



thermo scientific

# TriPlus RSH SMART

## Hardware Manual

Robotic Sample Handling

MI-317000-0040 Revision A September 2021

**ThermoFisher**  
SCIENTIFIC

© 2021 Thermo Fisher Scientific Inc. All rights reserved.

Thermo Scientific™ TriPlus RSH™ SMART, TRACE™ 1300, TRACE™ 1310, and TRACE™ GC Ultra, are trademarks of Thermo Fisher Scientific Inc., and its subsidiaries.

Published by Thermo Fisher Scientific S.p.A., Strada Rivoltana, km 4, 20090 Rodano - Milan - Italy  
Tel: +39 02 950591 - Fax: +39 02 9505276

Thermo Fisher Scientific Inc. provides this document to its customers with a product purchase to use in the product operation. This document is copyright protected and any reproduction of the whole or any part of this document is strictly prohibited, except with the written authorization of Thermo Fisher Scientific Inc.

The contents of this document are subject to change without notice. All technical information in this document is for reference purposes only. System configurations and specifications in this document supersede all previous information received by the purchaser.

This document is not part of any sales contract between Thermo Fisher Scientific Inc. and a purchaser. This document shall in no way govern or modify any Terms and Conditions of Sale, which Terms and Conditions of Sale shall govern all conflicting information between the two documents.

Release history:

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

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

## TriPlus RSH SMART TriPlus RSH SMART Hardware Manual, P/N MI-317000-0040, First Edition

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

fold — — If not, please comment below. Attach additional sheets if necessary.

## Customer Registration Card

Register now...and receive all the privileges associated with being a Thermo Fisher Scientific product user including customer support, application reports, and technical reports.

**MY ORGANIZATION IS: (Check only one)**

- ☐ Commercial (for profit) lab  
☐ Government lab  
☐ Hospital/Clinic  
☐ Industrial lab  
☐ Research Institute  
☐ University/College  
☐ Veterinary  
☐ Other \_\_\_\_\_

**MY PRIMARY APPLICATION IS: (Check only one)**

- ☐ Analytical  
☐ Biomedical  
☐ Clinical/Toxicology  
☐ Energy  
☐ Environmental  
☐ Food/Agricultural  
☐ Forensic/Toxicology  
☐ Pharmaceutical  
☐ Research/Education  
☐ Other \_\_\_\_\_

**MY PRIMARY JOB FUNCTION IS: (Check only one)**

- ☐ Administration  
☐ Lab management  
☐ Operator  
☐ Other \_\_\_\_\_

Name \_\_\_\_\_ Title \_\_\_\_\_  
 Company \_\_\_\_\_  
 Address \_\_\_\_\_  
 City/State \_\_\_\_\_ Postal Code \_\_\_\_\_  
 Country \_\_\_\_\_  
 Telephone \_\_\_\_\_ Ext. \_\_\_\_\_  
 Serial Number \_\_\_\_\_ Date purchased \_\_\_\_\_

**Fold and mail or e-mail to:**

Editor, Technical Publications  
 Thermo Fisher Scientific S.p.A.  
 Strada Rivoltana km 4  
 20090 Rodano (MI)  
 Italy

Editor, Technical Publications  
 Thermo Fisher Scientific SID GC-GC/MS  
 2215 Grand Avenue Parkway  
 Austin TX 78728-3812  
 United States of America





## 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.

**Thermo Fisher Scientific S.p.A.**

Strada Rivoltana, km 4, 20090 Rodano - Milan - Italy — Tel: +39 02 950591 - Fax: +39 02 9505276

## Regulatory Compliance

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

Thermo Fisher Scientific declares, under sole responsibility, that the product as originally delivered complies with the requirements of the following applicable European Directives and carries the CE marking accordingly:

- Low Voltage Directive:2014/35/EU
- EMC Directive:2014/30/EU
- Machinery Directive: 2006/42/EU
- RoHS Directive 2011/65/EU, including amending Delegate Directive 2015/863/EU

... and conforms with the following product standards:

### Safety

This device complies with:

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

### Electromagnetic Compatibility

This device complies with:

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

## Laser Class 1

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

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

## FCC Compliance Statement

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



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

## 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.

## WEEE Directive 2012/19/EU



Thermo Fisher Scientific is registered with B2B Compliance ([B2Bcompliance.org.uk](https://www.b2bcompliance.org.uk)) in the UK and with the European Recycling Platform ([ERP-recycling.org](https://www.eur-recycling.org)) in all other countries of the European Union and in Norway.

If this product is located in Europe and you want to participate in the Thermo Fisher Scientific Business-to-Business (B2B) Recycling Program, send an email request to [weee.recycle@thermofisher.com](mailto:weee.recycle@thermofisher.com) with the following information:

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

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

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

## **Directive DEEE**

**2012/19/EU**



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

## **WEEE Direktive**

**2012/19/EU**



Thermo Fisher Scientific hat Vereinbarungen mit Verwertungs-/Entsorgungsfirmen in allen EU-Mitgliedsstaaten getroffen, damit dieses Produkt durch diese Firmen wiederverwertet oder entsorgt werden kann. Weitere Informationen finden Sie unter [www.thermoscientific.de/rohs](http://www.thermoscientific.de/rohs).

# Contents

<b>Preface</b>	<b>xv</b>
About Your System	xvi
Power Rating	xvi
Contacting Us	xvi
Related Documentation	xvi
Safety Alerts and Important Information	xvii
Special Notices	xvii
Safety Symbols and Signal Words	xvii
Instrument Markings and Symbols	xix
Safety Information and Warnings	xx
General Considerations	xx
Electrical Hazards	xx
Laser Safety Information	xxii
Other Hazards	xxiii
Working with Toxic or other Harmful Compounds	xxiv
Biological Hazards	xxv
Maintenance	xxv
Disposal	xxvi
 <b>Chapter 1</b>	
<b>Specifications</b>	<b>1</b>
Electrical Specifications	2
Physical Specifications	3
Operating and Environmental Specifications	3
Sound Pressure Level	4
Hardware and Software Requirements	4
Computer Hardware Requirements	4
USB Stick (Memory Drive)	5
PC Software Requirements	5
TriPlus RSH SMART System Software Requirements	7

<b>Chapter 2</b>	<b>Installation of the TriPlus RSH SMART System. . . . .</b>	<b>9</b>
	Introduction . . . . .	10
	Who Performs the Installation. . . . .	10
	Space Requirements. . . . .	10
	Electrical Requirements. . . . .	10
	Sampler Mounting Brackets . . . . .	10
	Material Required for the Installation . . . . .	11
	Installation Quick Reference Guide. . . . .	11
	Unpacking the Components . . . . .	13
	Installing the TriPlus RSH SMART Mounting Brackets on the GC. . . . .	13
	Sampler Mounting Brackets Assembling . . . . .	14
	Installing the Mounting Brackets on a Single GC . . . . .	15
	Installing the Mounting Brackets on a Double TRACE 1300 Series GC. . . . .	15
	Installing the Mounting Brackets on a TRACE 1300 Series GC Coupled with a MS . . . . .	15
	Installing the Mounting Brackets on a Double TRACE GC Ultra. . . . .	16
	Installing the Mounting Brackets on a Double FOCUS GC . . . . .	16
	Installing the Mounting Brackets on a TRACE GC Ultra Coupled with a FOCUS GC . . . . .	17
	Installing the Mounting Brackets on a Double TRACE GC Ultra Coupled with a MS . . . . .	18
	Installing the Mounting Brackets on a TRACE GC Ultra and on a FOCUS GC Coupled with a MS. . . . .	19
	Placing the TriPlus RSH SMART on the Mounting Brackets. . . . .	19
	Optional Single Mounting Legs . . . . .	20
	Installation of the TriPlus RSH SMART System. . . . .	21
	Installing the TriPlus RSH SMART Head . . . . .	24
	Installing the Handheld Controller and Safety Guard . . . . .	28
	Installing the Purge Gas Pressure Regulator. . . . .	32
	Installing the Tool Stations . . . . .	34
	Installing the TR Station . . . . .	34
	Installing the ATC Station . . . . .	35
	Installing the Washing Stations . . . . .	37
	Installing the Standard Wash Station. . . . .	37
	Installing the Large Volume Wash Station. . . . .	38
	Installing the Solvents Station . . . . .	39
	Installing the Fast Wash Station . . . . .	40
	Installing Heating/Shaking Modules and Stations . . . . .	42
	Installing the Agitator/Incubator Module . . . . .	42
	Installing a Vortexer Module . . . . .	43
	Installing a Heatex Stirrer Module. . . . .	44
	Installing a SPME Conditioning Station . . . . .	46
	Installing a SPME Arrow Conditioning Station. . . . .	49

Installing the Tray Holders . . . . .	52
Installing a Standard Tray Holder . . . . .	52
Installing a Liquid Cooled Tray Holder . . . . .	53
Installing a Temperature Controlled Drawer . . . . .	54
Installing Optional Modules . . . . .	57
Installing the Centrifuge . . . . .	57
Installing a Barcode Reader . . . . .	59
Installing a MHE Station . . . . .	60
Installing an OC Injector Module . . . . .	62
Installing a Flow Cell Holder Module . . . . .	63
Installing a Dilutor Module . . . . .	64
Inserting Syringe/Fiber into the Tool . . . . .	76
Inserting a LS Syringe into the LS Tool . . . . .	76
Inserting a HS Syringe into the HS Tool . . . . .	78
Installing the SPME Fiber Protector . . . . .	80
Inserting a SPME Fiber Holder into the SPME Tool . . . . .	82
Inserting the SPME Arrow Holder Into the SPME Arrow Tool . . . . .	84
Managing an ITEX DHS Syringe and Trap Assemble . . . . .	85
Connecting the Power Module . . . . .	90
Combining the TriPlus RSH SMART to Other Devices . . . . .	92
Synchronization and Output Signals . . . . .	92
External Connectors . . . . .	93
Handheld Controller Connector . . . . .	94
USB Host Connector . . . . .	95
USB Device/Client Connector . . . . .	95
Ethernet Connector . . . . .	95
BUS Connector . . . . .	96
Interface Connector . . . . .	96
Fuse Port . . . . .	97
Power Connector . . . . .	97
Establishing Communication with the Computer . . . . .	98
Connecting the TriPlus RSH SMART with Factory Settings . . . . .	98
Setting Up the Direct Connection . . . . .	99
Setting up the Network Interface . . . . .	100
Setting up the Network Interface by using the Handheld Controller . . . . .	101
Restoring Factory Default Network Settings . . . . .	102
Setting up a Corporate Network . . . . .	103
<b>Chapter 3 TriPlus RSH SMART Defining Object Positions . . . . .</b>	<b>105</b>
Definitions of Teaching, Referencing, and Calibration . . . . .	106
Slot Positions . . . . .	108
Definition of Row and Column . . . . .	109
Definition of Vial or Well Position Pattern . . . . .	110
Definition of Inclination . . . . .	111

Teaching TriPlus RSH SMART Modules .....	113
Introduction .....	113
Teaching Tool Stations .....	114
Teaching TR Station Position .....	114
Teaching ATC Station Position .....	114
Teaching Tray Holders .....	115
Teaching Standard Tray Holder Position .....	115
Teaching Liquid Cooled Tray Holder Position .....	116
Teaching Temperature Controlled Drawer Position .....	117
Teaching Washing Stations .....	118
Teaching Standard Wash Station Position .....	118
Teaching Large Volume Wash Station Position .....	119
Teaching Solvents Station Position .....	120
Teaching Fast Wash Station Position .....	121
Teaching Heating/Shaking Modules and Stations .....	121
Teaching Agitator Module Position .....	122
Teaching Vortexer Module Position .....	123
Teaching the Heatex Stirrer Module Position .....	124
Teaching SPME Conditioning Station Position .....	125
Teaching SPME Arrow Conditioning Station Position .....	126
Teaching Optional Modules .....	127
Teaching the Centrifuge Position .....	127
Teaching the Barcode Reader Position .....	127
Teaching Flow Cell Holder Position .....	128
Teaching MHE Station Position .....	129
Teaching GC Injector Position .....	130
TriPlus RSH SMART Tool Referencing and Calibration .....	131
Introduction .....	131
TriPlus RSH SMART Tool Referencing .....	132
TriPlus RSH SMART Tool Calibration .....	133
Modules Teaching Step-by-Step Procedure .....	134

<b>Chapter 4</b>	<b>TriPlus RSH SMART Firmware .....</b>	<b>139</b>
	The RSH SMART Firmware .....	140
	Introduction .....	140
	TriPlus RSH SMART Firmware Filename Structure .....	141
	Overview of the Backup and Restore Function .....	141
	TriPlus RSH SMART Firmware Backup .....	142
	Create Diagnostic Backup File .....	143
	Copy a Diagnostic Backup File .....	144
	Create Configuration Backup File .....	145
	Copy a Configuration Backup File .....	146
	Restore Backup File .....	147
	Special Cases and Error Message .....	148
	After Completion of the Restore Process .....	149



	Update and Downgrade Functions . . . . .	149
	Updating the TriPlus RSH SMART Firmware . . . . .	151
	Updating Process . . . . .	151
	Downgrading the TriPlus RSH SMART Firmware . . . . .	153
	Downgrading Process . . . . .	154
	After Completion of an Update or a Downgrade Process . . . . .	157
<b>Chapter 5</b>	<b>Maintenance . . . . .</b>	<b>161</b>
	Routine Maintenance . . . . .	162
	Preventative Maintenance . . . . .	163
	Working with Hazardous Material and Decontamination . . . . .	164
	Sampler Removal from the GC . . . . .	164
	Emptying of the Waste Container . . . . .	165
	External Cleaning of the Sampler . . . . .	165
	Cleaning the Interior of the Head . . . . .	166
	Cleaning of the LS/HS Syringe . . . . .	166
	Cleaning the ITEX DHS Trap . . . . .	166
	Replacing the ITEX DHS Trap Heater and Cooling Fan . . . . .	166
	Maintaining a Liquid Cooler Tray Holder . . . . .	169
	Maintaining the Tray Cooler . . . . .	170
	Maintaining a Temperature Controlled Drawer . . . . .	170
	Maintaining a Fast Wash Station . . . . .	171
	Maintaining an Agitator/Incubator Module . . . . .	171
	Maintaining a Vortexer Module . . . . .	172
	Maintaining a Heater Stirrer Module . . . . .	172
	Maintaining a SPME Conditioning Station . . . . .	173
	Maintaining a SPME Arrow Conditioning Station . . . . .	173
	Maintaining a Centrifuge . . . . .	174
	Maintaining a Barcode Reader . . . . .	175
	Maintaining a MHE Station . . . . .	175
	Maintaining the Flow Cell Holder . . . . .	176
	Maintaining an OC Injector Actuator . . . . .	177
	Maintaining a Dilutor Module . . . . .	178
<b>Chapter 6</b>	<b>Troubleshooting . . . . .</b>	<b>179</b>
	General Points Related to TriPlus RSH SMART . . . . .	180
	TriPlus RSH SMART Firmware Related Points . . . . .	183
	LAN Communication Problems using Direct Connection . . . . .	184
	LAN Communication Problems within Corporate Network . . . . .	185
	LAN Communication Problems Related to Network Interface Card (NIC) . . . . .	186
	Troubleshooting Check for LAN Communication . . . . .	188
	System Status LED at Status Bar or at X-Axis Side Cover . . . . .	189
	LED Status at Control Board . . . . .	190
	Manually Removing a Tool from the Head . . . . .	191
	Liquid Cooled Tray Holder Troubleshooting . . . . .	194

Tray Cooler Troubleshooting . . . . .	194
Temperature Controlled Drawer Troubleshooting . . . . .	195
Fast Wash Station Troubleshooting . . . . .	197
Agitator/Incubator Module Troubleshooting . . . . .	198
Vortexer Module Troubleshooting . . . . .	199
Heatex Stirrer Module Troubleshooting . . . . .	200
SPME Conditioning Station Troubleshooting . . . . .	200
SPME Arrow Conditioning Station Troubleshooting . . . . .	201
Centrifuge Troubleshooting . . . . .	202
Barcode Troubleshooting . . . . .	202
MHE Station Troubleshooting . . . . .	203
OC Injector Actuator Troubleshooting . . . . .	205
Dilutor Module Troubleshooting . . . . .	205

# Preface

This manual contains information about installing, defining object, interfacing, maintaining, and troubleshooting the Thermo Scientific™ TriPlus RSH SMART™.

This manual is organized as follows:

- [Chapter 1, “Specifications,”](#) provides general specifications of the TriPlus RSH SMART.
- [Chapter 2, “Installation of the TriPlus RSH SMART System,”](#) provides information for installing the TriPlus RSH SMART System.
- [Chapter 3, “TriPlus RSH SMART Defining Object Positions,”](#) provides the instructions for defining the teaching position of the TriPlus RSH SMART 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 SMART 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 SMART 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 SMART

- 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.thermofisher.com> 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 SMART.

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

# 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
	<b>BIOHAZARD:</b> Indicates that a biohazard <i>will, could, or might</i> occur.
	<b>BURN HAZARD:</b> Alerts you to the presence of a hot surface that <i>could</i> or <i>might</i> cause burn injuries.
	<b>ELECTRICAL SHOCK HAZARD:</b> Indicates that an electrical shock <i>could</i> or <i>might</i> occur.
	<b>FIRE HAZARD:</b> Indicates a risk of fire or flammability <i>could</i> or <i>might</i> occur.
	<b>EXPLOSION HAZARD.</b> Indicates an explosion hazard. This symbol indicates this risk <i>could</i> or <i>might</i> cause physical injury.
	<b>FLAMMABLE GAS HAZARD.</b> Alerts you to gases that are compressed, liquefied or dissolved under pressure and can ignite on contact with an ignition source. This symbol indicates this risk <i>could</i> or <i>might</i> cause physical injury.

	<b>GLOVES REQUIRED:</b> Indicates that you must wear gloves when performing a task or physical injury <i>could</i> or <i>might</i> occur.
	<b>CLOTHING REQUIRED.</b> Indicates that you should wear a work clothing when performing a task or else physical injury <i>could</i> or <i>might</i> occur.
	<b>BOOTS REQUIRED.</b> Indicates that you must wear boots when performing a task or else physical injury <i>could</i> or <i>might</i> occur.
	<b>MATERIAL AND EYE HAZARD.</b> Indicates you must wear eye protection when performing a task.
	<b>HAND AND CHEMICAL HAZARD:</b> Indicates that chemical damage or physical injury <i>could</i> or <i>might</i> occur.
	<b>HARMFUL.</b> Indicates that the presence of harmful material <i>will, could, or might</i> occur.
	<b>INSTRUMENT DAMAGE:</b> Indicates that damage to the instrument or component <i>might</i> occur. This damage might not be covered under the standard warranty.
	<b>LIFTING HAZARD.</b> Indicates that a physical injury <i>could</i> or <i>might</i> occur if two or more people do not lift an object.
	<b>MATERIAL AND EYE HAZARD:</b> Indicates that eye damage <i>could</i> or <i>might</i> occur.
	<b>READ MANUAL:</b> Alerts you to carefully read your instrument's documentation to ensure your safety and the instrument's operational ability. Failing to carefully read the documentation <i>could</i> or <i>might</i> put you at risk for a physical injury.
	<b>TOXIC SUBSTANCES HAZARD:</b> Indicates that exposure to a toxic substance could occur and that exposure <i>could</i> or <i>might</i> cause personal injury or death.
	<b>LASER HAZARD.</b> Indicates that exposure to a laser beam <i>will, could, or might</i> cause personal injury.
	<b>RADIOACTIVE HAZARD.</b> Indicates that the presence of radioactive material <i>could</i> or <i>might</i> occur.
	For the prevention of personal injury, this general warning symbol precedes the <b>WARNING</b> safety alert word and meets the ISO 3864-2 standard. In the vocabulary of ANSI Z535 signs, this symbol indicates a possible personal injury hazard exists if the instrument is improperly used or if unsafe actions occur. This symbol and another appropriate safety symbol alerts you to an imminent or potential hazard that <i>could cause personal injury</i> .


# Instrument Markings and Symbols

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

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

Symbol	Description
	Direct Current
* 	Alternating Current
	Both direct and alternating current
3 	Three-phase alternating current
	Earth (ground) terminal
	Protective conductor terminal
	Frame or chassis terminal
	Equipotentiality
*	On (Supply)
* 	Off (Supply)
	Equipment protected throughout by DOUBLE INSULATION or REINFORCED INSULATION (Equivalent to Class II of IEC 536)
	Fuse
* 	Instruction manual symbol affixed to product. Indicates that the you must refer to the manual for specific <b>WARNING</b> or <b>CAUTION</b> 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 SMART, or parts of it (following the life cycle principle), as well as for the end user TriPlus RSH SMART in the lab during the learning phase, and in routine work.



**IMPORTANT** Read this section first before operating the TriPlus RSH SMART.

## General Considerations

- Before a unit is put to use, consult the *TriPlus RSH SMART 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 SMART.



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 SMART only to instruments complying with IEC 61010 safety regulations.

The power line and the connections between the TriPlus RSH SMART 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 SMART 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 SMART 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 SMART. 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 SMART 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 SMART. 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 SMART. If a power supply is not functioning, contact a Thermo Fisher Scientific representative.



The power supplies for the TriPlus RSH SMART, 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 SMART, 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 SMART.

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 SMART 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 SMART operation, keep your hands away from the syringe.



Do not operate the TriPlus RSH SMART 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 SMART.



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 SMART 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 SMART. 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 SMART, follow the generally accepted procedures for quality control and method development.

When using the TriPlus RSH SMART 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 SMART 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 SMART 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 SMART 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 tray, 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 SMART.

## 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 SMART for complimentary equipment pick-up and recycling.

**WARNING** The customer has to ensure that the TriPlus RSH SMART 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 SMART.

## Contents

- [Electrical Specifications](#)
- [Physical Specifications](#)
- [Operating and Environmental Specifications](#)
- [Sound Pressure Level](#)
- [Hardware and Software Requirements](#)
- [TriPlus RSH SMART System Software Requirements](#)

## 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 SMART with standard and extended X-axis 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 SMART standard X axis	46 <sup>1</sup>	18 <sup>1</sup>	85	33.5	54	21.3	13.3 <sup>4</sup>	29.3 <sup>4</sup>
TriPlus RSH SMART extended X-axis	46 <sup>1</sup>	18 <sup>1</sup>	120.5	47	54	21.3	15.3 <sup>4</sup>	33.7 <sup>4</sup>
TriPlus RSH SMART standard X axis (Working Range)	80 <sup>1</sup>	31.5	99 <sup>2</sup>	39 <sup>2</sup>	53 (74) <sup>3</sup>	20.9 (29) <sup>3</sup>	25	55
TriPlus RSH SMART extended X-axis (Working Range)	80 <sup>1</sup>	31.5	135 <sup>2</sup>	53 <sup>2</sup>	53 (74) <sup>3</sup>	20.9 (29) <sup>3</sup>	27	60

<sup>1</sup> About 20 cm (about 8-in.) of the orthogonal crossrail (Y-axis) are protruding the back of the GC.

<sup>2</sup> Dimension of the entire working range including Handheld bracket.

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

<sup>4</sup> Mass without accessories.

## Operating and Environmental Specifications

These specifications are listed in [Table 4](#).

**Table 4.** Operating and Environmental Specifications (Sheet 1 of 2)

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.

**Table 4.** Operating and Environmental Specifications (Sheet 2 of 2)

Parameter	Requirements
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	<p>Measured value:</p> <ul style="list-style-type: none"><li>• TriPlus RSH SMART (basic unit): 64 dBA</li><li>• TriPlus RSH SMART with Agitator: 66 dBA</li><li>• TriPlus RSH SMART with Vortexer without sample vial: 67 dBA</li><li>• TriPlus RSH SMART with Vortexer with 20 ml sample vial inserted: 78 dBA.</li></ul> <p>One meter from the equipment in the direction of maximum sound pressure level.</p>
According to UL 610107A-1, 1st Edition, clause 12.5.	Limit < 85 dBA; where 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 Thermo Scientific™ Chromatography Data System (CDS) in use.

For operation of the TriPlus RSH SMART an Ethernet (TCP/IP) is 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 SMART supports the Auto-MDI(X) protocol.

See the section “[Establishing Communication with the Computer](#)” on [page 98](#) for the networking setup.

The USB Device/Client Type B communication port of the TriPlus RSH SMART 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 SMART system.

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

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

For the operation of the TriPlus RSH SMART 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 SMART, it is important to note that the CDS to be used in conjunction with the TriPlus RSH SMART may 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 SMART 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 have to be unlocked. See the section “[Setting up a Corporate Network](#)” on [page 103](#) for details.

## 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 SMART System Software Requirements

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

- Operating System (OS)
- TriPlus RSH SMART Application Software
- TriPlus RSH SMART Configuration (persisted data)
- TriPlus RSH SMART Device Firmware
- Presets

When restoring a **TriPlus RSH SMART Configuration Backup**, the software packages **TriPlus RSH SMART 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 SMART device firmware are not stored in the Configuration Backup.

In case of a software update for the TriPlus RSH SMART 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 SMART 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, to provide the full compatibility could also be necessary to adapt both the **TriPlus RSH SMART Application** and the **TriPlus RSH SMART Configuration** software.

**Note** For detailed information see the [Chapter 4, “TriPlus RSH SMART Firmware.”](#)



# Installation of the TriPlus RSH SMART System

This chapter provides information for installing the TriPlus RSH SMART System.

## Contents

- [Introduction](#)
- [Installation Quick Reference Guide](#)
- [Unpacking the Components](#)
- [Installing the TriPlus RSH SMART Mounting Brackets on the GC](#)
- [Placing the TriPlus RSH SMART on the Mounting Brackets](#)
- [Optional Single Mounting Legs](#)
- [Installation of the TriPlus RSH SMART System](#)
- [Installing the TriPlus RSH SMART Head](#)
- [Installing the Handheld Controller and Safety Guard](#)
- [Installing the Purge Gas Pressure Regulator](#)
- [Installing the Tool Stations](#)
- [Installing the Washing Stations](#)
- [Installing Heating/Shaking Modules and Stations](#)
- [Installing the Tray Holders](#)
- [Installing Optional Modules](#)
- [Inserting Syringe/Fiber into the Tool](#)
- [Connecting the Power Module](#)
- [Combining the TriPlus RSH SMART to Other Devices](#)
- [Establishing Communication with the Computer](#)

# Introduction

This chapter describes the installation of the TriPlus RSH SMART and its modules. Referencing of the TriPlus RSH SMART and teaching of the various modules are described in [Chapter 3, “TriPlus RSH SMART Defining Object Positions.”](#)

## Who Performs the Installation



**CAUTION** The TriPlus RSH SMART 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 SMART must be installed making reference to the overall dimensions of the sampler described in the *TriPlus RSH SMART 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 SMART 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 SMART only to instruments complying with the IEC 61010 safety regulations.

## Sampler Mounting Brackets

The TriPlus RSH SMART is installed on the GC by using the two appropriate mounting brackets provided. Every mounting bracket has a bar provided with holes for 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 SMART and its modules, the following Tools are 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 work area and the GC System.	See the relevant <b>Preinstallation Requirements Guide</b> for the GC system and the TriPlus RSH SMART.
02	Check if all components of the TriPlus RSH SMART System are delivered.	See “Unpacking the Components” on page 13
03	Install the TriPlus RSH SMART mounting brackets on the GC	See “Installing the TriPlus RSH SMART Mounting Brackets on the GC” on page 13
04	Install the TriPlus RSH SMART on the GC.	See “Placing the TriPlus RSH SMART on the Mounting Brackets” on page 19
05	Connect the Active and Passive modules, to complete the required system configuration.	See “Installation of the TriPlus RSH SMART System” on page 21
06	Make the electrical connections, including for the Active modules	See “Installation of the TriPlus RSH SMART System” on page 21
07	Prepare the Tool(-s). Insert the required syringe(-s).	“Inserting a LS Syringe into the LS Tool” on page 76 or “Inserting a HS Syringe into the HS Tool” on page 78, or “Inserting a SPME Fiber Holder into the SPME Tool” on page 82 “Inserting the SPME Arrow Holder Into the SPME Arrow Tool” on page 84 “Managing an ITEX DHS Syringe and Trap Assemble” on page 85
08	Prepare the computer with the required software:	Follow the recommendations and specifications from Thermo Fisher Scientific. See the section <b>Hardware and Software Requirements</b> in the <i>TriPlus RSH SMART User Guide</i> .
09	Connect the TriPlus RSH SMART to a network. LAN cable provided with the system.	See “Combining the TriPlus RSH SMART to Other Devices” on page 92.
10	Power up the system	See the section <b>How to Start the TriPlus RSH SMART</b> in the <i>TriPlus RSH SMART User Guide</i> .

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

Step	Action	Reference
11	When Handheld Controller is not part of the TriPlus RSH SMART system: Establish LAN Communication and Start the Virtual Handheld Controller software under Xcalibur.	Follow the recommendations and specifications from Thermo Fisher Scientific.
12	Check the RSH SMART Firmware Version.  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.	Path from the Start Screen: Options   About. See the section <b>About Menu</b> in the <i>TriPlus RSH SMART User Guide</i> .  See “Updating the TriPlus RSH SMART Firmware” on page 151.
13	Change the Access Level to Extended User	See the section <b>Access Level</b> in the <i>TriPlus RSH SMART User Guide</i> .
14	Press Options and select in the pull-up menu Setup > Modules. - Check availability of the Active modules.  - Add all required Passive modules.  - Check or add (if necessary) in the following order: Signal, Input/Output Interface, Chromatograph System	See the chapter <b>Setup Menu Item</b> in the <i>TriPlus RSH SMART User Guide</i> .
15	From the Start Screen select the required Tool, press Enter and select menu item Needle Guide Type.  <b>NOTE:</b> The parameter <b>Cap Type</b> 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 <b>Needle Guide Type</b> is defined as <b>Not Specified</b> , a run is prohibited also when the <b>Cap Type</b> is set <b>No Cap</b> or <b>Non Magnetic Cap</b> .	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 <b>Options</b> and select in the pull-up menu Service   Installation. Follow step-by-step the installation wizard.	See the section <b>Service Menu - Installation Item</b> in the <i>TriPlus RSH SMART User Guide</i> .
17	Make a Backup file	See the section <b>Maintenance Menu Item- Backup</b> in the <i>TriPlus RSH SMART User Guide</i> and Chapter 4, “TriPlus RSH SMART Firmware.”

## Unpacking the Components

The TriPlus RSH SMART is shipped in two boxes. Depending on the configuration, and optional modules, the entire system may ship in more than two boxes:

- The main box contains the TriPlus RSH SMART base (X-,Y- axes assembly) and the standard modules such as the TriPlus RSH SMART Handheld Controller, Power Module, Tray Holders, Trays, Wash Stations, and so on.
- The second box contains the TriPlus RSH SMART 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, and remove the accessory boxes to compare to the packing list, and check for completeness of the shipment
2. Carefully lift the TriPlus RSH SMART 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 SMART base assembly on a bench.

3. Unpack the remaining box that includes the TriPlus RSH SMART Head. If applicable, unpack the other boxes with any additional accessories included.
4. When placing the TriPlus RSH SMART System onto a GC, make sure that no objects interfere with the Y-axis, or the TriPlus RSH SMART Head, throughout the entire potential range of movement.

**Note** Single modules and stations are shipped in single box separated from the main boxes of the TriPlus RSH SMART.

## Installing the TriPlus RSH SMART Mounting Brackets on the GC

The TriPlus RSH SMART mounting brackets are provided in a dedicated **GC Mounting Kit**.

To install the mounting brackets on your GC refer to the following procedures:

- “Installing the Mounting Brackets on a Single GC” on [page 15](#)
- “Installing the Mounting Brackets on a Double TRACE 1300 Series GC” on [page 15](#)
- “Installing the Mounting Brackets on a TRACE 1300 Series GC Coupled with a MS” on [page 15](#)
- “Installing the Mounting Brackets on a Double TRACE GC Ultra” on [page 16](#)

## 2 Installation of the TriPlus RSH SMART System

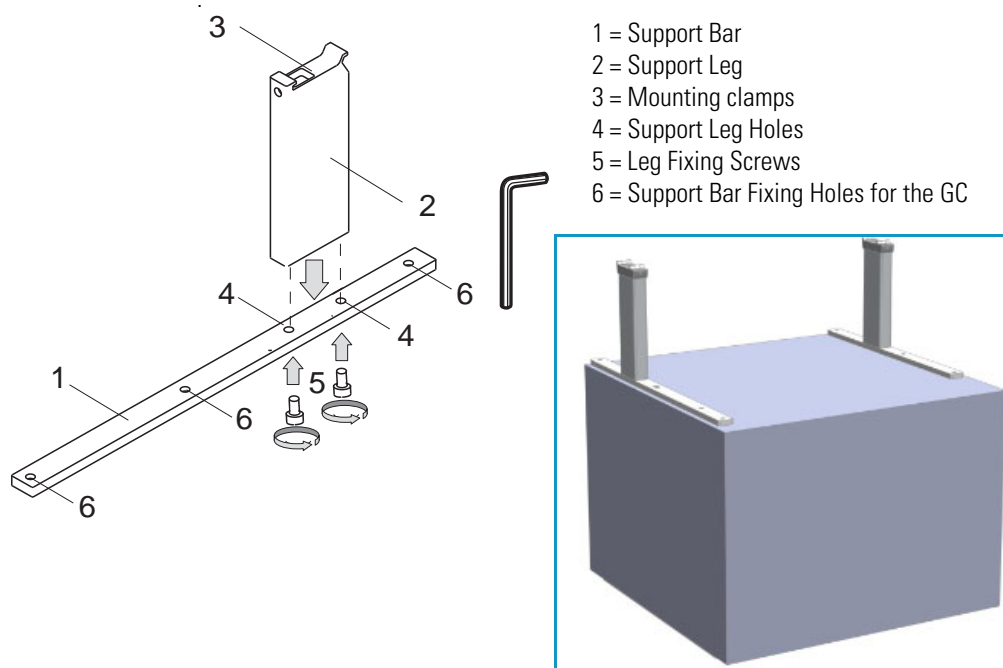
Installing the TriPlus RSH SMART Mounting Brackets on the GC

- “Installing the Mounting Brackets on a Double FOCUS GC” on page 16
- “Installing the Mounting Brackets on a TRACE GC Ultra Coupled with a FOCUS GC” on page 17
- “Installing the Mounting Brackets on a Double TRACE GC Ultra Coupled with a MS” on page 18
- “Installing the Mounting Brackets on a TRACE GC Ultra and on a FOCUS GC Coupled with a MS” on page 19

### Sampler Mounting Brackets Assembling

#### ❖ To assemble a sampler mounting bracket

**Figure 1.** Mounting Bracket Assembly



With reference to [Figure 1](#), proceed as follows:

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 Mounting Brackets on a Single GC

### ❖ To install the sampler mounting brackets 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 mounting bracket 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 Mounting Brackets on a Double TRACE 1300 Series GC

### ❖ To install the mounting brackets on a double TRACE 1300 Series GC 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 Series GCs 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 mounting bracket 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 Mounting Brackets on a TRACE 1300 Series GC Coupled with a MS

### ❖ To install the mounting bracket on a TRACE 1300 Series GC 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.

## 2 Installation of the TriPlus RSH SMART System

Installing the TriPlus RSH SMART Mounting Brackets on the 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 mounting bracket 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 Mounting Brackets on a Double TRACE GC Ultra

#### ❖ To install the mounting brackets 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 mounting bracket 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 Mounting Brackets on a Double FOCUS GC

#### ❖ To install the mounting brackets on two FOCUS GC 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 mounting bracket 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 SMART 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 mounting bracket 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 Mounting Brackets on a TRACE GC Ultra Coupled with a FOCUS GC

### ❖ To install the mounting brackets 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 Installation of the TriPlus RSH SMART System

Installing the TriPlus RSH SMART Mounting Brackets on the GC

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 mounting brackets must not be assembled. If the mounting brackets have already been assembled, one of them must be disassembled.

3. Disassemble one mounting bracket 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 mounting bracket 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 Mounting Brackets on a Double TRACE GC Ultra Coupled with a MS

- ❖ **To install the mounting brackets 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 SMART 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 mounting bracket 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 Mounting Brackets on a TRACE GC Ultra and on a FOCUS GC Coupled with a MS

- ❖ **To install the mounting brackets 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 SMART 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 mounting bracket 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 mounting brackets 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 SMART on the Mounting Brackets

- ❖ **To place the TriPlus RSH SMART onto the mounting brackets**

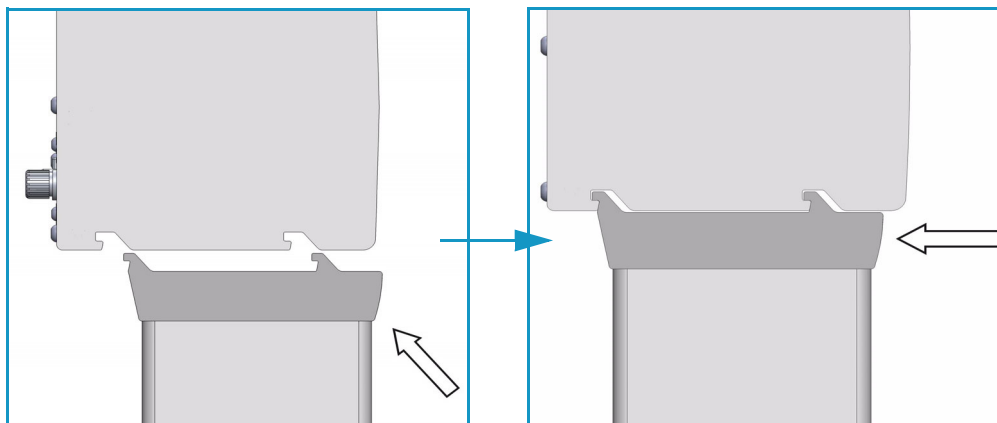
1. Loosen the two mounting clamps Torx screws of the vertical legs.
2. Place the TriPlus RSH SMART base assembly on top and fit the legs into the groove in the X- axis.



**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.

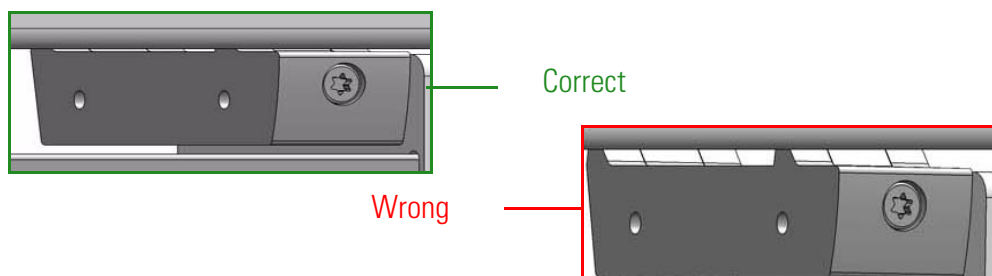
3. Be sure that the mounting clamps fit completely into the grooves. Alternately tighten the two Torx screws until the legs are firmly in place.

**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](#).

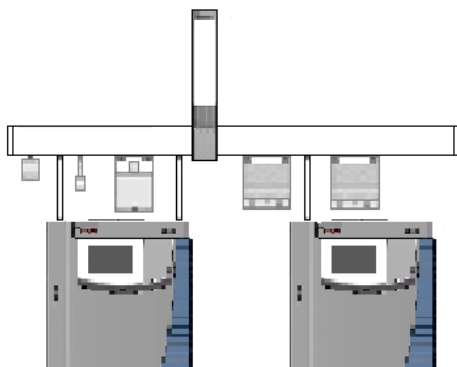
**Figure 3.** Correct and Wrong Hooking of Mounting Clamps



## Optional Single Mounting Legs

Single mounting Legs for Extended TriPlus RSH SMART are recommended in order to balance the excess of weight that occur when an **extended** TriPlus RSH SMART rail, fully loaded with accessories, is installed on a TRACE 1300 Series or a QEGC system. See [Figure 4](#), [Figure 5](#) and [Figure 6](#).

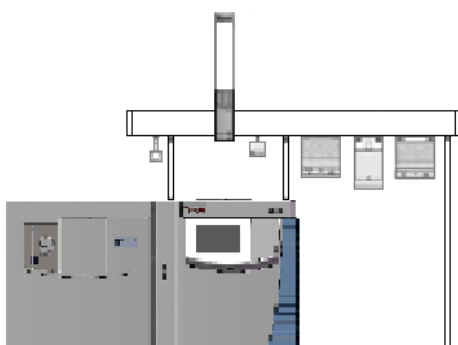
**Figure 4.** Optional Single Leg (1)



Single mounting leg (P/N 1R77010-1066) to connect a TriPlus RSH SMART installed on a main GC to an additional TRACE 1300 Series GC.

This mounting leg is 210 mm high. It is suitable for either left or right side connection.

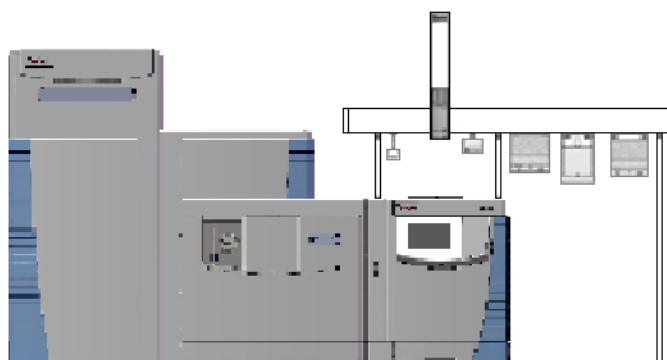
**Figure 5.** Optional Single Leg (2)



Single mounting leg (P/N 1R77010-1041) recommended in order to balance the excess of weight that occur when an extended TriPlus RSH SMART rail, fully loaded with accessories, is installed on a TRACE 1300 Series GC.

This mounting leg is 667 mm high. It is suitable for either left or right side connection.

**Figure 6.** Optional Single Leg (3)



Single mounting leg (P/N 1R77010-1042) recommended in order to balance the excess of weight that occur when an extended TriPlus RSH SMART rail, fully loaded with accessories, is installed on a QEGC system.

This mounting leg is 726 mm high.

## Installation of the TriPlus RSH SMART System

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

## 2 Installation of the TriPlus RSH SMART System

Installation of the TriPlus RSH SMART System



**Note for Field Service Engineers** — Discuss with the customer the positions of the TriPlus RSH SMART base and the TriPlus RSH SMART modules hooked to the X-axis considering the GC configuration.

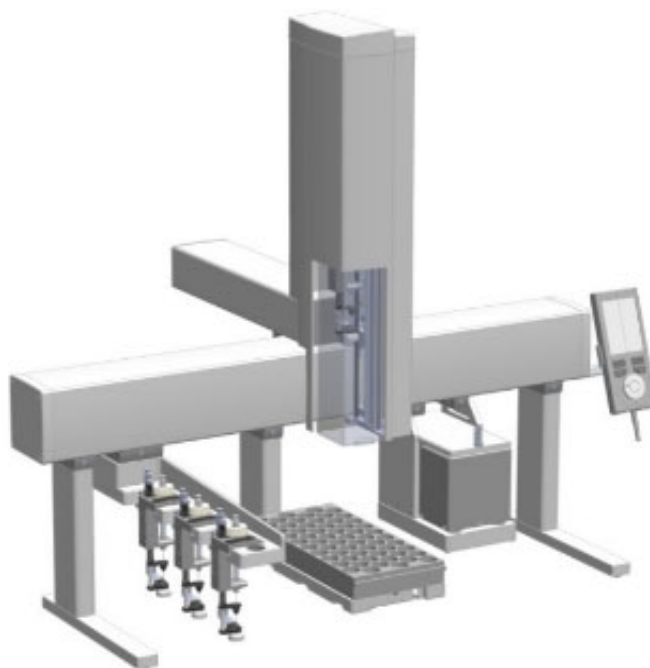
Open zones should be easily accessible by the TriPlus RSH SMART Head but placing a TriPlus RSH SMART object above a heated zone could be dangerous, or at the very least influence the stability of the analytical sample. Consider the space availability in the lab and to adjacent instruments as well.



**WARNING** Do not place a TriPlus RSH SMART 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 7 shows an example of a TriPlus RSH SMART system with its modules installed.

**Figure 7.** Example of TriPlus RSH SMART System Modules



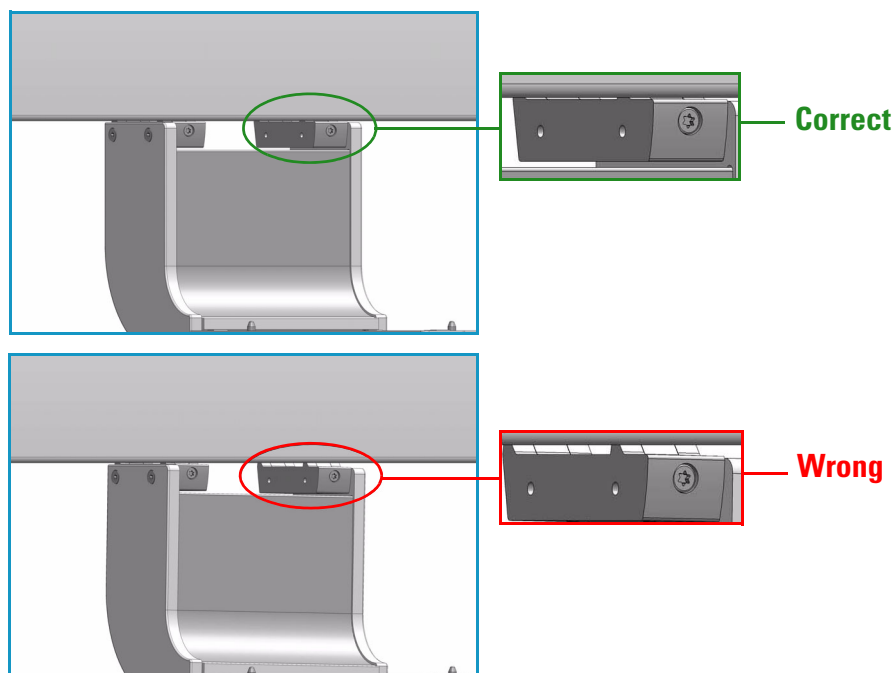
It is suggested to install the modules on the X-axis in the position more suitable, paying attention not to invade the injection zone. The installed components shall not prevent the Z-axis movements.

### ❖ To anchor a module 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 8](#).

**Figure 8.** Correct and Wrong Hooking of Module Mounting Clamps



4. Tighten the fixing screw located behind the clamp.

For installing each module refer to the following sections:

- “Installing the TriPlus RSH SMART Head” on [page 24](#)
- “Installing the Handheld Controller and Safety Guard” on [page 28](#)
- “Installing the Purge Gas Pressure Regulator” on [page 32](#)
- “Installing the Tool Stations” on [page 34](#)
- “Installing the Washing Stations” on [page 37](#)
- “Installing Heating/Shaking Modules and Stations” on [page 42](#)
- “Installing the Tray Holders” on [page 52](#)
- “Installing Optional Modules” on [page 57](#)

## Installing the TriPlus RSH SMART Head

**Note** Installation of the TriPlus RSH SMART 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.



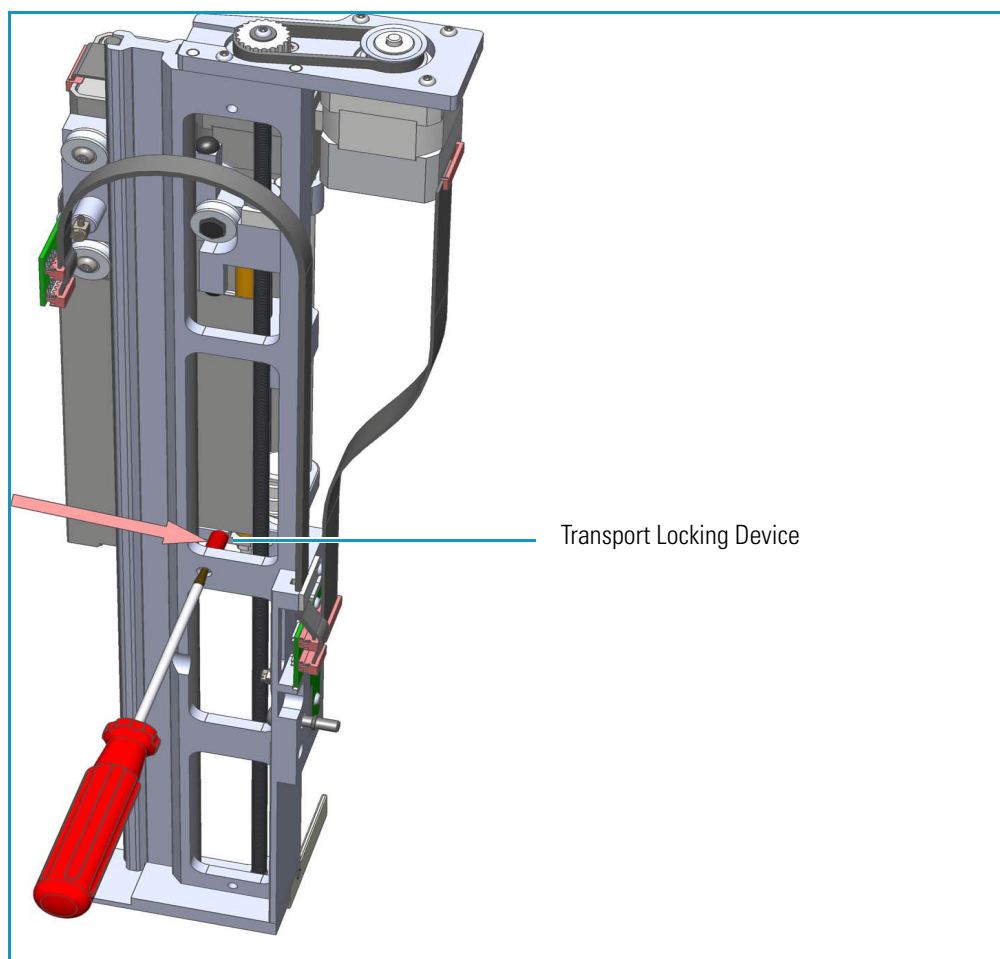
**IMPORTANT** The Head is secured with a **Transport Locking Device** in order to prevent uncontrolled movement of the slider along the Z-Axis during the shipping. The locking device must be removed before installing the Head to the base.

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

### ❖ To install the TriPlus RSH SMART head

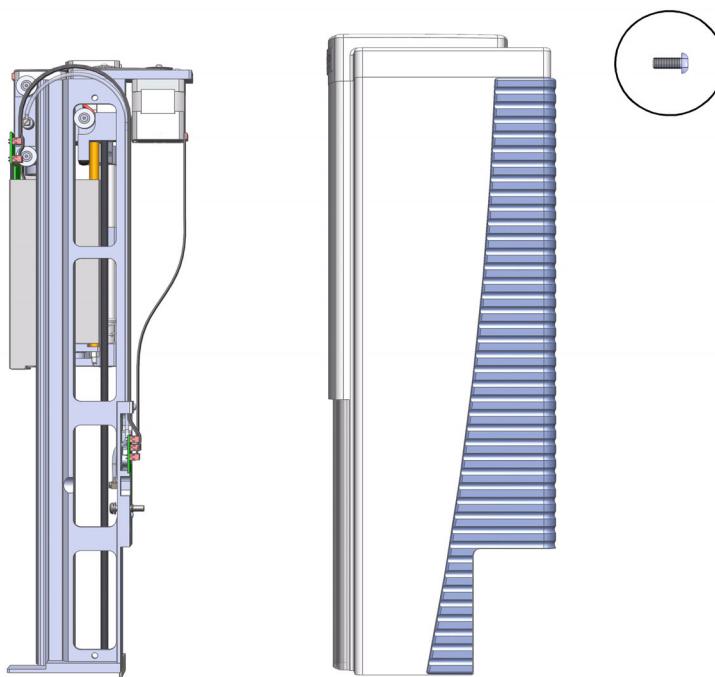
1. Locate the **Transport Locking Device** screw. Using a Torx T10 screwdriver remove the screw and the polymer spacer. See [Figure 9](#).

**Figure 9.** Transport Locking Device



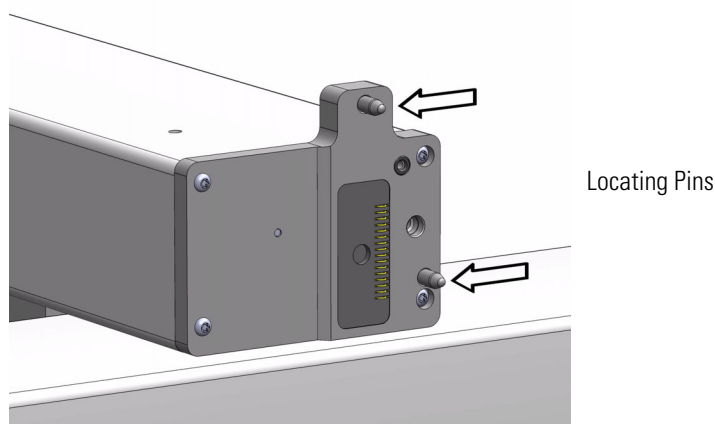
2. Save the Transport Locking Device for future use. If for any reason the Head unit has to be returned for inspection or repair, the Transport Locking Device must be reinstalled prior to shipping.
3. Locate the Torx mounting screw as shown in [Figure 10](#).

**Figure 10.** TriPlus RSH SMART Head Internal Mechanic Part and Cover

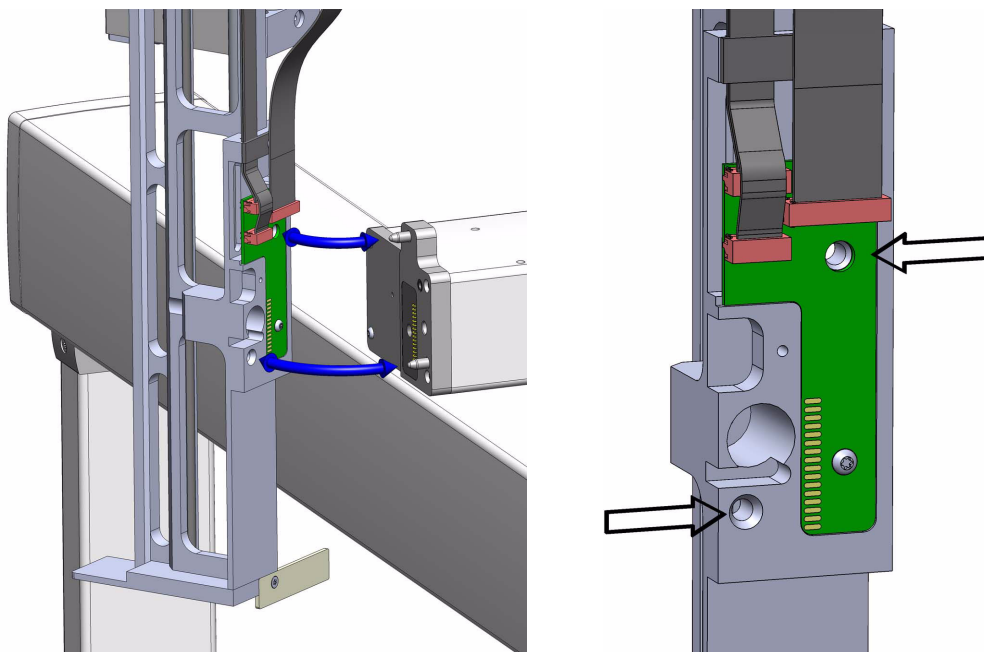


4. Hold the TriPlus RSH SMART Head in place against the Y-axis. Make sure the two locating pins on the Y-axis fit into the two guide pin holes on the TriPlus RSH SMART Head. See [Figure 11](#) and [Figure 12](#).

**Figure 11.** Head Mounting (1)

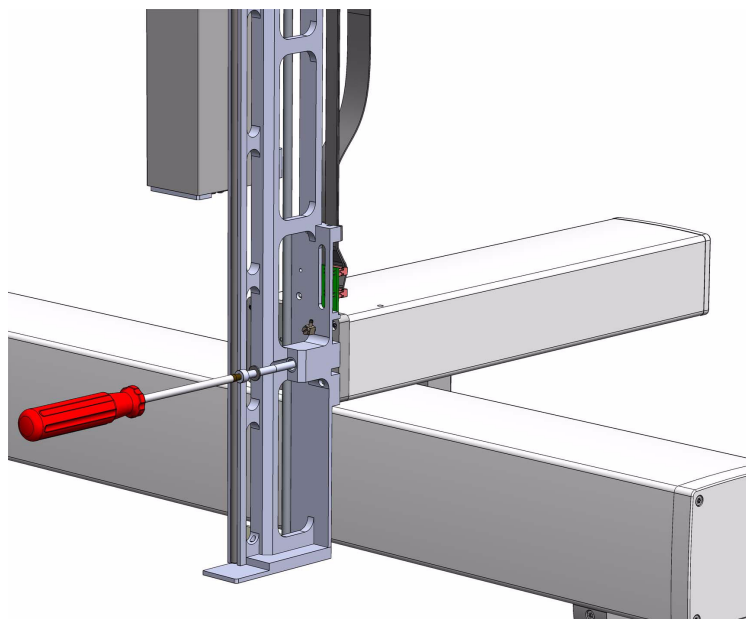


**Figure 12.** Head Mounting (2)



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 13](#).

**Figure 13.** Head Mounting (3)

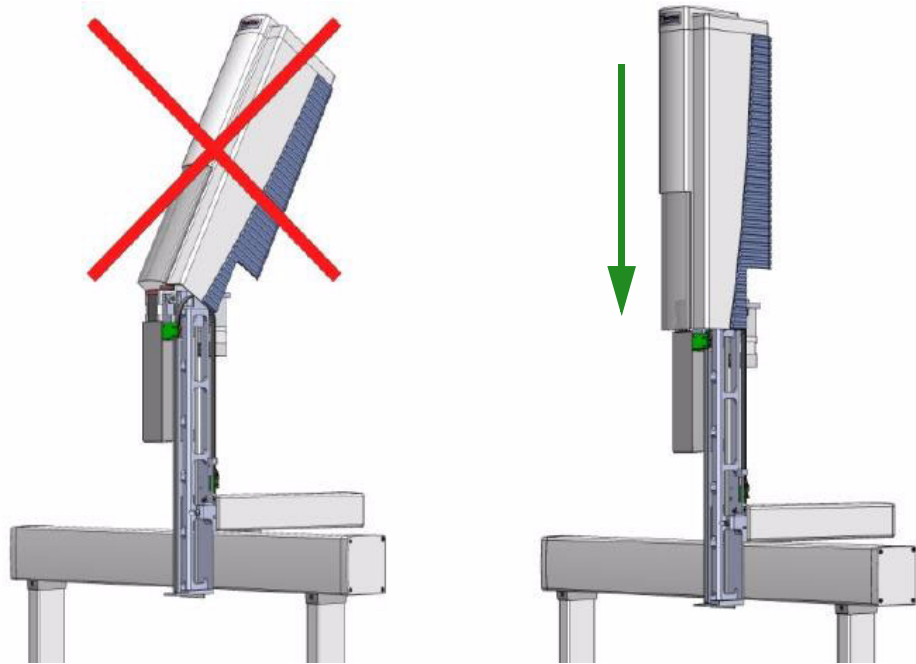


**Note** The Ribbon Cables and the Gas Purge Line within the TriPlus RSH SMART Head are already assembled and fixed. No installation of these parts is necessary. The Gas Purge Line connects the Y-axis, sealed by an O-ring, to the TriPlus RSH SMART Head.



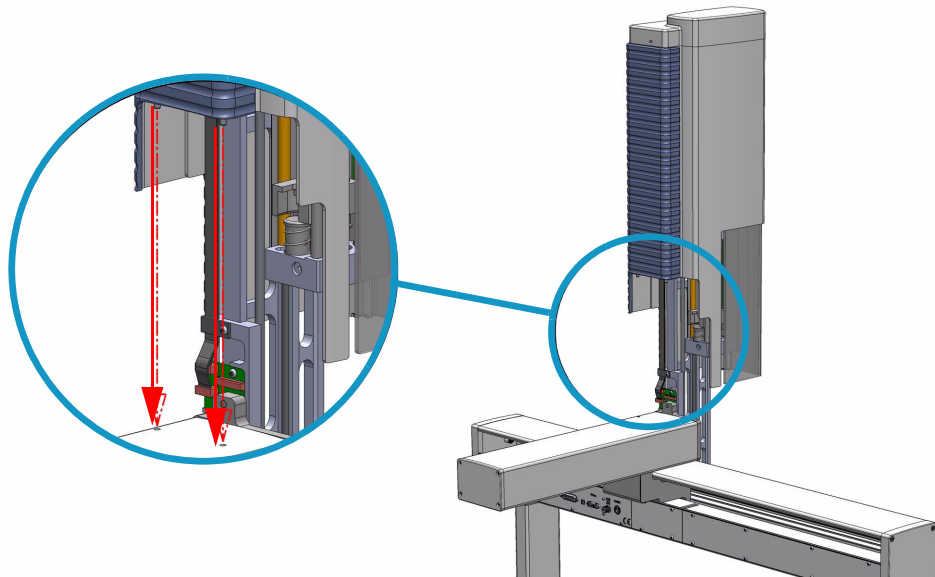
6. Locate the TriPlus RSH SMART Head cover and put it over the mechanical construction of the Head very carefully to avoid any damage to a ribbon cable, motor connections and other critical parts.
7. Hold the cover in a perpendicular way and slide it over the mechanics of the Head. Avoid angling of the cover when attaching it to the mechanics. See [Figure 14](#).

**Figure 14.** Head Mounting (4)



8. Put the Head cover over the mechanical construction from the top in perpendicular path. See [Figure 15](#).

**Figure 15.** Head Mounting (5)

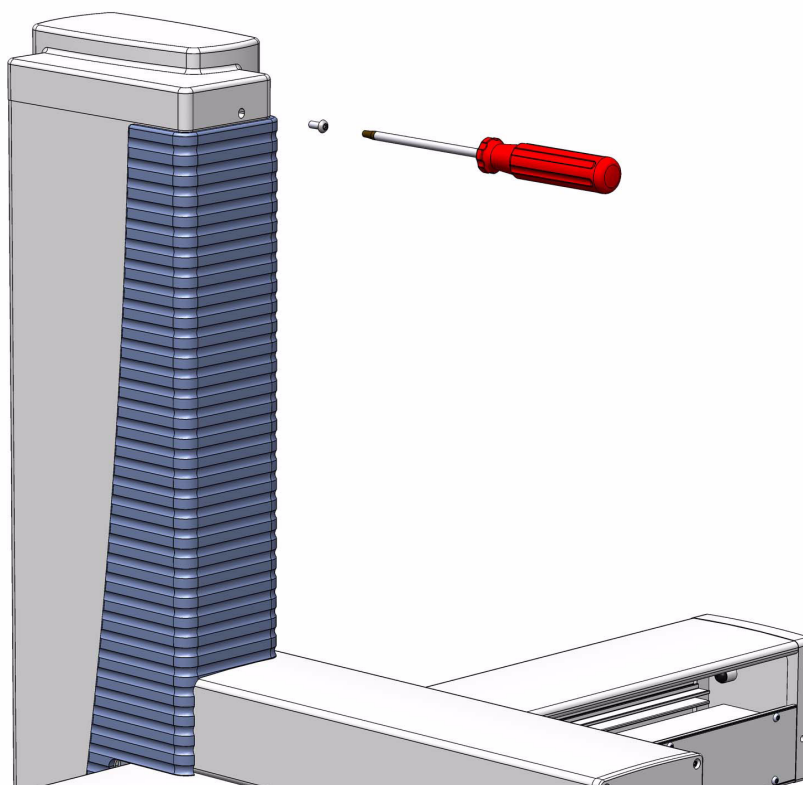


## 2 Installation of the TriPlus RSH SMART System

### Installing the Handheld Controller and Safety Guard

9. Tighten the screw at the backside of the cover to fix it to its mechanical part.  
See [Figure 16](#).

**Figure 16.** Head Mounting (6)



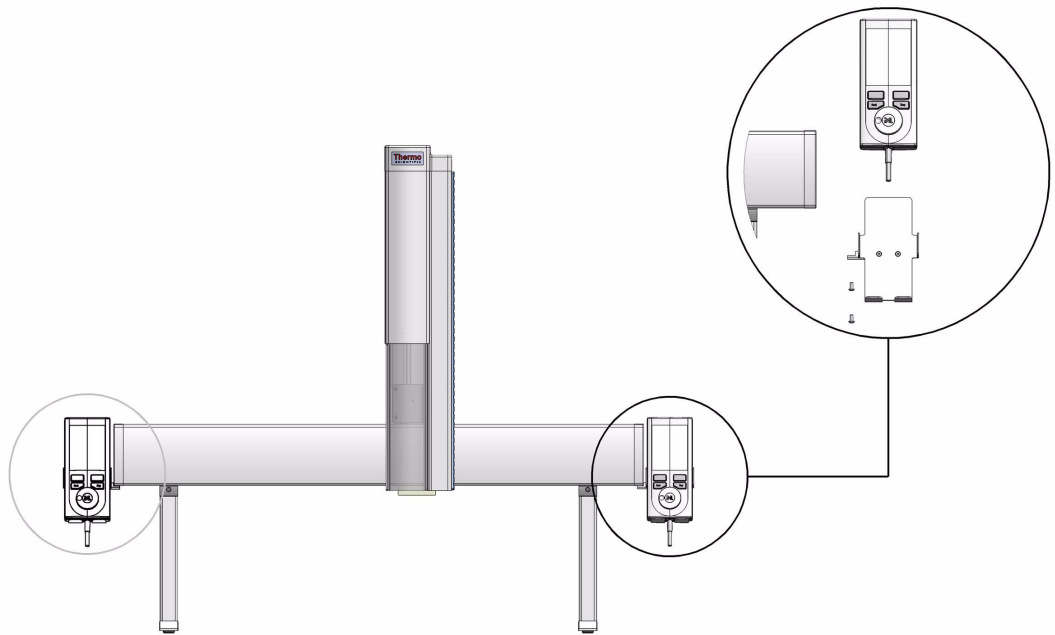
## Installing the Handheld Controller and Safety Guard

The Handheld Controller is an optional module for the TriPlus RSH SMART. If it is not part of the system configuration ordered, the TriPlus RSH SMART can be controlled with the Virtual Handheld Controller software. See [Figure 17](#).

**Note** If the Handheld Controller is part of the configuration, it is advisable to install first all the other modules which are connectible to the X-axis.

The Safety Guard can be installed at the end when everything else has been tested and completed.

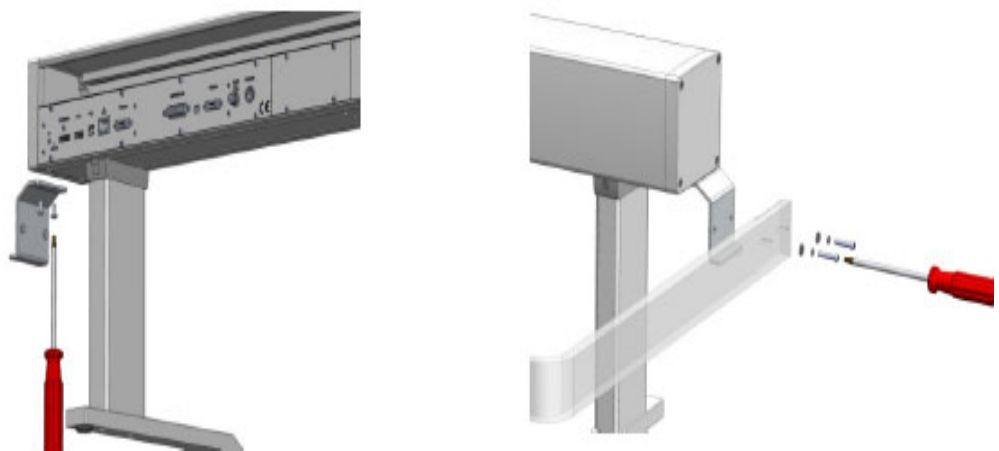
**Figure 17.** Handheld Controller Installation



❖ **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 18](#).

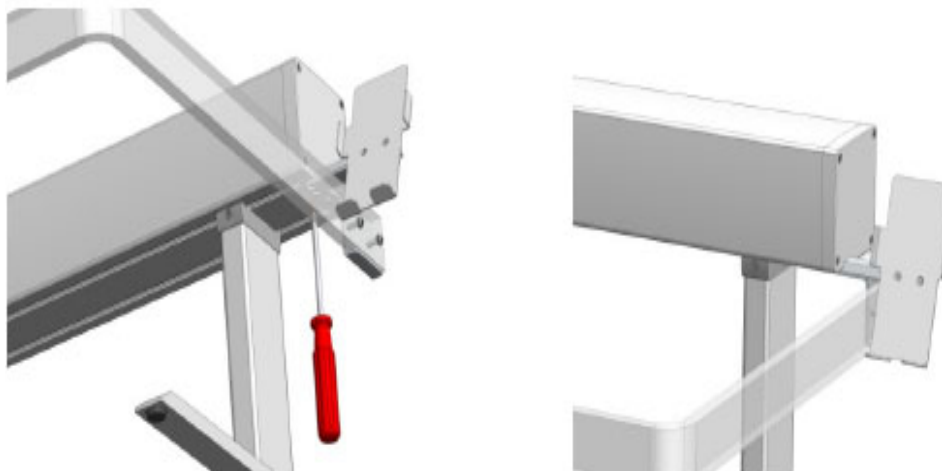
**Figure 18.** Safety Guard Installation



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.

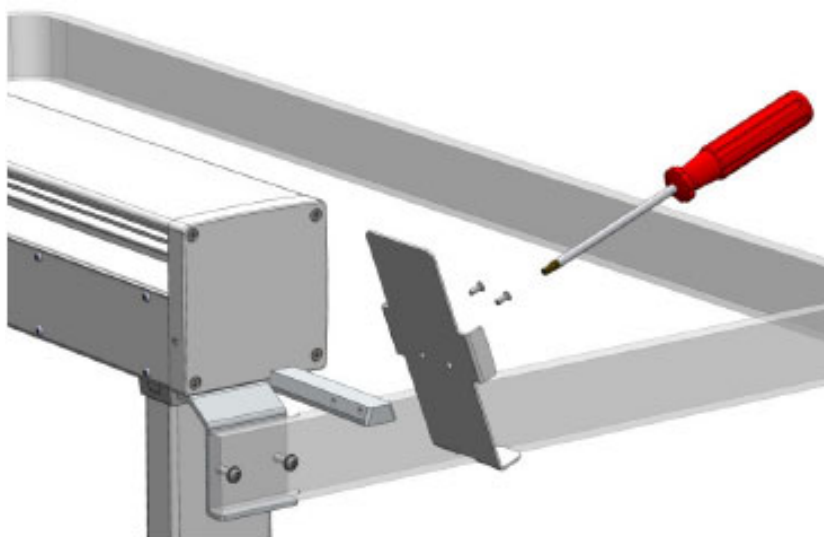
3. Install the Handheld Controller mounting bracket on either the right or left side of the X-axis. See [Figure 19](#).

**Figure 19.** Handheld Control Bracket Installation



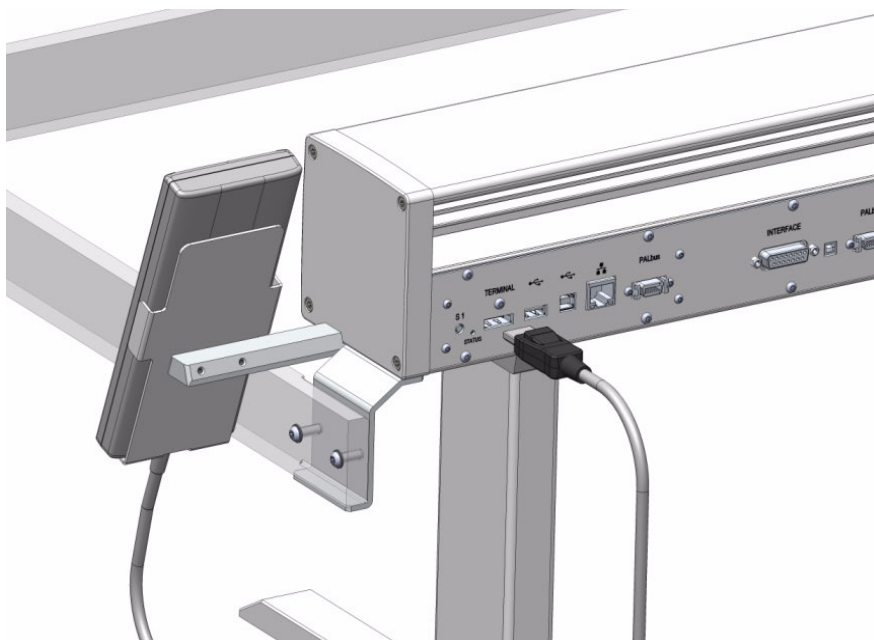
By default, the Handheld Controller bracket is assembled for the right hand installation. If the bracket is installed on the left hand side, remove the bracket from the holder, reverse it, and install it to the backside of the holder. See [Figure 20](#).

**Figure 20.** Reversing Handheld Controller Bracket for Left Side Installation



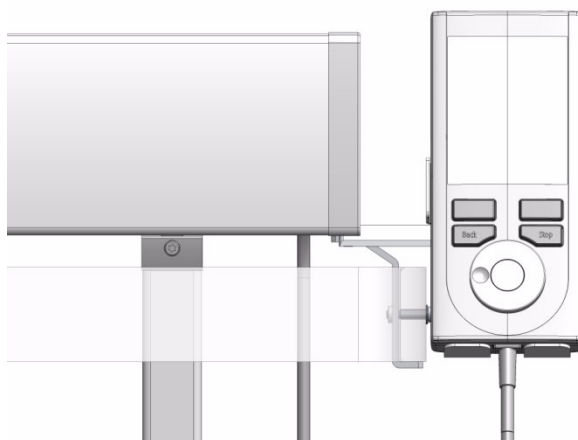
4. Connect the Handheld Controller cable to the TriPlus RSH SMART Control Interface connector marked **Handheld Controller** on the back of the X-axis. See [Figure 21](#).

**Figure 21.** Handheld Controller Connection



5. Place the Handheld Controller onto its mounting bracket. See [Figure 22](#).

**Figure 22.** Handheld Controller Position



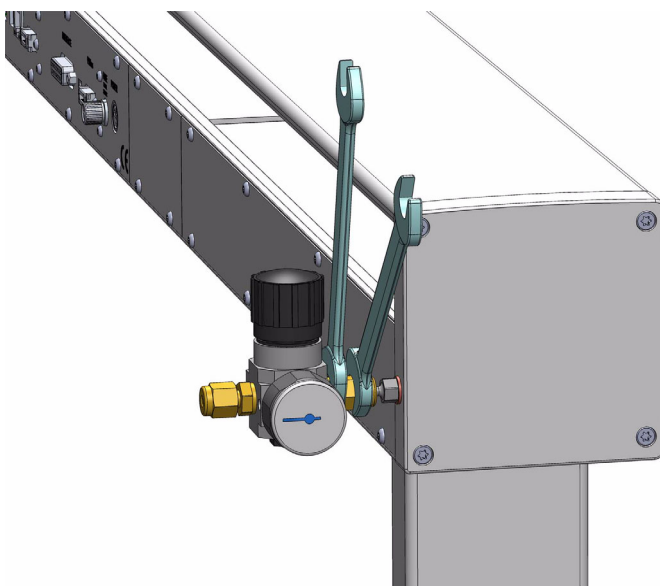
## Installing the Purge Gas Pressure Regulator



**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 23](#). Using only one wrench increases the chances of damaging or destroying the sealing gaskets.

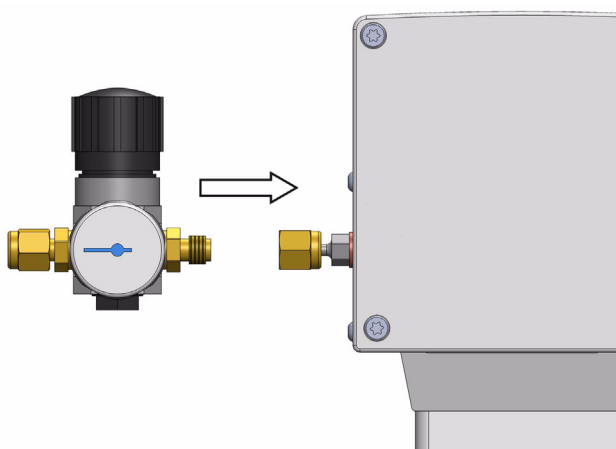
**Figure 23.** Installation of the Purge Pressure Regulator (1)



❖ **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 SMART. See [Figure 24](#).

**Figure 24.** 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 SMART 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 SMART 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 SMART Tools according to the specific requests.

To install the Tool Station you want, see the following sections:

- “Installing the TR Station” on page 34
- “Installing the ATC Station” on page 35

### Installing the TR Station

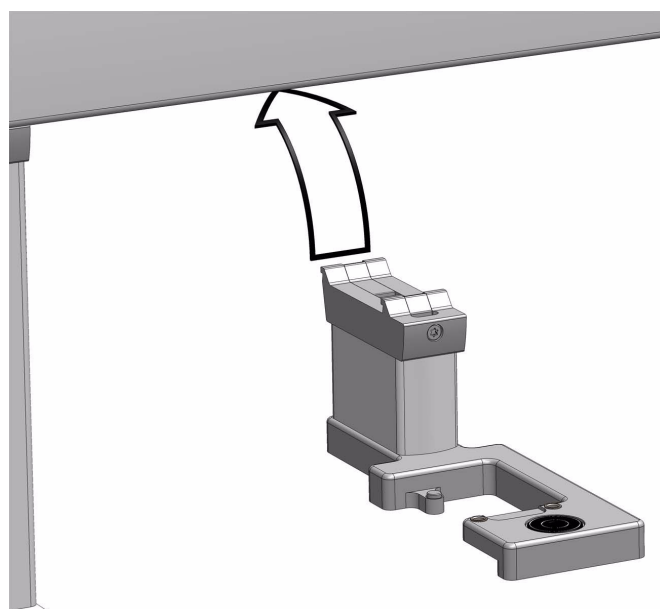
#### ❖ To install the TR station

**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 about **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. See [Figure 25](#).

**Figure 25.** 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.



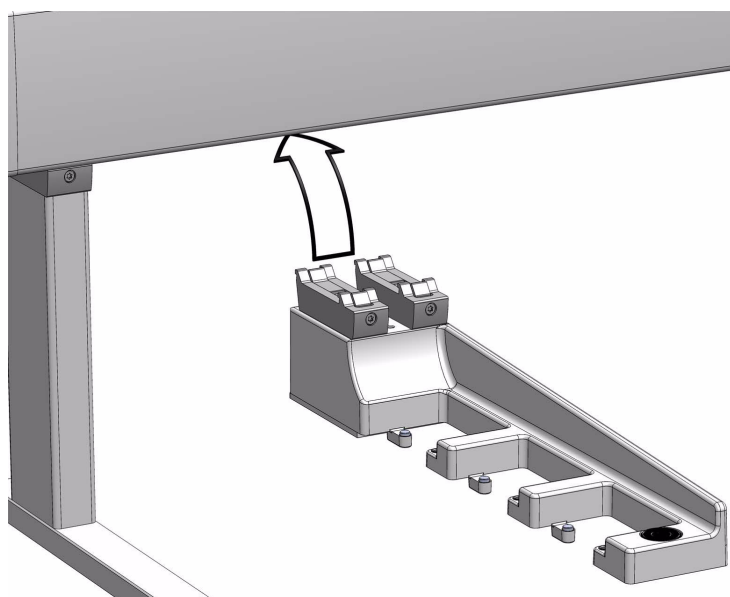
## Installing the ATC Station

### ❖ 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.

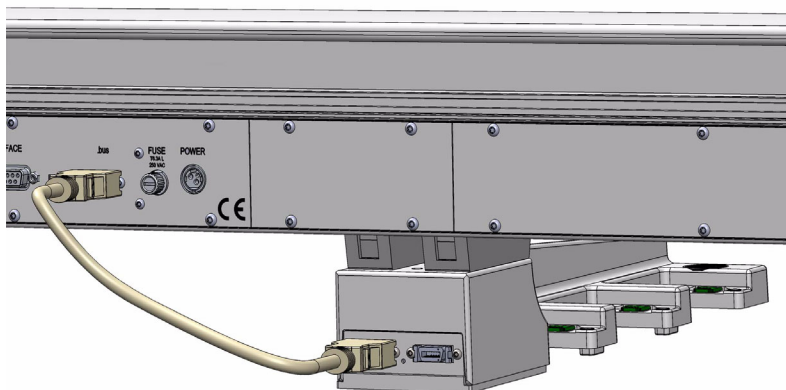
1. Use the T20 Torxhead screwdriver to loosen the two Torx screws on the ATC Station mounting bracket.
2. Hook the ATC Station to the X-axis. See [Figure 26](#).

**Figure 26.** 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. See [Figure 27](#).

**Figure 27.** Electrical Connection



**Note** It is possible to install two ATC Stations on the same TriPlus RSH SMART to enhance flexibility with various Tools. See the following **CAUTION Exceptional Circumstances** and the [Chapter 3, “TriPlus RSH SMART 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 SMART is powered off, connect the supplied control cable from the rear side of ATC Station #1 to the connector marked Bus on the TriPlus RSH SMART control interface. If Bus connector is already occupied, connect the cable to another Active module with an open connector.
4. DO NOT connect the control cable from ATC Station #2.
5. Power-up the system. The software will assign the module address to **ATC 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 Washing Stations

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

- “Installing the Standard Wash Station” on page 37
- “Installing the Large Volume Wash Station” on page 38
- “Installing the Solvents Station” on page 39
- “Installing the Fast Wash Station” on page 40



**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.

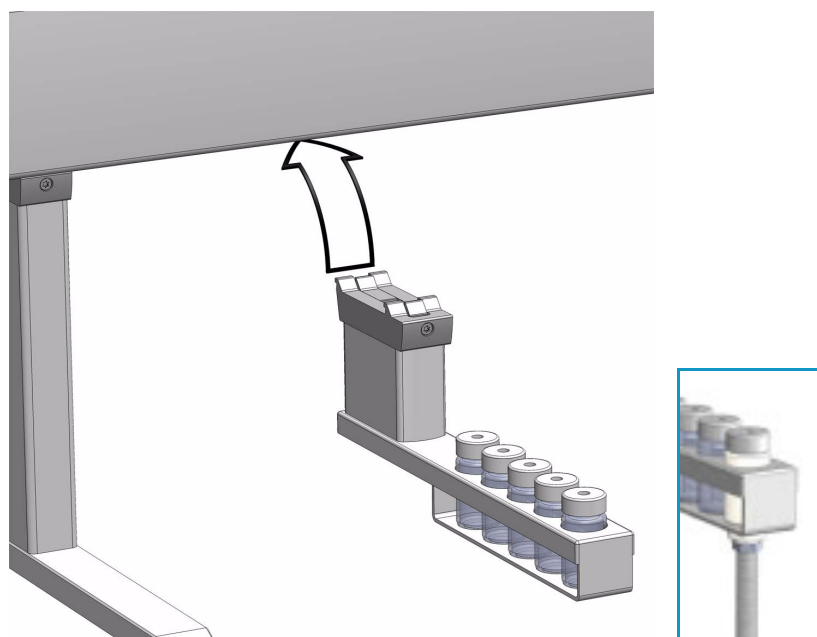
For GC, often highly flammable wash solvents are used (organic solvents such as hexane, acetone, esters, and so on).

### 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. See Figure 28.

**Figure 28.** Standard Wash Station



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.

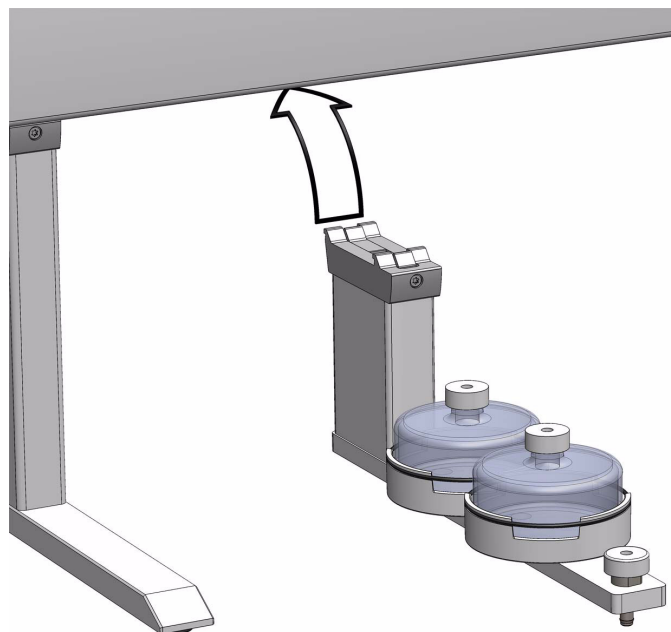
The drainage adapter resembles a vial, and the material is PVDF (Polyvinylidene fluoride). The same polymer cap (with septum inserted), used for the Wash vials, can be used for this adapter. The drainage adapter has a stainless steel nipple connected to the bottom. A waste tubing must be connected.

## Installing the Large Volume Wash Station

### ❖ To install the large volume wash station

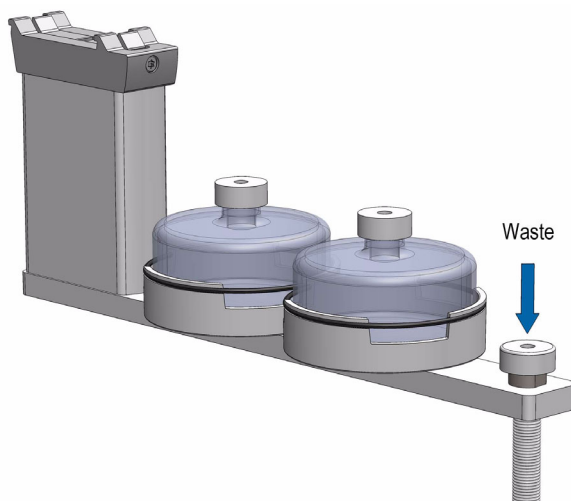
1. Use the T20 Torxhead screwdriver to loosen the screw from the Wash Station mounting clamp.
2. Hook the Large Volume Wash Station assembly to the X-axis. See [Figure 29](#).

**Figure 29.** 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. See [Figure 30](#).

**Figure 30.** Large Volume Wash Station with Waste Tubing



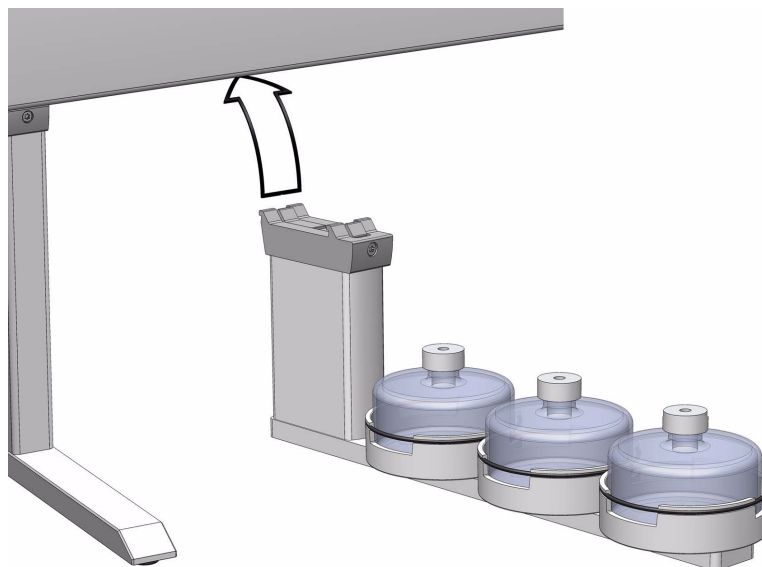
**WARNING** The Waste reservoir **MUST** be placed in a lower position than the Large Volume Wash Station assembly. Make sure that the waste liquid flows into the container without restriction. For safety reasons, place the waste container into a collection pan.

## 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. See [Figure 31](#).

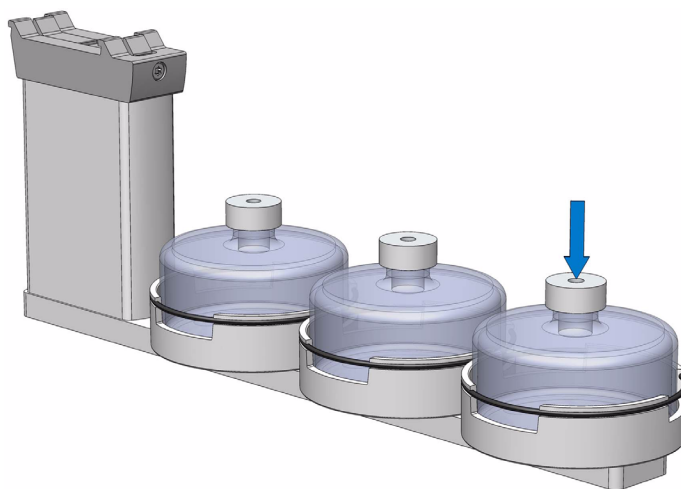
**Figure 31.** Solvent Station



## 2 Installation of the TriPlus RSH SMART System

### Installing the Washing Stations

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.

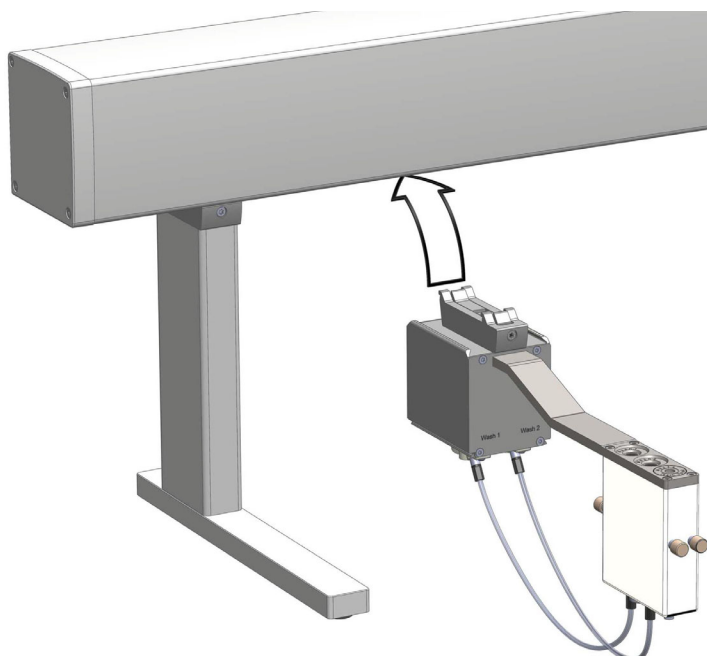


**CAUTION** Do not place the station and specifically the waste line above a heated zone. Tightly secure the waste line using a cable binder or similar item.

### ❖ To install the fast wash station

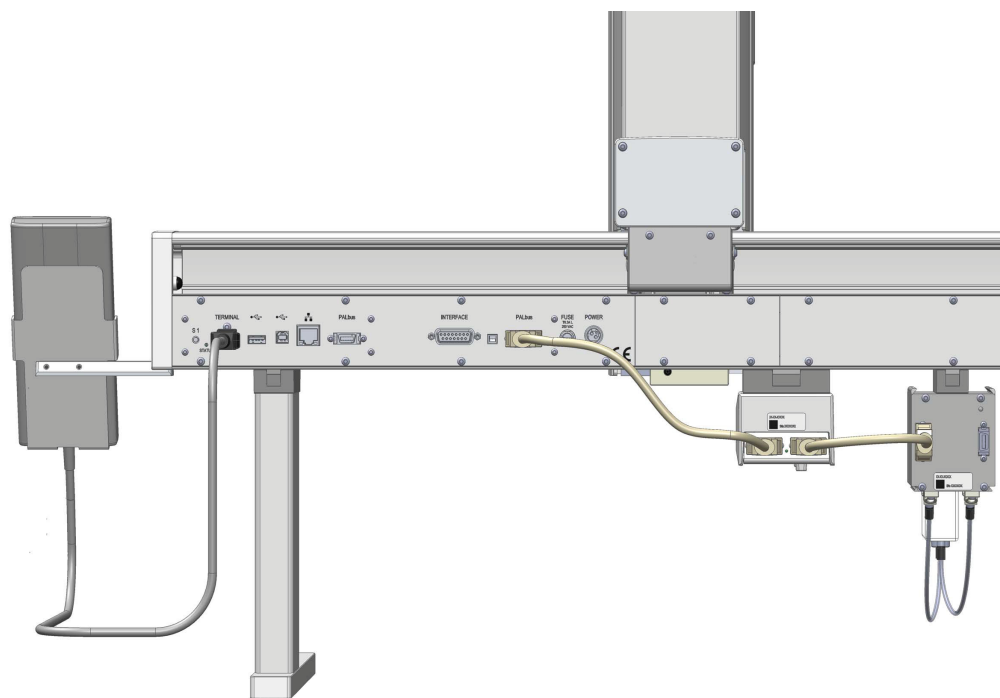
1. Connect the solvent lines from the **Solvent Reservoir Kit** to the Inlet connectors of the micro pump.
2. Loosen the two Torx screw on the mounting bracket for the module.
3. Hook the Fast Wash Station assembly to the X-axis.
4. Be sure that the clamp fits completely into the grooves. Alternately 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. See [Figure 32](#).

**Figure 32.** 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 33](#).

**Figure 33.** Fast Wash Station Electrical Connections



## Installing Heating/Shaking Modules and Stations

The TriPlus RSH SMART Autosampler can be equipped with the following Heating/Shaking modules and stations: **Agitator/Incubator**, **Vortexer**, **Heatex Stirrer**, **SPME Conditioning Station**, and **SPME Arrow Conditioning Station**. For details, see the following sections:

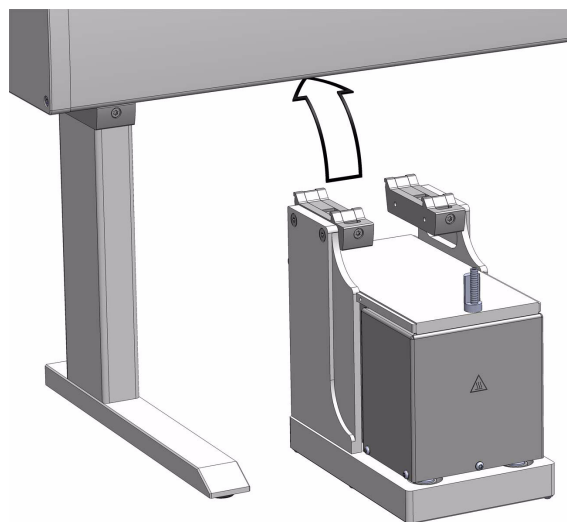
- “Installing the Agitator/Incubator Module” on page 42
- “Installing a Vortexer Module” on page 43
- “Installing a Heatex Stirrer Module” on page 44
- “Installing a SPME Conditioning Station” on page 46
- “Installing a SPME Arrow Conditioning Station” on page 49

### Installing the Agitator/Incubator Module

❖ **To install the agitator/incubator module**

1. Loosen the two Torx screws on the two Agitator/Incubator mounting clamps. See [Figure 34](#)

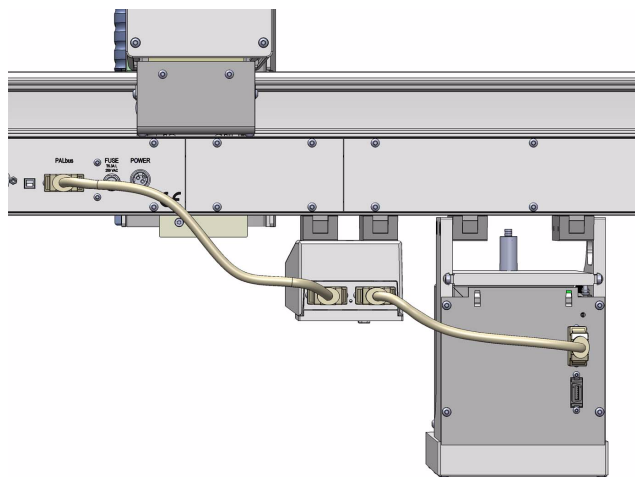
**Figure 34.** Installing the Agitator



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/Incubator 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/Incubator 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 35](#).



**Figure 35.** Agitator Electrical Connections

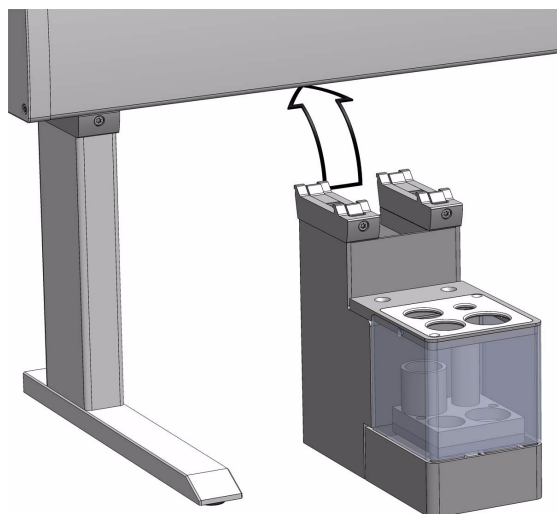


## Installing a Vortexer Module

❖ **To install a vortexer module**

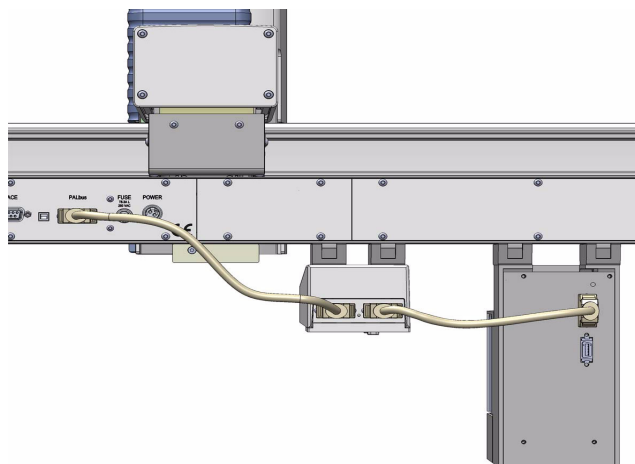
1. Loosen the two Torx screws on the two Vortexer mounting clamps. See [Figure 36](#).

**Figure 36.** 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 37](#).

**Figure 37.** Vortexer Electrical Connections



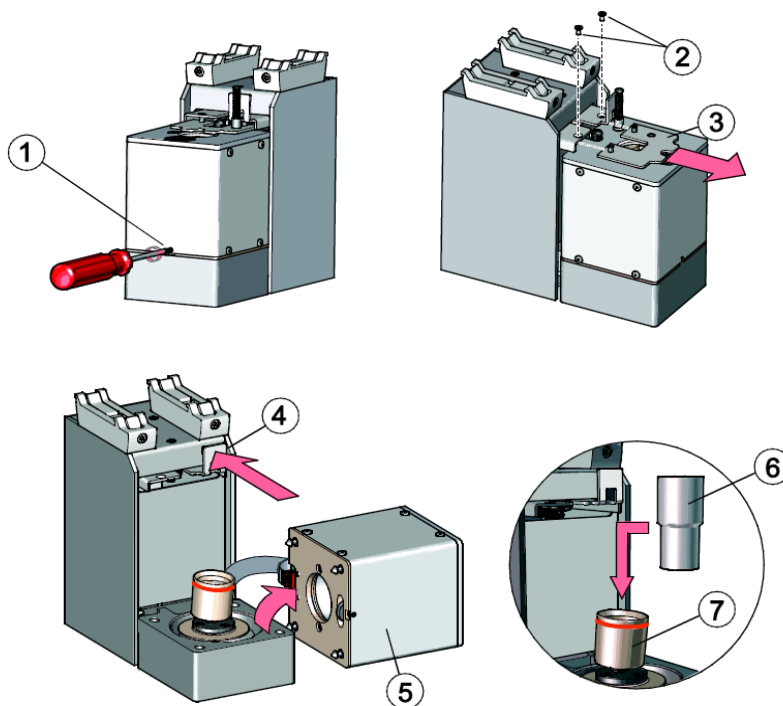
## Installing a Heatex Stirrer Module

The Heatex Stirrer Modules normally uses the 20 mL vial. Optionally the 10 mL vial can be used by inserting a dedicated adapter into the module. It is suggested to insert the adapter before the installation of the Heatex Stirrer Module on the TriPlus RSH SMART because it is necessary to partially disassemble the module.

To insert the adapter into the module see the following procedure referring to [Figure 38](#).

### ❖ To insert the 10 mL adapter into the heatex stirrer module

**Figure 38.** 10 mL Adapter Installation

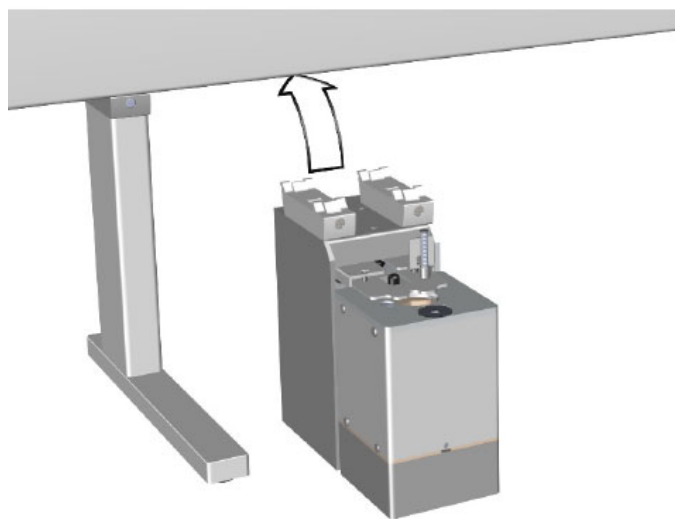


1. Loosen the screw (1) on the front of the Heatex Stirrer Module. This screw is holding the stirring chamber (5) in place.
2. Loosen and remove the two screws (2) holding the lower part of the slider (3).
3. Take away the lower part of the slider (3).
4. Push back the slider (4).
5. While holding back the slider (4), slightly lift up the stirring chamber (5) and carefully lay it aside of the module. Make sure not to damage the ribbon cable. (It is not necessary to disconnect the ribbon cable from the stirring chamber.)
6. Now the 10 mL adapter (6) can be entered from above into the vial holder (7).
7. Reassemble the Heatex Stirrer Module in the reversed order.
8. Now you can install the Heatex Stirrer Module on the TriPlus RSH SMART.

❖ **To install the heatex stirrer module**

1. Loosen the two Torx screws on the two Heatex Stirrer mounting brackets. See [Figure 39](#)

**Figure 39.** Installing a Heatex Stirrer 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 whether the Heatex Stirrer clamps are correctly attached to the X-Axis.
4. Perform the electrical connection of the module.



**CAUTION** Do not connect a Heatex Stirrer module and an Agitator/Incubator module to the same BUS connector. An unstable system may result.

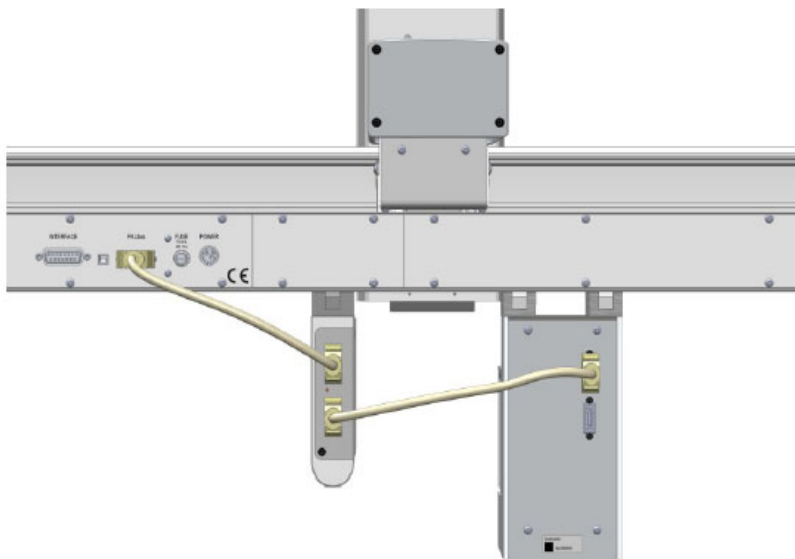
If a Heatex Stirrer module and an Agitator/Incubator module are present in your system, make sure to connect those to different BUS connectors.

## 2 Installation of the TriPlus RSH SMART System

### Installing Heating/Shaking Modules and Stations

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. See [Figure 40](#).

**Figure 40.** Heatex Stirrer Electrical Connections



## Installing a SPME Conditioning Station

**Note** Before starting, determine approximately where the SPME Conditioning Station must be located.

The TriPlus RSH SMART 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 SMART and the GC top cover, consider installing the module outside of the GC frame to the far left or far right side.

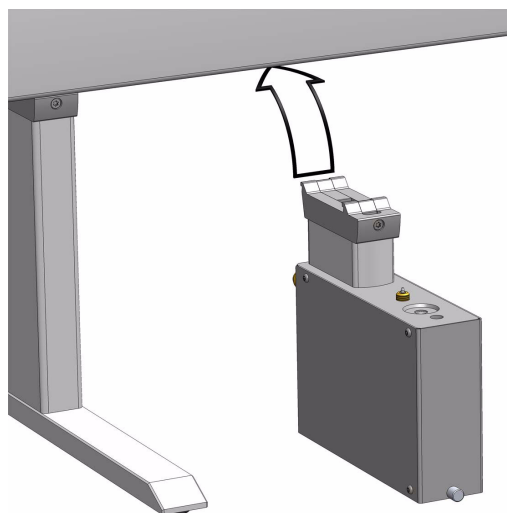
If the SPME Conditioning Station is installed with an existing TriPlus RSH SMART, another module might require to be shifted. Remember to re-position the modules accordingly.

To install the SPME Conditioning Station, proceed as follows:

### ❖ To install the SPME conditioning station

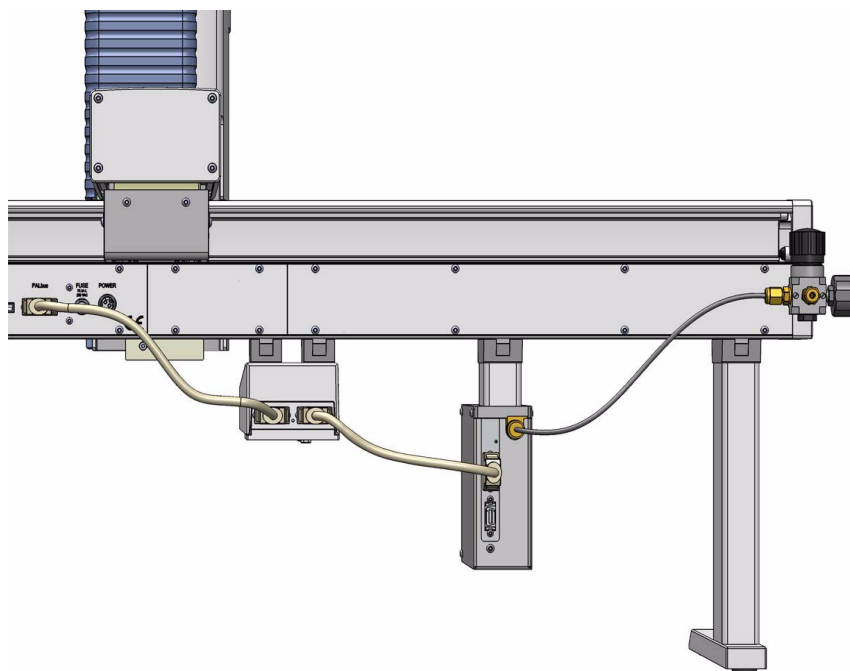
1. Loosen the Torx screw on the mounting clamps located on the top side of the Fiber Conditioning Station. See [Figure 41](#).

**Figure 41.** 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 SMART Control Interface connector marked **BUS**.  
If BUS connector is already occupied, connect the cable to another Active module with an open connector. See [Figure 42](#).

**Figure 42.** SPME Conditioning Station Electrical and Gas Connections



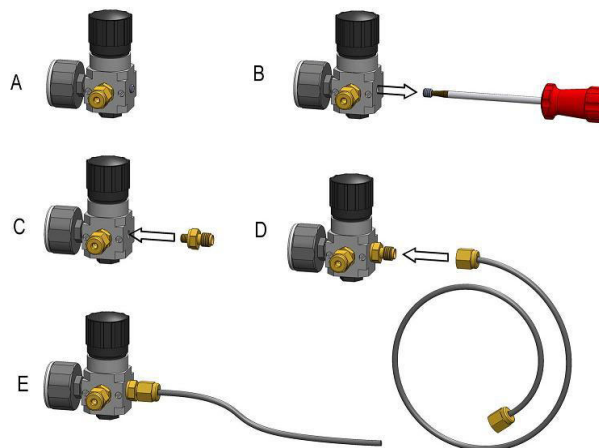
### 5. Connect the Gas Line.



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

- One end of the supplied black gas tube is connected to the gas purge regulator supplied with the TriPlus RSH SMART. See “[Installing the Purge Gas Pressure Regulator](#)” on [page 32](#).
- 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 the second gas line is shown in [Figure 43](#).

**Figure 43.** Gas Tube Connection from Pressure Regulator to SPME Conditioning Station



### 6. Set the Gas Flow

- 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 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 SPME Arrow Conditioning Station

**Note** Before starting, determine approximately where the SPME Arrow Conditioning Station must be located.

If there is not enough space between the X-axis of the TriPlus RSH SMART and the GC top cover, consider installing the module outside of the GC frame to the far left or far right side.

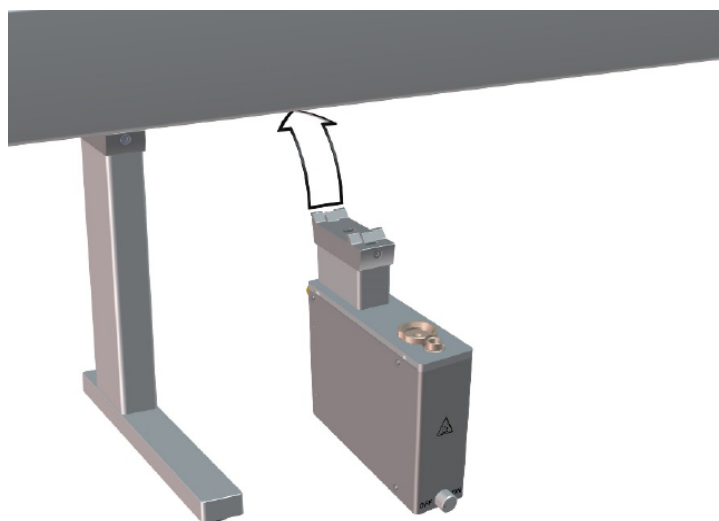
If the SPME Arrow Conditioning Station is installed with an existing TriPlus RSH SMART, another module might require to be shifted. Remember to re-position the modules accordingly.

To install the SPME Arrow Conditioning Station, proceed as follows:

### ❖ To install the SPME Arrow conditioning station

1. Loosen the Torx screw on the mounting clamps located on the top side of the Conditioning Station. See [Figure 44](#).

**Figure 44.** Installing the SPME Arrow Conditioning Station

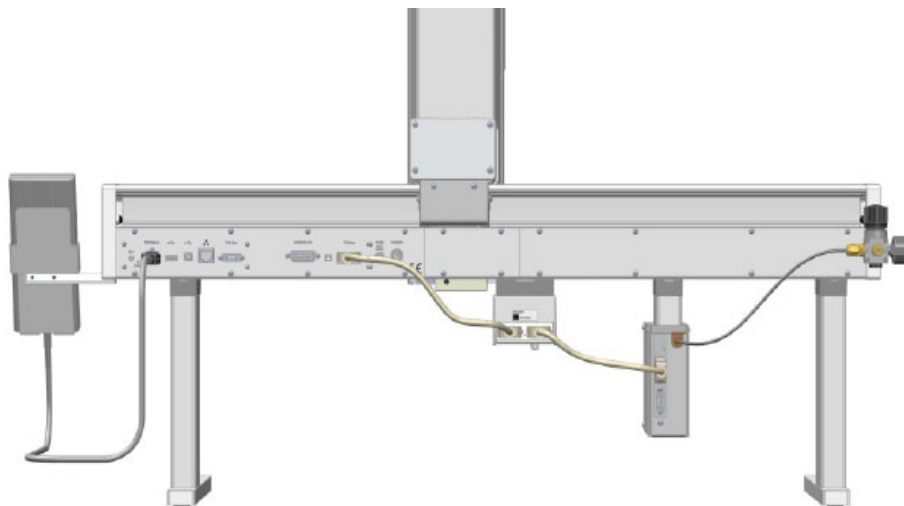


2. Be sure that the clamps fit entirely into the grooves. Tighten the Torx screw until the mounting clamps are firmly in place.
3. Double check if the SPME Arrow Conditioning Station clamp is correctly hooked to the X-axis.
4. Connect the supplied control cable (daisy chain cable) from the connector on the back side of the module to the TriPlus RSH SMART Control Interface connector marked

### BUS.

If BUS connector is already occupied, connect the cable to another Active module with an open connector. See [Figure 42](#).

**Figure 45.** SPME Arrow Conditioning Station Electrical and Gas Connections



5. Connect the Gas Line.

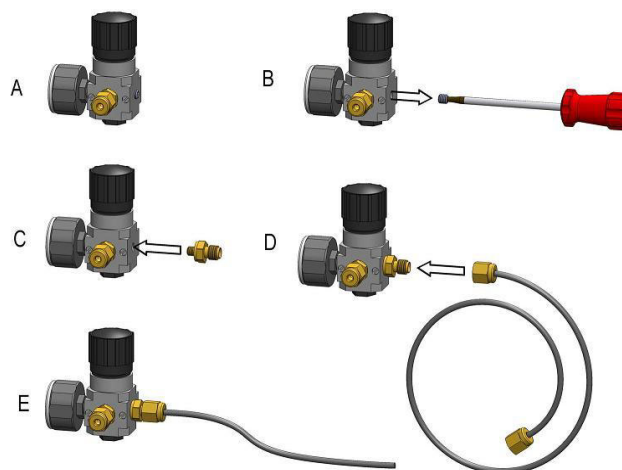


**WARNING** Do not use hydrogen or any other explosive gas or gas mixtures for the SPME Arrow Conditioning Station. Recommended gases are helium or nitrogen.

- a. One end of the supplied black gas tube is connected to the gas purge regulator supplied with the TriPlus RSH SMART. See [“Installing the Purge Gas Pressure Regulator”](#) on [page 32](#).
- 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 Arrow Conditioning Station. The installation of the second gas line is shown in [Figure 43](#).



**Figure 46.** Gas Tube Connection from Pressure Regulator to SPME Arrow 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 Arrow 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.

## Installing the Tray Holders

The TriPlus RSH SMART Autosampler can be equipped with the following Tray Holders: **Standard Tray Holder**, **Liquid Cooled Tray Holder**, and **Temperature Controlled Drawer**. For details, see the following sections:

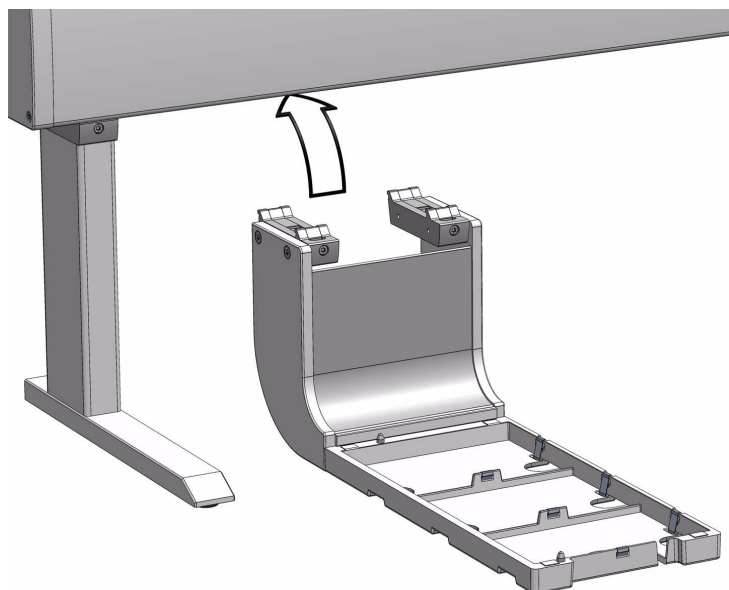
- “Installing a Standard Tray Holder” on page 52
- “Installing a Liquid Cooled Tray Holder” on page 53
- “Installing a Temperature Controlled Drawer” on page 54

### Installing a Standard Tray Holder

❖ **To install the standard 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. See [Figure 47](#).

**Figure 47.** Tray Holder Installation



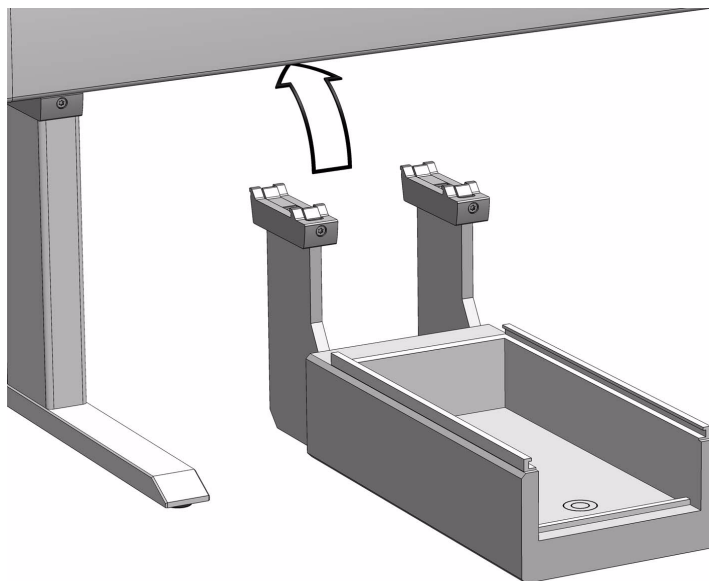
3. Alternately tighten the two Torx screws until the two mounting clamps are firmly in place.
4. Double check if the two clamps are correctly hooked to the X-axis.

## Installing a Liquid Cooled Tray Holder

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

1. Loosen the two Torx screws on the two module mounting clamps. See [Figure 48](#).

**Figure 48.** Installing the Liquid Cooled Tray Holder Module



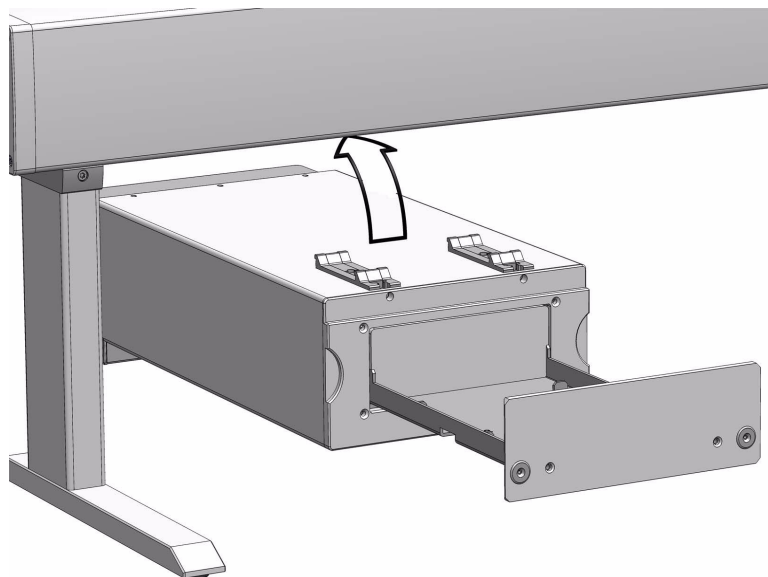
2. Be sure that the clamps fit completely into the grooves. Alternately tighten the two Torx screws until the two mounting clamps are firmly in place.
3. Double check if the Liquid Cooled Tray Holder clamps are correctly hooked to the X-axis.
4. Connect the hoses from the liquid circulation bath, tighten 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**

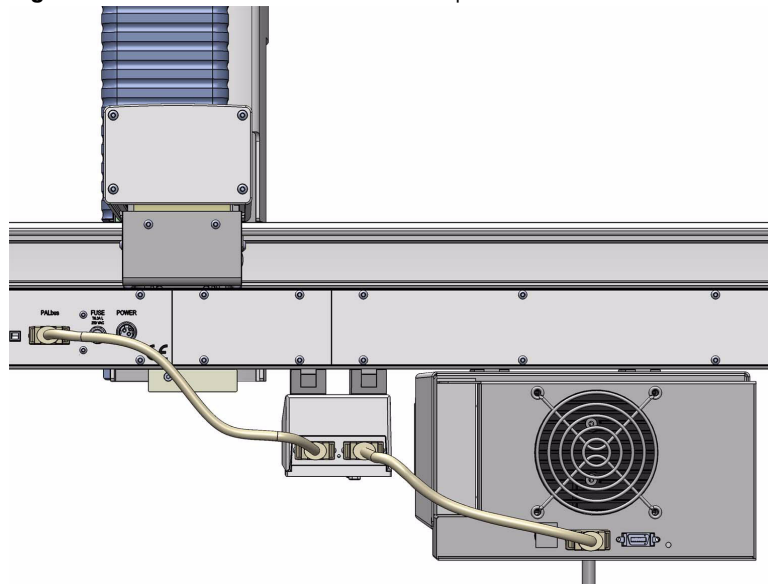
1. Loosen the two Torx screws on the two module mounting clamps. See [Figure 49](#).

**Figure 49.** Installing the Temperature Controlled Drawer



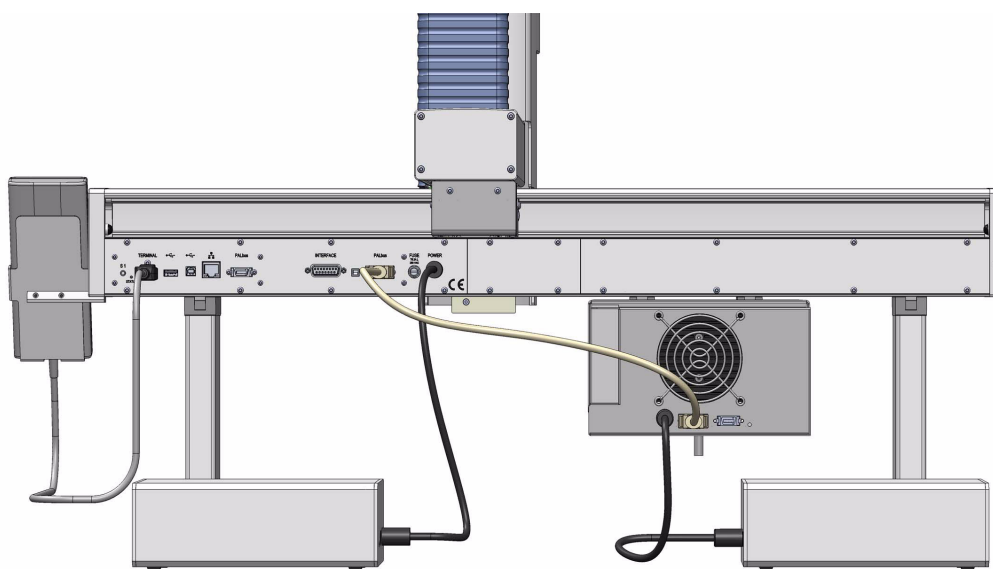
2. Be sure that the clamps fit completely into the grooves. Alternately tighten the two Torx screws until the two mounting clamps are firmly in place.
3. Double check if the Temperature Controlled Drawer clamps are correctly hooked to the X-axis.
4. Power off the TriPlus RSH SMART before making any electrical connections.
5. Connect the supplied control cable (daisy chain cable) from the connector on the back side of the module to the TriPlus RSH SMART Control Interface connector marked **BUS**.  
If BUS connector is already occupied, connect the cable to another Active module with an open connector. See [Figure 50](#).

**Figure 50.** Electrical Connections of Temperature Controlled Drawer



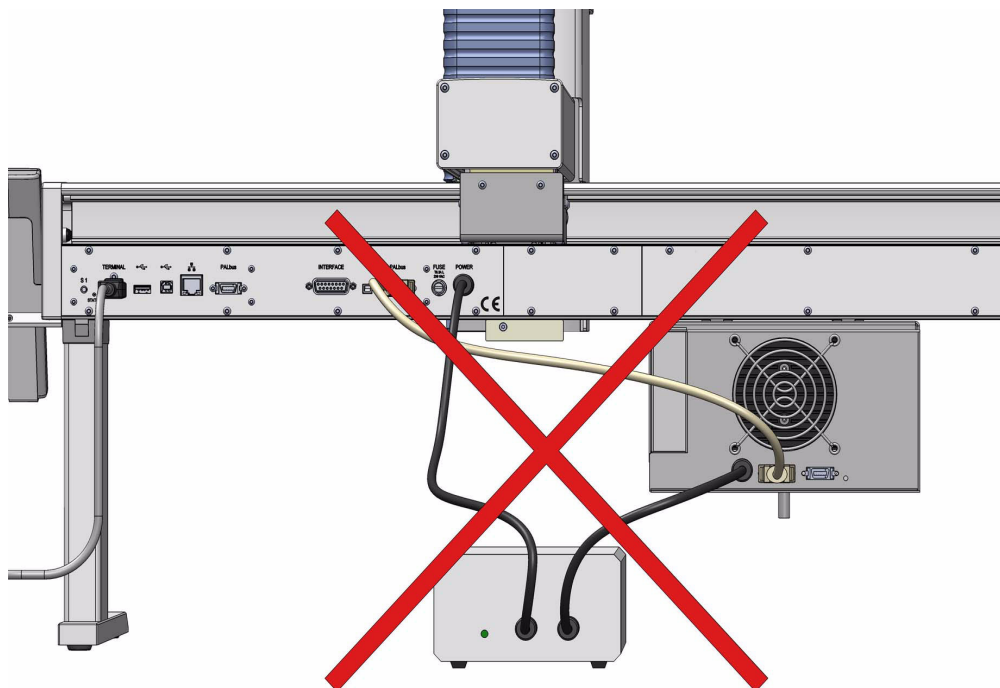
6. Connect the cable provided to the connector **OUT** of the Power Module (Power Supply) marked **TriPlus RSH SMART**.
7. Connect the other side of the cable to the Temperature Controlled Drawer at the back of the module. See [Figure 51](#).

**Figure 51.** 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 SMART is not occupied. The electrical demands of the entire system are too high to be covered by a single Power Module. See [Figure 52](#).

**Figure 52.** 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 Optional Modules

The TriPlus RSH SMART Autosampler can be equipped with the following Optional Modules: **Centrifuge**, **Barcode Reader**, **MHE Station**, **OC Injector Module** and **Dilutor**. See the following sections:

- “Installing the Centrifuge” on page 57
- “Installing a Barcode Reader” on page 59
- “Installing a MHE Station” on page 60
- “Installing an OC Injector Module” on page 62
- “Installing a Flow Cell Holder Module” on page 63
- “Installing a Dilutor Module” on page 64

## Installing the Centrifuge

Before you install the Centrifuge Module, you must remove the transport lock. The transport lock is a piece of foam that is clamped into the opening of the Centrifuge Module to avoid movement of the rotor during transport. The lock can be removed by pulling it gently out.

**Note** The Centrifuge Module will not operate if the transport lock is not removed.

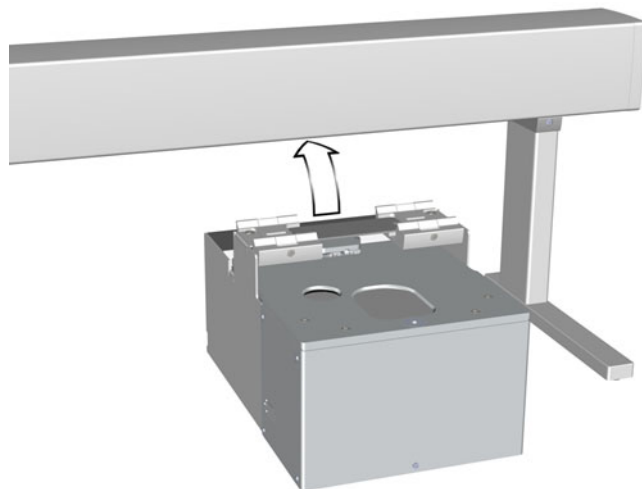


**CAUTION** The centrifuge is heavy. It is recommended to use two people when mounting the Centrifuge Module device to the X-Axis, moving it on the X-Axis, or removing it from the X-Axis. In case the Centrifuge Module slips down, crushed fingers or damage to devices/equipment located below may result.

### ❖ To install the centrifuge

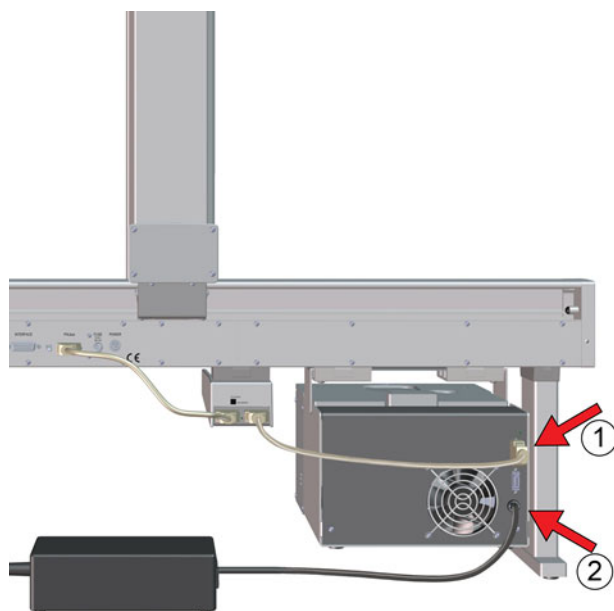
1. Loosen the two Torx screws on the two Centrifuge Module mounting brackets.
2. Carefully lift the Centrifuge Module up and slide the mounting brackets into the grooves at the bottom of the X-axis. See [Figure 53](#).

**Figure 53.** Installing the Centrifuge Module to the X-axis of the RSH SMART System



3. 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.
4. Double check whether the Centrifuge Module clamps are correctly attached to the X-Axis.
5. Connect the supplied Daisy chain cable from the connector on the rear side of the Centrifuge Module (Pos.1 in the following figure) to the control interface jack. If this is already occupied, connect to another Active module with an open jack. See [Figure 54](#).
6. Connect the DC-cable of the power supply to the corresponding port (Pos. 2 in the following figure) on the back of the Centrifuge Module. See [Figure 54](#).

**Figure 54.** Centrifuge Module Electrical Connections



7. Connect the power cord to a wall outlet.





**CAUTION** The Centrifuge Module must not be used with flammable or explosive substances or mixtures other than the following: acetone, acetonitrile, ethyl acetate, methyl tert-butyl ether, methanol, isopropanol, n-pentane, n-hexane, or cyclohexane, in a total amount of 20 mL (2 x 10 mL or 4 x 5 mL or 6 x 3.5 mL or 8 x 2 mL depending on type of centrifuge).

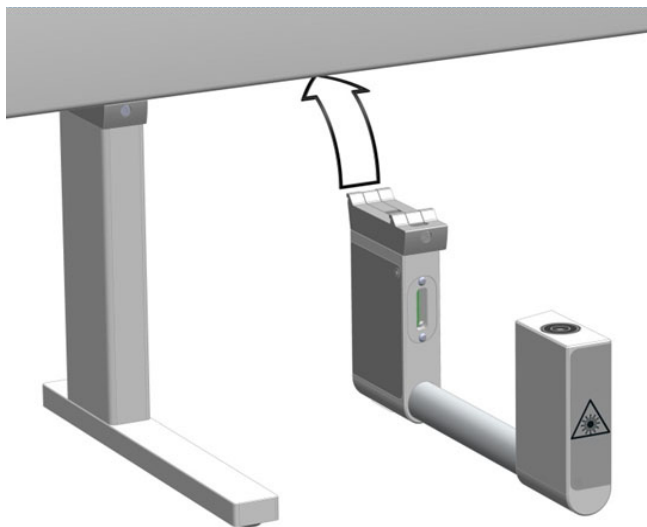
- The Centrifuge Module must not be used with microbiological samples.
- The Centrifuge Module must not be used with radioactive substances.
- Neither the Centrifuge Module and its parts are not autoclavable.

## Installing a Barcode Reader

### ❖ To install the barcode reader

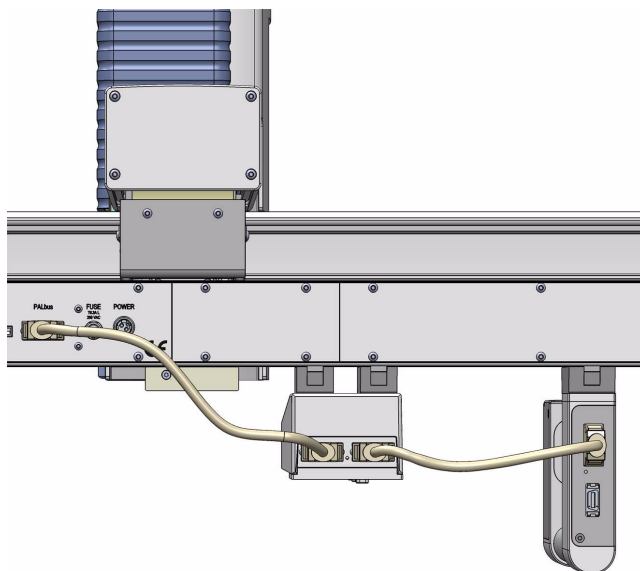
1. Loosen the two Torx screws on the two Barcode Reader mounting clamps. See [Figure 55](#).

**Figure 55.** 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 SMART Control Interface connector marked **BUS**. If BUS connector is already occupied, connect the cable to another Active module with an open connector. See [Figure 56](#).

**Figure 56.** Barcode Reader 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.

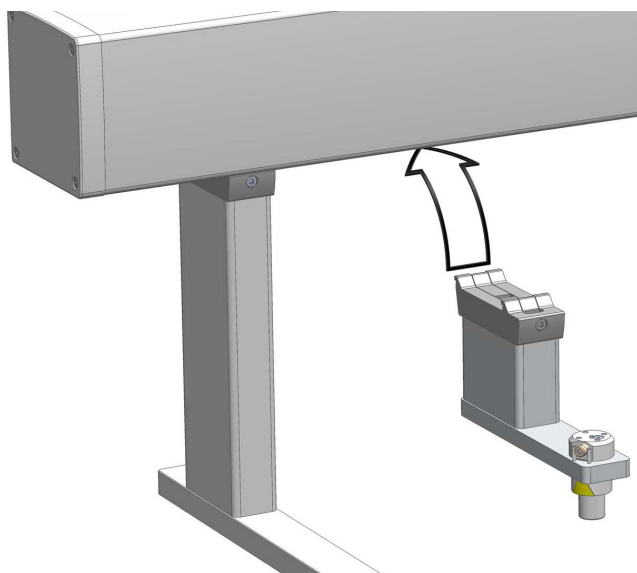
Likewise, if the Agitator is located at the far left, the MHE Adapter Holder should be placed to the right of the Agitator.

**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

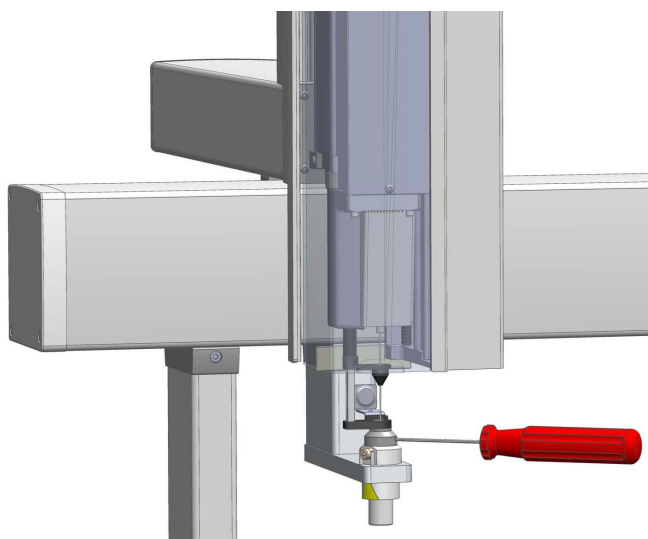
1. Loosen the Torx screw on the mounting clamps located on the top side of the Fiber Conditioning Station.
2. Be sure that the clamps fit entirely into the grooves. Tighten the Torx screw until the mounting clamps are firmly in place.
3. Double check if the MHE Adapter Holder clamp is correctly hooked to the X-axis.  
See [Figure 57](#).

**Figure 57.** 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 flange-less 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. See [Figure 58](#).

**Figure 58.** Magnet Transport Ring



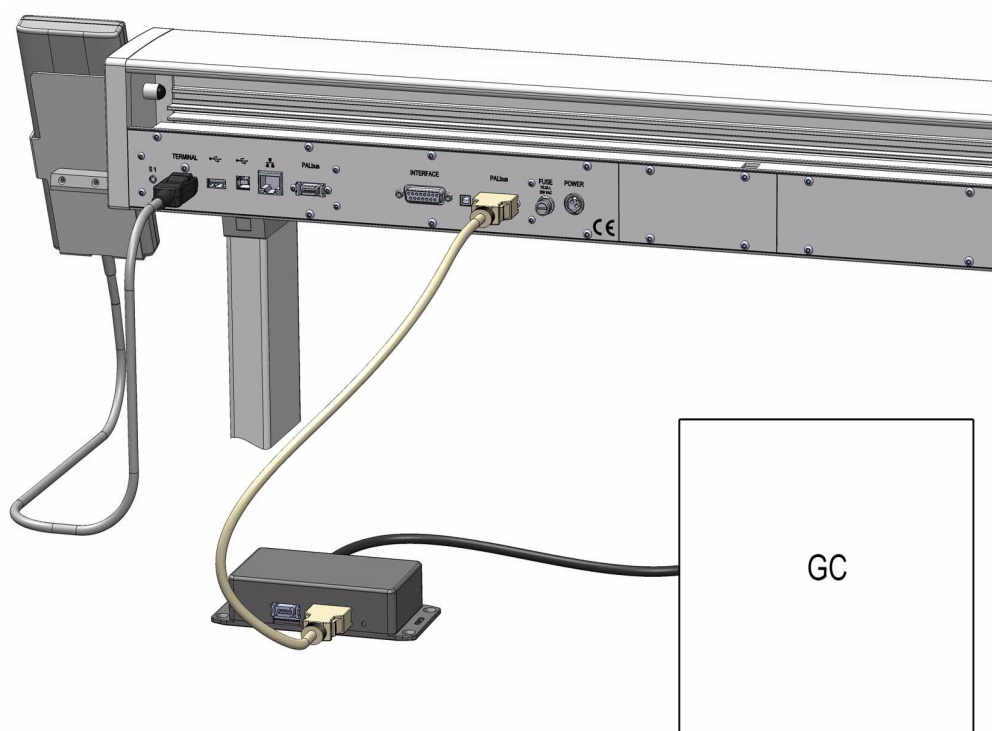
## Installing an OC Injector Module

### ❖ 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 SMART Control Interface connector marked **BUS**.

If BUS connector is already occupied, connect the cable to another Active module with an open connector. See [Figure 59](#).

**Figure 59.** Connecting the OC Electronic Box



5. Connect the cable from the OC Adapter to the OC Electronic Box.

## Installing a Flow Cell Holder Module

Before beginning the assembly process, determine approximately where the Flow Cell Holder will be located. Consider the height of the Flow Cell, and ensure there is sufficient space to be able to move a 20 mL vial from the Tray to the Agitator and vice versa if required and if such components are part of the system configuration.

If there is not enough space between the X-axis and the top of the GC, consider installing the Flow Cell Holder outside of the GC frame.

If you are installing the Flow Cell Holder within an existing system, another hardware module may need to be shifted. Remember to re-position the modules again.

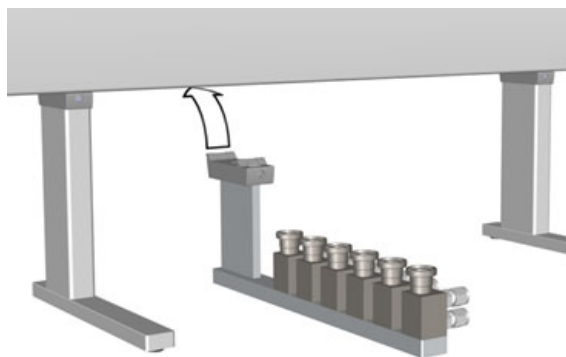
The Flow Cell can be installed on the Holder with the connections pointing to the front or turned by 90° and pointing to the side. This flexibility allows the user to adapt the set-up according to how the supply lines can be guided to the system without interference.

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

### ❖ To install the flow cell holder module

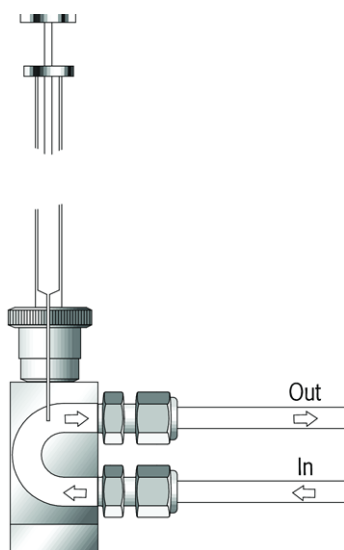
1. Loosen the Torx screw on the Flow Cell Holder Module mounting bracket
2. Be sure that the clamp fit completely into the grooves. Tighten the Torx screw until the mounting clamp is firmly in place.

**Figure 60.** Installing the Flow Cell Holder Module



3. Double check whether the Flow Cell Holder Module clamp is correctly attached to the X-Axis.
4. Connect the supply lines to the Flow Cell using the provided 6 mm (0.236 in.) Swagelok connections. The inlet line must be attached to the lower connection port as shown in [Figure 61](#).

**Figure 61.** Flow Cell Supply Line Connection



## Installing a Dilutor Module

The Dilutor Module is shipped in a dedicated box separated from the TriPlus RSH SMART system. The box also includes the Solvent Reservoir Kit(s), each consisting of a 1000 mL glass bottle, a glass frit, and the corresponding Tubing Kit.

The components of Single Dilutor and Multi Dilutor contained into the relevant shipping box are respectively detailed in [Table 7](#) and [Table 8](#).

**Table 7.** Single Dilutor Components (Sheet 1 of 2)

Component	Quantity
Dilutor Syringe Module	1
Syringe for Dilutor Syringe Module 1 mL, Scale 60 mm (pre-mounted)	1
Single Solvent Dilutor Valve (1/4-28-in. Fitting)	1 Pre-mounted
Mounting Bracket	1
Dilutor Tool	1
Solvent Reservoir Kit containing:	1
– 1 x Glass Bottle 1000 mL	
1 x Aspiration Tubing Kit, consisting of:	
– Tubing (PFA)	
– Glass Frit 40 µm pore size	
– Nut with feed-through holes	
Transfer Tubing Kit for Dilutor (1/16-in.)	1

**Table 7.** Single Dilutor Components (Sheet 2 of 2)

Component	Quantity
Needle Gauge 22 Pst 3 (for syringes 5 µL – 100 µL) (Set of 3)	3 (1 pre-mounted)
Bus Daisy Chain Cable, length 850 mm	1

**Table 8.** Multi Dilutor Components

Component	Quantity
Dilutor Syringe Module	1
Syringe for Dilutor Syringe Module 1 mL, Scale 60 mm (pre-mounted)	1
Multi Solvent Dilutor Valve - ceramic (1/4-28-in. -Fitting)	1
Mounting bracket	1
Dilutor Tool	1
Solvent Reservoir Kit containing:	5
– 1 x Glass Bottle 1000 mL	
1 x Aspiration Tubing Kit, consisting of:	
– Tubing (PFA)	
– Glass Frit 40 µm pore size	
– Nut with feed-through holes	
Transfer Tubing Kit for Dilutor (1/16-in.)	1
Needle Gauge 22 Pst 3 for syringes 5 µL – 100 µL	3 (1 pre-mounted)
BUS Daisy Chain Cable, length 850 mm	1

## Getting Started

For properly installing the Dilutor Module see the following sections:

- [“Installing the Dilutor Valve” on page 65](#)
- [“Installing the Dilutor Syringe” on page 67](#)
- [“Installing the Dilutor Syringe Module” on page 68](#)
- [“Installing the Dilutor Tool” on page 71](#)

## Installing the Dilutor Valve

The valve is pre-mounted to the Dilutor Syringe Module. If for any reason it is necessary to change the valve, see the following procedures:

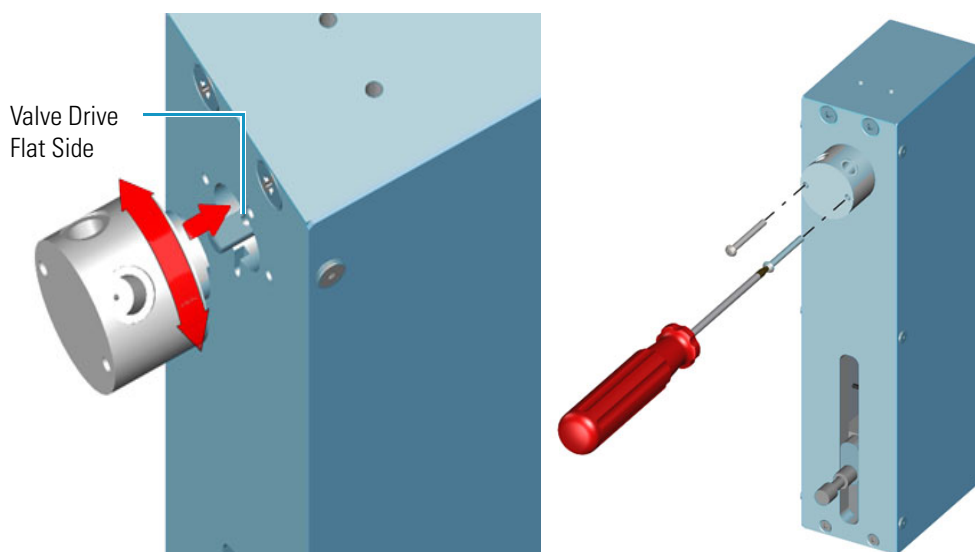
- [“To install the single solvent valve” on page 66](#)
- [“To install the multi solvent valve” on page 66](#)

❖ **To install the single solvent valve**

The Single Dilutor is equipped with a Single Solvent valve for enabling the handling of one solvent/reagent. A port (**Port 1**) is reserved for the syringe and another one (**Port 2**) for the Tool. The Single Solvent valve is fixed to the valve drive of the Dilutor using the two provided screws. The valve coupling of the valve drive has one flat side, ensuring the correct installation of the valve. See [Figure 62](#).

1. Attach the Dilutor Valve to the valve coupling, while slightly turning it to the left or to the right until it slides completely on the valve coupling.
2. Turn the valve with the Dilutor Valve coupling until the single port points downwards and the holes in the housing match with those in the valve.
3. Fix the valve with the two provided screws.

**Figure 62.** Single Solvent Valve Installation



❖ **To install the multi solvent valve**

The Multi Dilutor is equipped with a 7-port valve for enabling the handling of up to four solvents/reagents. The 7-port valve provides the following ports:

- one port for Tool connection (Port 1)
- one port for waste glass bottle (Port 2)
- four ports for solvent glass bottles (Ports 3-6)

Waste glass bottle is used only in case of power failure during syringe movement (aspirating or dispensing) blocking the homing of the plunger. The solvent discharge is normally carried out into the standard wash station with waste tube adapter or into the large wash station.

The 7-port valve is fixed to the valve drive of the Dilutor using the two screws integrated into the valve. These screws can be accessed from the front of the valve through the small holes using the provided Allen wrench.



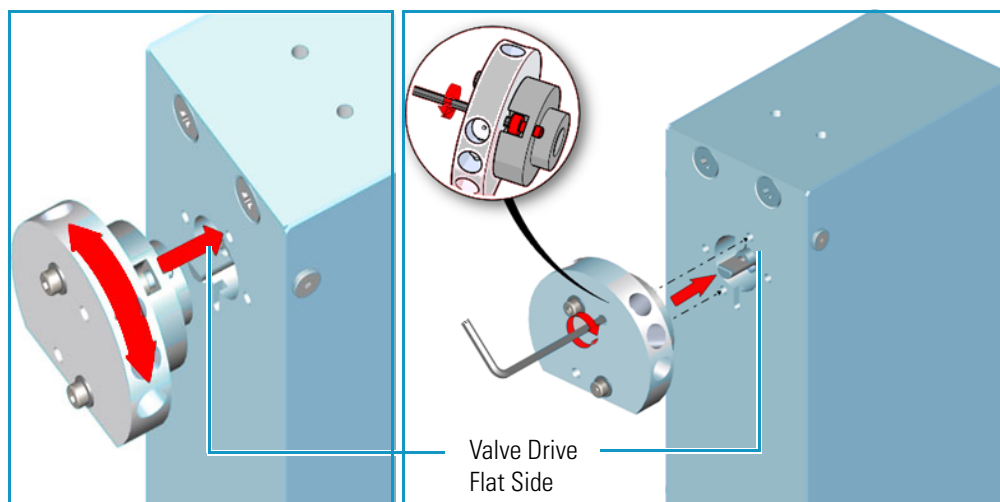


**CAUTION** Do not loosen the two screws on the front of the valve, otherwise the valve may leak.

The valve coupling of the valve drive has one flat side, ensuring the correct installation of the valve. See [Figure 63](#).

1. Attach the valve to the valve coupling, while slightly turning it to the left or to the right, until it slides completely on the valve coupling.
2. Turn the valve with the valve coupling until the single port points downwards and the holes in the housing match with those in the valve.
3. Fix the valve with the two provided screws.

**Figure 63.** 7-Port Valve Installation



## Installing the Dilutor Syringe

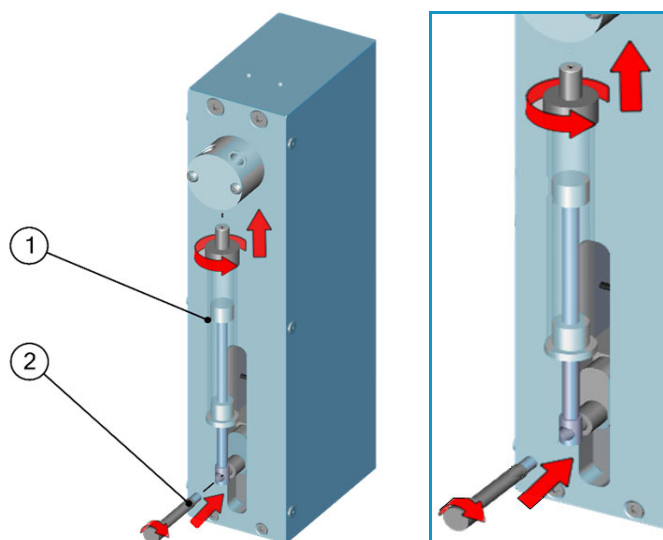
This section provides the instructions for installing the syringe to the Dilutor Syringe Module.

**Note** The syringe is pre-mounted to the Dilutor Syringe Module.

### ❖ To install the dilutor syringe

1. Screw the syringe clockwise from below into the lower port of the valve. See 1 of [Figure 64](#).
2. Unscrew the screw from the valve drive and pull the plunger of the screw out until the hole in the plunger matches the hole in the valve drive.
3. Fix the plunger with the screw to the valve drive. See 2 of [Figure 64](#).

**Figure 64.** Dilutor Syringe Installation



### Installing the Dilutor Syringe Module

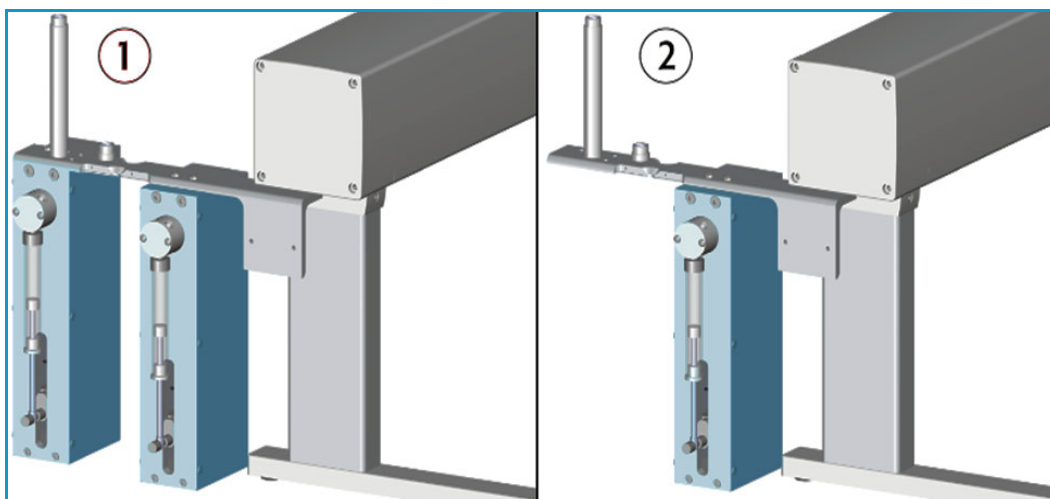
The Dilutor Syringe Module is attached to the X-Axis using the provided **mounting bracket**. Only one mounting bracket can be installed onto a TriPlus RSH SMART system. The mounting bracket can either hold up to two Dilutor Syringe Modules. See 1 of [Figure 65](#).



**ATTENTION** If the Safety Guard is already mounted to the TriPlus RSH SMART system, you must remove it before installing the mounting bracket for the Dilutor Module. The Safety Guard bracket on the left side of the TriPlus RSH SMART system will be replaced by the mounting bracket, so this also must be removed beforehand.

For installing only one Dilutor Module use the front mounting position, close to the X-Axis. See 2 of [Figure 65](#).

**Figure 65.** Example of Dilutor Mounting Positions



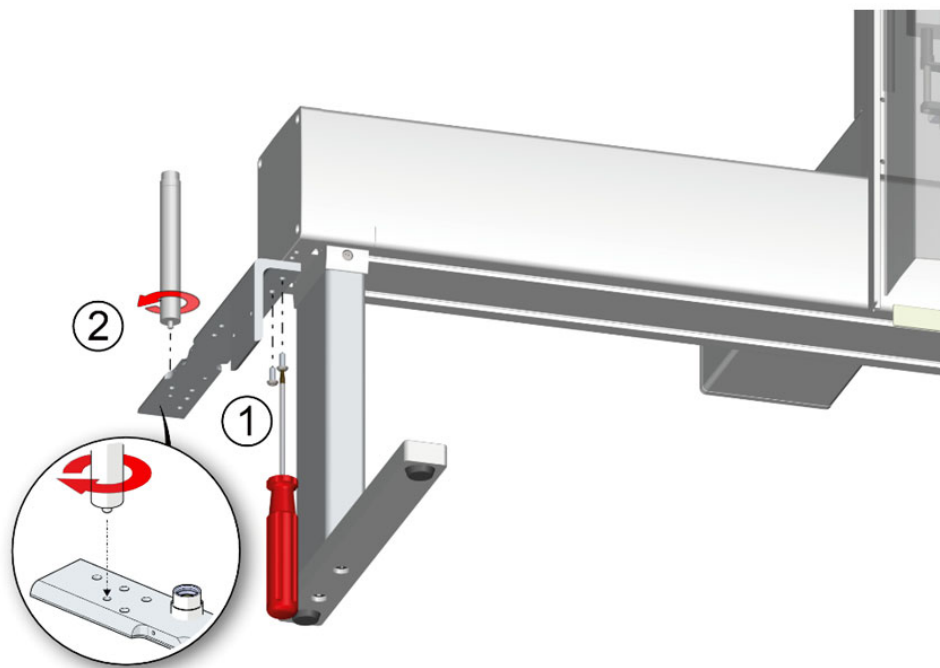
❖ **To install the dilutor syringe module on the TriPlus RSH SMART system**

1. Install the mounting bracket for the Dilutor on the left side of the X-Axis.  
The bracket is installed underneath the side cover of the X-Axis using the two holes at the back side. See 1 of [Figure 66](#).

The two front holes are reserved for the mounting bracket of the Handheld Controller (terminal).

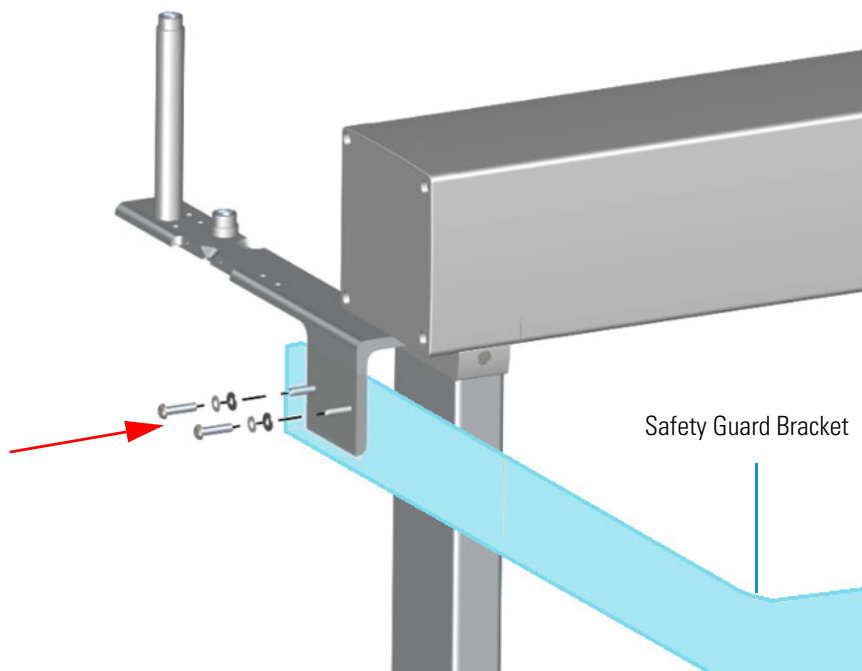
2. Screw the outer (higher) holder for the Guiding Wire into the bracket. See 2 of [Figure 66](#).

**Figure 66.** Mounting Bracket Installation



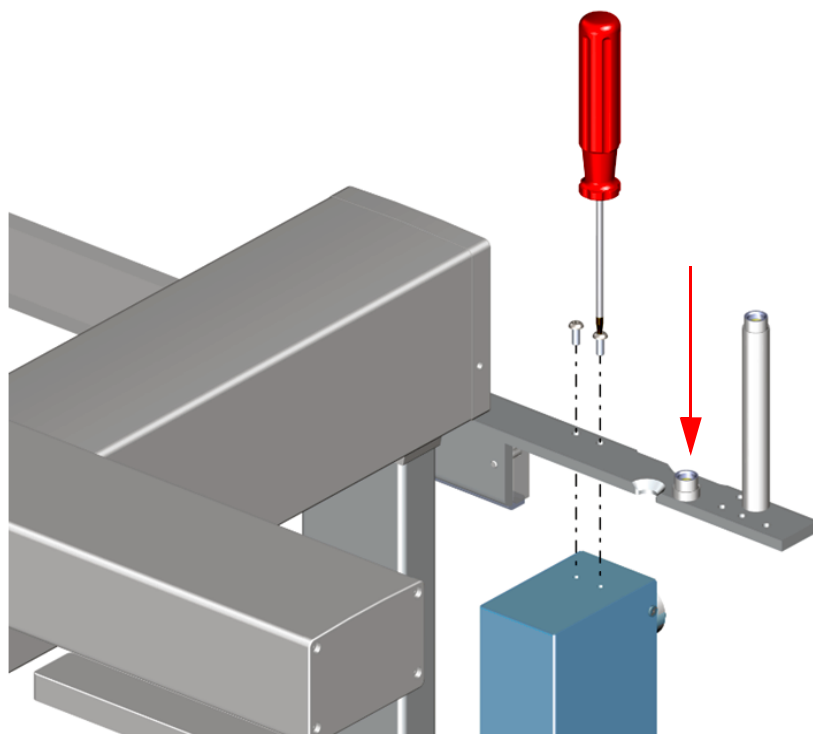
3. Attach the Safety Guard to the mounting bracket and fix it with the two screws provided.  
The Safety Guard Bracket is used on the right side of the X-Axis. See [Figure 67](#).

**Figure 67.** Installation of the Safety Guard to the Mounting Bracket



4. Install the Dilutor Syringe Module to the front position of the mounting bracket, closer to the X-Axis, and fix it using the two screws provided. See [Figure 68](#).

**Figure 68.** Installation of the Dilutor Syringe Module to the Mounting Bracket



## Installing the Dilutor Tool

**Note** For installing the Dilutor Tool, the ATC Station must be placed on the outermost left position of the X-Axis. The left leg of the system must be placed on the right side of the ATC Station.

It might be useful to connect the ATC Station at the end of a daisy chain – in doing so only one Bus connector is used and the ATC Station can be placed further left due to the free right connector.

The front or back mounting position of the Dilutor Syringe Module on the mounting bracket corresponds to the position of the Dilutor Tool in the ATC Station.

If only one Dilutor is added to the TriPlus RSH SMART system, the Dilutor Syringe Module must be installed on the front position, of the mounting bracket, close to the X-Axis.

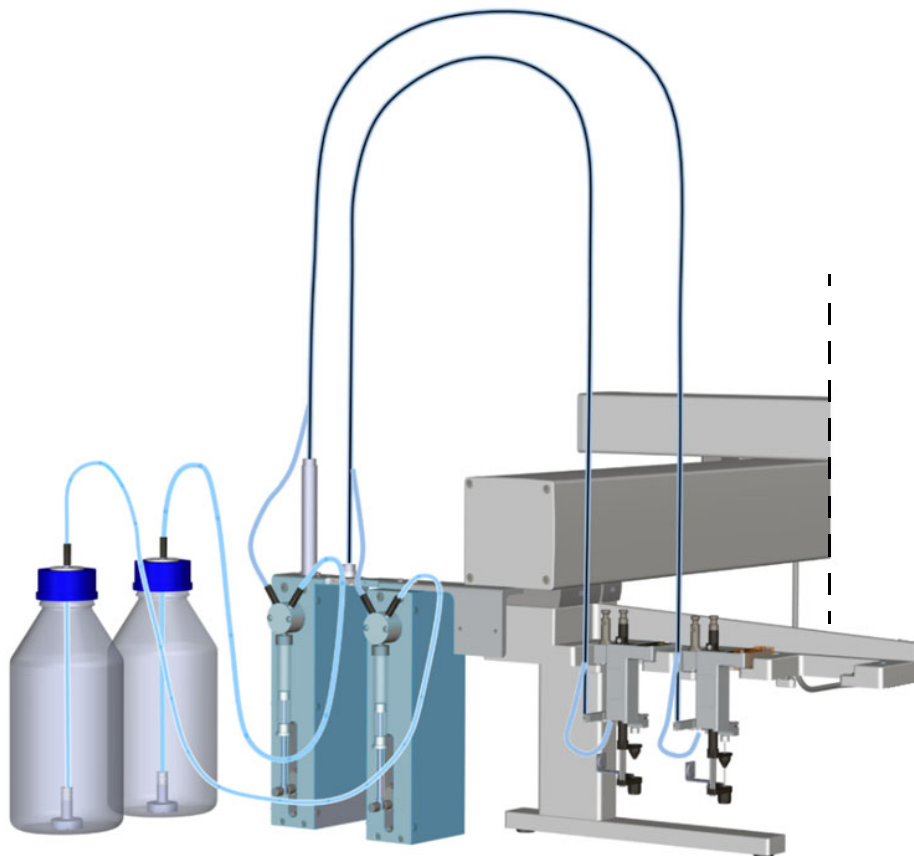
The corresponding Dilutor Tool is set to **Slot 1** of the ATC Station. The Guiding Wire is fixed to the lower holder on the mounting bracket.

If a second Dilutor is added, the second Dilutor Syringe Module must be installed on the back position of the mounting bracket. The corresponding Tool must be set in **Slot 2** of the ATC Station. The Guiding Wire is fixed to the higher holder on the mounting bracket.

[Figure 69](#) shows the installation of two Dilutor Modules.

See also “[Connecting the Transfer Tubing](#)” on [page 72](#).

**Figure 69.** Installation of Two Dilutor Modules



### Connecting the Transfer Tubing

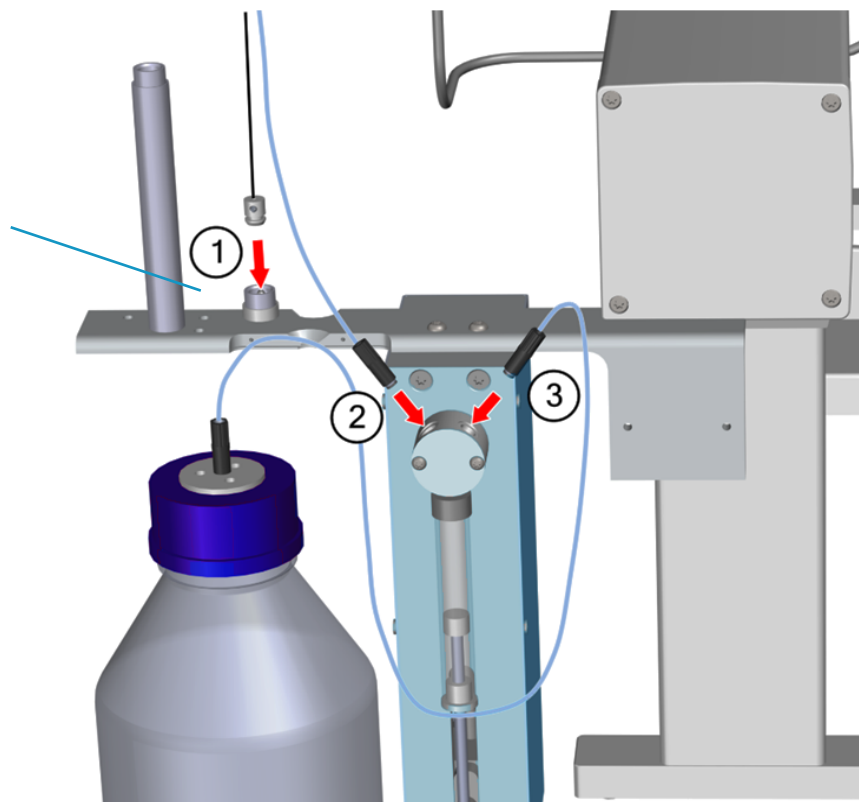
To properly connecting the Transfer Tubing, see the following procedure:

- “To connect the transfer tubing” on [page 72](#)

#### ❖ To connect the transfer tubing

1. Connect the Transfer Tubing to the Dilutor Syringe Module.
  - a. Place the end of the Guiding Wire in the **lower** holder of the mounting bracket. See **1** of [Figure 70](#).
  - b. Connect the Transfer Tubing to the Dilutor Valve. See **2** of [Figure 70](#).
  - c. Connect the Aspiration Tubing from the reservoir bottle to the Dilutor Valve. See **3** of [Figure 70](#).

**Figure 70.** Transfer Tubing Connection to the Dilutor Syringe Module



**Note** The Guiding Wire of a second Dilutor Module must be placed in the higher holder of the mounting bracket.

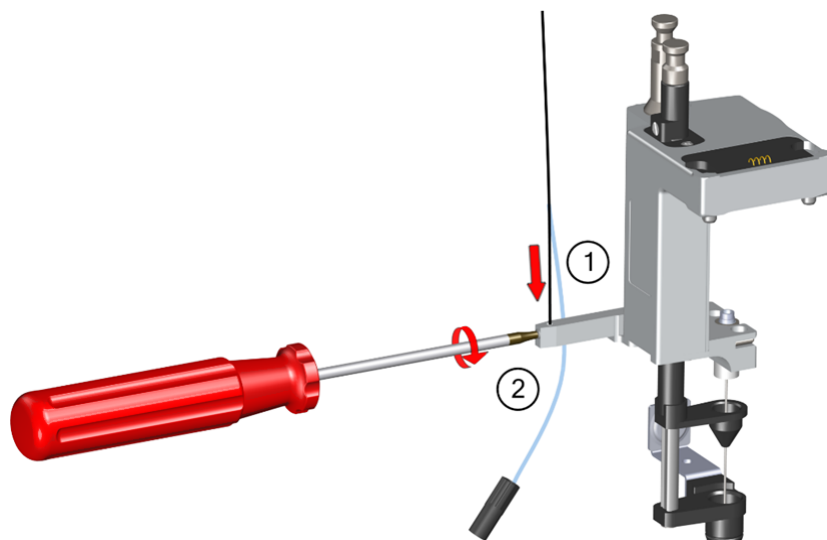
Never place the reservoir bottle(s) on a higher level than the TriPlus RSH SMART system itself to avoid draining of the liquid in case of any leakage.



**WARNING** The reservoir bottle(s) must be placed at the side of to the GC system away from any heated zones.

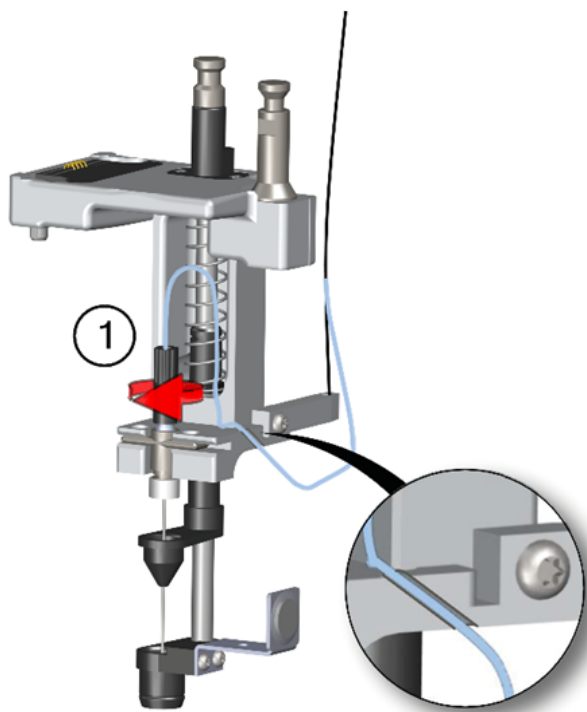
2. Connect the Transfer Tubing to the Dilutor Tool.
  - a. Insert the free end of the Guiding Wire into the corresponding holder on the Dilutor Tool and fix it with the integrated screw. See 1 and 2 of [Figure 71](#).

**Figure 71.** Transfer Tubing Connection to the Dilutor Tool



- b. Connect the free end of the Transfer Tubing to the needle in the Dilutor Tool. See 1 of [Figure 72](#).

**Figure 72.** Transfer Tubing Connection to the Needle of the Dilutor Tool



- c. Clamp the tubing in the groove on the back of the Tool.



## Electrical Connections

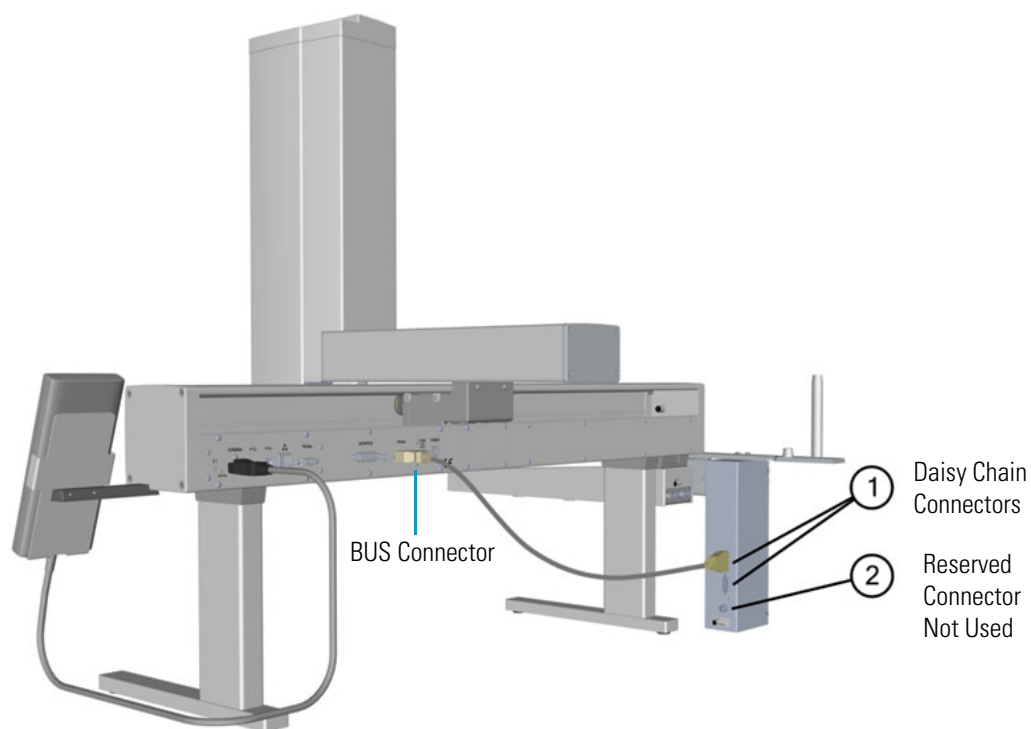
This section provides instructions for making the electrical connections of the Dilutor Module.



**WARNING** Before starting the electrical connections make sure that the TriPlus RSH SMART system is powered Off.

Connect the supplied Dilutor Module control cable from one of the daisy chain connectors on the back side of the module to the TriPlus RSH SMART Control Interface connector marked **BUS**. If the BUS connector is already occupied, connect the cable to another Active module with an open connector. For details see [Figure 73](#).

**Figure 73.** Dilutor Module Electrical Connections



# Inserting Syringe/Fiber into the Tool

See the following sections:

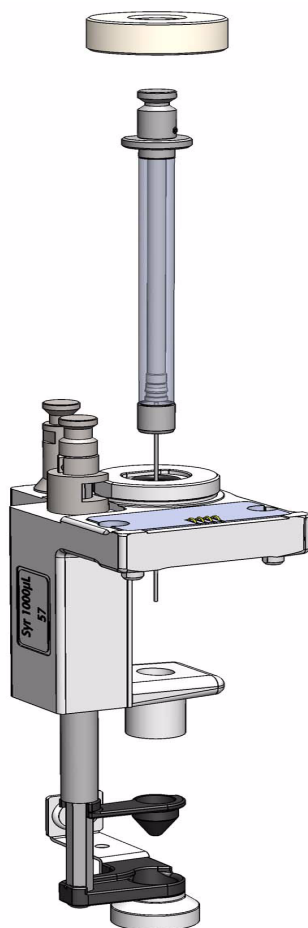
- “Inserting a LS Syringe into the LS Tool” on page 76
- “Inserting a HS Syringe into the HS Tool” on page 78
- “Installing the SPME Fiber Protector” on page 80
- “Inserting a SPME Fiber Holder into the SPME Tool” on page 82
- “Inserting the SPME Arrow Holder Into the SPME Arrow Tool” on page 84
- “Managing an ITEX DHS Syringe and Trap Assemble” on page 85

## Inserting a LS Syringe into the LS Tool

### ❖ To insert a LS syringe into the LS Tool

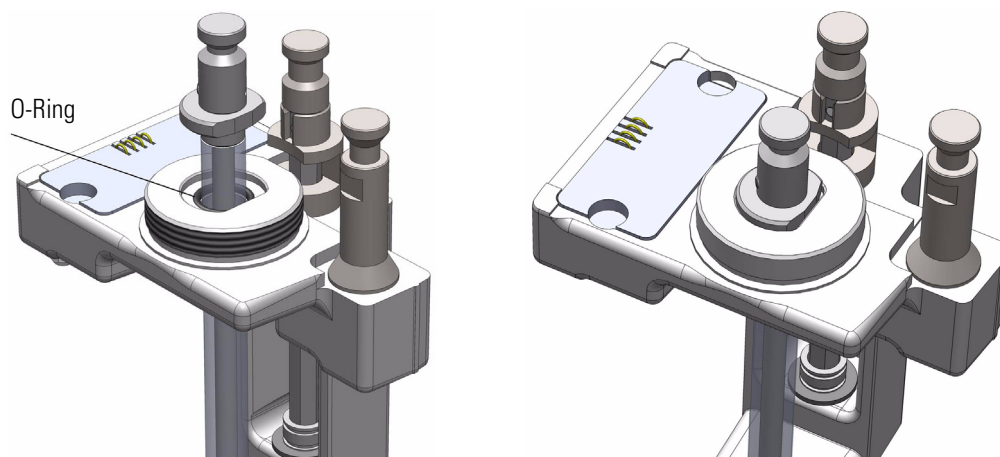
1. Remove the retaining nut from the LS Tool, then insert the syringe such that the flat side of the flange matches with the cut-out of the upper part of the holder. See [Figure 74](#).

**Figure 74.** Syringe Insertion into LS Tool



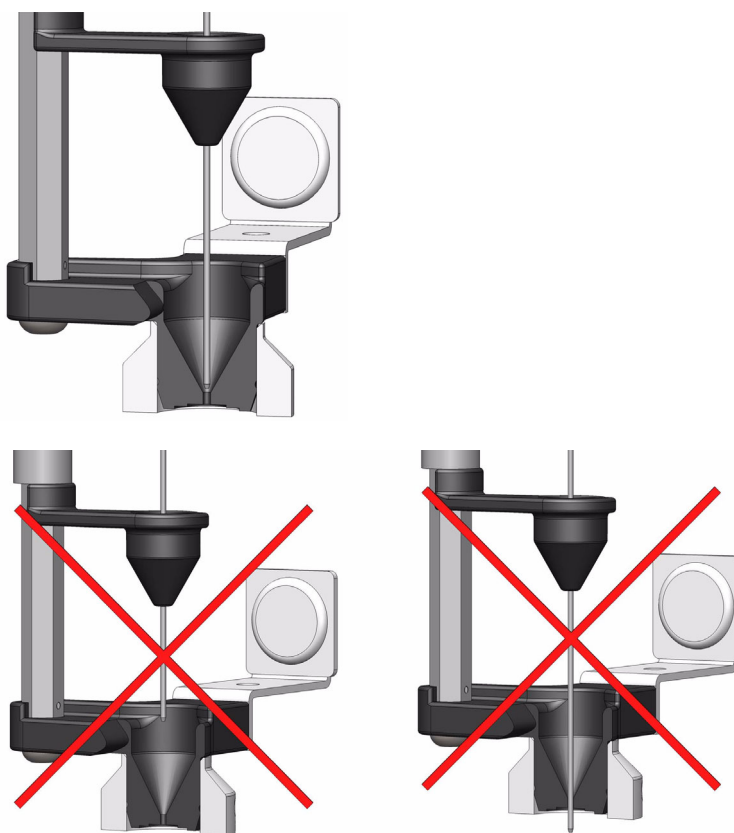
2. Carefully insert the syringe body guiding the needle tip into the upper and the lower needle guide. Press the syringe flange firmly into the Tool holder. See [Figure 75](#).

**Figure 75.** Syringe Alignment and Front View



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 76](#).

**Figure 76.** Correct and Incorrect Position of the Syringe Needle Tip

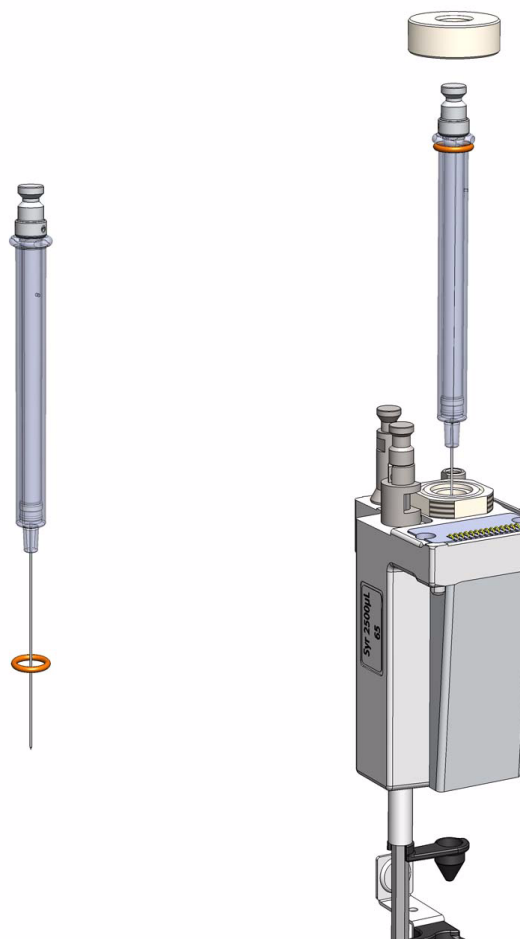


## Inserting a HS Syringe into the HS Tool

### ❖ 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 77](#).

**Figure 77.** Preparing HS-Syringe for Installation

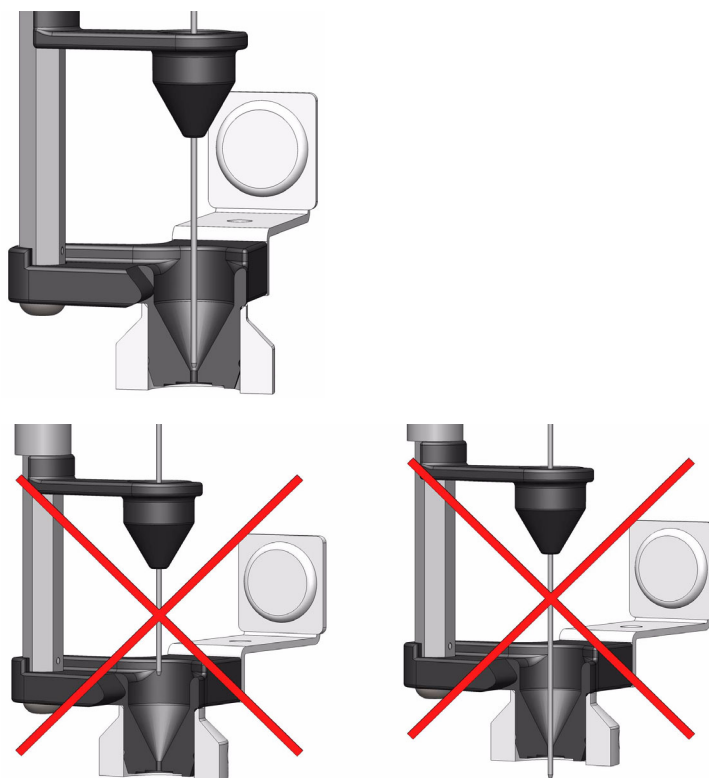


2. Insert the HS syringe into the HS Tool. Carefully insert the syringe body guiding the needle tip into the upper and lower needle guide.
3. Press the syringe firmly into position, and tighten the syringe flange with the retaining nut until a resistance is felt. The plunger is inserted in the syringe 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 78](#).

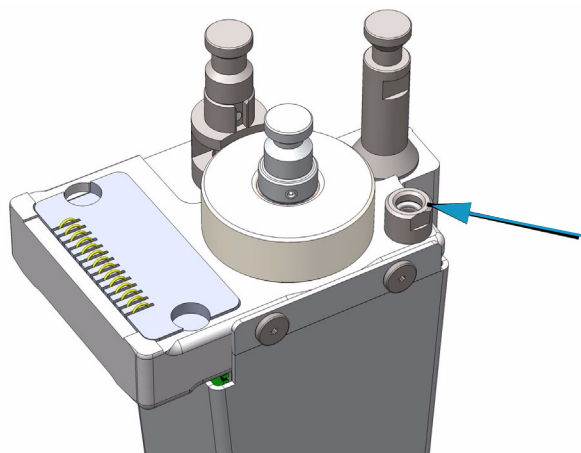
**Figure 78.** Correct and Incorrect Position of the Syringe Needle Tip



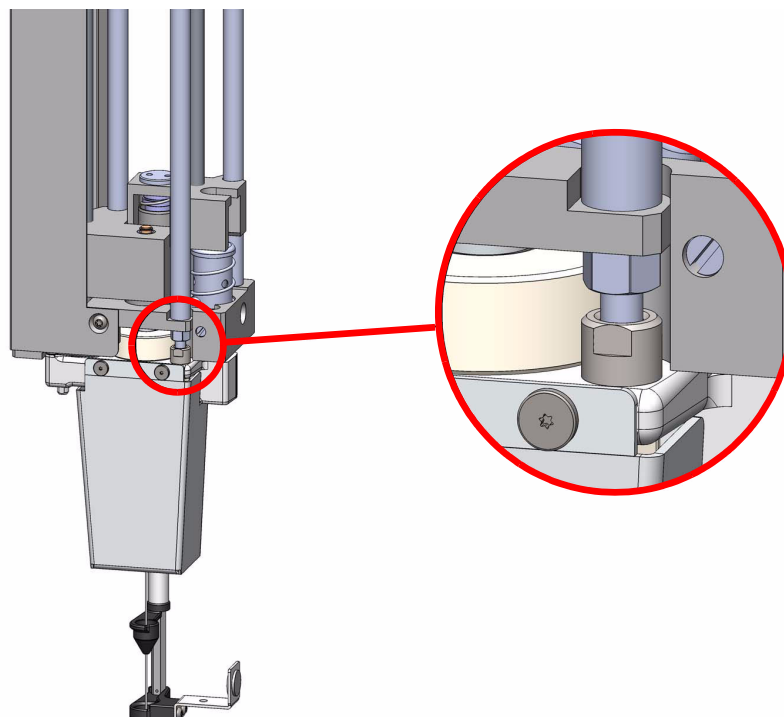
## Purge Gas Adapter

The purge gas adapter, mounted on the HS Tool, couples with the adapter from the TriPlus RSH SMART Head. See [Figure 79](#) and [Figure 80](#). The coupling is sealed through an O-ring installed in the HS Tool Purge Gas Adapter.

**Figure 79.** HS Tool Gas Adapter



**Figure 80.** Purge Gas Coupling of HS Tool and TriPlus RSH SMART 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™.



**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 be exchanged.

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

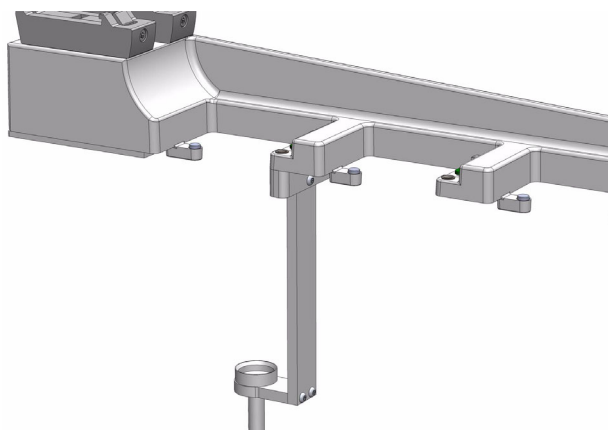
When the SPME Tool is originally positioned in Slot position #1, this position is available when the SPME Tool is returned.

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.

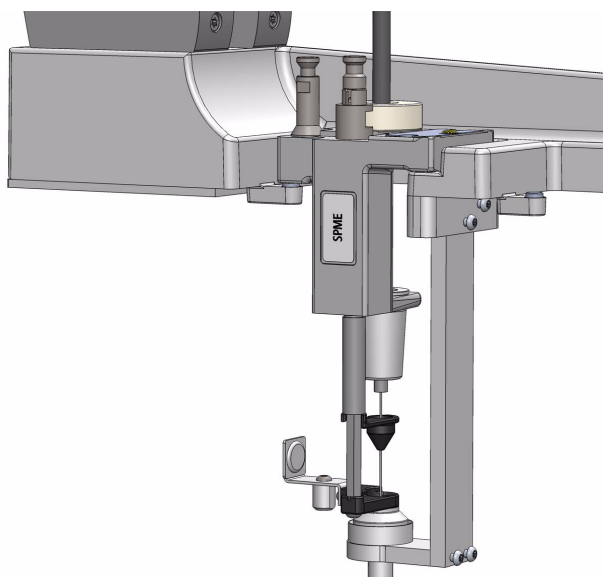
### ❖ To install the SPME fiber protector

Install the SPME fiber Protector as shown in [Figure 81](#) and [Figure 82](#).

**Figure 81.** SPME Fiber Protector



**Figure 82.** 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 SMART.

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 steps 3 and 4.

5. Install the TR Station or the ATC Station on the TriPlus RSH SMART as described in the section “[Installing the Tool Stations](#)” on [page 34](#).
6. Manually, check again the fiber matches with the Protector.

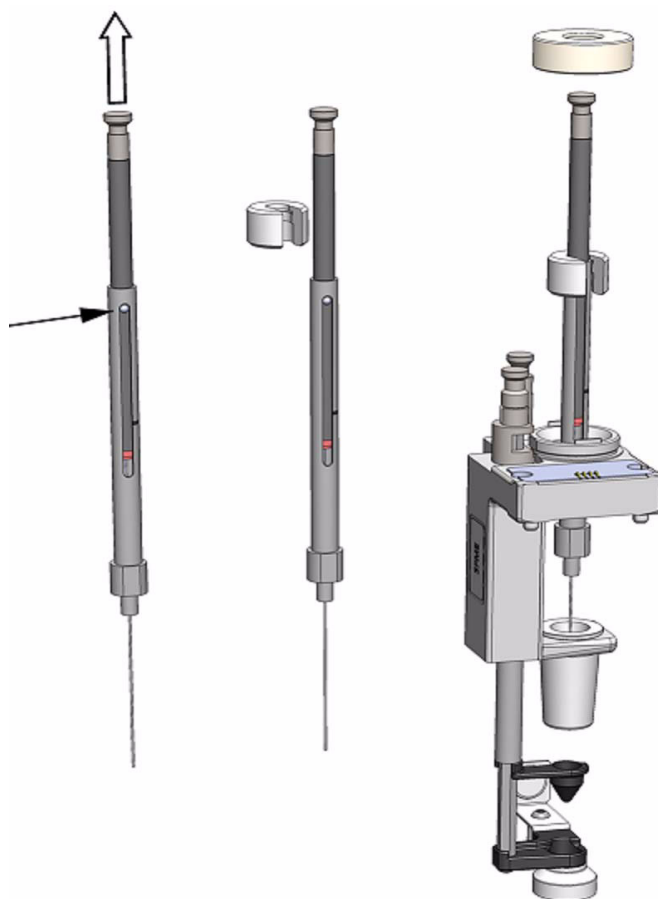
## Inserting a SPME Fiber Holder into the SPME Tool

### ❖ 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 sheath needle. This is the protected position for the fiber.

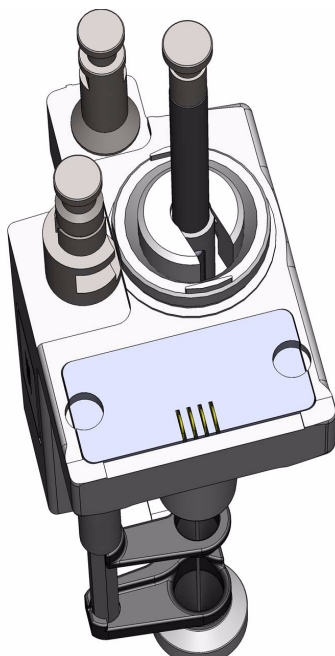
1. Remove the retaining nut and the SPME Tool Adapter. Insert the SPME Fiber Holder, making sure the fiber is also inserted.
2. Insert the SPME Tool Adapter such that it sits on the metallic part of the SPME Fiber Holder. See [Figure 83](#) and [Figure 84](#).

**Figure 83.** Inserting SPME Fiber Holder



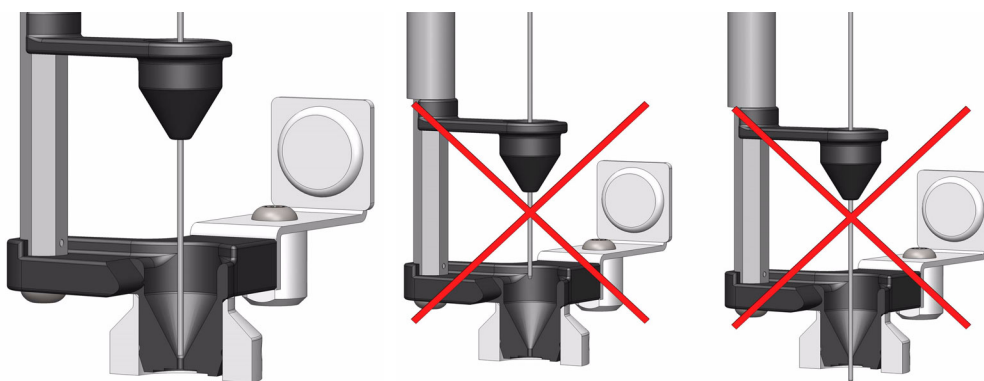


**Figure 84.** SPME Fiber Holder Inserted in SPME Tool



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 85](#).

**Figure 85.** 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.

### Inserting the SPME Arrow Holder Into the SPME Arrow Tool

**Note** The standby position of the SPME Holder plunger is identical as compared to a syringe. If the plunger is in pulled-up position, the Arrow is exposed.

❖ **To insert the SPME Arrow holder into the SPME Arrow Tool**

1. Insert the SPME Arrow holder into the SPME Arrow Tool, make sure that the SPME Arrow is also inserted. See [Figure 86](#).

**Figure 86.** Inserting SPME Arrow Holder



**Note** Pay attention to the right orientation of the holder – the upper flange is flattened on one side to ensure the right placement.

2. Tighten the Retaining Nut to the mechanical stop. Use normal force; do not over-tighten the nut.

## Managing an ITEX DHS Syringe and Trap Assemble

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

See the related topic:

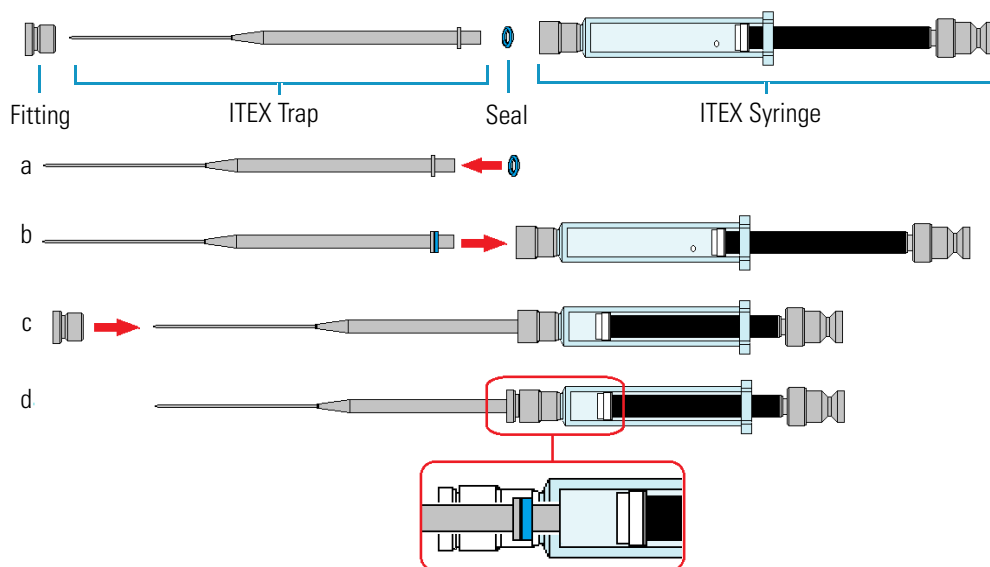
- “Installing the ITEX Syringe and Trap into the ITEX DHS Tool” on page 85
- “Removing the HS syringe from the ITEX DHS Tool” on page 87
- “Flush Gas Considerations” on page 87

### Installing the ITEX Syringe and Trap into the ITEX DHS Tool

#### ❖ To install an ITEX syringe and trap into the ITEX DHS Tool

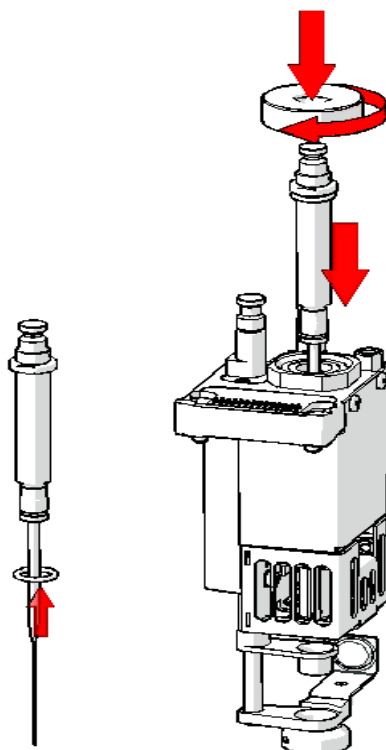
1. Assemble the ITEX Syringe with trap/needle following the order shows in [Figure 87](#).

**Figure 87.** 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 over-tightening.
  - 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 88](#).

**Figure 88.** Syringe Insertion into the ITEX DHS Tool

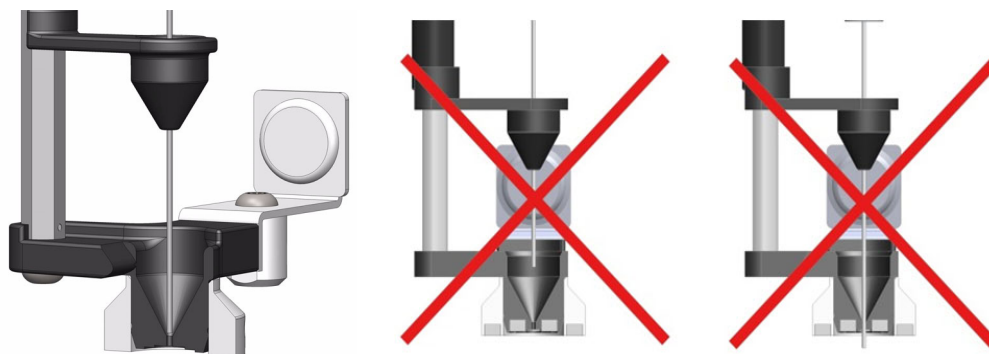


3. Insert the ITEX syringe into the ITEX DHS Tool. Lower the syringe body carefully to guide the needle tip into the upper and lower needle guide.
4. Press the syringe firmly into position and tighten the syringe flange with the Retaining Nut until resistance is felt. The plunger is inserted in the syringe 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 89](#).

**Figure 89.** Correct and Incorrect Position of the ITEX Syringe Needle Tip

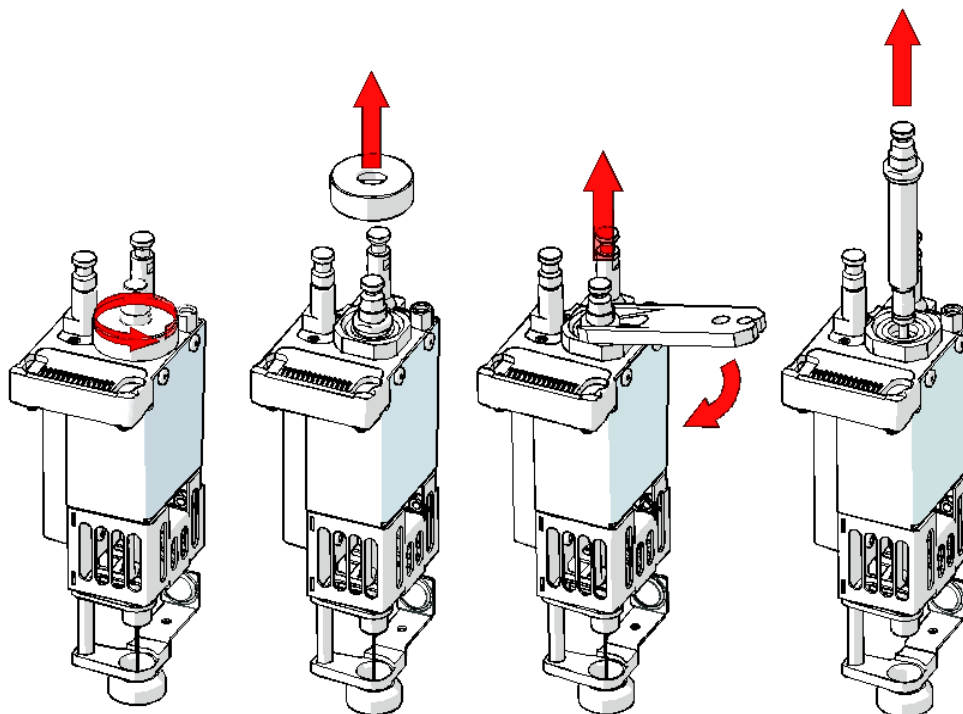


## Removing the HS syringe from the ITEX DHS Tool

### ❖ To remove the HS syringe from the ITEX DHS Tool

1. Remove the retaining nut from the Tool. See [Figure 90](#).

**Figure 90.** HS Syringe Removal



2. Carefully slide the ITEX Syringe Removal Tool under the syringe flange and pull the syringe out of the ITEX DHS Tool.

## Flush Gas Considerations

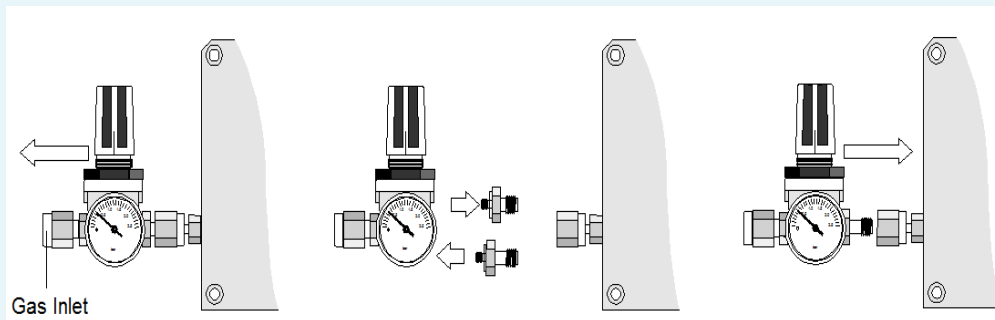
A gas flow level greater than 6 mL/min can destroy the bed of the trap, which will result in non-reproducible trapping efficiency.

### Setting Flush Gas Pressure

A gas flow restrictor union for the pressure regulator is integrated within the ITEX DHS Tool. This restriction allows a flow of approximately 7 mL/min helium or about 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 91](#).

**Figure 91.** 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  $\pm$  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 88](#).

#### ❖ 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, nitrogen, helium, and hydrogen are typically used as carrier gases. 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

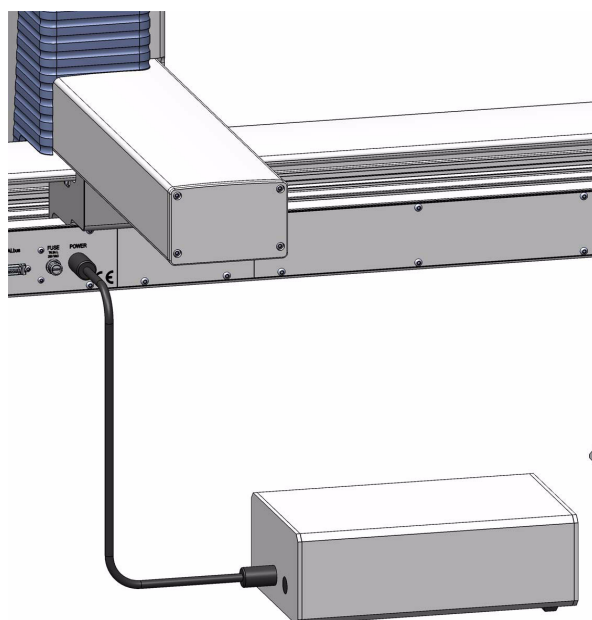


**WARNING** Always switch the TriPlus RSH SMART Power Module OFF before connecting or disconnecting any TriPlus RSH SMART accessories cables.

❖ **To connect the power module**

1. Locate the power supply module.
2. Connect the provided cable to the connector **OUT** of the Power Module. See [Figure 92](#).

**Figure 92.** Power Supply Connection

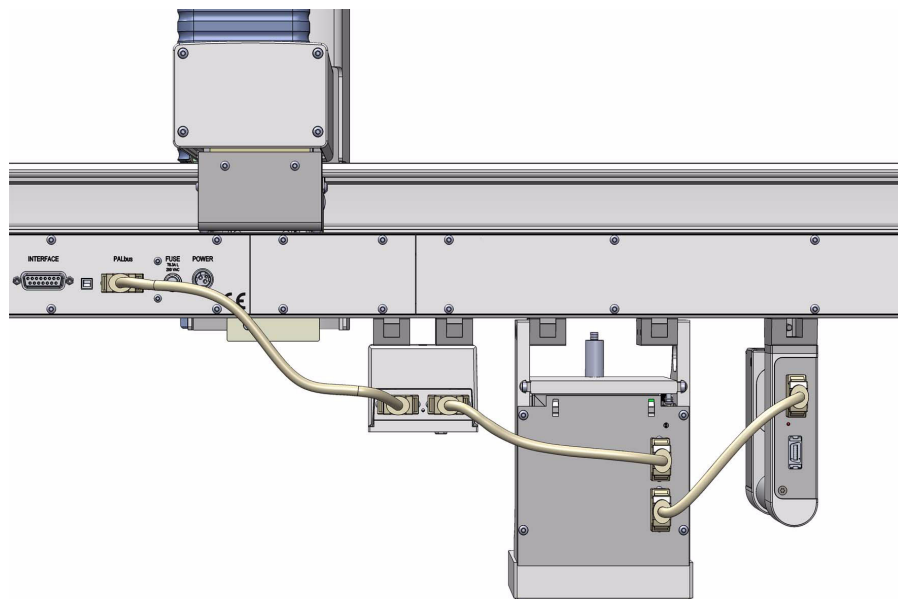


**Note** The second outlet marked AUX of the Power Module is identical to the TriPlus RSH SMART outlet, including connector size and pins, and outlet voltage.

3. Connect the other side of the cable to the connector marked **Power** at the backside of the TriPlus RSH SMART.
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 93](#).



**Figure 93.** Modules Electrical Connection



## Combining the TriPlus RSH SMART to Other Devices

Combining the TriPlus RSH SMART 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 SMART to wait or to proceed with a sample-processing step.

Output signals are sent from the TriPlus RSH SMART 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 SMART to the Gas Chromatographs. 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 SMART 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 SMART 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 SMART User Guide*.

## External Connectors

The external connectors of the control interface are shown in [Figure 94](#).

**Figure 94.** Control Interface Connectors



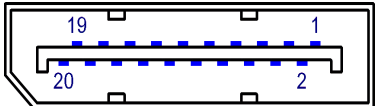
The connectors are the follows:

- [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 listed in [Table 9](#).

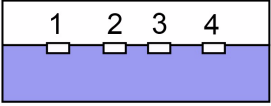
**Table 9.** Handheld Controller Connector Pin-out

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	TxCkOut-
	11	GND
	12	TxCkOut+
	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 listed in [Table 10](#).

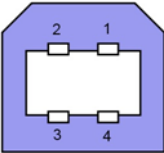
**Table 10.** USB Host Connector Pin-out

Connector Layout	Pin	Signal Name
	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 listed in [Table 11](#).

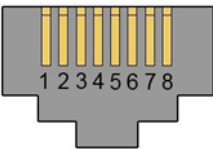
**Table 11.** USB Device/Client Connector Pin-out

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

## Ethernet Connector

The pin-out of the 8-pin RJ45 connector, marked , is listed in [Table 12](#). Currently this connector is not active.


**Table 12.** Ethernet Connector Pin-out

Connector Layout	Pin	Signal Name
	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 listed in [Table 13](#).

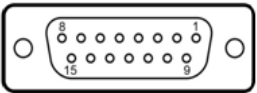
**Table 13.** BUS Connector Pin-out

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

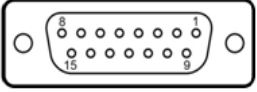
## Interface Connector

The pin-out of the Interface 15-pin DSUB female connector, marked INTERFACE, is listed in [Table 14](#).

**Table 14.** 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

**Table 14.** Interface Connector Pin-out (Sheet 2 of 2)

Connector Layout	Pin	Signal Name
 <p><i>Continued</i></p>	8	GND
	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 listed in [Table 15](#).

**Table 15.** 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 SMART and the computer.

### Connecting the TriPlus RSH SMART 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 SMART is directly connected to the computer via the LAN cable. There is no corporate network or router connection.
  - IP Address TriPlus RSH SMART: 192.168.99.230
  - IP Address computer: 192.168.99.210
  - Subnet Mask: 255.255.255.0
  - Default Gateway: not required, leave the field empty (if an address is entered, it will not be used)
- **Corporate Network with DHCP Protocol** — Ask the network administrator to verify and integrate the setup within a corporate network.  
Select the DHCP Protocol, the network assignees an IP Address and a Subnet Mask to the TriPlus RSH SMART.
- **Corporate Network with Fixed IP Address** — Ask the network administrator to provide the IP Address, the Subnet Mask, and the Default Gateway to configure the TriPlus RSH SMART within the corporate network.

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

- [“Setting Up the Direct Connection” on page 99](#)
- [“Setting up the Network Interface” on page 100](#)
- [“Setting up the Network Interface by using the Handheld Controller” on page 101](#)
- [“Restoring Factory Default Network Settings” on page 102](#)
- [“Setting up a Corporate Network” on page 103](#)



## Setting Up the Direct Connection



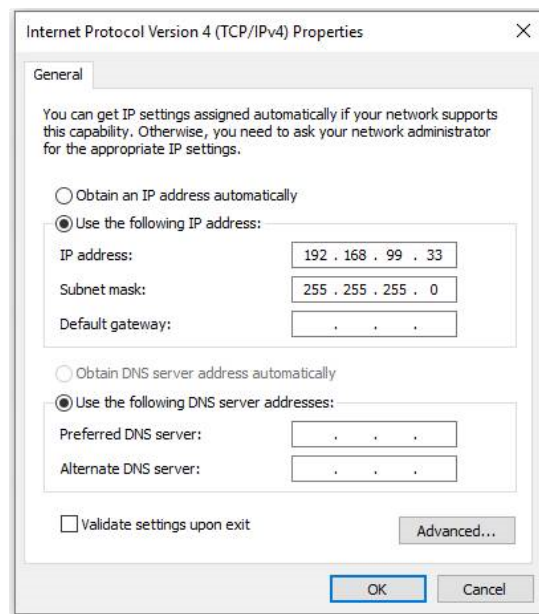
**CAUTION** The following description assumes that an Ethernet cable is connected directly from the TriPlus RSH SMART to a computer and not integrated within a customer network. If this is the case, consult your System Administrator for support. The same is true as soon as the DHCP Mode is activated. 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. See [Figure 95](#).

**Figure 95.** 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.

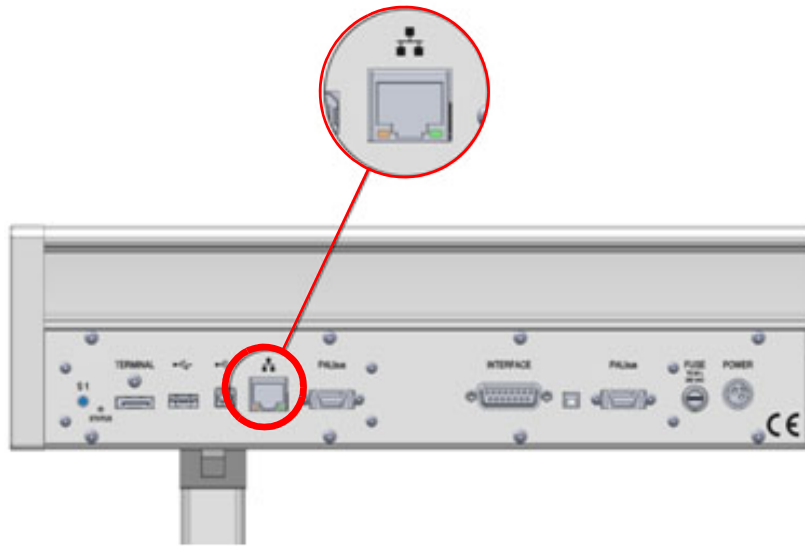
**Note** Use the proposed IP Address number as shown in [Figure 95](#).

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 SMART

3. Connect the Ethernet cable from the Control Board of the TriPlus RSH SMART to the computer, and verify that the LAN control LED lights when connected to a powered-on computer. See [Figure 96](#).

**Figure 96.** 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 SMART 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 97](#).

**Figure 97.** LAN Communication Settings

The screenshot shows a web browser window with the address bar displaying `http://192.168.99.230/RemoteAdmin/`. The page has a navigation bar with 'Home', 'Settings', and 'Firmware update'. The 'Settings' section is expanded, showing several configuration panels:

- Infos**:
  - Device Name: Robot
  - Serial Number: Uninitialized
  - Bootloader Version: 1.3.19274.2
  - OS Version: 2.1.21097.0
  - Build Version: 3.1.21211.1057
  - Product Version: 3.1.22
  - Edition: Thermo
- Installed Keys**:
  - CTC CtcEncryption v2
  - Thermo OemEncryption v2
- Ethernet Settings**:
  - MAC Address: 00-14-2d-a3-12-5a
  - IP Address: 192.168.99.230
  - Subnet Mask: 255.255.255.0
  - Default Gateway: 192.168.1.1
  - DHCP: Disabled
  - DNS: Unavailable
- Time and Date**:
  - Date: 9/21/2021
  - Time: 9:00 PM
  - Time Zone: (UTC+01:00) Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna
- Desktop apps download**:
  - [Desktop setup](#)
- User backup download**:
  - [Backup](#)

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 SMART 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 more details refer to the **Service Menu Item-Installation** section in the *TriPlus RSH SMART User Guide*.

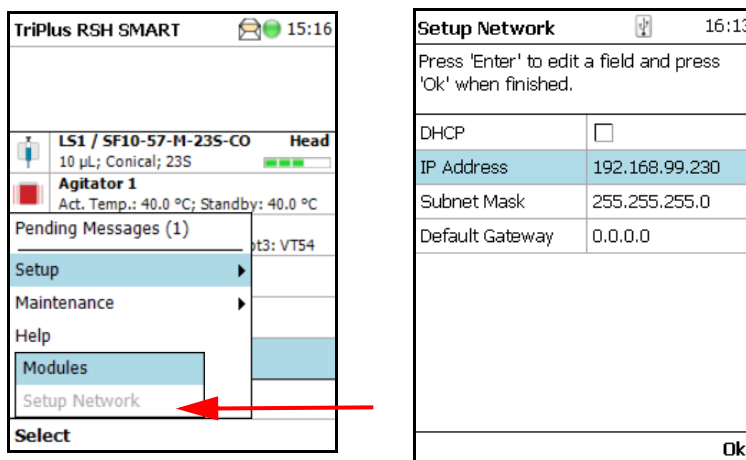
## Setting up the Network Interface by using the Handheld Controller

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 SMART User Guide*.

The computer settings must be accurate.

The TriPlus RSH SMART Network default settings are shown in [Figure 98](#).

**Figure 98.** TriPlus RSH SMART Network Settings



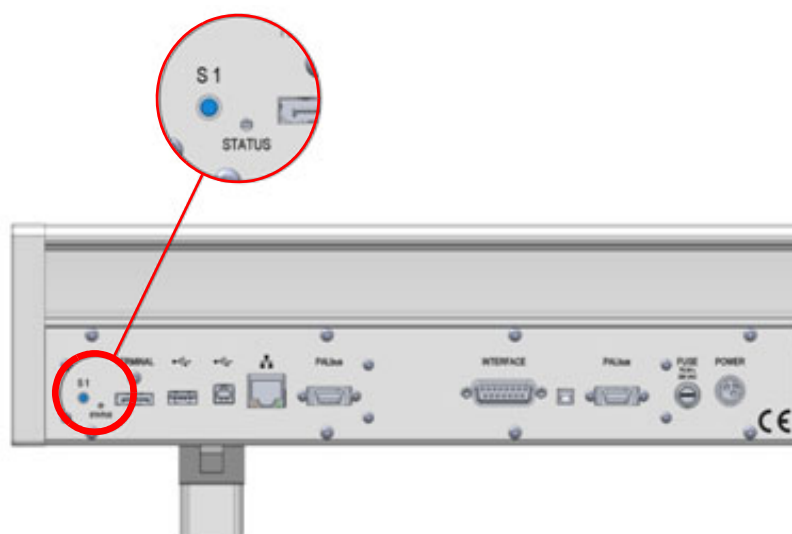
Do not use the DHCP mode nor an entry in the Default Gateway field.

## Restoring Factory Default Network Settings

It is sometimes desirable to restore the TriPlus RSH SMART factory default network settings if you moved the TriPlus RSH SMART 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. See [Figure 99](#).

**Figure 99.** Reset Button S1



### ❖ To reset the TriPlus RSH SMART

1. Power OFF the TriPlus RSH SMART.

2. Press the **Reset** button **S1** by using an appropriate Tool.
3. Power ON the TriPlus RSH SMART 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 SMART with Factory Settings](#)” on [page 98](#) 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 SMART 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 SMART, 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 SMART supports network connections Auto-MDI(X) of a switch which follows the protocol 1000Base-T standard.

The RSH SMART 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 SMART 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 SMART Defining Object Positions

This chapter provides instructions for defining the teaching position of the TriPlus RSH SMART 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

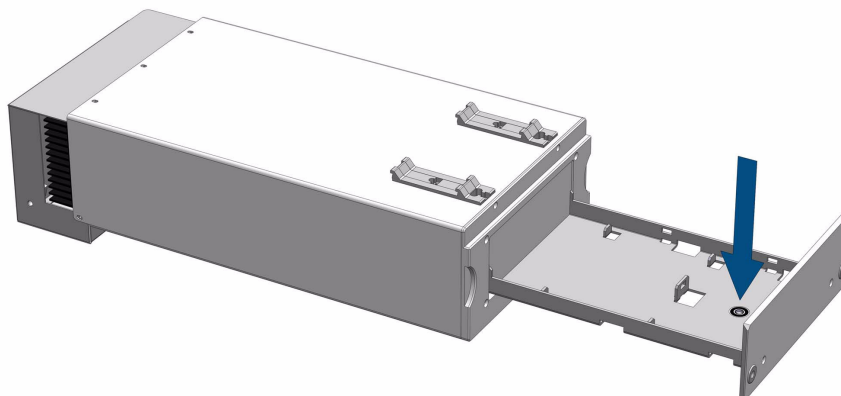
- Definitions of Teaching, Referencing, and Calibration
- Slot Positions
- Definition of Row and Column
- Definition of Inclination
- Teaching TriPlus RSH SMART Modules
- Teaching Tool Stations
- Teaching Tray Holders
- Teaching Washing Stations
- Teaching Heating/Shaking Modules and Stations
- Teaching Optional Modules
- TriPlus RSH SMART Tool Referencing and Calibration
- Modules Teaching Step-by-Step Procedure

## Definitions of Teaching, Referencing, and Calibration

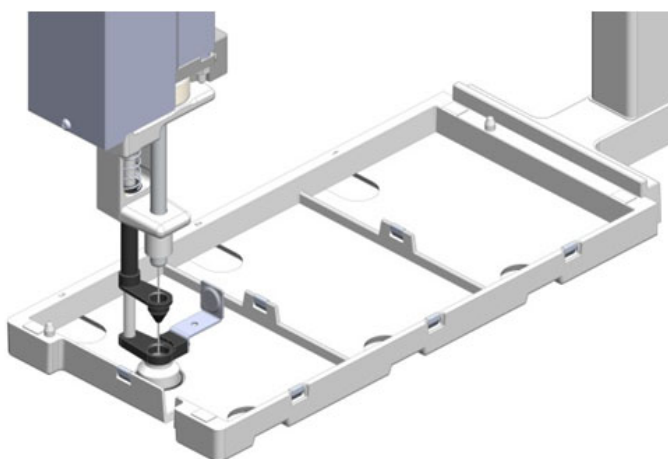
The term **Teaching** is used to define the X-, Y-, and Z-axis positions for each module.

The teaching process is activated by moving the TriPlus RSH SMART Head to the **Teach Point**. [Figure 100](#) and [Figure 101](#) show examples of teaching position for a Temperature Controlled Drawer, and for a Tray Holder.

**Figure 100.** Temperature Controlled Drawer Teaching Position



**Figure 101.** Tray Holder Teaching Position



The Tool is not part of the TriPlus RSH SMART 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 SMART, it is required to **Reference** and



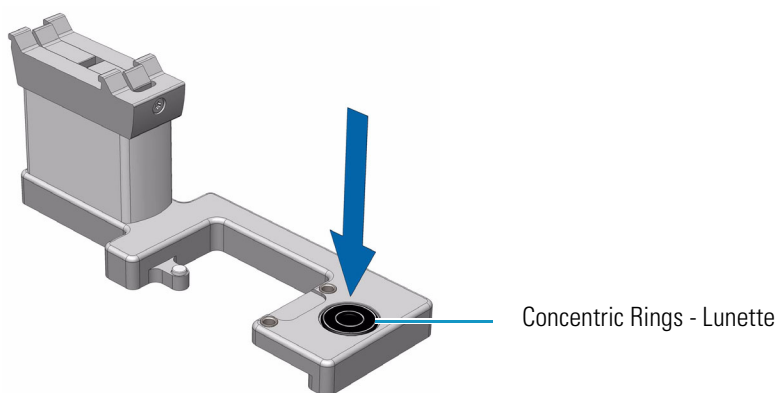
**Calibrate** the tools. This operation is necessary to compensate for minor deviations between one Tool and another.

See the section “[TriPlus RSH SMART Tool Referencing and Calibration](#)” on [page 131](#) for details.

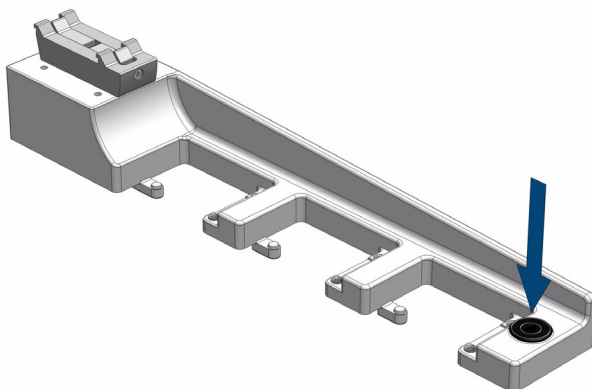
A Tool is defined as **Reference Tool** while all the other Tools are **Calibrated** in function of the **Reference Tool**. Possible deviations are stored with the Reference Tool. This step is important, for example, to enable reliable grasping of a Tool from a Slot in the ATC Station and to return it.

As a first step, define the Reference Point. Since the TriPlus RSH SMART 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 SMART Tool Referencing**. [Figure 102](#) and [Figure 103](#) illustrate the Reference Points for the two stations.

**Figure 102.** Reference Point at TR Station



**Figure 103.** Reference Point at ATC Station



The Reference Point is defined by moving the TriPlus RSH SMART Head to this point and the X-, Y-, and Z-axis Positions are stored. It is important that all other TriPlus RSH SMART 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** but the actual slots for the tools, which are individually taught.

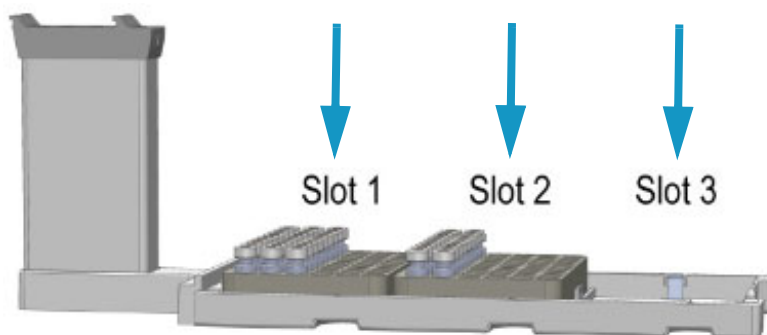
## Slot Positions

A **Slot** is defined as a position within a TriPlus RSH SMART module which can be occupied by a sample tray such as a Vial Tray 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 SMART X-axis to the front.

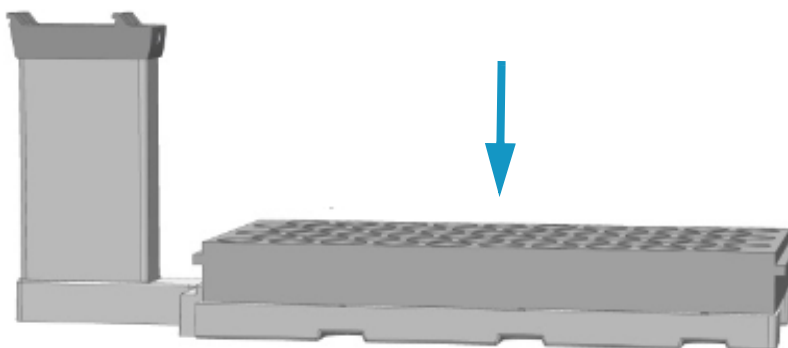
- [Figure 104](#) shows an example of a Tray Holder including the Slots with spaces for installing up to three VT 54 trays.

**Figure 104.** Tray Holder with Two Trays Installed



- [Figure 105](#) shows the same Tray Holder but with a tray R 60 installed, which spreads over the three slot positions. In this example, the Tray Holder is defined as holder with a single Slot.

**Figure 105.** Tray Holder with a Single Tray Installed



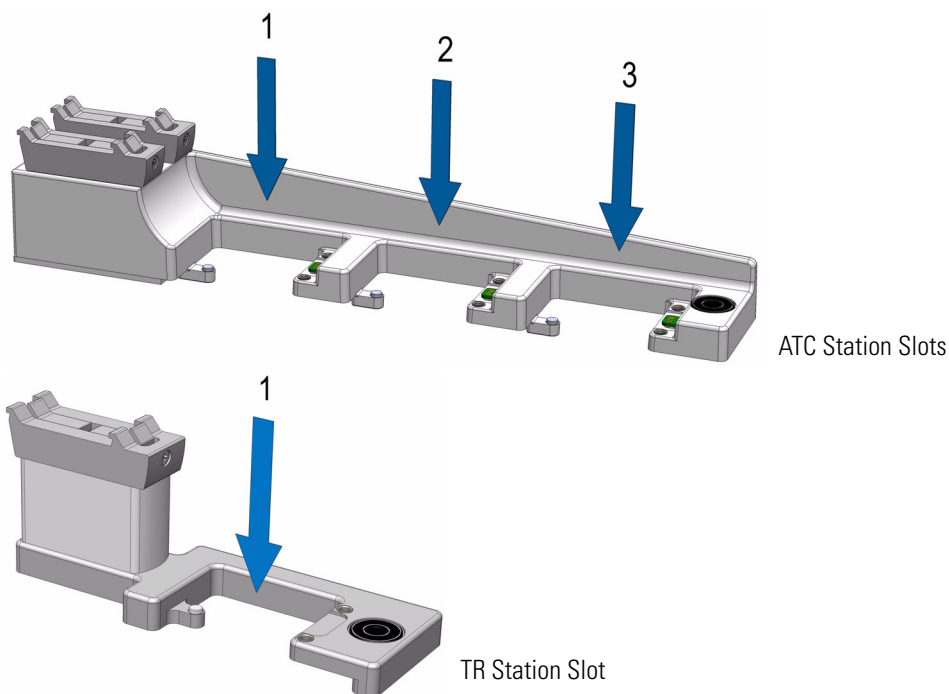
The term **Slot** is also used for both the ATC Station and TR Station.

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 106](#).

**Figure 106.** TC Station with 3 Slots for TriPlus RSH SMART Tools and TR Station with Single Slot



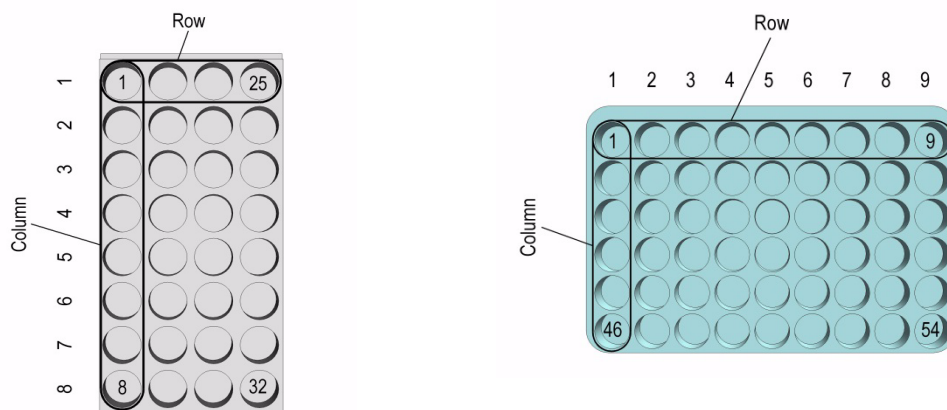
## Definition of Row and Column

The TriPlus RSH SMART 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 107](#) with the Tray R32 and the Tray VT54 (which has the same footprint as Well Plate).

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

**Figure 107.** Trays R32 and VT54



## Definition of Vial or Well Position Pattern

The definition of **Pattern** is only required for Trays and Well Plates.

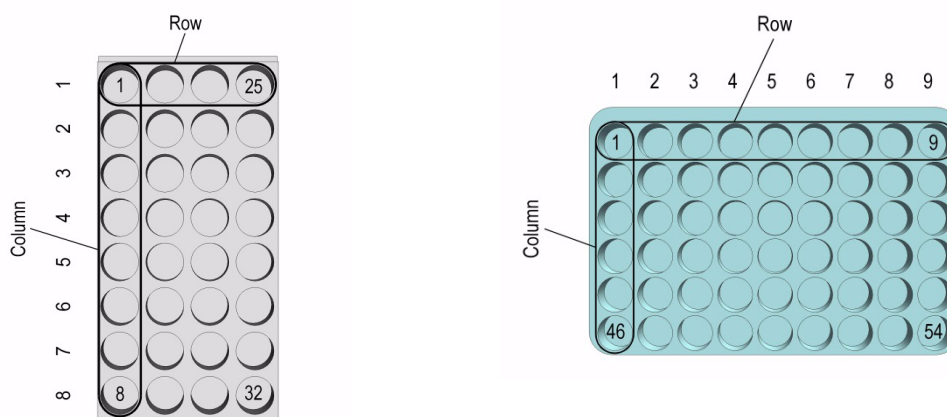
The arrangement of vial or well positions in a tray or well plate can be in a **regular** or what is often referred to as a **staggered** pattern. A staggered pattern can take two forms:

- **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

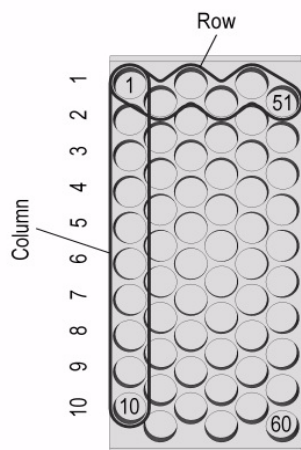
The vial or well positions are equally distributed.



### Pattern Type Staggered+

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

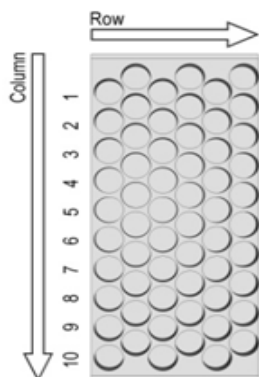
*Example:* The offset of the second Row is shifted by **+50%** of the hole pattern. The offset value is selectable (in mm).



### 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.

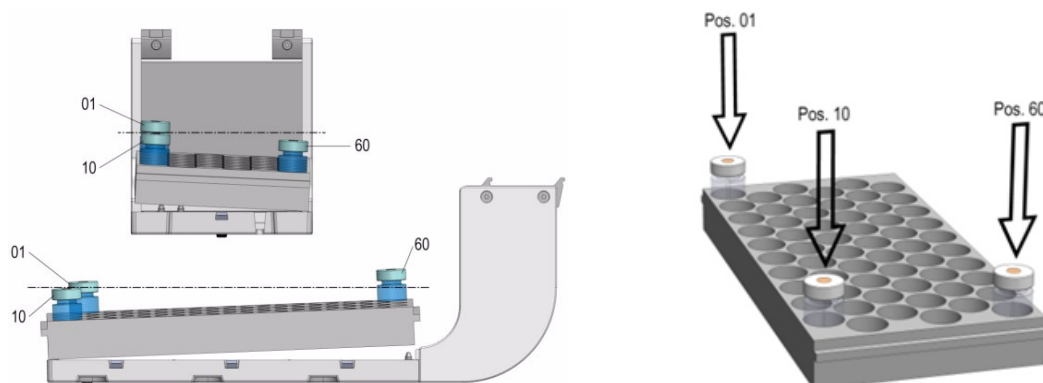


## Definition of Inclination

If the Tray surface is not exactly horizontal and planar but inclined in one or more axes, you can perform a correction through the TriPlus RSH SMART 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 108](#).

**Figure 108.** 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.

## Teaching TriPlus RSH SMART Modules

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

For details see the following sections:

- [“Introduction”](#) on page 113
- [“TriPlus RSH SMART Tool Referencing and Calibration”](#) on page 131

### Introduction

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

Before starting the procedure [“TriPlus RSH SMART Tool Referencing and Calibration”](#) on page 131, see to the following sections for an overview of the teach point of each module and station:

- [“Teaching TR Station Position”](#) on page 114
- [“Teaching ATC Station Position”](#) on page 114
- [“Teaching Standard Tray Holder Position”](#) on page 115
- [“Teaching Liquid Cooled Tray Holder Position”](#) on page 116
- [“Teaching Temperature Controlled Drawer Position”](#) on page 117
- [“Teaching Standard Wash Station Position”](#) on page 118
- [“Teaching Large Volume Wash Station Position”](#) on page 119
- [“Teaching Standard Wash Station Position”](#) on page 118
- [“Teaching Fast Wash Station Position”](#) on page 121
- [“Teaching Agitator Module Position”](#) on page 122
- [“Teaching Vortexer Module Position”](#) on page 123
- [“Teaching the Heatex Stirrer Module Position”](#) on page 124
- [“Teaching SPME Conditioning Station Position”](#) on page 125
- [“Teaching SPME Arrow Conditioning Station Position”](#) on page 126
- [“Teaching the Centrifuge Position”](#) on page 127
- [“Teaching the Barcode Reader Position”](#) on page 127
- [“Teaching Flow Cell Holder Position”](#) on page 128
- [“Teaching MHE Station Position”](#) on page 129
- [“Teaching GC Injector Position”](#) on page 130

To perform **step by step** the module teaching procedure, see the section [“Modules Teaching Step-by-Step Procedure”](#) on page 134.

## Teaching Tool Stations

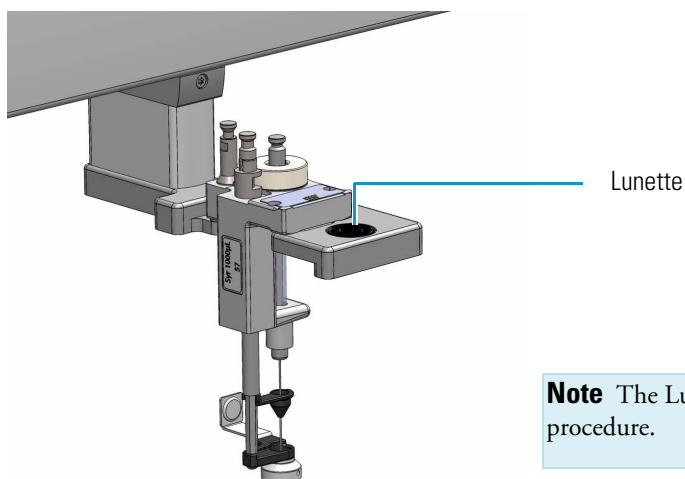
See the following sections:

- [Teaching TR Station Position](#)
- [Teaching ATC Station Position.](#)

### Teaching TR Station Position

Manually insert the required Tool into the TR Station as shown in [Figure 109](#).

**Figure 109.** TR Station



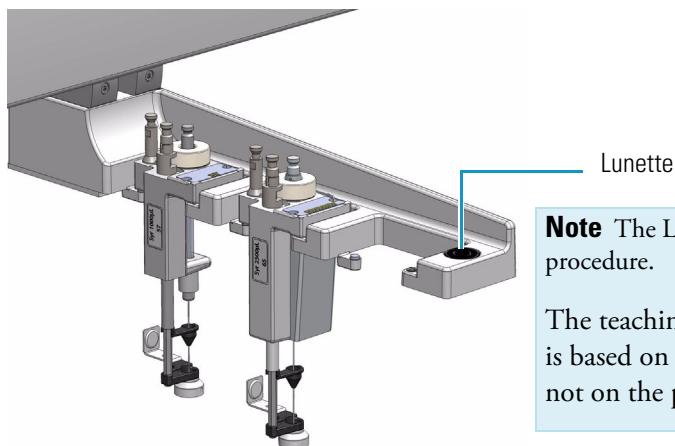
**Note** The Lunette is not used for the teaching procedure.

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 110](#).

**Figure 110.** Manually inserting the Tool to the ATC Station



**Note** The Lunette 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 Tray Holders

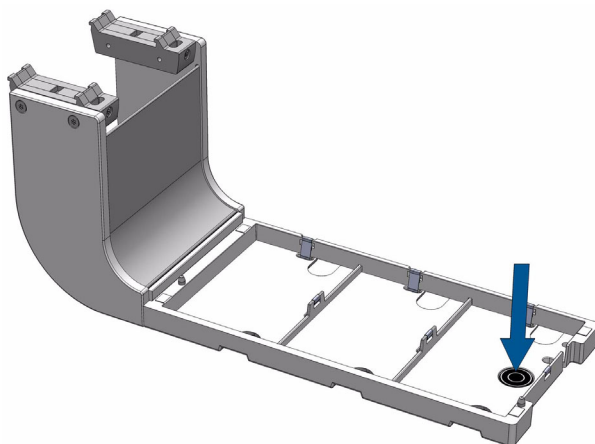
See the following sections:

- “Teaching Standard Tray Holder Position” on page 115
- “Teaching Liquid Cooled Tray Holder Position” on page 116
- “Teaching Temperature Controlled Drawer Position” on page 117.

### Teaching Standard Tray Holder Position

The teach position of a Tray Holder is the **Lunette** at the front of the module. See [Figure 111](#).

**Figure 111.** Teach Position for Tray Holder



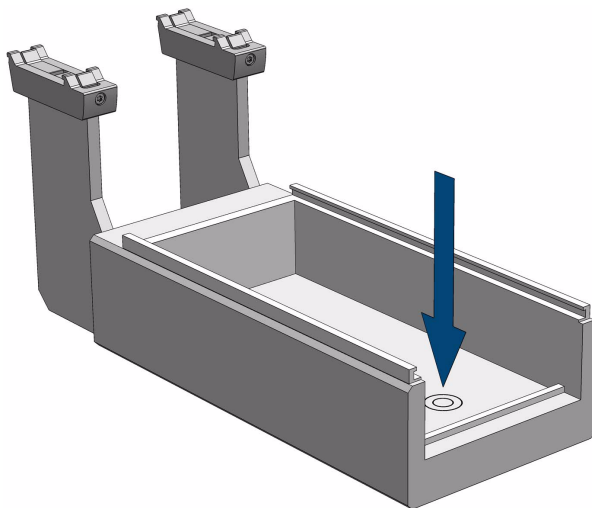
The Lower Needle Guide should be centered in the inner ring with the bottom of the Lower Needle Guide slightly touching the surface.

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

## Teaching Liquid Cooled Tray Holder Position

The Liquid Cooled Tray Holder teaching position is located as indicated in [Figure 112](#).

**Figure 112.** 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 **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 **Teach Module**.
6. Define the X-, Y-, Z- positions common to all objects as described in the section [“TriPlus RSH SMART Tool Referencing and Calibration”](#) on [page 131](#).

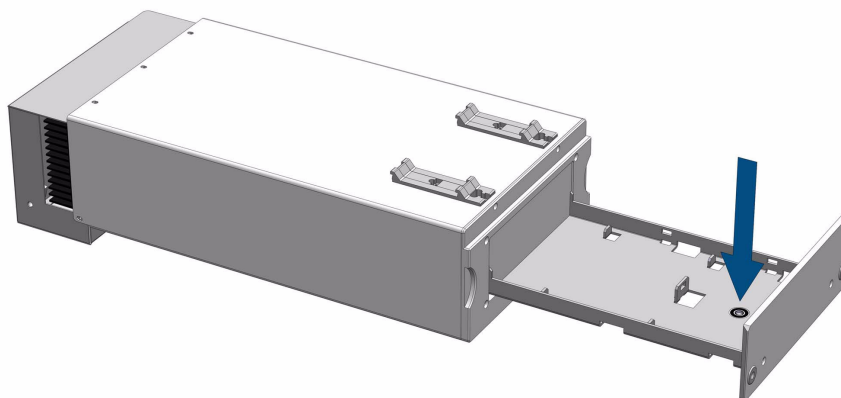
The teach position is located at the bottom of the module. The Lower Needle Guide should be centered on the Lunette.

**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 113](#).

**Figure 113.** 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 **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 **Teach Module**.
6. Define the X-, Y-, Z- positions common to all objects as described in the section “[TriPlus RSH SMART Tool Referencing and Calibration](#)” on [page 131](#).
7. 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.

## Teaching Washing Stations

See the following sections:

- “Teaching Standard Wash Station Position” on page 118
- “Teaching Large Volume Wash Station Position” on page 119
- “Teaching Solvents Station Position” on page 120
- “Teaching Fast Wash Station Position” on page 121.

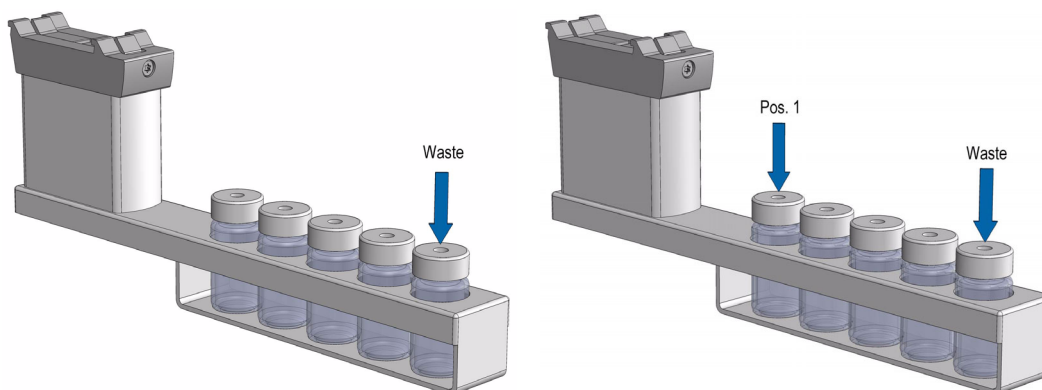
### Teaching Standard Wash Station Position

The teach position for the Standard Wash Station is the front vial **Waste** or **Vial #5**.

See [Figure 114](#).

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 114.** Teaching Position for Standard Wash Station and Fine-tuning of Vial #1

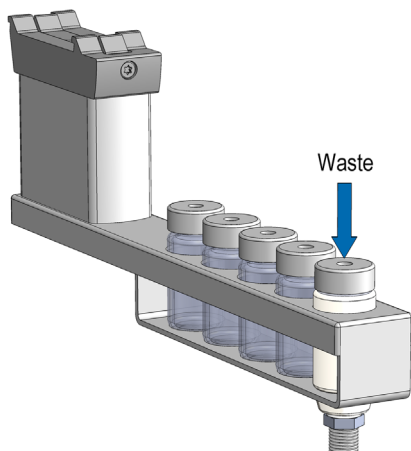


For the Standard Wash Station it is sufficient to teach **position # 5** only. As long as the station is mounted in square way, this approach is sufficient.

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 115](#).

**Figure 115.** Teaching of Waste Positions with Waste Line Adapter

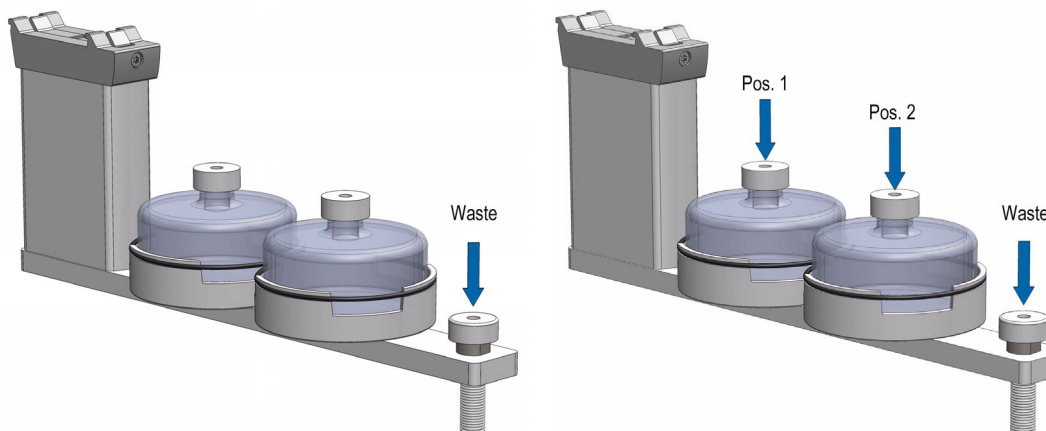


**WARNING** Observe safety measures if a waste line is installed in combination with a gas chromatograph. Do not place the waste line above a heated zone.

## Teaching Large Volume Wash Station Position

The teaching position for the Large Volume Wash Station is the **Waste position**.  
See [Figure 116](#).

**Figure 116.** 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.

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.

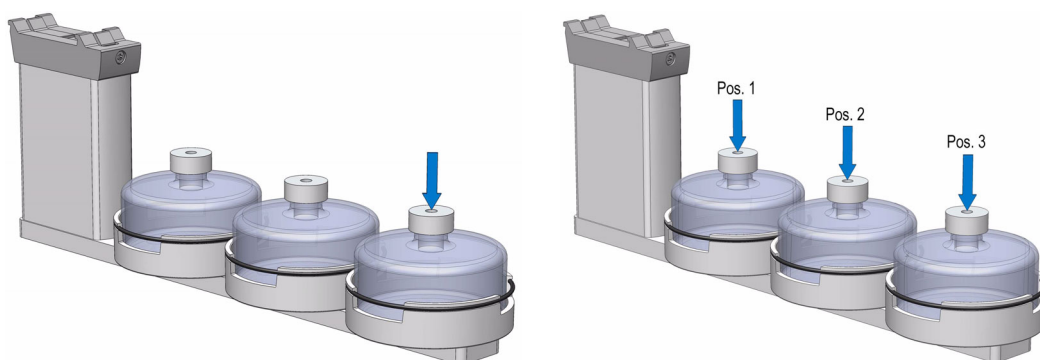
For the Large Volume Wash Station it is sufficient to teach the position **Waste** only. As long as the module is mounted squarely, this approach is sufficient.

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 for each position.

## Teaching Solvents Station Position

The teaching position for the Solvents Station is the **third position**. See [Figure 117](#).

**Figure 117.** Teach Points for Three Solvent Reservoir and Position 1 to 3



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.

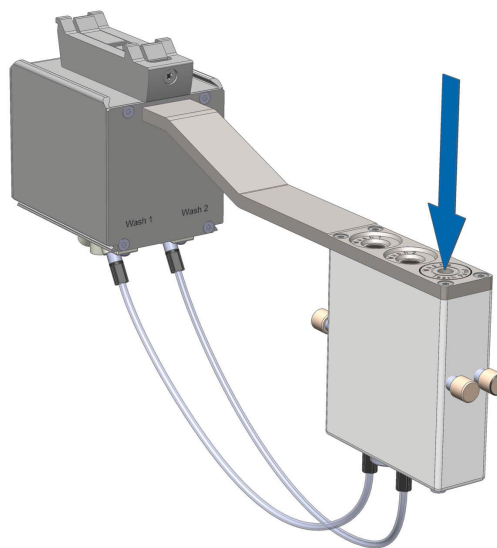
For the Solvent Station it is sufficient to teach position **#3** only. As long as the module is mounted squarely, this approach is sufficient.

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 for each position.

## Teaching Fast Wash Station Position

The teach position of a Fast Wash Station is the **Lunette** at the front of the module.  
See [Figure 118](#).

**Figure 118.** 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 **Setup > Modules > Wash Stations > Fast Wash (X)**.
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 as described in the section [“TriPlus RSH SMART Tool Referencing and Calibration”](#) on [page 131](#). The teach position is located at the front of the upper drawer. The lower needle guide should be centered in the Lunette.

## Teaching Heating/Shaking Modules and Stations

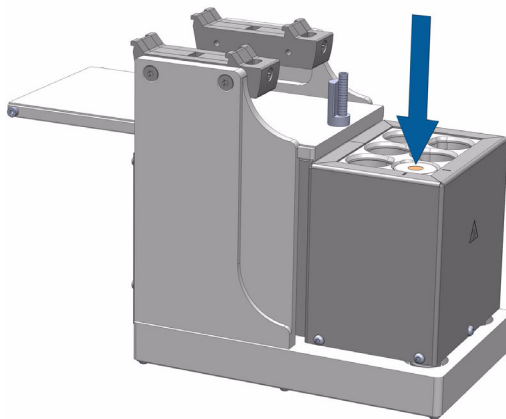
See the following sections:

- [“Teaching Agitator Module Position”](#) on [page 122](#)
- [“Teaching Vortexer Module Position”](#) on [page 123](#)
- [“Teaching the Heatex Stirrer Module Position”](#) on [page 124](#)
- [“Teaching SPME Conditioning Station Position”](#) on [page 125](#)
- [“Teaching SPME Arrow Conditioning Station Position”](#) on [page 126](#).

## Teaching Agitator Module Position

The Agitator teaching position is located as indicated in [Figure 119](#).

**Figure 119.** 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 **Setup > Modules > Agitator & Vortexer**.
3. From the **Options** pull-up menu select **Teach Module**.
4. Open the white Agitator cover manually and block it open by fitting a screwdriver into the side of the cover. Insert a 20 mL vial in sample position #1.
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 SMART Tool Referencing and Calibration](#)” on [page 131](#). 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.

7. Remove the screwdriver and close the Agitator cover.

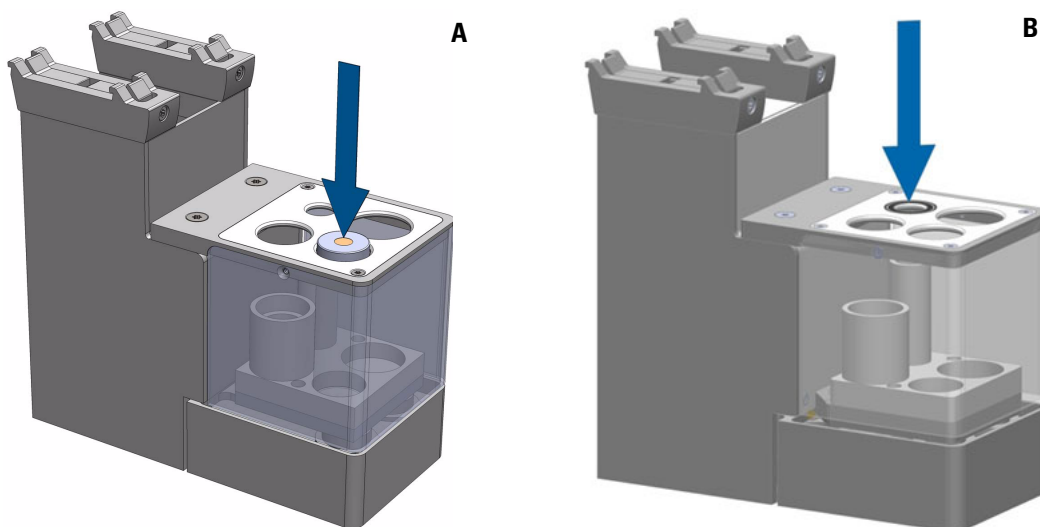
**Note** It is recommended that you create a Configuration Backup before a module is added or shifted in the system.



## Teaching Vortexer Module Position

The Vortexer teaching position is located as indicated in [Figure 120](#).

**Figure 120.** Vortexer Teaching Position



**Note** Using the TriPlus RSH SMART 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 120 B](#).

### ❖ To define the position of the vortexer

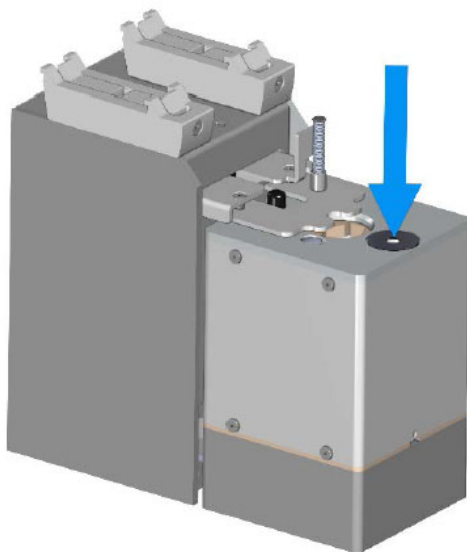
1. Select the access **Extended User Level**.
2. From the **Options** pull-up menu select **Setup > Modules > Agitator & Vortexer**.
3. From the **Options** pull-up menu select **Teach Module**.
4. Insert a vial with corresponding size in sample position as indicated according the used TriPlus RSH SMART Firmware version as described above.
5. Connect the 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 SMART Tool Referencing and Calibration](#)” on [page 131](#).  
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 the Heatex Stirrer Module Position

The Heatex Stirrer Module teaching position is located as indicated in [Figure 122](#).

**Figure 121.** Teaching Position for Heatex Stirrer Module



### ❖ To define the position of the heatex stirrer

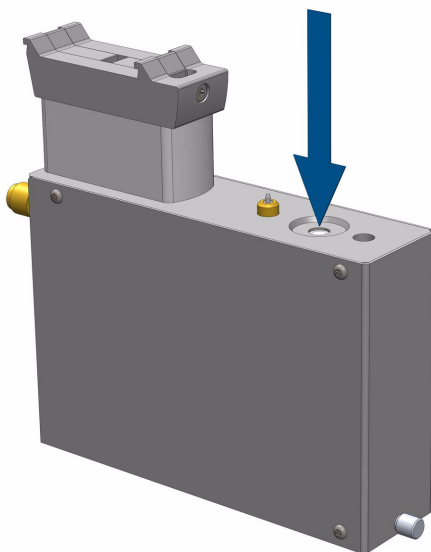
1. Select the access **Extended User Level**.
2. From the **Options** pull-up menu select **Setup > Modules > Agitator & Vortexer > Heatex Stirrer**.
3. From the **Options** pull-up menu select **Teach Module**.
4. Insert a vial with corresponding size into the sample position.
5. Connect the vial transport ring to the lower needle guide.
6. Define the X-, Y-, Z- positions common to all objects as described in the section [“TriPlus RSH SMART Tool Referencing and Calibration”](#) on [page 131](#).  
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 SPME Conditioning Station Position

The SPME Conditioning Station teaching position is located as indicated in [Figure 122](#).

**Figure 122.** Teaching Position for SPME Conditioning Station



❖ **To define the position of the SPME conditioning station**

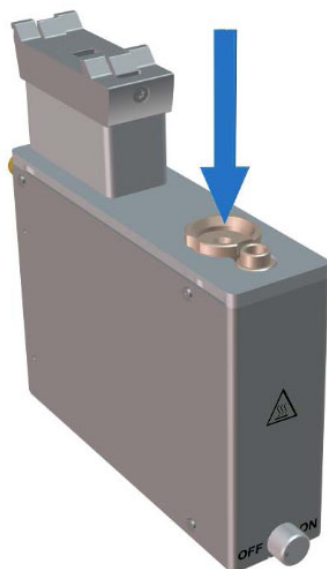
1. Select the access **Extended User Level**.
2. From the **Options** pull-up menu select **Setup > Modules > SPME Cond Stations**.
3. Select **SPME Cond.Station**.
4. From the **Options** pull-up menu select **Teach Module**.
5. Connect the vial transport ring to the lower needle guide.
6. Define the X-, Y-, Z- positions common to all objects as described in the section “[TriPlus RSH SMART Tool Referencing and Calibration](#)” on [page 131](#).  
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 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 SPME Arrow Conditioning Station Position

The SPME Arrow Conditioning Station teaching position is located as indicated in [Figure 123](#).

**Figure 123.** Teaching Position for SPME Arrow Conditioning Station



❖ **To define the position of the SPME Arrow conditioning station**

1. Select the access **Extended User Level**.
2. From the **Options** pull-up menu select **Setup > Modules > SPME Cond Stations**.
3. Select **SPME Arrow Cond**.
4. From the **Options** pull-up menu select **Teach Module**.
5. Connect the 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 SMART Tool Referencing and Calibration”](#) on [page 131](#).  
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.

**Note** It is recommended that you create a Configuration Backup before a module is added or shifted in the system.

## Teaching Optional Modules

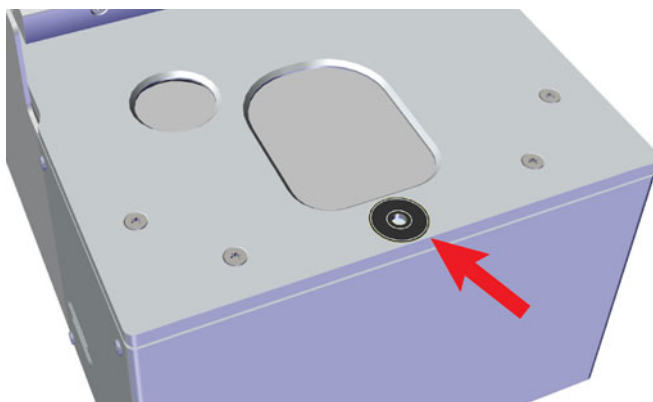
See the following sections:

- “Teaching the Barcode Reader Position” on page 127
- “Teaching Flow Cell Holder Position” on page 128
- “Teaching MHE Station Position” on page 129
- “Teaching GC Injector Position” on page 130.

## Teaching the Centrifuge Position

The Centrifuge teaching position is shown in [Figure 124](#).

**Figure 124.** Teaching Position for the Centrifuge

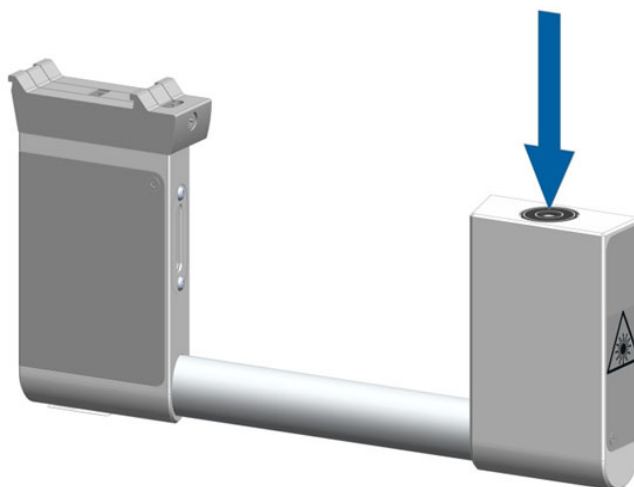


The Flow Cell Holder can be used with the TriPlus RTC SMART System, but needs to be defined manually as an Obstacle. See “[Modules Teaching Step-by-Step Procedure](#)” on [page 134](#) for more information.

## Teaching the Barcode Reader Position

The Barcode Reader teaching position is located as indicated in [Figure 125](#).

**Figure 125.** Teaching Position for Barcode Reader



❖ **To define the position of the barcode reader**

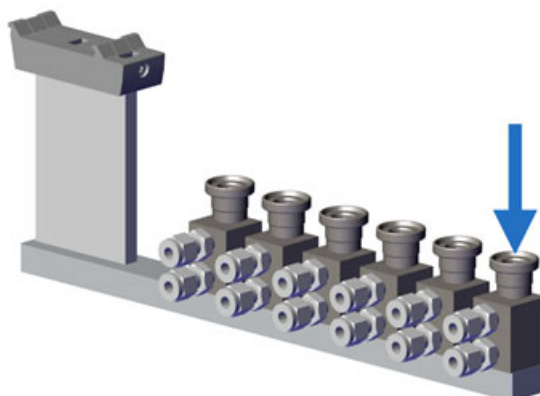
1. Select the access **Extended User Level**.
2. From the **Options** pull-up menu select **Setup > Modules > Barcode Reader**.
3. Select **Scanner 1** or **Scanner 2**.
4. From the **Options** pull-up menu select **Teach Module**.
5. Define the X-, Y-, Z-positions common to all objects as described in the section [“TriPlus RSH SMART Tool Referencing and Calibration”](#) on page 131.  
The teach position 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 Flow Cell Holder Position

The module teaching position is located as indicated in the following figure.

**Figure 126.** Teaching Position for the Flow Cell Holder

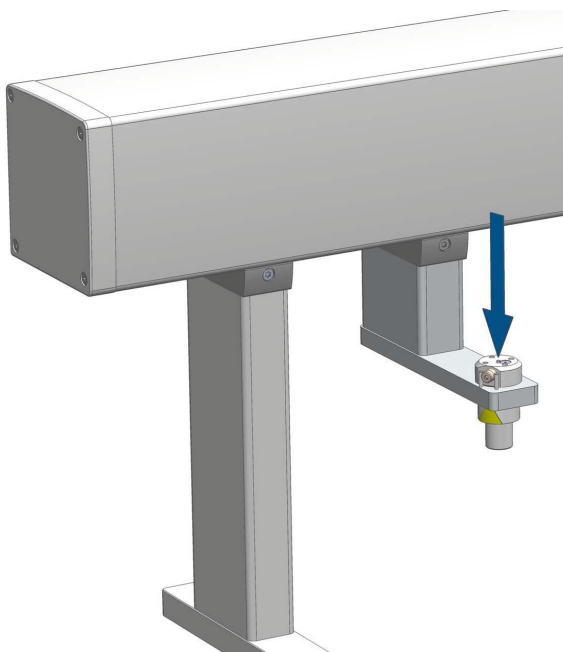


Currently, software support for the Flow Cell Holder has not been implemented. The Flow Cell Holder can be used with the RTC SMART System, but needs to be defined manually as an Obstacle. See “[Modules Teaching Step-by-Step Procedure](#)” on [page 134](#) for more information.

## Teaching MHE Station Position

The teaching position of a MHE Station is shown in [Figure 127](#).

**Figure 127.** 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 ring to the magnets of the MHE Adapter.
5. Define the X-, Y-, and Z- positions common to all objects as described in the section [“TriPlus RSH SMART Tool Referencing and Calibration”](#) on [page 131](#).

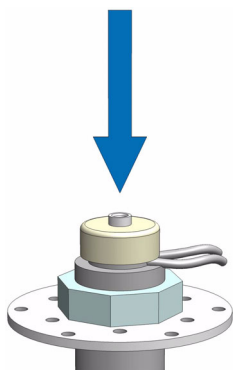
## Teaching GC Injector Position

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 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 128.** GC Injector (GC Inj1) Teaching Point





# TriPlus RSH SMART 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.

## Introduction

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

This process is necessary only if more than one TriPlus RSH SMART 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 Tools should be used. If the Station in object has changed position, it is necessary to re-define the Reference Point and re-calibrate all the other Tools.



**ATTENTION** If for any reason, the referencing (**Set Reference Point**) has been repeated, it is mandatory to re-calibrate all Tools. Using the step **Set Reference Point**, the calibration data for the individual tools are cleared. Beginning with Control Software version 1.4.0 a message will appear to inform the operator of the necessary steps.

If the Reference Tool is accidentally 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.

See the following sections for details:

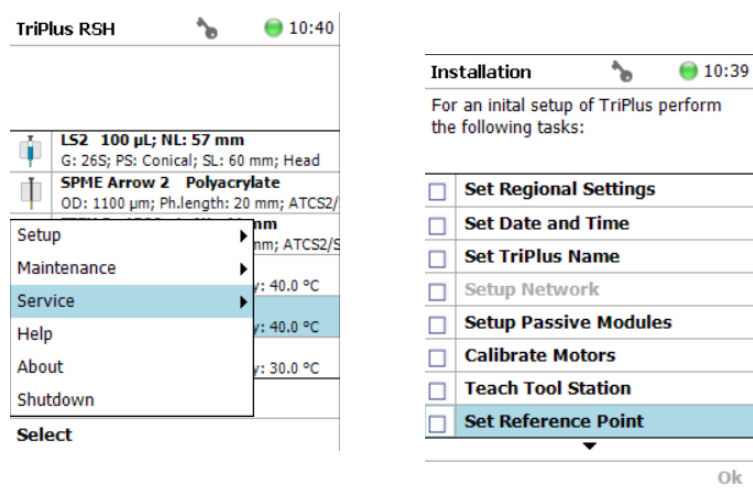
- “[TriPlus RSH SMART Tool Referencing](#)” on [page 132](#)
- “[TriPlus RSH SMART Tool Calibration](#)” on [page 133](#)

## TriPlus RSH SMART Tool Referencing

Follow the **Installation** for the referencing of the **reference tool**. Select the 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** At the moment of installing the system it is mandatory to follow the **Installation Wizard** step-by-step.

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

The following message is displayed: **Move the TriPlus RSH SMART Head to the reference position and press Save when finished.**



**CAUTION** To move the 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 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**, the Head moves automatically back to the **Home** Position.

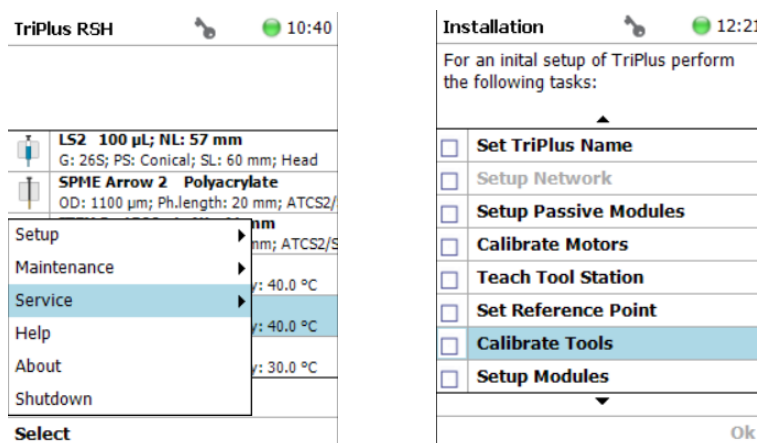
## TriPlus RSH SMART Tool Calibration

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

**Note** A Tool which has not been calibrated cannot be used within the TriPlus RSH SMART system. When a new 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 Wizard** step-by-step.

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

The following message is displayed: **Move the TriPlus RSH SMART Head to the reference position 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 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. Select the corresponding **Syringe Type** and **Needle Guide Type**.
5. Pressing **Change Tool**, the wizard moves the Head back to the original Slot, the tool is ejected, and the next Tool is picked up for calibration.
6. Finish by pressing **Ok**, the 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 SMART.

### ❖ 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 enable **Extended User** Access Level.

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

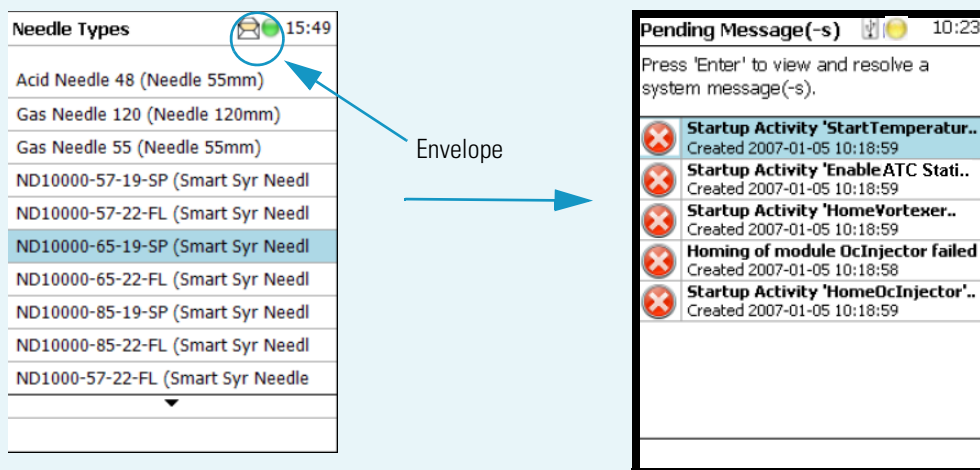
When the system is already setup and a position of a module is changed, you can choose the path **Options > Setup > Modules**.

1. Switch on the TriPlus RSH SMART. The sampler will boot-up and Start Screen is displayed on the Handheld Controller. See [Figure 129](#).

**Figure 129.** Start Screen

TriPlus RSH SMART		15:03
	<b>LS1 / SF10-57-M-23S-CO</b> 10 µL; Conical; 23S	<b>Head</b> 
	<b>Agitator 1</b> Act. Temp.: 40.0 °C; Standby: 40.0 °C	
	<b>Trayholder 1</b> Slot1: VT54; Slot2: VT54; Slot3: VT54	
	<b>Trayholder 2</b> Slot1: R60; Slot2: -; Slot3: -	
	<b>Standard Wash 1</b>	
	<b>Arrow Inj 1</b>	
		
<b>Options</b>		

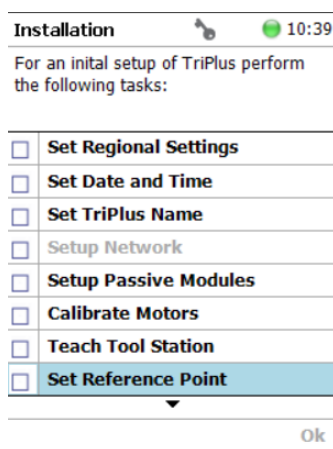
**Note** If an error appears during the boot-up procedure, an envelope will appear in the Status Line indicating a **Pending Message**.



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 SMART** in the *TriPlus RSH User Guide*.

- 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.

- 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 SMART devices. You may now move the TriPlus RSH SMART manually to any position.

Installation <span style="float: right;">12:26</span>	
For an initial setup of TriPlus perform the following tasks:	
<input type="checkbox"/>	Setup Passive Modules
<input type="checkbox"/>	Calibrate Motors
<input type="checkbox"/>	Teach Tool Station
<input type="checkbox"/>	Set Reference Point
<input type="checkbox"/>	Calibrate Tools
<input type="checkbox"/>	Setup Modules
<input type="checkbox"/>	<b>Teach Modules</b>
<input type="checkbox"/>	Check Teaching Modules
Ok	

The following message is displayed: **Move the TriPlus RSH SMART 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.





**CAUTION** To move the 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 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 SMART 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   12:31	
For an initial setup of TriPlus perform the following tasks:	
▲	
<input type="checkbox"/>	Calibrate Motors
<input type="checkbox"/>	Teach Tool Station
<input type="checkbox"/>	Set Reference Point
<input type="checkbox"/>	Calibrate Tools
<input type="checkbox"/>	Setup Modules
<input type="checkbox"/>	Teach Modules
<input type="checkbox"/>	Check Teaching Modules
<input type="checkbox"/>	Create Configuration Backup
Ok	





## TriPlus RSH SMART Firmware

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

### Contents

- [The RSH SMART Firmware](#)
- [Create Diagnostic Backup File](#)
- [Create Configuration Backup File](#)
- [Restore Backup File](#)
- [Update and Downgrade Functions](#)
- [Updating the TriPlus RSH SMART Firmware](#)
- [Downgrading the TriPlus RSH SMART Firmware](#)



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



**WARNING** During any of the operations described in this chapter, it is mandatory that the TriPlus RSH SMART 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 SMART can no longer be started. In such a case the Control Board must be returned in the factory for the re-configuration of boot loader.

## The RSH SMART Firmware

This section introduces the RSH SMART Firmware and its structure.

**Note** Starting with the software version 2.0 the software has been renamed from **Control Software** to **RSH SMART Firmware**.

Please note that this term is valid for the entire software package with file extension **\*.cont**. The **Device Firmware**, which is part of the entire package, will be named specifically **Device Firmware** to avoid any misunderstanding.

## Introduction

The RSH SMART 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, Data base
- **Device Firmware** — Firmware of all active modules which are part of the specific TriPlus RSH SMART 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 TriPlus RSH SMART Firmware is **\*.cont**

Two different backup types are available: **Configuration Backup** and **Diagnostic Backup**. The Configuration Backup can be used to restore the TriPlus RSH SMART Firmware. Therefore, both backup file types can be used to restore the TriPlus RSH SMART 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 must 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 TriPlus RSH SMART Firmware package, included in a **\*.cont** file only.

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

## TriPlus RSH SMART 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 SMART-1.4.1-1.4.12071.1101.7662.cont**

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

- **Product Name** — Product name of the TriPlus RSH SMART 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 TriPlus RSH SMART 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 TriPlus RSH SMART 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 SMART, which means that the Application Software and the key encryption will match, and the Configuration of the TriPlus RSH SMART is known.
- The **Update** process is not carried out through the Handheld Controller menu dialog.
- The **Backup** option creates a backup file of the TriPlus RSH SMART in its current status. This backup file is stored on the SD Card in the Control Board.

## TriPlus RSH SMART Firmware Backup

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 SMART User Manual*, and “[Create Configuration Backup File](#)” on page 145.
- **Diagnostic Backup** — Supports and troubleshoots a TriPlus RSH SMART 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](mailto:gc.gcms.customersupport@thermofisher.com), with the file description, and providing as well the TriPlus RSH SMART 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 16](#):

**Table 16.** Backup Files Differences (Sheet 1 of 2)

Item	Configuration Backup	Diagnostic Backup
<b>TriPlus RSH SMART Firmware packages included in Backup file</b>		
Operating system (OS)	No	No
Application Software	No	Yes
Configuration (Persistent Data, Data Base)	Yes	Yes
Device Firmware	No	Yes
Presets	No	Yes
<b>File Details</b>		
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.

**Table 16.** Backup Files Differences (Sheet 2 of 2)

Item	Configuration Backup	Diagnostic Backup
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 TriPlus RSH SMART Firmware versions 1.3.1/1.3.2, and 1.4.0, or higher. With the TriPlus RSH SMART Firmware Version 1.3.0, the Operating Software (OS) and the Application Software have been stored additionally.

## Create Diagnostic Backup File

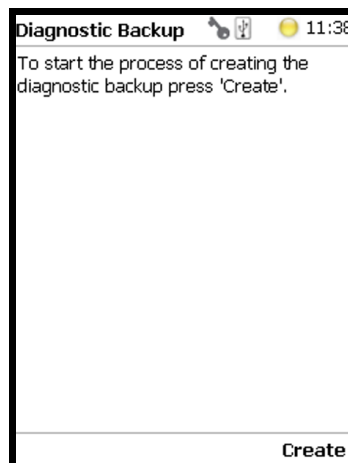
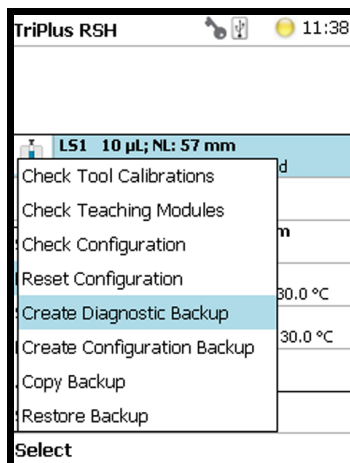
This option creates a diagnostic backup file of the TriPlus RSH SMART in its current status. The Configuration Backup is stored on the SD Card installed on the control board.



**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 144.

### ❖ To create a Diagnostic Backup file

1. Select Access Level **Extended User**.
2. Select **Maintenance** the **Options** pull-up menu.
3. Select **Create Diagnostic Backup**.



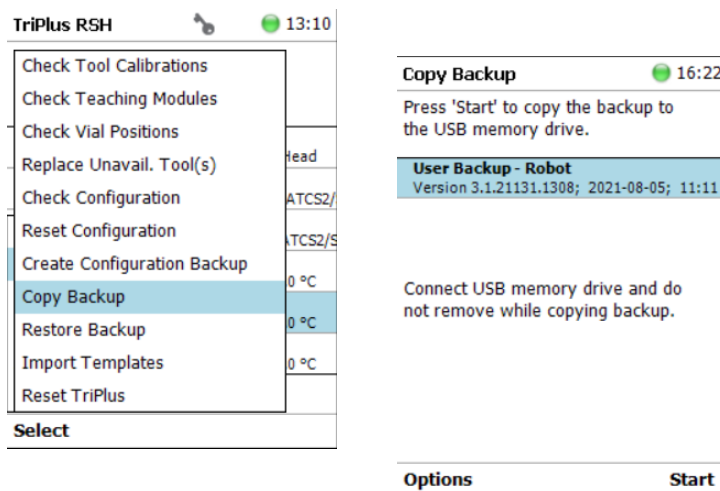
4. Press **Create** to start the process, the blue LED blinks signaling the execution mode.
5. This process takes several minutes.
6. At the end of the process the message **backup has been created successfully** appears.

## 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 **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**.

## Create Configuration Backup File

This option creates a Configuration Backup file of the TriPlus RSH SMART in its current status. The backup file 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 146.

### ❖ To create a Configuration Backup file

1. Select **Maintenance** from the **Options** pull-up menu.
2. Select **Create Configuration Backup**.

The screenshot shows two parts of the device's interface. On the left, a pull-up menu titled 'TriPlus RSH' is open, displaying a list of maintenance options. The option 'Create Configuration Backup' is highlighted in blue. Below the list is a 'Select' button. On the right, the 'Config. Backup' screen is shown. It prompts the user to 'Press 'Start' to create a configuration backup.' and features a text input field containing the word 'Robot'. Below the input field, there is an optional comment field with the text 'Optional: You can enter a comment to help identify the configuration backup.' At the bottom of this screen are two buttons: 'Options' and 'Start'.

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**.

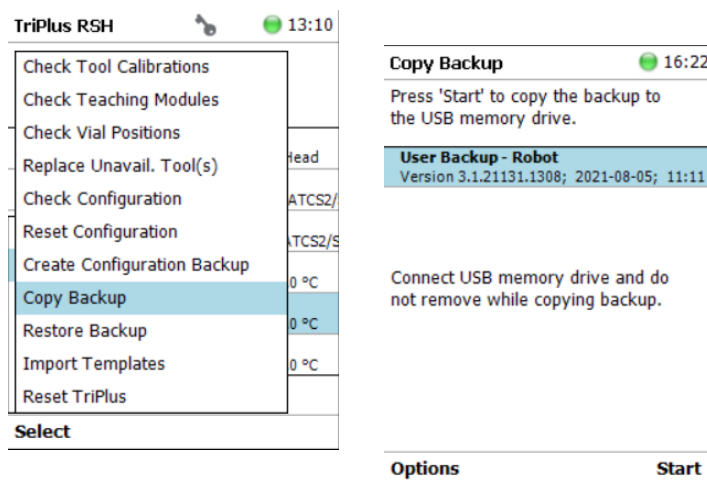
4. Press **Start** to begin the process; the **blue** LED blinks, signaling the execution mode. This process takes several minutes.
5. At the end of the process the message **backup has been created successfully** appears.

## 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 **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 Backup** loads a backup file saved from the same TriPlus RSH SMART system back to the system. Only a Backup file (\*.pack file) can be used.

The key, the encryption of the Application, and the device firmware files have to match.

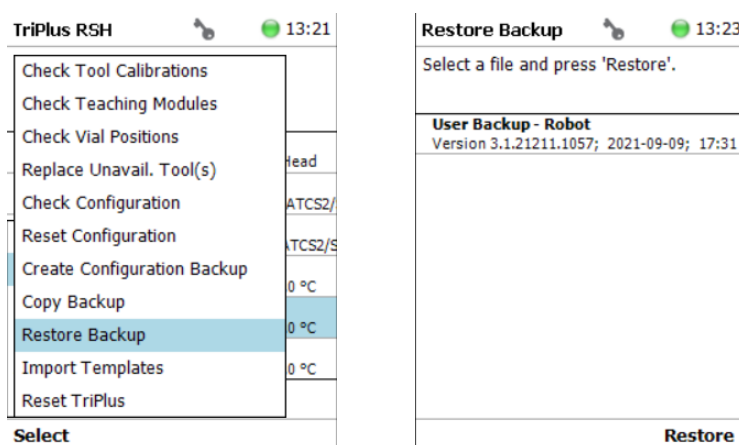


**CAUTION** The following **Restore Backup File** process is a general description. Before starting the process, please read through these points first. Be aware that an older backup file may contain a Configuration which is no longer compatible. See also the section [Update and Downgrade Functions](#).

### ❖ To restore a backup file:

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

1. Select **Maintenance** from the **Options** pull-up menu.
2. Select **Restore Backup** 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 must 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 turn off 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.

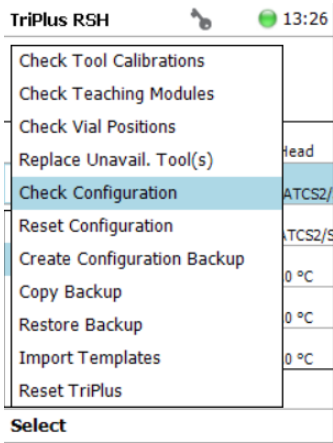
At the start of the Restore process the **compatibility of the selected Restore file** is checked against the Application and the installed key of the TriPlus RSH SMART. If an incompatibility is detected, the process of restoring is aborted, and the error message is displayed.



**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. See [“Update and Downgrade Functions”](#) on page 149.

## After Completion of the Restore Process

When the correct file is re-loaded to the corresponding TriPlus RSH SMART 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 TriPlus RSH SMART 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 SMART. This means that the Configuration Software and the key encryption will match.

The **Update** function is the process to upgrade the entire TriPlus RSH SMART 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 17 illustrates the possible paths for Update/Downgrade the TriPlus RSH SMART Firmware:

**Table 17.** Update/Downgrade Path

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
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 17](#).

The first released Software version for the TriPlus RSH SMART 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 SMART 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 TriPlus RSH SMART Firmware see the following sections:

- “[Updating the TriPlus RSH SMART Firmware](#)” on [page 151](#)
- “[Downgrading the TriPlus RSH SMART Firmware](#)” on [page 153](#)

## Updating the TriPlus RSH SMART Firmware

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

- Check the required update path is possible according to the [Table 17](#) on [page 150](#).
- 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 but not in the directory Autorun, or on any other safe drive outside of the TriPlus RSH SMART.
- Use a TriPlus RSH SMART Firmware package as provided by Thermo Fisher Scientific.  
**Important:** The Firmware must be a file with the extension **\*.cont**.
- The TriPlus RSH SMART 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 TriPlus RSH SMART 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 TriPlus RSH SMART 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** You must spell **Autorun** correctly.

2. Load the directory **Autorun** onto the USB Stick.
3. Turn off the power from the TriPlus RSH.

4. Insert the prepared USB Stick in the USB connector of the Control Board on the back of the TriPlus RSH SMART.
5. Power up the TriPlus RSH SMART.
6. Start the automated execution of the Update process:

Loading such a file to the TriPlus RSH SMART from the USB Stick will store the file in the flash memory, SD Card. Next, the various software files are installed in TriPlus RSH SMART, and those provided by the new \*.cont file compared.

If a newer version of the Operating System is detected, and the other software packages are compatible with it, the new version will be installed.

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 SMART.
9. Select the **Maintenance** menu, then **Reset Configuration**. Select the dedicated configuration for the TriPlus RSH SMART. 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 TriPlus RSH SMART Firmware version 1.4.0 or higher.
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 9 the data base has been neutralized. This means that you must calibrate the TriPlus RSH SMART, and teach all positions of the X-, Y- and Z-axes.

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

11. After successful installation setup and testing of the TriPlus RSH SMART, we recommend creating a **Configuration Backup**.
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 SMART.
- 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 SMART will be denied.



**CAUTION** The TriPlus RSH SMART 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 SMART will power up without going through the upgrade. Always check under **About** to verify that the desired software version has been installed.

## Downgrading the TriPlus RSH SMART Firmware

It is possible to safely downgrade the TriPlus RSH SMART 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 17](#) on [page 150](#) 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 SMART.

- Confirm that the Backup File from this particular TriPlus RSH SMART System lower level software version is available.
- Confirm that the Backup File matches the key and whether it is a Thermo Fisher Scientific key.
- Use a RSH SMART Firmware package as provided by Thermo Fisher Scientific.  
**Important:** The file must be a file with the extension \*.cont.
- The TriPlus RSH SMART 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. Include as well the text file **force.txt** into the directory Autorun. 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 SMART. If a downgrade is necessary, it must be performed step-by-step following the appropriate procedure:

- **Step1:** Downgrade first by using an original file **TriPlus RSH SMART Firmware** package with the extension **\*.cont**.
- **Step2:** Use a **Backup** or a **Restore Backup** file of the TriPlus RSH SMART, 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 TriPlus RSH SMART Firmware version 2.0.0, the **Needle Guide Type NonMagn2mL** is available. Pay attention when downgrading the firmware because a firmware version lower than 2.0.0 does not 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 next steps:

### ❖ To downgrade the TriPlus RSH SMART 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.

**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 recognize this filename and 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 SMART.
5. Insert the USB Stick in the USB connector of the Control Board on the back of the TriPlus RSH SMART.
6. Power **UP** the TriPlus RSH SMART.
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 of the SD Card. In the next step, the various software packages are checked for compatibility; 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 SMART is booted automatically after installing the software. Remove the USB Stick. This avoids another software installation after a reboot of the TriPlus RSH SMART.
10. After the Downgrade process has been successfully completed, check the Menu Item **About** to confirm that the RSH SMART 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 SMART. 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 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 is planned, use a Backup File 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 SMART. The backup file contains the Configuration software, which includes the data bank for the configuration. Calibration of the motors and X-, Y-, and Z-axes position values are stored in the data bank and are available.



**CAUTION** Perform this step only if you know with certainty the source of the backup and that the configuration of the TriPlus RSH SMART 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 SMART, 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 SMART, 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 SMART. 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 Start 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 firmware version 1.4.0, the software package **Presets** are part of the 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 TriPlus RSH SMART 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 **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 **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.

## Contents

- Routine Maintenance
- Preventative Maintenance
- Working with Hazardous Material and Decontamination
- Sampler Removal from the GC
- Emptying of the Waste Container
- External Cleaning of the Sampler
- Cleaning the Interior of the Head
- Cleaning of the LS/HS Syringe
- Cleaning the ITEX DHS Trap
- Maintaining a Liquid Cooler Tray Holder
- Maintaining the Tray Cooler
- Maintaining a Temperature Controlled Drawer
- Maintaining a Fast Wash Station
- Maintaining an Agitator/Incubator Module
- Maintaining a Vortexer Module
- Maintaining a Heater Stirrer Module
- Maintaining a SPME Conditioning Station
- Maintaining a SPME Arrow Conditioning Station
- Maintaining a Centrifuge
- Maintaining a Barcode Reader
- Maintaining a MHE Station
- Maintaining an OC Injector Actuator
- Maintaining a Dilutor Module

## Routine Maintenance

Regular maintenance procedures help to ensure the accuracy and precision of the TriPlus RSH SMART system. Suggested intervals of maintenance procedures are included to ensure uninterrupted operations.

If you use the system for prolonged period of time (for example, overnights or on weekends), or if you use corrosive solvents, you must to perform the maintenance procedures more frequently.

**Table 18.** Maintenance Steps (Sheet 1 of 2)

Maintenance Step	Interval
Cleaning the TriPlus RSH SMART including the surfaces of all modules. Use only a soft lint-free cloth dampened with mild soap and water.	Weekly or as needed.
Check the functionality and integrity of the TriPlus RSH SMART system including all the modules.	Weekly or as needed.
Clean syringe.	Daily or as needed.
Replace the syringe plunger.	<p>The Syringe Plunger for a liquid syringe (Metal Plunger sealing against glass) should be cleaned on a regular basis with an aqueous alcohol solution.</p> <p>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.</p> <p>The Syringe Plunger for a gas tight syringe (polymer tip) has to be replaced on a regular basis.</p> <p>The interval is highly dependent on the application, throughput, quality of sample solution (particles, and so on), and type of washing solvent.</p> <p>It is advisable to check the tightness of the plunger on a regular basis to gain experience with the application.</p>
Wash and Waste Solvent reservoirs (Standard or Large Wash Module)	<p>Weekly or as needed.</p> <p>Replace the septum to avoid carry-over.</p>

**Table 18.** Maintenance Steps (Sheet 2 of 2)

Maintenance Step	Interval
Wash and Waste Solvent reservoirs (Fast Wash Module)	Weekly or as needed. <ul style="list-style-type: none"> <li>• Check the solvent frit for contamination or biological growth in the solvent reservoir bottle.</li> <li>• Check solvent lines and connectors for integrity.</li> <li>• Check glass liners in the wash block for integrity and ensure free flow in the wash block.</li> <li>• Check waste line for blockage.</li> </ul>
Cleaning the TriPlus RSH SMART when working with hazardous material.	For regular cleaning and maintenance or after a spill. See <a href="#">“Working with Hazardous Material and Decontamination”</a> on page 164.

## Preventative Maintenance

Planned Preventative Maintenance (PM) is a procedure to protect and maintain the operating performance of the TriPlus RSH SMART. 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 SMART is still running according to Thermo Fisher Scientific specifications. Failure to implement the PM check can compromise the reliability of the TriPlus RSH SMART 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 SMART.



**IMPORTANT** There are no operator-serviceable or replaceable parts inside the Power Module of the TriPlus RSH SMART. 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 must be on hand.

Any parts of the equipment which can potentially be contaminated, such as the sample vial tray, 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 must be properly eliminated with all the necessary precautions, abiding by the international and national 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 SMART.

## 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 SMART.
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 Material Safety Data Sheet (MSDS) supplied by the manufacturer referring to the relevant Chemical Abstract Service (CAS) 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 Material Safety Data Sheet (MSDS) supplied by the manufacturer referring to the relevant Chemical Abstract Service (CAS) number. Use proper protective gloves.

❖ **To clean externally the sampler**

1. Externally clean the instrument with a soap and water solution, or with a household non-abrasive product. Avoid that any liquid seeps into the instrument.
2. Dry with a clean cloth.

If you just suspect that a substance used for cleaning or a product submitted to analysis has infiltrated inside the instrument, immediately shut down the instrument and call an authorized customer support engineer for proper actions. The service engineer must be fully informed on the nature of the concerned substance.



**WARNING** It is your responsibility to avoid that dangerous liquids and/or materials seeping inside the TriPlus RSH SMART during operation and maintenance. If you have any doubt about compatibility of decontamination or cleaning agents with parts of the equipment or with material contained in, please contact your Thermo Fisher Scientific Representative.

## 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 PTFE 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 DHS 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 DHS 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.

## Replacing the ITEX DHS Trap Heater and Cooling Fan

This operation is required only when a problem on the ITEX DHS Trap Heater, the Trap Cooling Fan or both is observed.

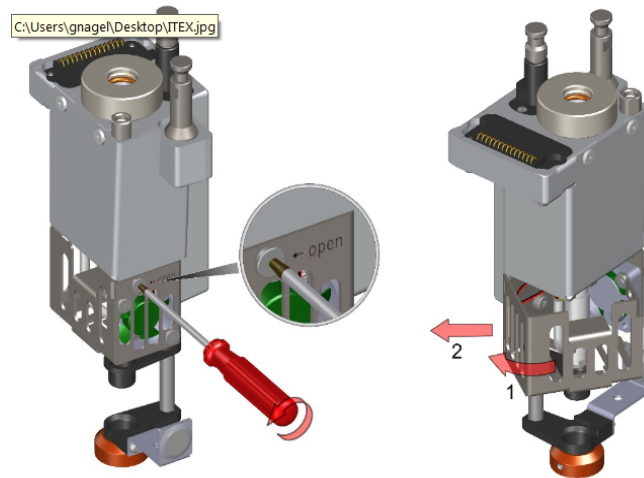


**CAUTION** Before starting, make sure that the ITEX DHS Tool is cooled down at room temperature to avoid burns.

❖ **To replace the ITEX DHS trap heater**

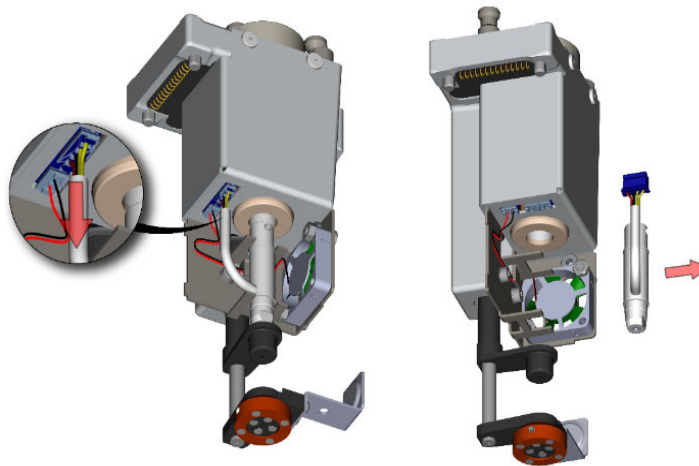
1. Remove the tool from the TriPlus RSH SMART X-axis.
2. Remove the screw marked **open** on the back side of the housing, then swivel the cover of the protective housing to the left and remove it. See [Figure 130](#).

**Figure 130.** Replacing the ITEX DHS Trap Heater (1)



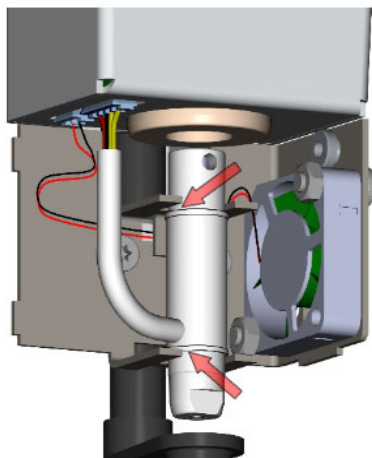
3. Unplug the connector of the Trap Heater, then remove it. See [Figure 131](#).

**Figure 131.** Replacing the ITEX DHS Trap Heater (2)



4. Carefully insert the new Trap heater. Make sure the two notches of the Trap Heater appear on the correct place inside of the holder. See the two red arrows in [Figure 132](#).

**Figure 132.** Replacing the ITEX DHS Trap Heater (3)

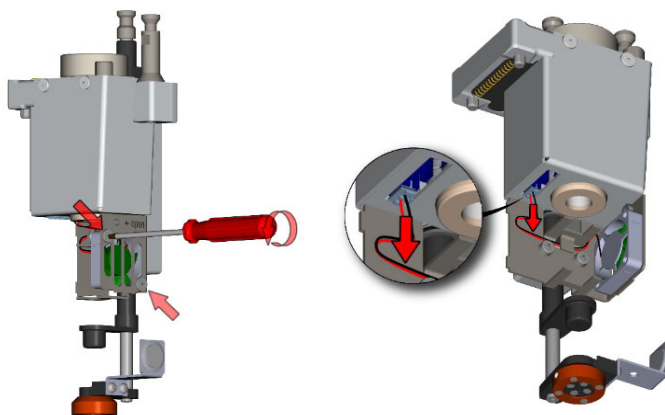


5. Insert the plug of the Trap Heater into the socket (only possible in one position).
6. Reassemble the ITEX DHS Tool performing the operation in the reversed order.

#### ❖ To replace the ITEX DHS trap cooling fan

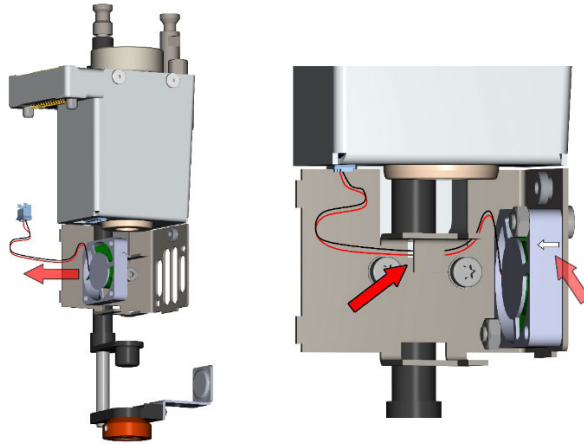
1. Remove the Trap Heater as described in the previous procedure [“To replace the ITEX DHS trap heater”](#) on [page 167](#).
2. Loosen the two screws fixing the Trap Cooling Fan to the housing, while fixing the corresponding lock nuts with an appropriate wrench. Then unplug the connector of the Trap Cooling Fan. See [Figure 133](#).

**Figure 133.** Replacing the ITEX DHS Trap Cooling Fan (1)



3. Remove the Trap Cooling Fan. Install the new Trap Cooler and fix it with the two screws with lock nuts. Observe the small arrow on the housing of the Trap Cooling Fan indicating the correct orientation for mounting.
4. Insert the plug of the Trap Cooling Fan into the socket (only possible in one position). Make sure the cables are stored safely under the clip in the housing. See [Figure 134](#).

**Figure 134.** Replacing the ITEX DHS Trap Cooling Fan (2)



5. Reassemble the ITEX DHS Tool performing the operation in the reversed order.

## 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  $\pm$  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 SMART.

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 the Tray Cooler

Check the compartments of the tray cooler regularly for pollution and condensation water. If necessary, clean the compartments with a soft cloth and alcohol.

Check regularly if the drain at the bottom of the module is clear and if the drain hose is tight and continuous.

## 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  $22\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ . If condensation is observed, clean the compartment on a regular basis as needed.



**CAUTION** Before any maintenance step is initiated, turn off the TriPlus RSH SMART.

Maintenance Step	Interval
Clean the outside of the Drawer: 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: <ul style="list-style-type: none"> <li>Grease: AL Lub Kit: about 8 g grease and brush</li> <li>Grease Temperature Range: <math>-130\text{ }^{\circ}\text{C}</math> to <math>+150/+200\text{ }^{\circ}\text{C}</math></li> </ul>	After a year if the system is not exposed to acidic vapor. If acids are used for the sample solution and the cooler is exposed to the vapor, the 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, and condensation build-up.
Verify the position and condition of the stopper and holding magnet of the drawer(-s).	Monthly or as needed.

## Maintaining a Fast Wash Station



**WARNING** Before any maintenance step is initiated, turn off the TriPlus RSH SMART.

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.
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/Incubator Module



**WARNING** Before any maintenance step is initiated, turn off the TriPlus RSH SMART 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/Incubator: 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 Module



**WARNING** Before any maintenance step is initiated, turn off the TriPlus RSH SMART 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 Heater Stirrer Module



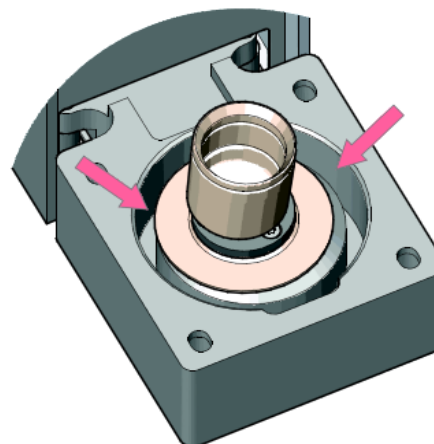
**WARNING** Before any maintenance step is initiated, turn off the TriPlus RSH SMART and ensure that the temperature inside the unit is below 50 °C to avoid any burns.

Maintenance Step	Interval
Cleaning the outside of the Heatex Stirrer: Use only a soft lint-free cloth dampened with mild soap and water.	Weekly or as needed.

Cleaning the inside of the housing.	Yearly or as needed.
-------------------------------------	----------------------

The bottom of the housing comes with an integrated drip pan. See the picture on the right.

This drip pan will collect any leaked liquid, in case a vial gets broken. Since the capacity of the drip pan is limited (around 20 mL), it is necessary to clean/empty it every time you notice a broken vial with a loss of liquid. For cleaning the drip pan, the Heatex Stirrer needs to be disassembled as described in the section [“Installing a Heatex Stirrer Module”](#) on [page 44](#). After disassembly, the drip pan can be cleaned/emptied with an absorbent cloth.



## Maintaining a SPME Conditioning Station



**WARNING** Before any maintenance step is initiated, turn off the TriPlus RSH SMART and let the SPME Conditioning Station cool down.  
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 SPME Arrow Conditioning Station



**WARNING** Before any maintenance step is initiated, turn off the TriPlus RSH SMART and let the SPME Arrow Conditioning Station cool down.  
To avoid any burns be careful when touching the module or parts which have been inserted into the unit, such as the thermocouple.

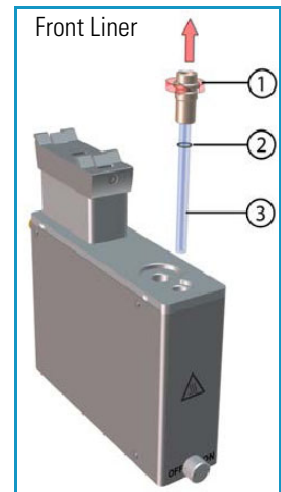
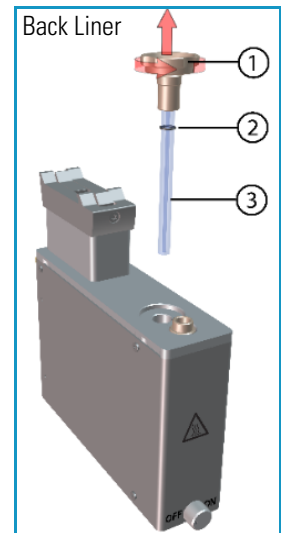
Maintenance Step	Interval
Cleaning the outside of the SPME Arrow Conditioning Station: Use only a soft lint-free cloth dampened with mild soap and water.	Weekly or as needed.
Check opening and closing of the gas purge valve.	Weekly or as needed.
Check purge gas flow.	Monthly or as needed
Check the liners (front and back position) for damage or stain and replace it if necessary. See <a href="#">“To replace the liners”</a> on page 174.	Monthly or as needed.

### ❖ To replace the liners

1. Check the liner of the back position.
  - a. Unscrew and remove the screw cap of the back position (1). The liner will get stuck to the cap, so it can be pulled out easily. If not, it can be “picked up” and pulled out with the screw cap.
  - b. Make sure not to lose the black O-ring (2).
  - c. Replace the liner (3) with a new one (if necessary) and reassemble the Conditioning Module.
2. Check the liner of the front position.

**Note** You must remove the screw cap of the back position first, to get access to the screw cap of the front position for removal as described in the step 1a.

- a. Unscrew and remove the screw cap of the front position (1). The liner will get stuck to the cap, so it can be pulled out easily. If not, it can be “picked up” and pulled out with the screw cap.
- b. Make sure not to lose the black o-ring (2).
- c. Replace the liner (3) with a new one (if necessary) and reassemble the Conditioning Module.



## Maintaining a Centrifuge



**WARNING** Before any maintenance step is initiated, turn off the TriPlus RSH SMART and ensure that the temperature inside the unit is below 50 °C to avoid any burns.

Regularly performed maintenance ensures the accuracy and precision of the system. Suggested intervals for maintenance procedures are listed below to ensure smooth, uninterrupted operation.

If you use the system extensively (for example, nights and weekends), or if you use corrosive solvents, you may need to perform the maintenance procedure more frequently.



**CAUTION** Before any other cleaning or decontamination process other than that recommended by the manufacturer is applied, the user has to check with the manufacturer that the planned process does not damage the device.

The Rotor is not dishwasher safe - only clean it by hand and disinfect with liquids. Neither the complete Centrifuge Module nor any parts of it are auto-clavable - never autoclave the Centrifuge Module or parts of it.

Maintenance Step	Interval
Cleaning the outside of the Centrifuge Module: Use only a soft lint-free cloth dampened with 70% ethanol.	Weekly or as needed.
The surface must be dried immediately after cleaning.	

## Maintaining a Barcode Reader



**WARNING** Before any maintenance step is initiated, turn off the TriPlus RSH SMART 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 MHE Station



**WARNING** Before any maintenance step is initiated, turn off the TriPlus RSH SMART.

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 the Flow Cell Holder



**WARNING** Before any maintenance step is initiated, turn off the TriPlus RSH SMART.

The Flow Cell Holder should be maintained on a regular basis. The frequency of maintenance is dependent on the frequency of sampling. The septum is the most critical part and has to be replaced regularly. As a rule of thumb, the septum should be replaced at a similar interval as that for a GC injector.

If you use the system extensively (for example, nights and weekends), or if you use aggressive solvents, you may need to perform maintenance procedures more frequently. The critical parts for maintenance are listed in the following table.

Maintenance Step	Interval
Cleaning the outside of unit. Use a soft and lint-free cloth dampened with mild soap and water.	Weekly or as needed.
Check the inlet and outlet connections for leaks.	Weekly or as needed.
Replace the septum.	Daily or weekly depending on the sampling rate.
Clean inside septum nut.	Solutions with a pH < 2 or > 13 can cause corrosion if left over a long period of time.  After finishing a procedure, clean the entire PAL Flow Cell with an application-compatible solvent and importantly, neutralize the media.

## Maintaining an 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  $22\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ . If condensation is observed, clean the compartment on a regular basis as needed.



**CAUTION** Before any maintenance step is initiated, turn off the TriPlus RSH SMART.

Maintenance Step	Interval
Verify the homing position of the On-Colum Actuator.	Weekly or as needed.
For further maintenance steps, refer to the relevant GC's manual.	As required.

## Maintaining a Dilutor Module

Regular maintenance procedures help to ensure the accuracy and precision of the TriPlus RSH SMART 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 perform the maintenance procedures more frequently.



**WARNING** Before starting a maintenance make sure that the TriPlus RSH SMART is powered Off.

Maintenance Steps	Interval
Clean the outside of the Dilutor Module. 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.
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.
Check the integrity of the Dilutor Syringe.	Daily or as needed.

# Troubleshooting

This chapter gives an overview of possible causes and recommended actions which can be taken to eliminate an erratic behavior.

## Contents

- General Points Related to TriPlus RSH SMART
- TriPlus RSH SMART Firmware Related Points
- LAN Communication Problems using Direct Connection
- LAN Communication Problems within Corporate Network
- LAN Communication Problems Related to Network Interface Card (NIC)
- Troubleshooting Check for LAN Communication
- System Status LED at Status Bar or at X-Axis Side Cover
- LED Status at Control Board
- Manually Removing a Tool from the Head
- Liquid Cooled Tray Holder Troubleshooting
- Tray Cooler Troubleshooting
- Fast Wash Station Troubleshooting
- Agitator/Incubator Module Troubleshooting
- Vortexer Module Troubleshooting
- Heatex Stirrer Module Troubleshooting
- SPME Conditioning Station Troubleshooting
- SPME Arrow Conditioning Station Troubleshooting
- Centrifuge Troubleshooting
- Barcode Troubleshooting
- MHE Station Troubleshooting
- OC Injector Actuator Troubleshooting
- Dilutor Module Troubleshooting



## General Points Related to TriPlus RSH SMART

Table 19 provides general troubleshooting guidelines regarding the TriPlus RSH SMART:

**Table 19.** General Points Related to TriPlus RSH SMART - 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.	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 SMART, if still not recognized, restore the RSH SMART Firmware.
	Software.	
	Device firmware not loaded or not on current level to match with RSH SMART Firmware version.	Restore the Configuration Backup. Reload a complete new RSH SMART 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 <b>Handheld Controller</b> in the <i>TriPlus RSH SMART User Guide</i> for reference value tables. Repeat the syringe wizard as described in the section <b>TriPlus Basic Information</b> in the <i>TriPlus RSH SMART User Guide</i> .
	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 SMART tool or the syringe type. Repeat the syringe wizard as described in <b>TriPlus Basic Information</b> in the <i>TriPlus RSH SMART User Guide</i> .
	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 <b>TriPlus Basic Information</b> in the <i>TriPlus RSH SMART User Guide</i> .
	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 19.** General Points Related to TriPlus RSH SMART - 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 SMART 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 <b>Tool Eeprom Access</b> in ATC Station).
Plunger cannot be coupled.	Plunger Coupling Device in closed position.	<p>The Plunger Coupling Device has to be opened manually. Turn off the power from the TriPlus RSH SMART system and follow the instructions described in the section <a href="#">“Manually Removing a Tool from the Head”</a> on <a href="#">page 191</a>.</p> <p>After receiving free access to the Plunger and Needle Guide Coupling Blocks make following steps:</p> <ul style="list-style-type: none"> <li>• Remove the inserted tool manually.</li> <li>• Press the Plunger Coupling Device upwards. The device spring has to engage in OPEN position.</li> </ul>
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.

## 6 Troubleshooting

### General Points Related to TriPlus RSH SMART

**Table 19.** General Points Related to TriPlus RSH SMART - 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.
	Reference Point of the Tool Station has been changed.	Check configuration for a possible mismatch with specified Tray Holder, Tray Type or Well Plate Type, Vial Type and Needle Guide Type.  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 SMART.
Guide Rollers are not moving (sticky).	The TriPlus RSH SMART system or part of it has been stored at lower temperature, typically for transport reasons.	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.
	The grease has a high viscosity.	

## TriPlus RSH SMART Firmware Related Points

Table 20 provides troubleshooting guidelines regarding the TriPlus RSH SMART firmware.

**Table 20.** TriPlus RSH SMART 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.  *.pack file used instead of *.cont file.  *.cont not in File directory <b>Autorun</b> .  <b>Force.txt</b> file not used for downgrading.  USB Stick with more than one partition used.	Carefully see the <a href="#">Chapter 4, “TriPlus RSH SMART Firmware,”</a> to find any source of mismatch.  If not successful:  Check for any <b>Pending Message</b> or <b>Service Issue</b> .  Create a <b>Diagnostics File</b> , and send it for evaluation to your representative from Thermo Fisher Scientific.
Red LED at Control Board is blinking continuously.	- Firmware update error  - Hardware error	Reboot the autosampler.  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 <b>Force.txt</b> to install RSH SMART Firmware. This is true for <b>Updates</b> or <b>Downgrading</b> .

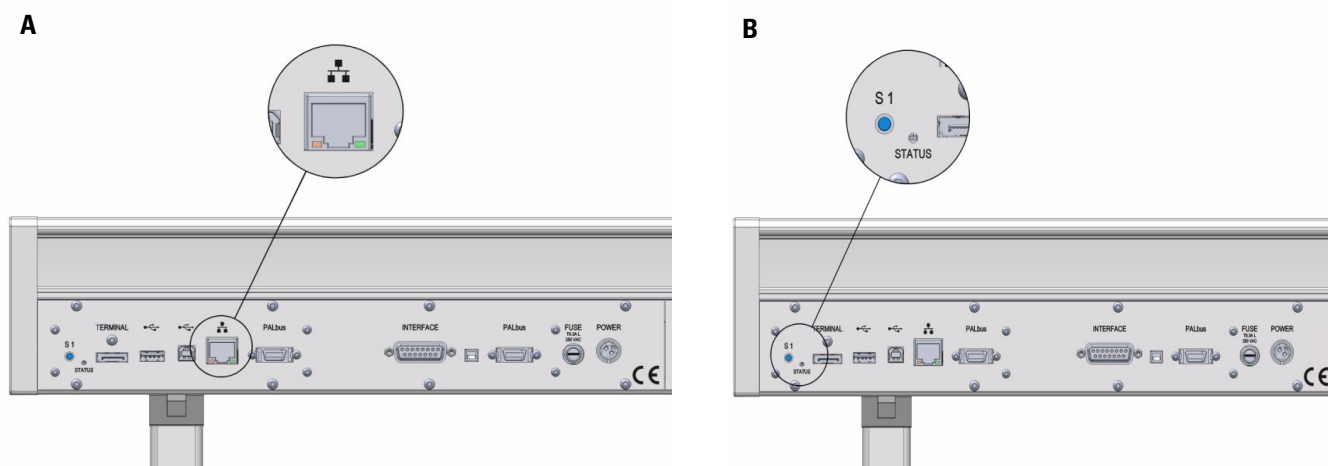
## LAN Communication Problems using Direct Connection

Table 21 provides troubleshooting guidelines regarding the LAN direct (Peer-to-Peer) connection.

**Table 21.** LAN Direct Connections Troubleshooting Guideline

Symptom or Error Message	Possible Cause	Recommended Action
LAN communication See “Establishing Communication with the Computer” on page 98 for details.	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 SMART, 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 135 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.	Reboot the autosampler.
	Hardware error.	Reinstall the firmware.  See Figure 135 B.

**Figure 135.** LAN Communication, Detail LED, Reset Button, and Status LED



# LAN Communication Problems within Corporate Network

Table 22 provides troubleshooting guidelines regarding the LAN Corporate Network.

**Table 22.** 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 SMART, or Company network, or PC.	Ask your local Network administrator for assistance with TCP/IP settings.
	Verify the correctness of: <ul style="list-style-type: none"> <li>• IP Address</li> <li>• Subnet Mask</li> <li>• Default Gateway</li> </ul>	Check the settings in the computer and in the TriPlus RSH SMART.  <b>Note:</b> 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 <a href="#">Figure 135 B</a> .
		Use the <b>ping</b> command to verify the communication. See <a href="#">Table 22</a> .
	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 “ <a href="#">Setting Up the Direct Connection</a> ” on <a href="#">page 99</a> . Be aware that the IP settings in the computer and TriPlus RSH SMART have to be changed accordingly.
		If direct connection is not successful: <ul style="list-style-type: none"> <li>• replace the LAN cables</li> <li>• replace the workstation (computer)</li> <li>• reload the RSH SMART Firmware</li> <li>• replace the control PCB</li> </ul>
		If direct connection is successful: <ul style="list-style-type: none"> <li>• replace the switch (hub if used)</li> <li>• ask network administrator for support.</li> </ul>
	Latency time in network.	The RSH SMART 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)

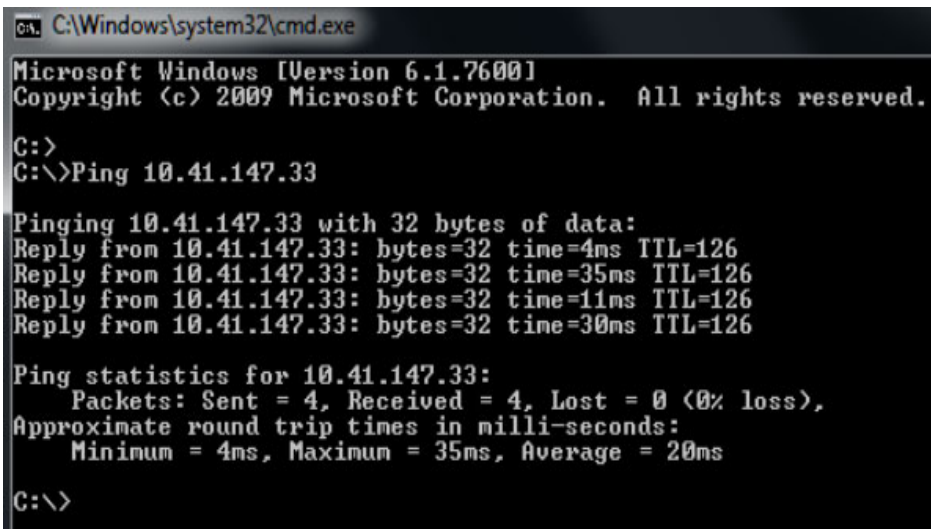
A network interface controller (also known as a network interface card, network adapter, LAN adapter and by similar terms) is a computer hardware component that connects a computer to a computer network. It is called here in short form NIC.

Table 23 provides troubleshooting guidelines regarding the LAN Network Interface Card.

**Table 23.** 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 <b>unplugged</b> to <b>connected</b> .
	IP address setting in the TriPlus RSH SMART 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 23.** LAN Network Interface Card Troubleshooting Guideline 1 (Sheet 2 of 2)

Symptom or Error Message	Possible Cause	Recommended Action
No LAN communication. (Continued)	<p>Check the communication by using the <b>Ping</b> command.</p> <p>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 SMART] and press enter.</p> <p>Figure 136 shows a successful communication with the TriPlus RSH SMART and confirms that the Network requirements for communication are fulfilled.</p>	
	<b>Figure 136.</b> Ping Command	
	 <pre> C:\Windows\system32\cmd.exe Microsoft Windows [Version 6.1.7600] Copyright (c) 2009 Microsoft Corporation. All rights reserved.  C:\&gt; C:\&gt;Ping 10.41.147.33  Pinging 10.41.147.33 with 32 bytes of data: Reply from 10.41.147.33: bytes=32 time=4ms TTL=126 Reply from 10.41.147.33: bytes=32 time=35ms TTL=126 Reply from 10.41.147.33: bytes=32 time=11ms TTL=126 Reply from 10.41.147.33: bytes=32 time=30ms TTL=126  Ping statistics for 10.41.147.33:     Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),     Approximate round trip times in milli-seconds:         Minimum = 4ms, Maximum = 35ms, Average = 20ms  C:\&gt; </pre>	
LAN Communication interrupted or unstable.	Firewall or Virus Scanner activated.	<p>Check for any installed firewall or virus scanner software which may cause interferences.</p> <p>For details see the section “<a href="#">Hardware and Software Requirements</a>” on <a href="#">page 4</a>.</p>
	Screen Saver activated.	<p>Check for any monitor screen saver which may cause interferences. The best screen saver is turning off the monitor.</p> <p>For details see the section “<a href="#">Hardware and Software Requirements</a>” on <a href="#">page 4</a>.</p>
	Computer hard disk power management activated.	<p>Check if the power management option is turned off.</p> <p>For details see the section “<a href="#">Hardware and Software Requirements</a>” on <a href="#">page 4</a>.</p>



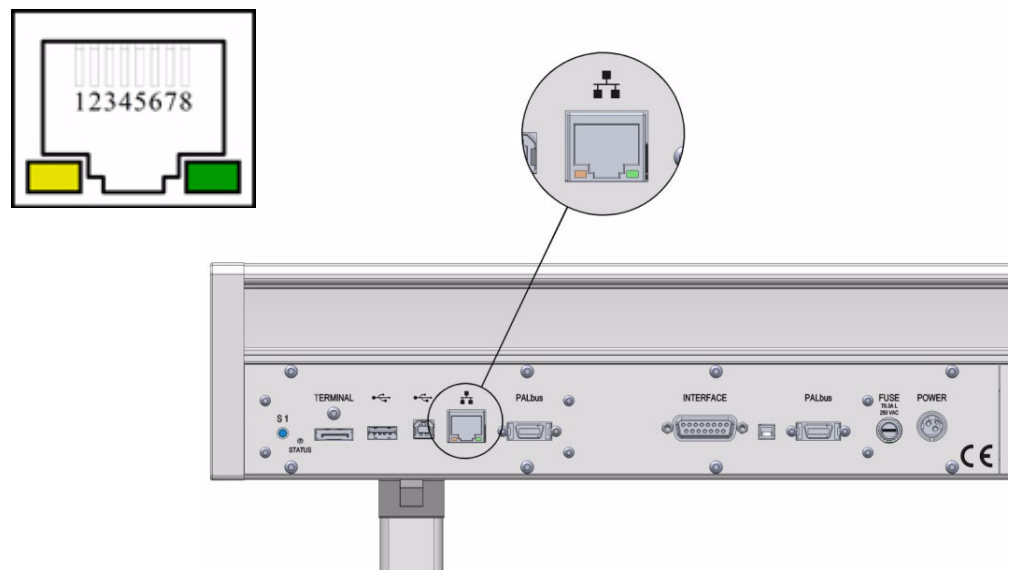
## Troubleshooting Check for LAN Communication

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 SMART.

**Figure 137.** LAN Communication LEDs

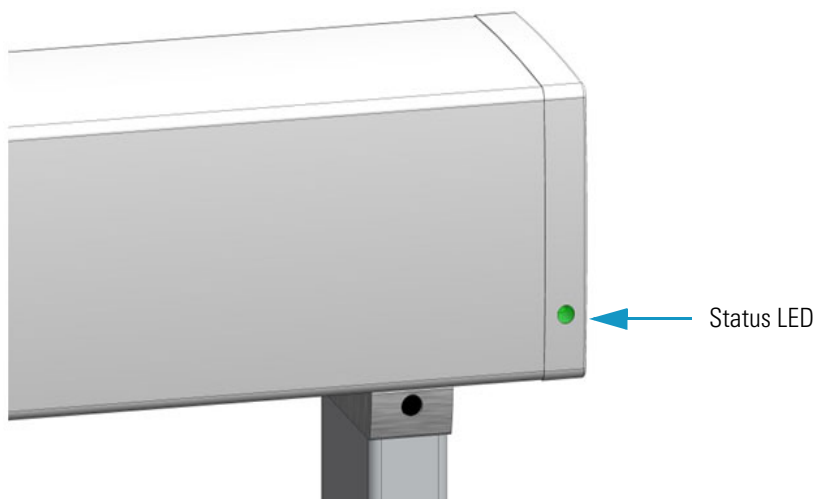


- **The LED on the left** — Status LED. Orange color indicates that the current is applied to the connector.
- **The LED on the right** — Indicates the Ethernet communication status. Green blinking status indicates that the Ethernet communication is established.

## 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 138](#).

**Figure 138.** Side Cover Status LED










[Table 24](#) lists the different LED statuses and the corresponding tasks or errors.

**Table 24.** LED Status (Sheet 1 of 2)

TriPlus RSH SMART Status	LED Color	LED Status
<b>Successful Booting Process</b>		
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
<b>Errors during Booting Process</b>		
Software failed to start application		Solid On
Application software is not installed		Solid On
Fatal error		Solid On

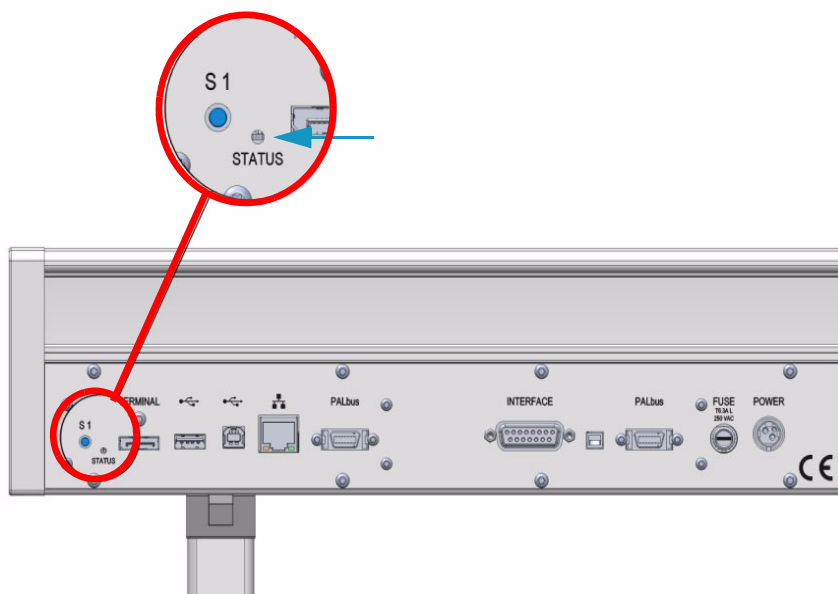
**Table 24.** LED Status (Sheet 2 of 2)

TriPlus RSH SMART Status	LED Color	LED Status
<b>LED Status during Operation</b>		
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 SMART has limited functionality. See [Figure 139](#).

**Figure 139.** Control Status LED and Reset Button



During the booting-up process, the following status changes can be observed in [Table 25](#).

**Table 25.** LED Status

TriPlus RSH SMART Status	LED Color	LED Status
<b>Successful Booting Process</b>		
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 102](#).

## 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.

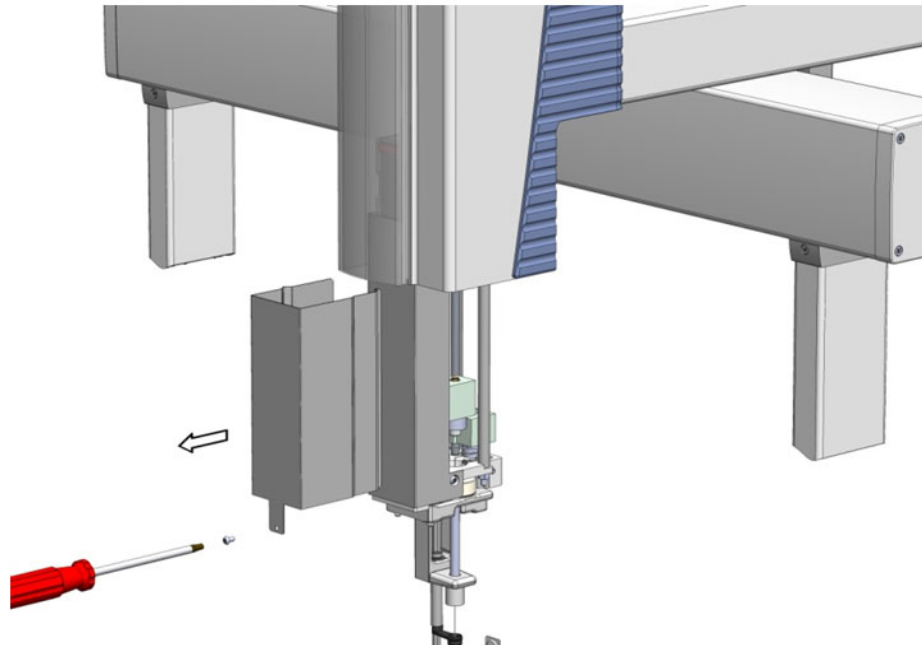


**WARNING** Turn off the power to the TriPlus RSH SMART before any repair steps are taken.

### ❖ To remove a tool from the head of the TriPlus RSH SMART

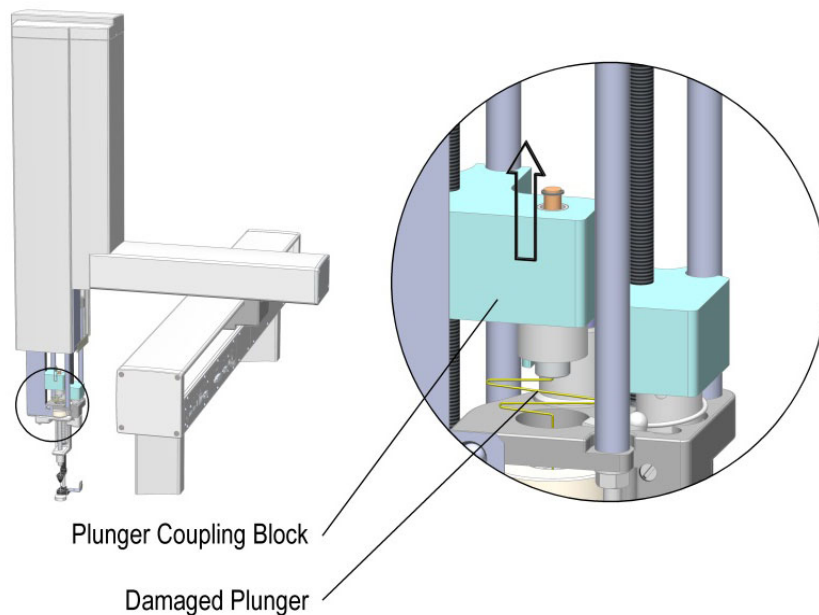
1. Turn Off the power to the TriPlus RSH SMART system.
2. Move the Head manually in a position where it is easily accessible, preferably to an empty slot of the Tool Station. Manually pull down the Z-axis to gain easy access to the lower part.
3. Remove the front cover by loosening the screw at bottom of the cover. See [Figure 140](#).

**Figure 140.** Front Cover Removal



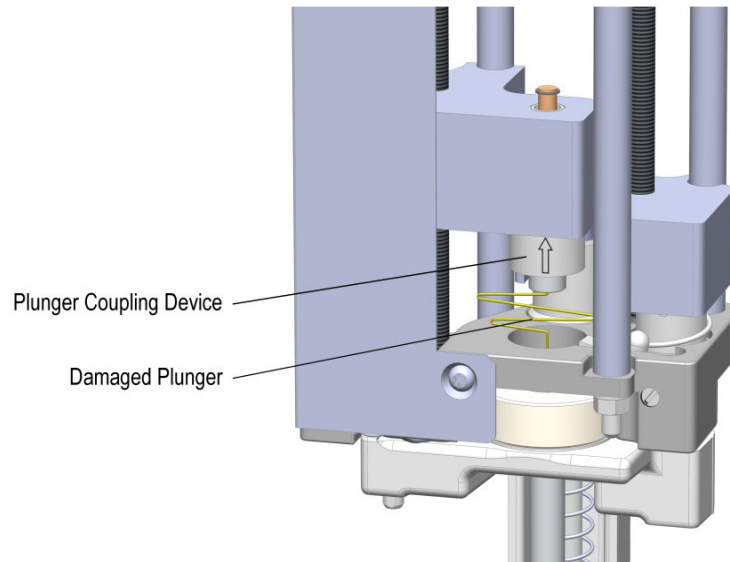
4. Locate the **Plunger Coupling Block** (left side of the Head) and move the block manually approximately 50 mm up. See [Figure 141](#).

**Figure 141.** Move the Plunger Coupling Block up



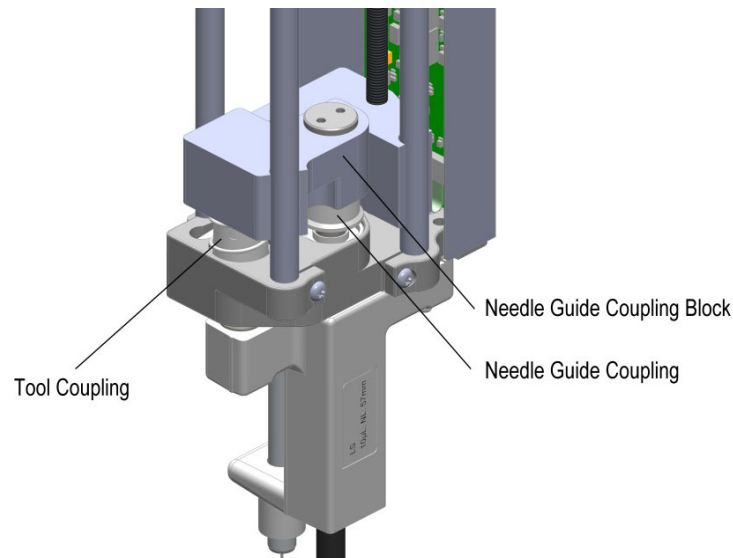
5. Locate the **Plunger Coupling Device** underneath the block; push it up to decouple the plunger adapter. See [Figure 142](#).

**Figure 142.** 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 143](#).

**Figure 143.** 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 SMART system before reinstalling the outer cover.

## 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, turn off the TriPlus RSH SMART.

Observation	Recommended Action
Syringe Needle bent	<ul style="list-style-type: none"> <li>• Are the X-, Y-, Z- Positions correctly taught?</li> <li>• Check the cover type. Is the cover correct for desired?</li> </ul>

## Tray Cooler Troubleshooting

This section lists the most important information to enable the user to overcome a faulty or problematic situation.



**CAUTION** Before starting any repair step, turn off the TriPlus RSH SMART.

Observation	Recommended Action
Tray Cooler cannot be heated or cooled.	<ul style="list-style-type: none"> <li>• Check all cables and their connections. Does the software recognize the module? Is the Standby Temperature set properly?</li> <li>• If these details are confirmed, check the Actual Temperature or if any error message occurred. It is possible that a fan is no longer working or there is a blown over-temperature fuse.</li> </ul> <p>Check for a "Pending Message" and if necessary, take corrective action. When in doubt, ask your Thermo Fisher Scientific representative for technical assistance.</p>

Observation	Recommended Action
Power supply problem.	<ul style="list-style-type: none"> <li>• Is the TriPlus RSH SMART power supply connected, turned on, and the green LED ON (at outlet side)?</li> <li>• If these details are verified but the problem remains, ask your Thermo Fisher Scientific representative for technical assistance.</li> </ul>

## Temperature Controlled Drawer Troubleshooting

This section lists the most important points to overcome a faulty or problematic situation.



**CAUTION** Before starting any repair step, turn off the TriPlus RSH SMART.

Observation	Recommended Action
The Drawer does not open or not close reliably.	<ul style="list-style-type: none"> <li>• Manually check the movement of the drawer. <i>Are any restrictions felt?</i> <i>If yes, investigate for the reason.</i></li> <li>• Clean the rolls and rails, grease these parts again and check the movement after cleaning.</li> <li>• <i>If still not satisfactory, is there mechanical damage?</i></li> </ul> <p>When this is confirmed contact your Thermo Fisher Scientific representative for technical assistance.</p>



Observation	Recommended Action
Opening of the drawer not reliable.	<p>Another reason for problems with opening of the drawer could be the Drawer Magnet, connected to the lower needle guide of the Tool.</p> <ul style="list-style-type: none"> <li>Is the magnet out of alignment, is its attachment no longer square? If not, try bring it back to square.</li> </ul> <p>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.</p> <ul style="list-style-type: none"> <li>Check manually if it is possible to open the drawer.</li> </ul> <p>If the Drawer Magnet is the source of the problems ask your Thermo Fisher Scientific representative for technical assistance.</p>
Drawer does not stay in closed position.	<p>The drawer is kept in position by a magnet installed at the back of the unit (inside of the compartment).</p> <ul style="list-style-type: none"> <li>If this magnet has become loose, it is possible that the drawer slides out of the closed position in a random manner.</li> </ul> <p>If this is the case, ask your Thermo Fisher Scientific representative for technical assistance.</p>
Temperature Controlled Drawer cannot be cooled or heated anymore.	<ul style="list-style-type: none"> <li>Check all cables and their connections. Can the module be recognized by the software (BUS)?</li> <li>Is the Standby Temperature set properly? If these points are confirmed, check the Actual Temperature or if any error message occurred.</li> <li>It is possible that the fan is no longer working or there is a blown over-temperature fuse.</li> </ul> <p>When in doubt, ask your Thermo Fisher Scientific representative for technical assistance.</p>

Observation	Recommended Action
Power Supply Problem	<ul style="list-style-type: none"> <li>Is the Temperature Controlled Drawer connected to the same power module as the TriPlus RSH SMART? If yes, use the second power module, provided with the Temperature Controlled Drawer.</li> <li>Is the power module connected, turned on and the green LED ON (at outlet side)?</li> </ul> <p>If these points are verified but the problem remains, ask your Thermo Fisher Scientific representative for technical assistance.</p>

There are no 'operator-serviceable or replaceable parts inside the power supply. In case of failure, contact your Thermo Fisher Scientific representative.

## 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 SMART.

Observation	Recommended Action
Syringe Needle bending.	<ul style="list-style-type: none"> <li>Check the teaching position for X-, Y-, and Z-Axes.</li> </ul>
Solvent flow not sufficient.	<ul style="list-style-type: none"> <li>Check the position of the solvent reservoir bottles. Level should not be lower than 50 cm from the Micro Pump of the station.</li> <li>Check the cleanliness of the solvent frits.</li> </ul>
Air bubbles in solvent lines.	<ul style="list-style-type: none"> <li>Check the solvent levels in the reservoir bottles.</li> <li>Check the position of the solvent reservoir bottles. Level should not be lower than 50 cm from the Micro Pump of the station.</li> <li>Check the cleanliness of the solvent frits.</li> <li>Check the flow by using the task <b>Prime Wash Liner</b>.</li> </ul>

Observation	Recommended Action
Solvent flow blocked.	<ul style="list-style-type: none"> <li>Check the electrical connections from the station to the Bus, or daisy chaining to the next module.</li> <li>Check the position of the solvent reservoir bottles (see the point above).</li> <li>Check the solvent level in the reservoir bottles.</li> <li>Check the cleanliness of the solvent frits.</li> </ul> <p>Activate the priming function (path described above) and check for the blockage.</p>
Waste line blocked.	<ul style="list-style-type: none"> <li>Check the position of the Waste line in the waste container. <i>Is the end of the line within the liquid or above it?</i></li> <li>Check for any particles which may hinder free flow of the solvent.</li> </ul>
Wash Block leaking.	<ul style="list-style-type: none"> <li>Check the composition of the wash solvents. Be aware of the material used for the various parts of the Fast Wash Station.</li> </ul>

## Agitator/Incubator Module 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 SMART, 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.	<ul style="list-style-type: none"> <li>Check control cable connections.</li> <li>Check the availability of the Agitator module within the software. <i>If not available, is the TriPlus RSH SMART configuration laid out for liquid injection only?</i></li> <li>If necessary load a Configuration Backup prepared for the liquid and headspace technique.</li> </ul>
Module responds to the initiation step but the block does not turn.	<ul style="list-style-type: none"> <li>Check the condition of the Agitator belt. If necessary, replace the belt.</li> </ul>

Observation	Recommended Action
Vial broken; spill in the Agitator compartment.	<ul style="list-style-type: none"> <li>• Turn off the TriPlus RSH SMART and disconnect the Agitator module.</li> <li>• Carefully investigate the damage and try to clean the compartment as best as possible.</li> <li>• When in doubt, contact your Thermo Fisher Scientific representative.</li> </ul> <p>Be prepared to provide all information concerning the type of solvent and extent of the spill.</p>

## Vortexer Module 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 SMART.

Observation	Recommended Action
Module does not respond to initiation step.	<ul style="list-style-type: none"> <li>• Check control cable connections.</li> <li>• Check the availability of the Vortexer module within the software. If not available, load a Configuration Backup prepared with the Vortexer device firmware.</li> <li>• Check for <b>Pending Message</b> and take corrective actions if necessary.</li> </ul>
Module responds to the initiation step but the block does not turn.	<ul style="list-style-type: none"> <li>• Check the condition of the Vortexer toothed motor belt. If necessary, replace the belt.</li> </ul>
Mixing of module does fail.	<ul style="list-style-type: none"> <li>• Check for a Pending Message at power-up of system, Vortex Motor may have failed.</li> </ul>
Vial broken, spill in the Vortexer collection pan.	<ul style="list-style-type: none"> <li>• Turn off the TriPlus RSH SMART and disconnect the Vortexer module.</li> <li>• Carefully investigate the damage and try to clean the compartment as best as possible.</li> <li>• When in doubt, contact your Thermo Fisher Scientific representative.</li> </ul> <p>Be prepared to provide all information concerning the type of solvent and the extent of the spill.</p>

## Heatex Stirrer Module 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 SMART.

Observation	Recommended Action
Module does not respond to initiation step.	<ul style="list-style-type: none"><li>• Check control cable connections.</li><li>• Check the availability of the Heatex Stirrer module within the software. If not available, load a Configuration Backup prepared with the Heatex Stirrer device firmware.</li><li>• Check for <b>Pending Message</b> and take corrective actions if necessary.</li></ul>
Module responds to the initiation step but the block does not turn.	<ul style="list-style-type: none"><li>• Check the condition of the Heatex Stirrer toothed motor belt. If necessary, replace the belt.</li></ul>
Mixing of module does fail.	<ul style="list-style-type: none"><li>• Check for a Pending Message at power-up of system, Heatex Motor may have failed.</li></ul>
Vial broken, spill in the Vortexer collection pan.	<ul style="list-style-type: none"><li>• Turn off the TriPlus RSH SMART and disconnect the Heatex Stirrer module.</li><li>• Carefully investigate the damage and try to clean the compartment as best as possible.</li><li>• When in doubt, contact your Thermo Fisher Scientific representative.</li></ul> <p>Be prepared to provide all information concerning the type of solvent and the extent of the spill.</p>

## SPME Conditioning Station Troubleshooting

This section lists the most important points to overcome a faulty or problematic situation.



**CAUTION** Before starting any repair step, turn off the TriPlus RSH SMART, 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.	<ul style="list-style-type: none"> <li>Check control cable connections.</li> <li>Check the availability of the SPME Conditioning Station within the software. <b>If not available, is the TriPlus RSH SMART configuration laid out for liquid injection only?</b></li> <li>If necessary load a Configuration Backup prepared for liquid, headspace and SPME technique.</li> <li>Check for a <b>Pending Message</b> and take corrective actions if necessary.</li> </ul>
No purge gas flow.	<ul style="list-style-type: none"> <li>Disconnect the purge gas tube at the module side; remove the Swagelok® union and clean the frit installed. See the section “<a href="#">Installing a Heatex Stirrer Module</a>” on <a href="#">page 44</a>.</li> </ul>
Purge Gas Valve does not open.	<ul style="list-style-type: none"> <li>Manually move the valve pin up and down to check for any restriction or broken spring.</li> <li>When in doubt, contact your Thermo Fisher Scientific representative for technical assistance.</li> </ul>

## SPME Arrow Conditioning Station Troubleshooting

This section lists the most important points to overcome a faulty or problematic situation.



**CAUTION** Before starting any repair step, turn off the TriPlus RSH SMART, 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.	<ul style="list-style-type: none"> <li>Check control cable connections.</li> <li>Check the availability of the SPME Arrow Conditioning Station within the software. <b>If not available, is the TriPlus RSH SMART configuration laid out for liquid injection only?</b></li> <li>If necessary load a Configuration Backup prepared for liquid, headspace and SPME technique.</li> <li>Check for a <b>Pending Message</b> and take corrective actions if necessary.</li> </ul>

Observation	Recommended Action
No purge gas flow.	<ul style="list-style-type: none"> <li>Disconnect the purge gas tube at the module side; remove the Swagelok® union and clean the frit installed. See the section “<a href="#">Installing a Heatex Stirrer Module</a>” on page 44.</li> </ul>
Purge Gas Valve does not open.	<ul style="list-style-type: none"> <li>Manually move the valve pin up and down to check for any restriction or broken spring.</li> <li>When in doubt, contact your Thermo Fisher Scientific representative for technical assistance.</li> </ul>

## Centrifuge 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 SMART, 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.	<ul style="list-style-type: none"> <li>Check control cable connections.</li> <li>Check the availability of the Centrifuge Module within the software.</li> <li>Check for "Pending Message" and if necessary, take corrective actions.</li> </ul>
Module responds to the initiation step but the rotor cannot be moved.	<ul style="list-style-type: none"> <li>Check if the transport lock is still mounted. If so, remove the transport lock.</li> </ul>

## 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 SMART, 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.	<ul style="list-style-type: none"> <li>• Check control cable connections.</li> <li>• Check the availability of the Barcode Reader module within the software. <i>If not available, is the TriPlus RSH SMART configuration laid out for a cycle excluding the Barcode Reader?</i></li> <li>• If necessary load a Configuration Backup prepared for the Barcode Reader device.</li> <li>• Check for a Pending Message and take corrective actions if necessary.</li> </ul>
Barcode not readable.	<ul style="list-style-type: none"> <li>• Check the horizontal orientation of the barcode lines.</li> <li>• Check the barcode length, minimum 19 mm for use with a 20 mL vial.</li> <li>• Check the type of the barcode symbol. See the section <b>Approved Barcode Label</b> in the <i>TriPlus RSH User Guide</i>.</li> <li>• Check the barcode length, minimum 19 mm for use with a 20 mL vial.</li> <li>• Check the label quality.</li> <li>• Check the print quality of the barcode lines.</li> <li>• Check the density of the barcode lines.</li> <li>• Check if barcode is 1D; 2D barcodes cannot be decoded.</li> </ul>
Barcode not identified.	<ul style="list-style-type: none"> <li>• <i>Is a barcode label attached?</i></li> <li>• <i>Is the barcode oriented such that the bars are in a horizontal direction? Any shifted angle?</i></li> <li>• <i>Is the label of correct quality?</i> <ul style="list-style-type: none"> <li>- <i>Is the background white for contrast?</i></li> <li>- <i>Is it burned (blackened) from elevated temperature, for example Agitator?</i></li> <li>- <i>Is the surface wet (moisture)?</i></li> <li>- <i>Is there a reflection?</i></li> </ul> </li> </ul>

## 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 SMART.



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.
Vent tubing catches during movement.	<ul style="list-style-type: none"> <li>• Check the integrity of the tubing. Check the installation position of the MHE Adapter Holder.</li> <li>• Consider also the distance to the Agitator.</li> </ul>
Gas cannot be vented.	<ul style="list-style-type: none"> <li>• Check the MHE Adapter for integrity. Is the needle damaged or clogged? Is the Vent Outlet open?</li> </ul>

## OC Injector Actuator Troubleshooting

This section lists the most important points to overcome a faulty or problematic situation.



**CAUTION** Before starting any repair step, turn off the TriPlus RSH SMART.

Observation	Recommended Action
The OC Actuator does not turn.	<ul style="list-style-type: none"><li>• Verify the electrical connections from the OC Adapter to the OC Electronic Box.</li><li>• Verify the connection from the OC Electronic Box to the BUS connector.</li><li>• Verify any mechanical damage at the OC Actuator.</li></ul>
Needle Bending	<ul style="list-style-type: none"><li>• Check the teaching position of the OC Injector.</li></ul>
Other items observed, such as bad chromatographic results, may have other sources which lead to the injector itself.	<ul style="list-style-type: none"><li>• Consult the Manuals of the GC.</li></ul>

## Dilutor Module Troubleshooting

This section gives a quick overview of possible causes and recommended actions which can be taken to eliminate an erratic behavior.

Symptom	Recommended Actions
Syringe Needle bending.	<ul style="list-style-type: none"><li>• Check the teaching position for X-, Y-, and Z-Axes.</li></ul>
Solvent flow not sufficient.	<ul style="list-style-type: none"><li>• Check the cleanliness of the solvent frits.</li></ul>
Air bubbles in solvent lines.	<ul style="list-style-type: none"><li>• Check the solvent levels in the reservoir bottles.</li><li>• Check the cleanliness of the solvent frits.</li><li>• Check the flow by using the task <b>PrimeWashLiner</b>.</li></ul>
Solvent flow blocked.	<ul style="list-style-type: none"><li>• Check the solvent level in the reservoir bottles.</li><li>• Check the cleanliness of the solvent frits.</li><li>• Check the integrity of the lines and connections.</li><li>• Activate the priming function (path described above) and check systematically for the blockage.</li></ul>

Symptom	Recommended Actions
Dilutor Module not available for TriPlus RSH SMART system.	<ul style="list-style-type: none"> <li>Check the electrical connections from the module to the Bus connector (or daisy chaining to the next module).</li> </ul>
Low Precision in dispensing solvent.	<ul style="list-style-type: none"> <li>Check the back-pressure of the Transfer Line to the Needle. The Dilutor Valve is tight to approximately 3 - 4 bar (300 - 400 kPa; 43.5 - 58 psig).</li> <li>Check for air bubbles – reduce the speed of Aspirating/ Dispensing in case of air bubbles.</li> </ul>
Guiding Wire with Transfer Tubing catches against other parts of the system.	<ul style="list-style-type: none"> <li>Check the position of the Dilutor Syringe Module.</li> <li>Check if the Guiding Wire is twisted.</li> <li>Check for a correct installation of the Dilutor Tool. See <a href="#">“Installing the Dilutor Tool”</a> on <a href="#">page 71</a>.</li> </ul>
Dilutor Syringe worn out within short time.	<ul style="list-style-type: none"> <li>Check for particles in the Dilutor Syringe and in the Liquid Filter.</li> </ul>