriPlus RSH, and ensure the temperature inside the unit is below 50 °C to avoid any burns.

Observation	Recommended Action
Module does not respond to initiation step.	• Check control cable connections. • Check the availability of the Agitator module within the software. If not available, is the TriPlus RSH configuration laid out for liquid injection only? • If necessary load a configuration backup prepared for the liquid and headspace technique.
Module responds to the initiation step but the block does not turn.	• Check the condition of the Agitator belt. If necessary, replace the belt.
Vial broken; spill in the Agitator compartment.	• Power down the TriPlus RSH and disconnect the Agitator module. • Carefully investigate the damage and try to clean the compartment as best as possible. • When in doubt, contact your Thermo Fisher Scientific representative. Be prepared to provide all information concerning the type of solvent and extent of the spill.

Vortexer Troubleshooting

This section lists the most important points to overcome a faulty or problematic situation.

CAUTION Before starting any repair step, power off the TriPlus RSH.

Observation	Recommended Action
Module does not respond to initiation step.	• Check control cable connections. • Check the availability of the Vortexer module within the software. If not available, load a configuration backup prepared with the Vortexer device firmware. • Check for **Pending Message** and take corrective actions if necessary.
Module responds to the initiation step but the block does not turn.	• Check the condition of the Vortexer toothed motor belt. If necessary, replace the belt.
Mixing of module does fail.	• Check for a Pending Message at power-up of system, Vortex Motor may have failed.
Vial broken, spill in the Vortexer collection pan.	• Power down the TriPlus RSH and disconnect the Vortexer module. • Carefully investigate the damage and try to clean the compartment as best as possible. • When in doubt, contact your Thermo Fisher Scientific representative. Be prepared to provide all information concerning the type of solvent and the extent of the spill.

MHE Station Troubleshooting

This section lists the most important points to overcome a faulty or problematic situation.

⚠️ **CAUTION** Before starting any repair step, power off the TriPlus RSH.

Observation	Recommended Action
MHE Adapter cannot be picked up from Adapter Holder.	Verify the installation of the large magnetic ring as used for the 20 mL vials.
MHE Adapter cannot be returned to the Holder without collision.	Manually move the head above the MHE Adapter. Verify that the Vent outlet of the MHE Adapter is positioned in between the two pins. Loosen the screw of the magnetic ring and allow the magnets to align with those of the MHE Adapter. Tighten the screw of the magnetic ring after a successful alignment.

Observation	Recommended Action
Vent tubing catches during movement.	• Check the integrity of the tubing. Check the installation position of the MHE Adapter Holder. • Consider also the distance to the Agitator.
Gas cannot be vented.	• Check the MHE Adapter for integrity. Is the needle damaged or clogged? Is the Vent Outlet open?

SPME Conditioning Station Troubleshooting

This section lists the most important points to overcome a faulty or problematic situation.

CAUTION Before starting any repair step, power down the TriPlus RSH, and ensure that the temperature inside the unit is below 50 °C to avoid any burns.

Observation	Recommended Action
Module does not respond to initiation step.	• Check control cable connections. • Check the availability of the SPME Conditioning Station within the software. If not available, is the TriPlus RSH configuration laid out for liquid injection only? • If necessary load a configuration backup prepared for liquid, headspace and SPME technique. • Check for a Pending Message and take corrective actions if necessary.
No purge gas flow	• Disconnect the purge gas tube at the module side; remove the Swagelok union and clean the frit installed. See the section "Installing a SPME Conditioning Station" on page 45.
Purge Gas Valve does not open.	• Manually move the valve pin up and down to check for any restriction or broken spring. • When in doubt, contact your Thermo Fisher Scientific representative for technical assistance.

Barcode Troubleshooting

This section lists the most important points for overcoming a faulty or a problematic situation.

CAUTION Before starting any repair step, power off the TriPlus RSH, and ensure the temperature inside the unit is below 50 °C to avoid any burns.

Observation	Recommended Action
Module does not respond to initiation step.	• Check control cable connections. • Check the availability of the Barcode Reader module within the software. If not available, is the TriPlus RSH configuration laid out for a cycle excluding the Barcode Reader? • If necessary load a configuration backup prepared for the Barcode Reader device. • Check for a Pending Message and take corrective actions if necessary.
Barcode not readable	• Check the horizontal orientation of the barcode lines. • Check the barcode length, minimum 19 mm for use with a 20 mL vial. • Check the type of the barcode symbol. See the section **Approved Barcode Label** in the *TriPlus RSH User Guide*. • Check the barcode length, minimum 19 mm for use with a 20 mL vial. • Check the label quality. • Check the print quality of the barcode lines. • Check the density of the barcode lines. • Check if barcode is 1D; 2D barcodes cannot be decoded.
Barcode not identified	• Is a barcode label attached? • Is the barcode oriented such that the bars are in a horizontal direction? Any shifted angle? • Is the label of correct quality? - Is the background white for contrast? - Is it burned (blackened) from elevated temperature, for example Agitator? - Is the surface wet (moisture)? - Is there a reflection?

Liquid Cooled Tray Holder Troubleshooting

This section lists the most important points to overcome a faulty or problematic situation.

⚠️ **CAUTION** Before starting any repair step, power down the TriPlus RSH.

Observation	Recommended Action
Syringe Needle bent	• Are the X-, Y-, Z- Positions correctly taught? • Check the cover type. Is the cover correct for desired?

Temperature Controlled Drawer Troubleshooting

This section lists the most important points to overcome a faulty or problematic situation.

⚠️ **CAUTION** Before starting any repair step, power down the TriPlus RSH.

Observation	Recommended Action

The Drawer does not open or not close reliably.	• Manually check the movement of the drawer.
	  Are any restrictions felt?
	  If yes, investigate for the reason.
	• Clean the rolls and rails, grease these parts again and check the movement after cleaning.
	• If still not satisfactory, is there mechanical damage?
	
	When this is confirmed contact your Thermo Fisher Scientific representative for technical assistance.

Observation	Recommended Action
Opening of the drawer not reliable.	Another reason for problems with opening of the drawer could be the Stack Drawer Magnet, connected to the lower needle guide of the Tool. • Is the magnet out of alignment, is its attachment no longer square? If not, try bring it back to square. Other possibilities are that the protective foil for the magnet is damaged, the magnet is corroded, or the tool has been exposed to higher temperatures and the magnetic force has been lost. • Check manually if it is possible to open the drawer. If the Stack Drawer Magnet is the source of the problems ask your Thermo Fisher Scientific representative for technical assistance.
Drawer does not stay in closed position.	The drawer is kept in position by a magnet installed at the back of the unit (inside of the compartment). • If this magnet has become loose, it is possible that the drawer slides out of the closed position in a random manner. If this is the case, ask your Thermo Fisher Scientific representative for technical assistance.
Temperature Controlled Drawer cannot be cooled or heated anymore.	• Check all cables and their connections. Can the module be recognized by the software (BUS)? • Is the Standby Temperature set properly? If these points are confirmed, check the Actual Temperature or if any error message occurred. • It is possible that the fan is no longer working or there is a blown over-temperature fuse. When in doubt, ask your Thermo Fisher Scientific representative for technical assistance.

Observation	Recommended Action
Power Supply Problem	• Is the Temperature Controlled Drawer connected to the same power module as the TriPlus RSH? If yes, use the second power module, provided with the Temperature Controlled Drawer. • Is the power module connected, turned on and the green LED ON (at outlet side)? If these points are verified but the problem remains, ask your Thermo Fisher Scientific representative for technical assistance.

There are no 'operator-serviceable or replaceable parts inside the power supply. In case of failure, contact your Thermo Fisher Scientific representative.

OC Injector Actuator Troubleshooting

This section lists the most important points to overcome a faulty or problematic situation.

> ⚠️ **CAUTION** Before starting any repair step, power down the TriPlus RSH.

Observation	Recommended Action
The OC Actuator does not turn.	• Verify the electrical connections from the OC Adapter to the OC Electronic Box. • Verify the connection from the OC Electronic Box to the BUS connector. • Verify any mechanical damage at the OC Actuator.
Needle Bending	• Check the teaching position of the OC Injector.
Other items observed, such as bad chromatographic results, may have other sources which lead to the injector itself.	• Consult the Manuals of the GC.