Operating Manual

Freedom EVO®

Document Status Sheet

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1	0	2003-07-30	New edition		
1	1	2003-12-16	Updated: Labels and warnings pertaining to laser light; additional information on liquid and clot detection; diverse minor corrections Preface new: Use of the product, CE conformity and other regulatory approvals moved from chapter safety		
1	2	2004-05-24	Updated: Intended use; various minor corrections Mentioned: Freedom EVOware (application software); 2-tip LiHa Implemented: Chemical resistance table		
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1	4	2005-03-29	Correction of minor errors. Reader types (GENios Pro, Ultra, and Safire^2) explicitely mentioned. Part numbers adapted to SAP-format.		
2	0	2005-08-31	Updated: Various minor corrections and adaptations. Implemented: Second LiHa on instrument, PosID-3, PnP DCU, RoMa-3 Mentioned: USB port		
3	0	2006-06-30	Updated: Various minor corrections and adaptations. Implemented: MCA96; MultiSense option; Infinite reader		
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4	0	2008-09-26	Updated: Various minor corrections and adaptations. Implemented: MCA384 Removed: Nanopipetting system (Active Tips)		
5	0	2009-03-30	Updated: Various minor corrections and adaptations. Implemented: MCA384 Gripper (CGM)		
6	0	2010-11-09	Updated: Various minor corrections and adaptations plus MCA, MultiSense, Lower DiTi Eject, etc.		
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7	2	2012-11-20	Mentioned: Loading interface Updated: Air LiHa maintenance, various minor corrections and adaptations		
7	3	2013-04-29	Updated: New safety instructions “How to lift the instrument”, MCA96 channel heads without fixed tip block retainers, Sensored Pump Option (SPO)		
7	4	2013-11-08	Updated: Various minor corrections and adaptations		
8	0	2015-02-27	Updated: New Applications, Air LiHa DiTis, Various corrections		
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9	1	2019-06-06	Updated: Section 2.2, Tab. 7-1, Tab. 7-2, Tab. 7-3, Tab. 7-10		
10	0	2021-07-08	Updated: Section 3.2.9, Tab. 3-27, Tab. 3-28		
10	1	2024-03-08	Updated: Preface (Area of use), Section 2.1.2 and 2.2 (laser notice, magnetic hazard, power supply set); Section 3.2.9 (additional info EMC and FCC 15); Chapter 12 (updated address Tecan China and Australia)		

0 Preface

For Your Safety

Before performing any work on or with the Freedom EVO, first read the Operating Manual carefully, in particular chapter 2 “Safety”.

0.1 Manufacturer

Address of Manufacturer

Tecan Schweiz AG
Seestrasse 103
CH-8708 Männedorf
SWITZERLAND

0.2 Use of the Product

0.2.1 Intended Use

Intended Use

The Freedom EVO is an open automation platform product for general laboratory use. It is intended for routine laboratory tasks, such as general purpose pipetting and general purpose liquid handling and robotic processes.

0.2.2 Area of Use

Area of Application

The Freedom EVO may be used in a variety of laboratory environments according to its intended use.
In each environment the individual laboratory is responsible for the validation of the Freedom EVO instrument together with the specific liquids and labware used in the laboratory’s application workflow or method.

0.2.3 Improper Use

Improper Use

The Freedom EVO must not be used with options or components which are not approved by Tecan.

WARNING

The use of not approved options may impair the safety concept of the Freedom EVO.
This means that the safety and compliance to national and international standards, as required for UL/CSA certification, by EC directives, etc. cannot be ensured any more.

0.3 CE Conformity

Declaration of Conformity

The Freedom EVO is designed and built in compliance with the basic safety and health requirements of applicable EC Directives. With the declaration of conformity the manufacturer declares conformity with the provisions of the Directives.

CE Label

The CE label is affixed to the Freedom EVO.

0.4 CSA Certification

The Freedom EVO is tested and certified by the Canadian Standards Association (CSA).

CSA Marking

The CSA marking is affixed to the Freedom EVO.

Radio Interference

According to the ICES-001 notice the following statement applies to the Freedom EVO:

English

Canadian Radio Interference Regulations

ICES-001 Notice for Industrial, Scientific and Medical Radio Frequency Generators:
This ISM apparatus meets all requirements of the Canadian interference-causing equipment regulations.
Please note that this requirement is only for generators which operate at over 10,000 Hz.

Français

Réglementation canadienne en matière de perturbations radioélectriques

Avis de l'ICES-001, générateurs de radiofréquences dans le domaine industriel, scientifique et médical:

Cet appareil ISM (industriel, scientifique et médical) satisfait à toutes les exigences définies par la réglementation canadienne en matière d'équipements générant des perturbations radioélectriques.

Veuillez noter qu'il s'agit d'une exigence concernant uniquement les générateurs fonctionnant au-delà de 10 000 Hz.

0.5 FCC Rules

Radio Interference

According to the rules of the US government agency “Federal Communications Commission (FCC)” the following statement applies to the Freedom EVO:

English

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 18 (ISM equipment) of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the Operating Manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

ATTENTION

Changes or modifications not expressly approved by the manufacturer could void the user’s authority to operate the equipment.

Table of Contents

1 About This Manual

Purpose of This Chapter

This chapter points out the purpose of the manual, specifies the product the manual deals with and who the manual is intended for. Furthermore, it explains the symbols, conventions and abbreviations used and offers other general information.

Purpose of This Manual

This manual describes the Freedom EVO and provides all information required for its safe operation and to maintain it in good working order.

Product Pictures

The delivered instrument may not exactly match the product pictures shown in this operating manual.

Target Group

This manual is intended for everyone who wants to learn about the safe operation of the Freedom EVO and how to maintain its perfect working condition. In particular, laboratory personnel and operators are addressed.

Laboratory personnel operating Freedom EVO instruments require also thorough knowledge of applications, instrument functions and software programs as well as all applicable safety rules and regulations.

Scope

This manual is applicable for

- FREEDOM EVO-2 100 Base; Part No. 10641100; from serial No. 1202...... (Freedom EVO 100 base)
- FREEDOM EVO-2 150 Base; Part No. 10641150; from serial No. 1202...... (Freedom EVO 150 1 LiHa)
- FREEDOM EVO-2 150 Base; Part No. 10641152; from serial No. 1202...... (Freedom EVO 150 2-LiHa)
- FREEDOM EVO-2 200 Base; Part No. 10641200; from serial No. 1202...... (Freedom EVO 200 1 LiHa)
- FREEDOM EVO-2 200 Base; Part No. 10641202; from serial No. 1202...... (Freedom EVO 200 2-LiHa)
- FREEDOM EVO 100 BASE; Part No. 30020010; from serial No. 1202...... (Freedom EVO 100 MCA96)
- FREEDOM EVO 150 BASE; Part No. 30020015; from serial No. 1202...... (Freedom EVO 150 MCA96)
- FREEDOM EVO 200 BASE; Part No. 30020020; from serial No. 1202...... (Freedom EVO 200 MCA96)
- FREEDOM EVO 100 BASE; Part No. 30032010; from serial No. 1202...... (Freedom EVO 100 MCA384)
- FREEDOM EVO 150 BASE; Part No. 30032015; from serial No. 1202...... (Freedom EVO 150 MCA384)
- FREEDOM EVO 200 BASE; Part No. 30032020; from serial No. 1202...... (Freedom EVO 200 MCA384)
- FREEDOM EVO-2 100; Part No. 30048278; from serial No. 1202...... (Freedom EVO 100/4)

Symbols and Conventions

- Cross-references appear as follows: e.g. “Refer to section “1.1.1 🗎 1-2“
  – 1.1.1 refers to the corresponding chapter number
  – The symbol 🗎 denotes “page number”

– 1-2 refers to the page number, whereas the first number stands for the chapter number (chapter 1 page 2)

Note: *The symbols pertaining to safety (WARNINGS and ATTENTIONS) are explained in chapter* *2 "Safety", 2 2-1.*

1.1 Reference Documents

Additional reference documents are listed below but are not enclosed or linked.

What Does the Doc. ID Tell You?

The Doc. IDs listed below are root numbers. Therefore, they do not contain information about the language, document version or the medium (data storage medium, hardcopy, downloadable file, etc.) of the document.
Check the scope of the corresponding document to make sure that you are in possession of the correct version.

Note: *The Doc. ID does not represent ordering information. For orders refer to the number on the binder, CD casing, etc.*

Manuals supplied with Freedom EVO Instruments

The following manuals are included in the shipment and considered part of a Freedom EVO instrument:

- Freedom EVO Operating Manual
  (Doc ID 392886)
- Instrument Software Manual
  (Doc ID 392888)
- Freedom EVO Maintenance and Service Logbook
  (Doc ID 392815)
  (includes Daily/Weekly Maintenance Checklist)

Any individual or separate operating manuals for optional equipment according to your order configuration can be applicable.

Application Software Manuals

According to your order configuration and to the applications you plan to run, the following documents are supplied:

- Freedom EVOware, Extended Device Support, Software Manual
  (Doc ID 393172)
- Freedom EVOware, Limited Device Support, Software Manual
  (Doc ID 393804)
- EVO Logic Software Manual
  (Doc ID 396614)

Other Reference Documents:

- QC Kit Application Manual (Doc ID 397069)
- QC Kit Application Software Manual (Doc ID 397070)
- PMP Application Manual
  (Doc ID 395390)

For information about the liquids to use with the Freedom EVO, refer to section 3.7 "Chemical Resistance", 2 3-85.

1.2 Trademarks

The following product names and any registered and unregistered trademarks mentioned in this manual are used for identification purposes only and remain the exclusive property of their respective owners (for simplicity reasons, the symbols for trademarks, such as ® and ™ are not repeated later in the manual):

- Freedom EVOware® and Freedom EVO® are registered trademarks of Tecan Group Ltd. in major countries
- Monovette® is a registered trademark of Sarstedt, Inc.
- Kel-F® is a registered trademark of 3M Company, Maplewood, Minnesota, USA
- Luminex 100™ and Luminex 200™ are trademarks of the Luminex Corporation, Austin, Texas
- Luminex®, FLEXMAP® and MAGPIX® are registered trademarks of the Luminex Corporation, Austin, Texas
- Windows® is a registered trademark of Microsoft Corporation
- Tygon® is a registered trademark of Saint-Gobain Performance Plastics Corporation
- Bacillol Plus® is a registered trademark of the Bode Chemie Hamburg
- Decon90® is a registered trademark of Decon Laboratories Limited
- DNAzap® is a registered trademark of Ambion Inc.

1.3 Abbreviations

Air LiHa	Air displacement pipetting arm
CGM	Common Gripper Module (MCA384 Gripper)
cLLD	Capacitive liquid level detection
CV	Coefficient of variance or variation
DiTi	Disposable tip
DMSO	Dimethyl sulfoxide
EN	European Norm
EPDM	Ethylene Propylene Diene Monomer
ETFE	Ethylene/Tetrafluoroethylene-copolymer
FaWa	Fast wash pump
FEP	Tetrafluoroethylene/Perfluoropropylene-copolymer
FFPM	Perfluoroelastomer
FSE	Field service engineer
FWO	Fast wash option
ILID	Integrated liquid detector
LH	Liquid handling

LICOS	Liquid container supervisor
LiHa	Liquid handling arm
MCA	Multichannel arm
MCA96	Multichannel arm with 96 channel pipetting head
MCA384	Multichannel arm with 384 channel pipetting head
MIO	Monitored incubator option
MP	Microplate
MPO	Monitored pump option
PCTFE	Polychlorotrifluoroethylene
PE	Polyethylene
PEEK	Polyetheretherketone
pLLD	Pressure based liquid level detection
PMP	Pressure monitored pipetting
PnP	Pick and place arm
POM	Polyoxymethylene
PP	Polypropylene
PosID	Positive identification option, barcode scanner
PS	Polystyrene
PTFE	Polytetrafluoroethylene
PVC	Polyvinylchloride
PVDF	Polyvinylidenefluoride
RoMa	Robotic manipulator arm
RF	Radio frequency
SPO	Sensored pump option
USB	Universal serial bus
UPS	Uninterruptable power supply
WHO	World Health Organization

2 Safety

This chapter describes the safety concept of Freedom EVO, provides general rules of correct behavior, and warnings concerning hazards associated with the use of the Freedom EVO.

2.1 Safety Message Conventions

2.1.1 Signal Words

WARNING indicates the possibility of personal injury or even loss of life if the instructions are not followed.

ATTENTION indicates the possibility of equipment damage, malfunctions or incorrect process results, if instructions are not followed.

2.1.2 Safety Symbols

General warning

Toxic material

Biological hazard

Radioactive radiation

Fire hazard

Electrical danger

Crushing hazard

Strong magnetic fields

Laser hazard

Explosive material

Wear protective gloves

Read this

Disturbance of functions by electromagnetic RF waves.
Do not use a cellular phone.

2.2 General Safety Information

WARNING

Freedom EVO is designed and built in accordance with the present state-of-the-art technology and the recognized technical safety regulations. Nevertheless, risks to users, property and the environment can arise if the Freedom EVO is used without due care and attention.

The safety of all users and personnel depends on the strict observation of these safety instructions and awareness of the safety-related warnings provided in this manual.

- Please pay great attention to the following general safety information.
- This manual must always be available to all persons performing the tasks described herein.
- Legal regulations, such as local, state and federal laws concerning the use or application, as well as the handling, of dangerous materials in connection with the Freedom EVO must be strictly followed.
- The operating company is responsible for defining instructions in accordance with company procedures and local legal requirements. The instructions provided by the operating company must be strictly observed.
- Observe the correct environmental conditions for storage and operation.
- Structural changes to the safety devices are forbidden.
- Damaged safety devices must be replaced immediately as described in this manual.
- Always use the power cable supplied with the instrument.
- Do not use the power cable with other products.
- The Freedom EVO must not be modified in any way without prior consultation and written approval of Tecan. Authorized modifications to the system may only be performed by an FSE certified for the repair and upgrading of the Freedom EVO.
  Tecan will reject any claim resulting from unauthorized modifications.
- Fire hazard caused by the improper use of the Freedom EVO. The Freedom EVO should not be installed in locations where there is a hazard of explosion.
- Chemical, biological, and radioactive hazards can be associated with the substances used or the samples and reagents processed with the Freedom EVO (e.g., during loading and unloading). The same applies to waste disposal.
  - Always be aware of possible hazards associated with these substances.
  - Use appropriate protective clothing, safety goggles and gloves.
  - The handling of substances and the disposal of waste may be subject to local, state, or federal law, or to regulations with regard to health, environment, or safety. Strictly observe the corresponding provisions.
- Any contamination must be dealt with immediately as described in this manual.
- The user is responsible for ensuring that the Freedom EVO is always operated under proper conditions, and that maintenance, service, and repair tasks are performed with care, on schedule, and only by authorized personnel.
- Risk of incorrect measuring results. After system care or maintenance has been performed, operation must only be resumed after the correct system operating conditions have been verified.
- Always use recommended consumables and original spare parts for maintenance and repair to assure good system performance and reliability.

- Lifting or moving the instrument can cause serious injuries
  - Injuries to the back due to overload can occur
  - Lifting or moving the instrument must be correctly prepared and may only occur under the direction of a qualified Tecan person
- Lifting or moving the instrument can cause damage due to unsecured parts
  - Lifting or moving the instrument must be correctly prepared and may only occur under the direction of a qualified Tecan person
- Potentially lethal voltage inside the instrument.
  - Equipment is to be connected to a grounded power source using an approved power cord with grounding conductor.
  - Do not remove covers and other parts protecting from electricity.
  - Always keep the areas of electric parts, such as power supply plug, mains switch, etc., dry.
- Though the safety concept assumes that the safety panel is always closed during normal operation, it is necessary to have access to the elements in the working area behind the safety panel for setup, maintenance and troubleshooting purposes.
- Pointed tips and other sharp-edged elements, which might cause injuries when you reach into the working area with the safety panel open.
  - Always be aware of the mechanical hazards.
  - Wear laboratory apparel, rubber gloves, safety goggles, etc. as appropriate.
- Unsafe operating condition and wrong measuring results in the process, if the system is leaking.
  - If liquid is dripping from the tips or other parts of the liquid system, the Freedom EVO must not be operated any more.
  - Operation may only be resumed if the necessary maintenance or repair work has been performed and the proper condition of the system has been verified.
- Electromagnetic RF waves from a cellular phone may affect the function of the liquid detection.
  - Faulty detection of the liquid surface may be the consequence, which causes the system to produce incorrect results.
  - Keep a distance of at least 2 m from the instrument when using a cellular phone.
- On the MCA96 / MCA 384, especially the parts of the pipetting head are moved with great force.
  Injuries (piercing and crushing) possible when you reach into the working area of the pipetting head.
  - Make sure that all safety covers are in place before starting the instrument.
  - Do not reach into the working area of the instrument.
- Danger of contusions caused by moving flask flipper.
  - Switch the instrument off before reaching into the flask flipper working area.
- Chemical, biological and radioactive hazards can be associated with the substances used or the samples processed with the Freedom EVO.
  The same applies to waste disposal.
  - Always be aware of possible hazards associated with these substances.
  - Use appropriate protective clothing, safety goggles, mouth/nose protection and gloves.

- The handling of substances and the disposal of waste may be subject to local, state or federal law or regulations with regard to health, environment or safety. Strictly observe the corresponding provisions.
- Caustic substances can cause burns and eye injury.
  - Always be aware of possible hazards associated with these substances.
  - Avoid exposure to caustic substances.
  - Use appropriate protective clothing, safety goggles, mouth/nose protection and gloves.
- The instrument is not explosion protected. Not for use in Ex zones.
  When using flammable material take the risk of fire into consideration:
  - Avoid the formation and accumulation of flammable vapors.
  - Avoid the spillage of flammable material.
- Regarding all hazards (referring to the listed hazards earlier in this section) pay attention to the following:
  - Prior to using hazardous materials perform a risk assessment.
  - Consider specific workplace conditions, such as temperature, air ventilation, electrostatic discharge.
  - Make sure that the risk is acceptable prior to use of the instrument.
- Wrong sample results due to disturbances, such as electromagnetic fields or supply voltage fluctuations, caused by external devices.
  - Do not place devices emitting electromagnetic fields close to the instrument.
  - Do not connect devices that may interfere with the supply grid to the same power line as the instrument.
- For California residents only: This product can expose you to chemicals such as lead which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov/product.
- Options used on the worktable of the Freedom EVO instrument can produce strong magnetic fields, which may interfere with the function of medical devices implanted or worn by an operator, such as pacemakers or insulin pumps. Freedom EVO is supplied with a strong magnetic fields safety sign which should be applied by the user to the front door in a position visible to the user in the event of use of options producing strong magnetic fields.
- Some laser parts on the instrument may show outdated labelling (e.g. Laser Notice No. 50), but the instrument including that part has been tested according to standard IEC 60825-1:2014

2.3 Operating Company

The operating company must ensure that the Freedom EVO and in particular the safety features, function properly and that all the personnel in contact with the instrument are adequately trained.

Responsibilities

- Method and process validation.
- Defining the processes in compliance with the Standard Operating Procedures.
- Ensuring that installation and operational qualifications (IQ OQs) have been completed.
- Ensuring that all personnel in contact with the Freedom EVO are adequately trained.

- Ensuring the availability of appropriate protective clothing and equipment.
- Ensuring the maintenance and safe operation of the Freedom EVO.
- Requiring adherence to laboratory safety regulations and directives.

2.4 User Qualification

The laboratory personnel must be fully qualified and trained to operate the Freedom EVO. The work described in this Operating Manual must only be performed by authorized personnel with the qualifications prescribed below.

Laboratory personnel must:

- have suitable technical training,
- be familiar with the laboratory safety regulations and directives,
- be familiar with the instructions for the safety elements of the instrument,
- use protective clothing and equipment,
- be familiar with and adhere to good laboratory practices,
- and have read and understood the instructions in the Operating Manual.

Tecan recommends that the operator attends an operator training course. Please ask the Tecan Customer Service about available courses. Refer to section 12 “Customer Support”, 2 12-1.

2.4.1 Operator

The operator (lab technician) works for the operating company.

Required Skills

- No specific application or system knowledge
- Command of local languages
- Command of English is preferable

The operator has application software access rights allowing him to run methods and perform system care.

2.4.2 Key Operator

The key operator (application specialist) supports the operating company or works for the same company.

Required Skills

- Extensive application knowledge
- Limited system knowledge
- Command of local languages
- Command of English
- In-depth knowledge of the corresponding software manual

Responsibilities

- Instructing the operator
- Writing, running and validating methods
- Helping the operator to solve problems with the instrument

2.5 Safety Elements

Safety Panels

The space around the worktable is protected with safety panels. Whereas the front safety panel can be opened, the other safety panels are permanently installed on the Freedom EVO.

WARNING

Injuries caused by moving parts

A not completely opened front safety panel might close automatically.

- Open the front safety panel completely (more than 180°).

Door Locks

During operation the front safety panel is locked by means of two door locks.

The safety concept of the Freedom EVO assumes that the front safety panel is always closed when the instrument is running.

Modifications on the Safety Panels

Some options for the Freedom EVO require modifications on the safety panels. These modifications must be performed by an authorized Tecan FSE (field service engineer) when the option is installed.

WARNING

If the options which require modifications on the Freedom EVO are installed improperly, the safety concept may be impaired.

Always make sure that the options are installed in compliance with the instructions given by the manufacturer.

WARNING

If any safety element fails to operate as expected, e.g. if the door locks fail to lock or open at the expected time, immediately notify the Tecan field service engineer.

Which are Safety Elements?

The following figures show the elements of the Freedom EVO, which have a protective function or have in any other way to do with safety.

Freedom EVO with Standard Front Safety Panel

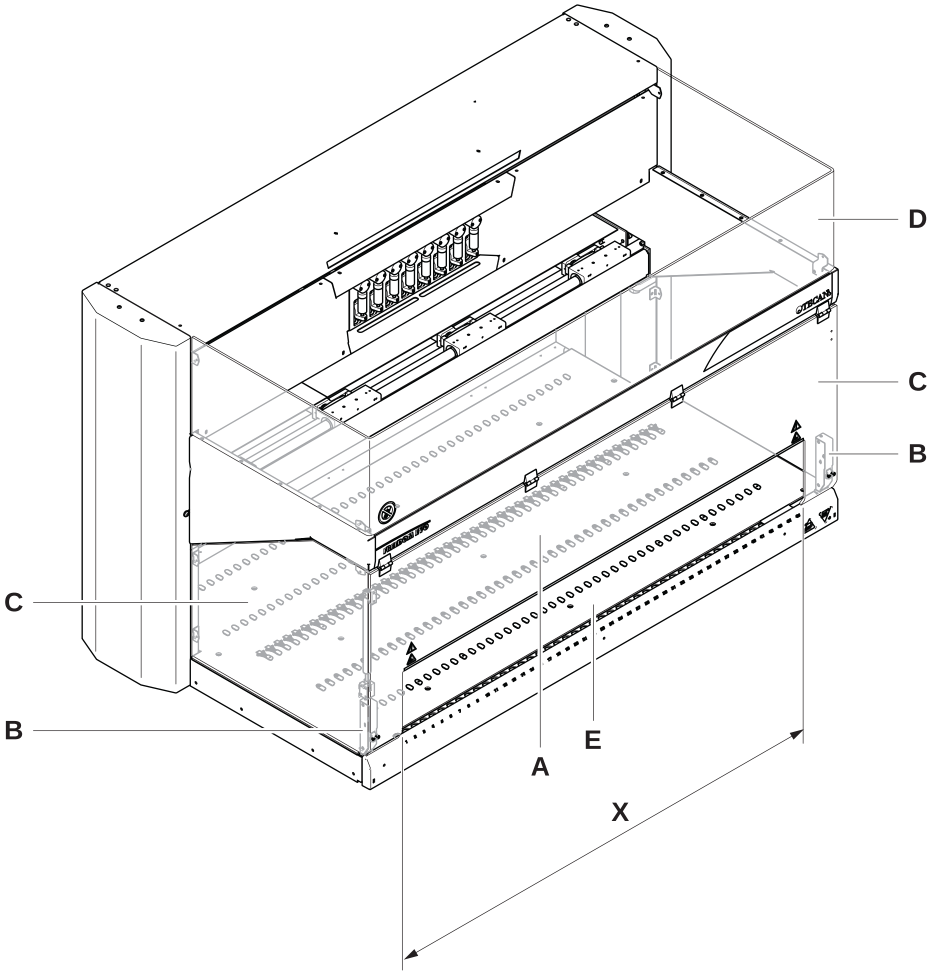


Fig. 2-1 *Safety elements / standard (open) front safety panel*

A	*Standard front safety panel*	***D***	*Top safety panel*
B	*Door lock*	***E***	*Loading interface (optional)*
C	*Side safety panel*	***X***	*Cutout for continuous loading*

Note: *A Freedom EVO with a standard front panel cannot be used with a MCA 96 or MCA 384.*

Freedom EVO with Closed Front Safety Panel (Option)

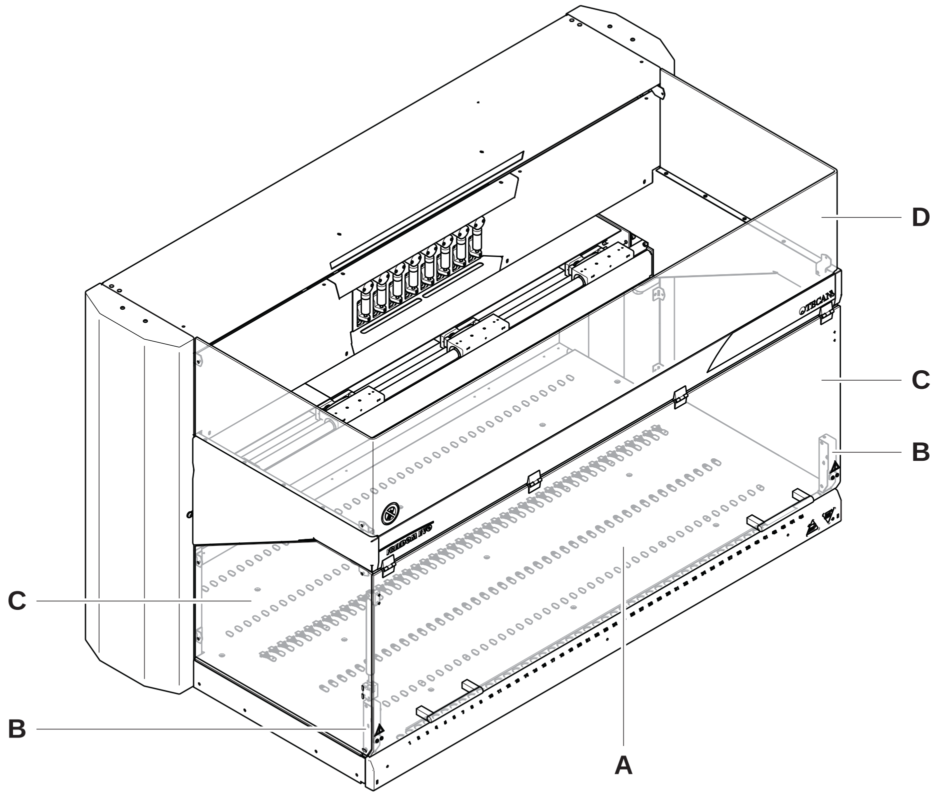


Fig. 2-2 *Safety elements / closed front safety panel (option)*

A	*Closed front safety panel*	***C***	*Side safety panel*
B	*Door lock*	***D***	*Top safety panel*

Freedom EVO with Front Safety Panel with Adjustable Access Window (Option)

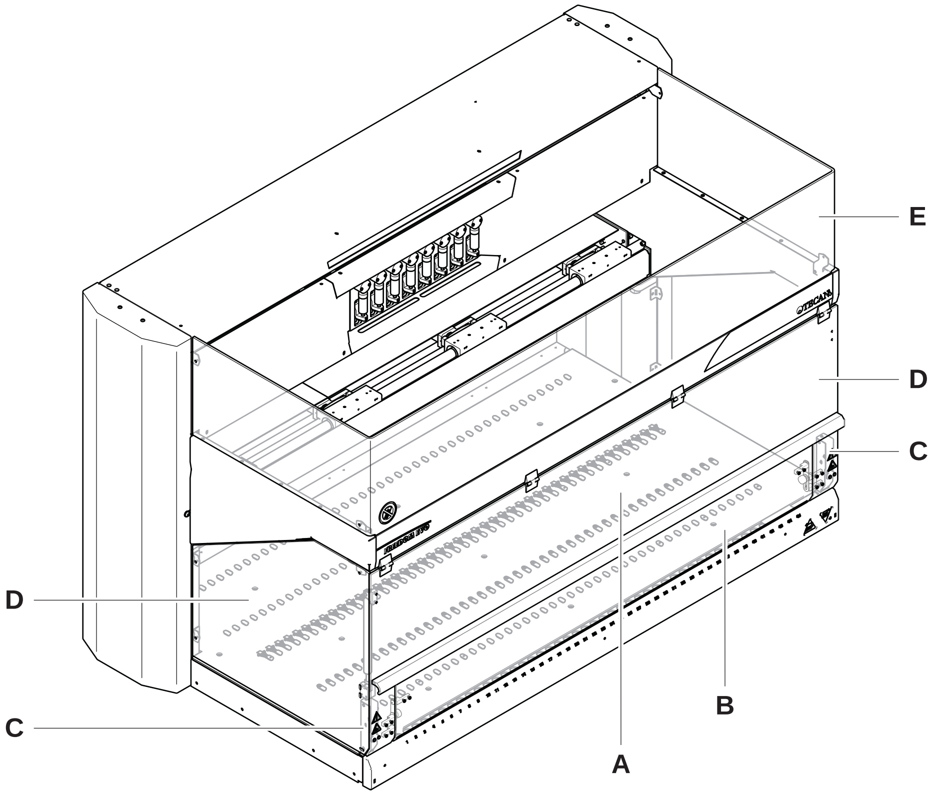


Fig. 2-3 *Safety elements / front safety panel with adjustable access window (option)*

A	*Front safety panel*	***D***	*Side safety panel*
B	*Adjustable access window*	***E***	*Top safety panel*
C	*Door lock*		

MCA96

The pipetting head cover prevents direct access to the plunger drive of the pipetting head. The plunger cover prevents access to the moving plunger plate.

Fig. 2-4 Safety elements/covers on 96 channel pipetting head

A Pipetting head cover *B Plunger cover*

MCA384

The pipetting head cover prevents direct access to moving parts like the plunger drive, DiTi pick up mechanism and the clamps of the pipetting head.

Fig. 2-5 Safety covers on 384 channel pipetting head

A Pipetting head cover *B Clamps*

General

Removal of Safety Elements

The protective and safety devices installed on the Freedom EVO must not be removed or disabled during operation.

In the event such elements were removed, e.g. for maintenance work, operation may only be resumed when all protective and safety devices have been completely installed and checked.

2.6 Product Safety Signs

Where are Safety Notices Attached?

Freedom EVO Instrument

The figure shows the safety notices that are attached to the Freedom EVO instrument. It also shows their locations:

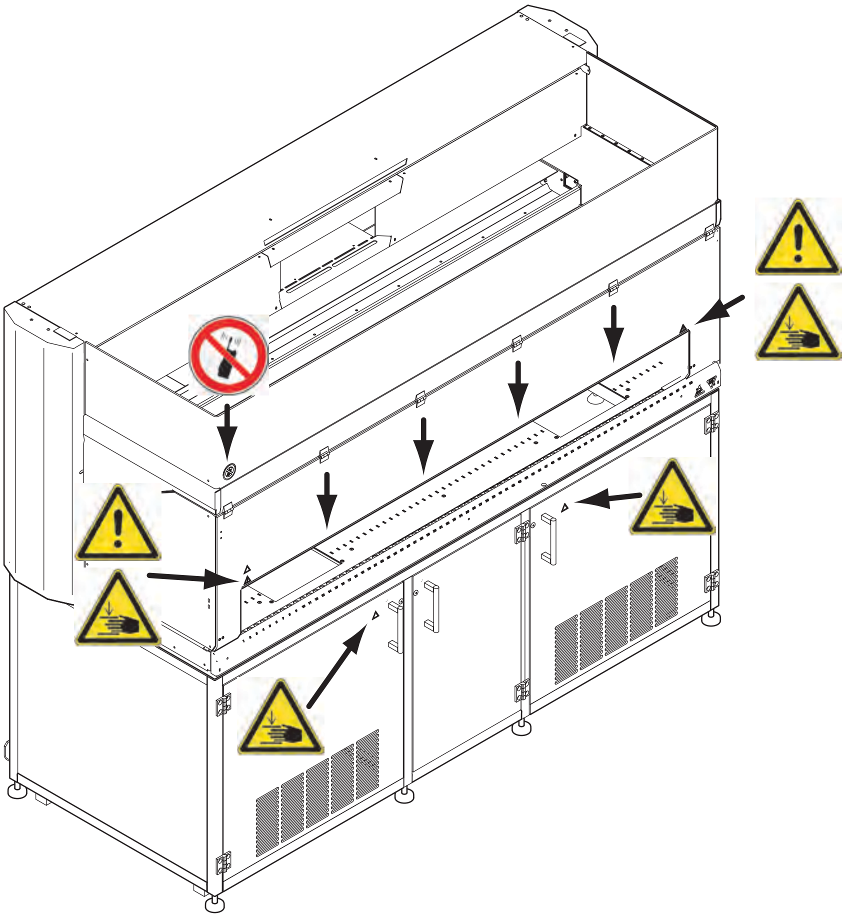


Fig. 2-6 Safety notices attached to the product

The following table explains the significance of the notices:

Tab. 2-1 Significance of the safety notices

Symbol	Significance
	Warning of hazards if you reach beyond the yellow line (see short arrows)
	Warning of hazards if you reach into the cabinet if, for instance, a reader or centrifuge is installed.
	Do not use a cellular phone

MCA96 and MCA384

Safety Notices on the MCA96

The figure shows the safety notices that are attached to the MCA:

Fig. 2-7 Safety notices on the MCA96 pipetting head cover

Safety Notices on the MCA384

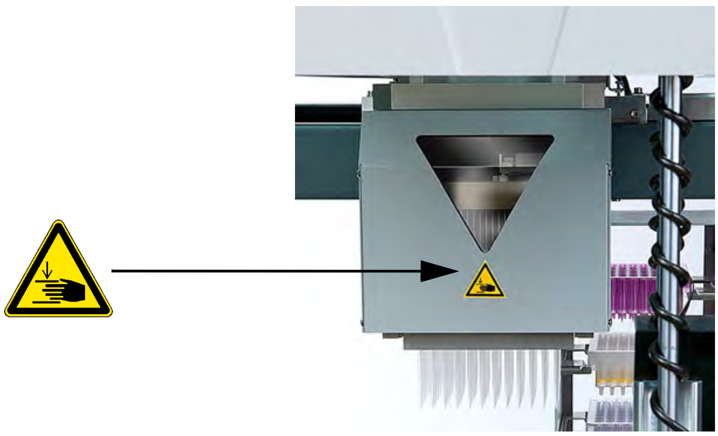


Fig. 2-8 Safety notices on the MCA384 pipetting head cover

The table explains the significance of the notice:

Tab. 2-2 Significance of the safety notice

Symbol	Significance
	Warning from mechanical hazards (piercing and crushing)

Flask Flipper

Safety Notices on the Flask Flipper

The figure shows the safety notices that are attached to the flask flipper:

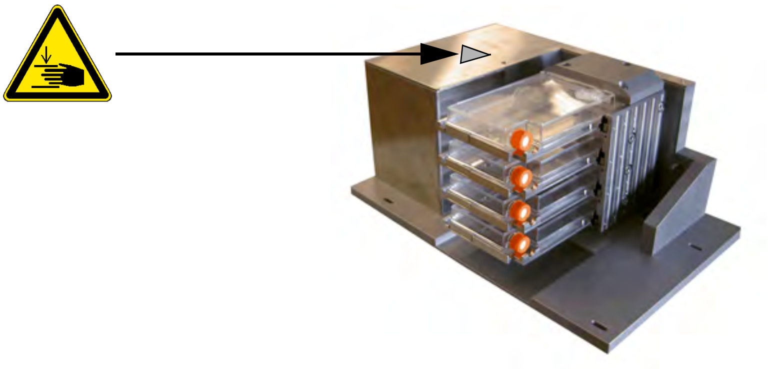


Fig. 2-9 Safety notices on the flask flipper

The table explains the significance of the notice:

Tab. 2-3 Significance of the safety notice

Symbol	Significance
	Warning from mechanical hazards (piercing and crushing)

General

Damaged, lost or illegible symbols (notices or stickers) must be replaced immediately.

2.7 Laser Radiation

WARNING

Fig. 2-10 *Class 1 Laser Product*

Class 1 Laser Product pursuant to IEC 60825-1:2007
"Complies with 21 CFR 1040.10 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007"

PosID

Safety Notices on the PosID

The figure shows the safety notices that are attached to the PosID.

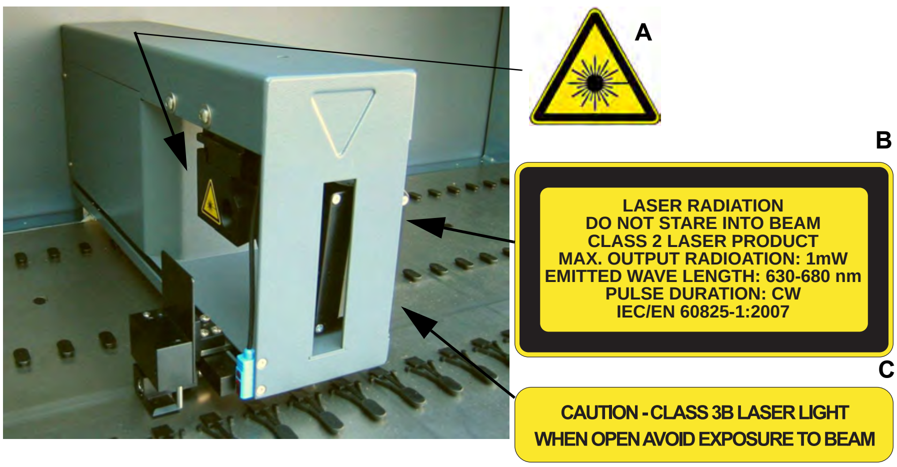


Fig. 2-11 *Laser labelling on PosID*

Class 2 Laser Product pursuant to IEC 60825-1:2007:
"Complies with 21 CFR 1040.10 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007"

Fig. 2-12 Label on PosID scanner head

Tab. 2-4 Significance of the safety notices on the PosID

Label	Significance	Location
A	**Warning label:** Laser hazard symbol	See Fig. 2-11 , 2 2-15
B	**Explanatory label:** Identifies a CLASS 2 LASER PRODUCT[a)] that contains an embedded visible low power laser barcode scanner. Warns against direct viewing into laser beam or its reflections.	On barcode scanner, see Fig. 2-11 , 2 2-15
C	**Label for panels:** Warns against removing or displacing of protective housing/panels, which permits human access to the laser light.	On barcode scanner, see Fig. 2-11 , 2 2-15
D	**Label for scanner head**: Warns against rotating the scanner head assembly by hand which could damage motor and head assembly.	On barcode scanner head, see Fig. 2-12, 2 2-16

a) According to IEC/EN 60825-1

Te-PS Sensor Plate

Safety Notices on the Sensor Plate

The figure shows the safety notices that are attached to the Te-PS sensor plate:

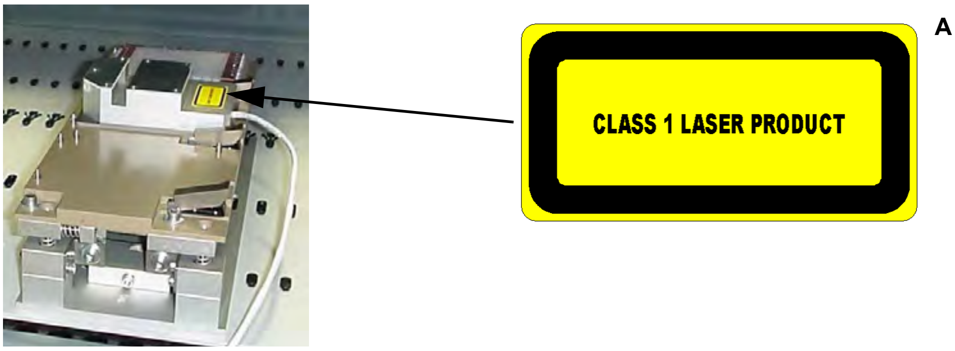


Fig. 2-13 *Laser labelling on Te-PS sensor plate*

Tab. 2-5 *Significance of the safety notices on the Te-PS sensor plate*

Label	Significance	Location
A	Explanatory label: Identifies a CLASS 1 LASER PRODUCT[a)]	See Fig. 2-13 , 2 2-17

a) According to IEC60825-1

Note: *The Te-PS sensor plate conforms to the applicable requirements of both IEC 60825-1 and CDRH 21 CFR 1040 at the date of manufacture. The product is classified as a Class 1 Laser Product according to IEC 60825-1 regulations and as Class I Laser Product according to CDRH regulations.*

Symbol BC Scanner

Safety Notices on the Symbol BC Scanner

The figure shows the safety notices that are attached to the symbol BC scanner:

Fig. 2-14 Laser labelling on the symbol BC scanner

Tab. 2-6 Significance of the safety notices on the symbol BC scanner

Label	Significance	Location
A	Explanatory label: Identifies a CLASS 2 LASER PRODUCT[a] that contains an embedded visible low power laser barcode scanner. Warns against direct viewing into laser beam or its reflections.	See Fig. 2-14 , 2 2-18

a) *According to IEC/EN 60825-1:2007*

2.8 Decontamination Declaration

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Decontamination	See section 7.5 “Decontamination”, 2 7-85

When to Decontaminate

Apart from regular decontamination, the user must thoroughly decontaminate the instrument according to standard laboratory regulations in the following cases:

- Before any maintenance or service work is performed on the instrument
- In case of accidents (e.g. crash, spilled substances, etc.)
- Before a Tecan field service engineer (FSE) performs any on-site work on the instrument
- Before the instrument or parts of it are returned to Tecan (e.g. for repair)
- Prior to storage of the instrument
- Prior to disposal of the instrument or parts of it
- Generally before the instrument or parts of it leave the user’s site

Decontamination Method

The decontamination method must be adapted to the respective application and the substances associated with it. The user takes the full responsibility for the appropriate decontamination of the entire equipment.

WARNING

Biological or chemical hazard and/or radioactive radiation.

Contamination hazard due to parts of the instrument which are not completely decontaminated.

Not only the parts having direct contact with chemicals or biological material must be treated, but also the tubing system as well as the whole upstream equipment.

Certificate of Decontamination

Before a Tecan FSE carries out any work on the instrument, or before the instrument is returned to Tecan, the owner of the instrument must confirm in writing that the decontamination has been performed properly and in accordance with good laboratory practice guidelines. For this, the owner must enclose a declaration (e.g. Certificate of Decontamination).

Tecan can provide the corresponding forms (Certificate of Decontamination or Repair Order) in case the owner of the instrument has no template for such a declaration at hand. Contact the Tecan helpdesk for further information.

Note: *Tecan reserves the right to refuse any instrument or a part of it, or will charge an extra fee, if the decontamination is not declared sufficiently.*

3 Technical Data

Purpose of This Chapter

This chapter introduces the reader to the Freedom EVO and its main components. It contains technical data, requirements and performance data.

3.1 Introduction

What is Freedom EVO?

The Freedom EVO is a precision instrument designed for automating routine laboratory tasks in the domains of life science and bio pharma. The Freedom EVO is an open and flexible platform.

Delivery

The Freedom EVO is delivered only to Tecan authorized field service engineers, who take responsibility for assessing and investigating each installation at an end-user site to comply with local requirements.

Optional Instrument Placing

Optionally, instruments like for example a centrifuge can be placed in the cabinet (optional) underneath the worktable.

3.1.1 Freedom EVO Overview

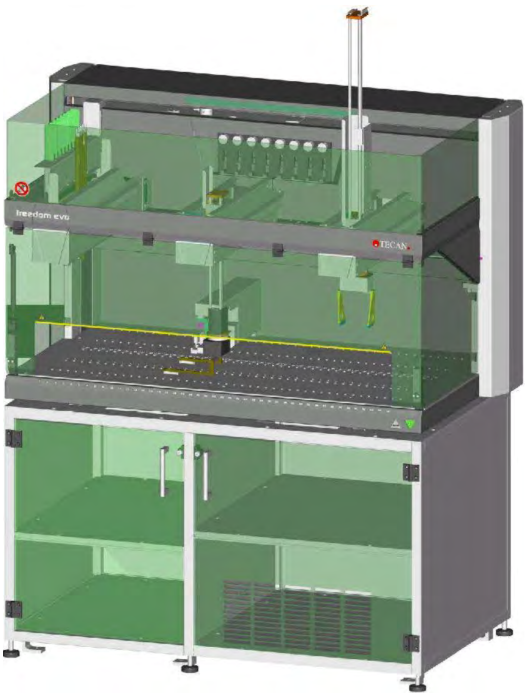


Fig. 3-1 Freedom EVO instrument overview

3.1.2 Product Identification and Labeling

Type Plate

Details for product identification can be read from the type plate, which is located on the back side of the instrument near the power inlet.

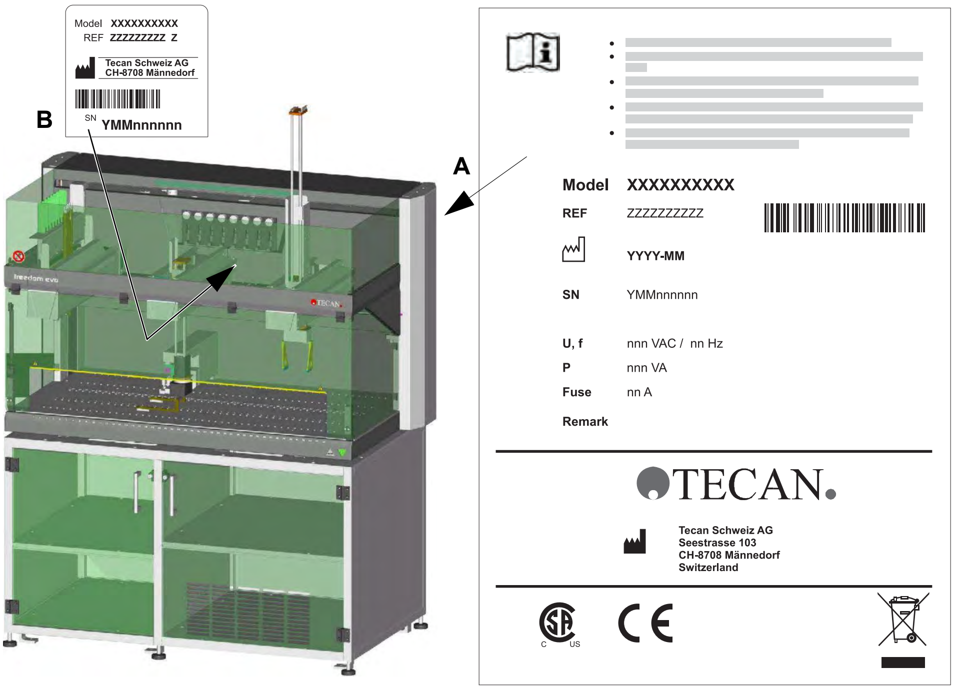


Fig. 3-2 Freedom EVO

On the type plate (A) you find the following information:

- Identification data
  - Model
  - REF: Ordering information (material number)/revision level
  - Production date
  - SN: Serial number
- Technical data
  - U, f: Supply voltage (Volts), frequency (Hertz)
  - P: Power consumption (VA)
  - Fuse: Required fuse protection (A)
- Manufacturer’s name and address
- Conformity marking

More details of product identification, such as specific data of the instrument according to the order configuration, can be taken from the **Freedom EVO Maintenance and Service Logbook**.

Serial Number Label

The identification data is also printed on the serial number label (B). This label can be viewed from the front side of the instrument. It is attached below the diluters.

3.2 Technical Data

3.2.1 Dimensions and Weights

Instrument Overall Dimensions

The figure shows the dimensions of the different instrument versions:

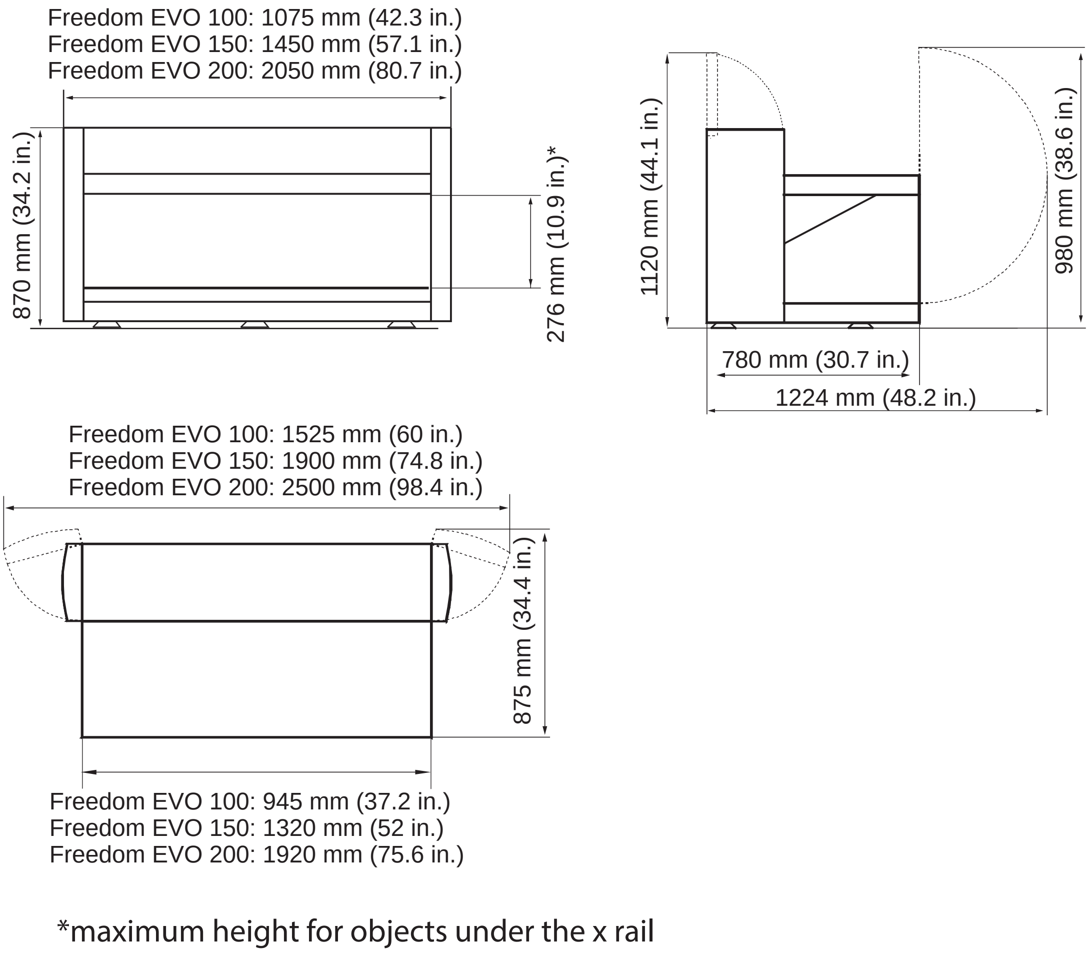


Fig. 3-3 *Instrument overall dimensions*

Instrument Height

Tab. 3-1 Instrument heights

Instrument equipped with:	Instrument height:	
Liquid handling arm, LiHa	980 mm	38.6 in.
Air displacement pipetting arm, Air LiHa	1070 mm	42.1 in.
Multichannel arm, MCA96	870 mm	34.3 in.
Multichannel arm, MCA384	910 mm	35.8 in.
MCA384 Gripper	976 mm	38.4 in.
Robotic manipulator arm, RoMa	920 mm	36.2 in.
Robotic manipulator arm long, RoMa long	1275 mm	50.2 in.
Pick and place arm, PnP	975 mm	38.4 in.

Cabinet Weight and Dimensions

Tab. 3-2 Cabinet weight and dimensions

	Cabinet 100	Cabinet 150	Cabinet 200	Cabinet for Carousel or extensions
Length	940 mm/37.0 in.	1315 mm/51.7 in.	1915 mm/75.3 in.	795 mm/31.3 in.
Depth	780 mm/30.7 in.	780 mm/30.7 in.	780 mm/30.7 in.	780 mm/30.7 in.
Height	765 mm/30.1 in.	765 mm/30.1 in.	765 mm/30.1 in.	765 mm/30.1 in.
Weight	35 kg/77 lbs	44 kg/97 lbs	65 kg/143.3 lbs	34 kg/75 lbs

Weights

Tab. 3-3 Instrument/modules weights

	Freedom EVO 100	**Freedom EVO 150**	**Freedom EVO 200**
Platform	110 kg / 242.5 lbs	130 kg / 286.6 lbs	182 kg / 401.2 lbs
LiHa	9 kg / 19.8 lbs	9 kg / 19.8 lbs	9 kg / 19.8 lbs
Air LiHa	9.5 kg / 20.9 lbs	9.5 kg / 20.9 lbs	9.5 kg / 20.9 lbs
MCA96 complete	18.1 kg / 39,9 lbs	18.1 kg / 39,9 lbs	18.1 kg / 39,9 lbs
MCA96 arm[a)]	11.9 kg / 26.2 lbs	11.9 kg / 26.2 lbs	11.9 kg / 26.2 lbs
MCA X-carriage	0.8 kg / 1.8 lbs	0.8 kg / 1.8 lbs	0.8 kg / 1.8 lbs
MCA96 head	4.8 kg / 10.6 lbs	4.8 kg / 10.6 lbs	4.8 kg / 10.6 lbs
MCA96 gripper	0.6 kg / 1.3 lbs	0.6 kg / 1.3 lbs	0.6 kg / 1.3 lbs
MCA384	10.8 kg / 23.8 lbs	10.8 kg / 23.8 lbs	10.8 kg / 23.8 lbs
MCA384 head	6.9 kg / 15.2 lbs	6.9 kg / 15.2 lbs	6.9 kg / 15.2 lbs
MCA384 Gripper	5.2kg / 11.5 lbs	5.2kg / 11.5 lbs	5.2kg / 11.5 lbs
RoMa standard	6.9 kg / 15.2 lbs	6.9 kg / 15.2 lbs	6.9 kg / 15.2 lbs
RoMa long	8.2 kg / 18.1 lbs	8.2 kg / 18.1 lbs	8.2 kg / 18.1 lbs
PnP	6.4 kg / 14.1 lbs	6.4 kg / 14.1 lbs	6.4 kg / 14.1 lbs
XP SMART[b) c)]	0.8 kg / 1.8 lbs	0.8 kg / 1.8 lbs	0.8 kg / 1.8 lbs
PosID	8.9 kg / 19.6 lbs	8.9 kg / 19.6 lbs	8.9 kg / 19.6 lbs
Packaging	31.5 kg / 69.4 lbs	50.5 kg/111.3 lbs	70 kg/154.3 lbs

a) Without X-carriage, head and gripper
b) Two, four, or eight diluters, according to instrument configuration
c) Up to 16 diluters for instrument with 2 LiHas

Tab. 3-4 Options weights

FWO/SPO/MPO	2 kg (4.4 lbs)
Te-Link	3.1 kg (6.8 lbs)

3.2.2 Worktable Access Range

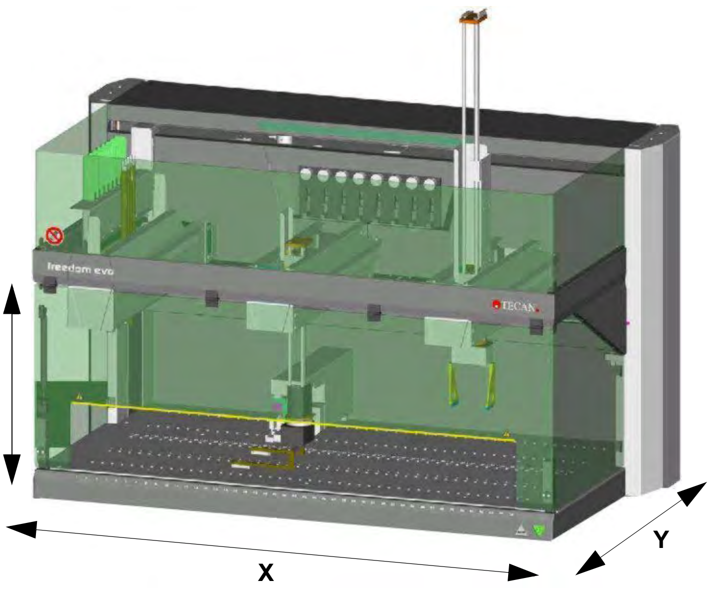


Fig. 3-4 *Worktable access range*

The RoMa Long reaches maximally 350 mm (13.78 in) underneath the worktable (measured from worktable surface).

Worktable Dimensions

Tab. 3-5 *Worktable dimensions*

	Freedom EVO 100	Freedom EVO 150	Freedom EVO 200
Accessible X-range (X-travel)	757 mm (29.8 in.)[a)] 659 mm (25.9 in.)[b)]	1132 mm (44.6 in.) 1034 mm (40.6 in.)	1732 mm (68.2 in.) 1634 mm (64.3 in.)
Accessible Y-range (Y-travel)	Depending on LiHa type: Refer to Tab. 3-20 , 2 3-32 and Tab. 3-37, 2 3-49		
Accessible Z-range	Refer to Tab. 3-21 , 2 3-33 and Tab. 3-38, 2 3-50.		
Grid positions on worktable[c)]	30	45	69
Worktable cutout for centrifuge	See Fig. 3-5 , 2 3-7.		

a) With one arm (LiHa, Air LiHa, RoMa or PnP); each additional arm reduces the range by 130 mm (5.1 in.)
b) With a multichannel arm, MCA96 reduces the range by 230 mm (9.1 in.)
c) Spacing of positioning pins: 25 mm (0.98 in.)

The following figures show the dimensions of the worktable cutouts for a centrifuge in the cabinet under the worktable:

Note: *Several combinations of different cutouts (position on the left or on the right side; or on both sides, shape) in the worktable are possible.*

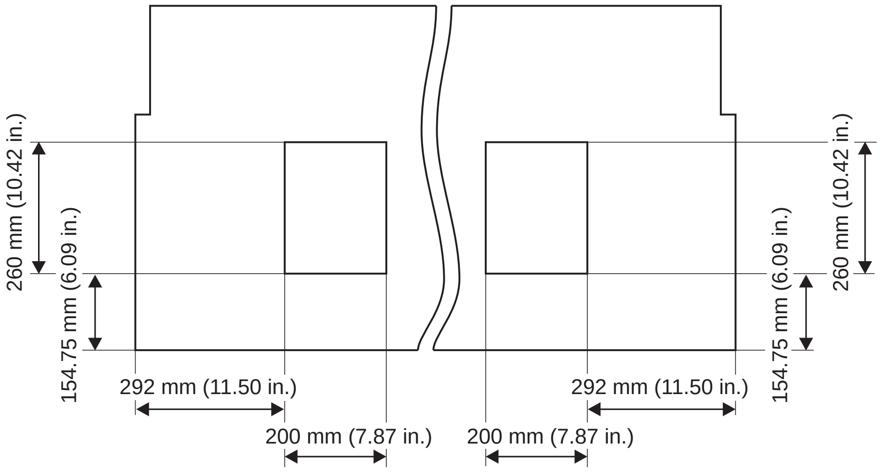


Fig. 3-5 *Cutout for centrifuge, on the right or the left side (or both sides)*

3.2.3 Worktable Types

There are two different worktable types available. The following table lists the characteristics of the two types:

Tab. 3-6 *Worktable types*

Aluminium, coated	Stainless steel
• Coating not resistant to strong cleaning agents, like bleach, etc. • Standard finish	• Highly resistant to chemicals, like cleaning agents, etc. • Exclusive finish

3.2.4 Safety Panel Opening

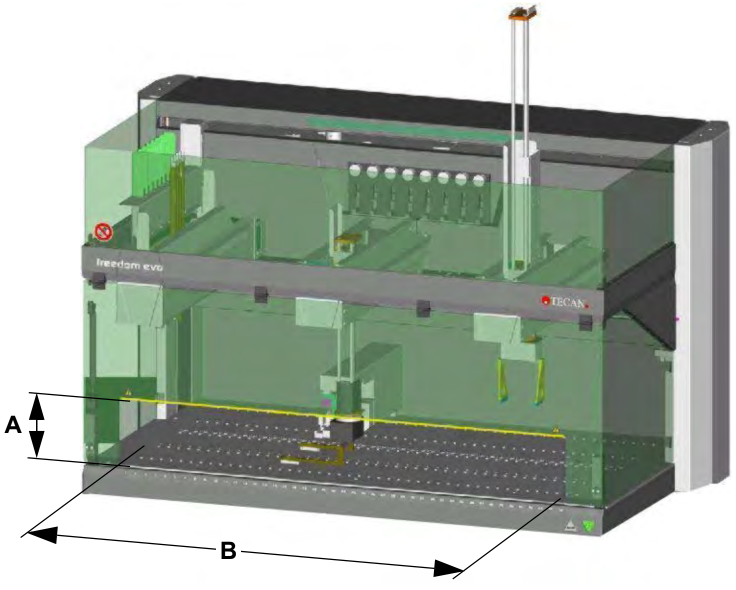


Fig. 3-6 *Safety panel opening*

A *Height of safety panel opening* ***B*** *Width of safety panel opening*

Dimensions

Dimensions of the opening in the front safety panel:

- Freedom EVO 100: 755 x 170 mm (29.7 x 6.7 in.)
- Freedom EVO 150: 1130 x 170 mm (44.5 x 6.7 in.)
- Freedom EVO 200: 1730 x 170 mm (68.1 x 6.7 in.)

3.2.5 Supplies

Supply Ratings

Tab. 3-7 Supply ratings

	Freedom EVO 100	Freedom EVO 150, 200
Line voltage (single phase)	100 - 120, 220 - 240 V AC (-15% / +10%)	100 - 120, 220 - 240 V AC (-15% / +10%)
Frequency	50/60 Hz	50/60 Hz
Power	600 VA	1200 VA
Fuses	2 x T10A (instrument power) 2 x T2A (main powered options)	2 x T10A (instrument power) 2 x T2A (main powered options)

***Note:** Considering possible undervoltage on the mains supply, the combined power consumption in the lower input voltage band (100 - 120 VAC) must not exceed 1000 VA in order to keep the input current below the fused values.*

Electrical Safety

Classification with regard to electrical safety according to EN/IEC standards:

Tab. 3-8 Electrical specifications (safety)

Overvoltage category	II	IEC 60664-1
Pollution degree	2	(EN) IEC 61010-1

Power Switch

The power switch is placed at the level of the front access panel. The power switch does not switch the mains voltage directly, but gives a control signal to the power supply.

Tab. 3-9 Power switch specifications

Specification	Description
Circuit break	By unplugging the instrument.
Power on delay	0.2 - 0.5 sec.
Power off delay[a)]	1 - 2 sec.

a) To prevent unintentional switching off, which could result in loss of process data

***Note:** At installation or later movement of the instrument, ensure that it is always possible to unplug the mains cable at the instrument.*

Uninterruptible Power Supply (UPS)

For an optimal operation of instruments and smooth running of the relevant application, Tecan recommends connecting an online UPS, so that the power supply runs via the UPS with a filter effect.

UPS recommendations:

UPS type:	short-circuit-proof
UPS power output:	1.5 times the average consumption of the equipment

For further assistance contact your site manager or your nearest Tecan representative.

Note: *A switched UPS type that switches over to batteries only after network breakdown is not recommended.*

3.2.6 Status Lamp

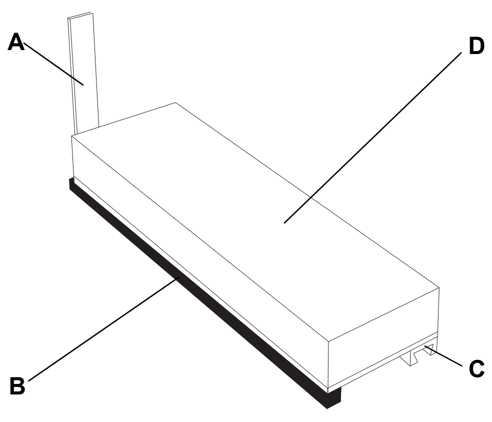
The status lamp is located above the diluters in the center of the instrument front surface. It displays the instrument operational states with red and green light that is either continuous or flashing. When the status lamp light is red, an acoustic alarm sounds (status lamp functions: Refer to 6.1.2 “Display Elements”, 2 6-3).
The illuminated area is 540 x 18 mm (21.26 x 0.7 in.).

3.2.7 Carrier Data

Standard Carriers

Refer to 11.7 “Carriers, Racks, Troughs”, 2 11-10 for information on standard carriers for various containers, such as tubes, microplates and troughs.

Custom Carrier



Carrier for reagents
Solid block, which can be drilled/ milled according to customer’s specific requirements
Width: 3 grid spaces
(75 mm (2.95 in.))

A	*Barcode flag*
B	*Glider*
C	*Positioning rail*
D	*Plastic block*

Fig. 3-7 *Custom carrier (example)*

Custom Carrier Specifications

Customized carriers must fulfil the following specifications:

Width:	25 mm (0.98 in.) or a multiple of 25 mm (0.98 in.) minus 0.5 mm (0.02 in.) to 1.5 mm (0.06 in.); e.g. 74 ±0.5 mm (2.91 ±0.02 in.)	
Height:	Longest tip of instrument configuration	Max. carrier height (uppermost container rim)
	Standard tip	170 mm (6.69 in.)
	10 µl DiTi, with/without filter	220 mm (8.66 in.) [170 mm (6.69 in.)][a]
	200 µl DiTi, with/without filter	210 mm (8.26 in.) [170 mm (6.69 in.)][a]
	1000 µl DiTi, with/without filter	170 mm (6.69 in.)
Length:	max. 316 mm (12.44 in.)	
Weight:[b]	Max. weight (fully loaded): See technical data of PosID.	

a) *If using lower DiTi eject option*
b) *If carrier is intended to be moved by PosID gripper for container barcode identification*

For positive identification by the PosID module:

- All barcodes need to be arranged either horizontally or vertically
- Max. 24 items on one carrier (in several equidistant item spacing groups)
- Also refer to 3.5.9 “Positive Identification (PosID)”, 2 3-78

Carrier Editor

Note: *Customized carriers must be defined by means of the “Carrier editor” software tool to be properly handled by the PosID.*
Refer to the “Instrument Software Manual”.

384-Well Carrier

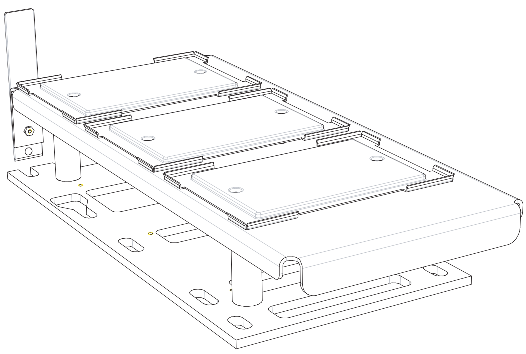


Fig. 3-8 *Carrier for three 384-well microplates*

Note: *Carrier identification by means of the PosID is possible while microplate identification is NOT possible.*

Te-PS Carrier

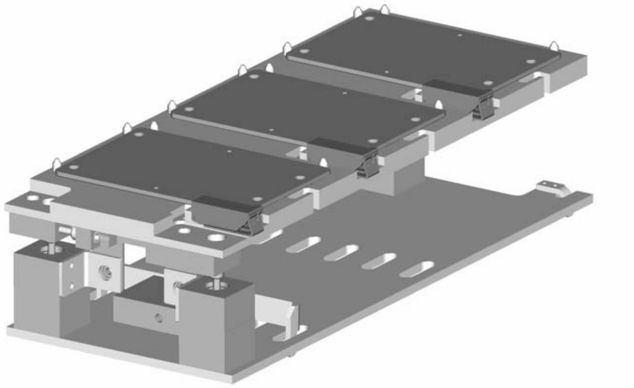


Fig. 3-9 *Te-PS carrier for three 1536-well microplates*

Note: *Carrier identification by means of the PosID is possible while microplate identification is NOT possible.*

Note: *When working with Te-PS, microplates by Greiner are required, in order to ensure exact mechanical accuracy. Accordingly, use Greiner 1536-well microplates.*

Equivalent types with regard to material properties resulting in exactly identical dimensions are acceptable.

3.2.8 Environmental Conditions

All instruments are intended for indoor operation and storage only. The tables below give an overview.

ATTENTION

Barcodes cannot be read due to the influence of sunlight or other light sources on the barcode scanner.

- Do not expose the instrument to direct sunlight.
- Do not install strong light sources that may impair the function of the barcode scanner near the instrument.

Operating Conditions

Operating temperature	15°C to 32°C (59°F to 90°F)
Operating humidity	30% to 80% relative (non condensing) at 30°C (86°F) or below
Operating altitude	max. 2000 m above sea level

Pipetting Conditions

Pipetting temperature	20°C to 27°C (68°F to 80.6°F)
Pipetting humidity	30% to 60% relative (non condensing) at 25°C (77°F) or below

Storage Conditions

Storage temperature	1°C to 60°C (34°F to 140°F)
Storage humidity	5% to 80% relative (non condensing) at 30°C (86°F) or below

Transport Conditions

Transport temperature	-20°C to 60°C (-4°F to 140°F) for maximum 24 hours
Transport humidity	20% to 80% relative (non condensing) for maximum 24 hours

3.2.9 Emission and Immunity

Noise Emission

Noise emission (EN61010-1)	< 85 dBA [61.3 dBA (sound pressure), measured at a distance of 1 m from the instrument]

EMC

The Freedom EVO complies with the emission and immunity requirements described in IEC 61326-1 and IEC 61326-2-6. However, the electromagnetic environment should be evaluated prior to the operation of the Freedom EVO. It is the operator's responsibility to ensure that a compatible electromagnetic environment for the Freedom EVO can be maintained in order that the Freedom EVO will perform as intended.

The Freedom EVO is classified as GROUP 1 CLASS B EQUIPMENT (CISPR 11).

This equipment is designed for use in a BASIC ELECTROMAGNETIC ENVIRONMENT (IEC 61326-1) and PROFESSIONAL HEALTHCARE FACILITY ENVIRONMENT (IEC 61326-2-6).

It is likely to perform incorrectly if used in an INDUSTRIAL ELECTROMAGNETIC ENVIRONMENT (IEC 61326-1) and a HOME HEALTHCARE FACILITY ENVIRONMENT (IEC 61326-2-6).

Do not operate the Freedom EVO in close proximity to sources of strong electromagnetic radiation (e.g., unshielded intentional RF sources), as these can interfere with the proper operation.

FCC 15

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

3.3 Configuration Data

3.3.1 Arm Configuration

Possible Arm Configurations

The Freedom EVO can be equipped with up to three arms. The table shows all possible arm configurations. Depending on the configuration, not all instrument sizes are available (for space and connectivity reasons).

Explanations to the table Tab. 3-10 “Possible arm configurations”, 2 3-15:

- The Freedom EVO can only be equipped with one MultiSense LiHa.
  Since the Air LiHa includes Air LiHa MultiSense functionality it is not possible to have a MultiSense LiHa together with an Air LiHa or two Air LiHas on the same instrument. However, one Air LiHa and one LiHa can be configured in any position combination.
- If there is more than one liquid handling arm (LiHa or Air LiHa), the one labeled as second (2nd) is always mounted on the left side.
- MCA can be a multichannel arm with 96 channel pipetting head or 384 channel pipetting head.

Tab. 3-10 *Possible arm configurations*

<table>
<tr><th rowspan="2">Conf. code a)</th><th rowspan="2">Number of arms</th><th colspan="3">Arm position on instrument</th><th rowspan="2">Possible instrument sizes</th></tr>
<tr><th>Left</th><th>Middle</th><th>Right</th></tr>
<tr><td>2</td><td>1</td><td colspan="3">LiHa</td><td>100
150
200</td></tr>
<tr><td>3</td><td>1</td><td colspan="3">LiHa with MultiSense option</td><td>100
150
200</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">LiHa with Te-Fill option</td><td>100
150
200</td></tr>
<tr><td>5</td><td>1</td><td colspan="3">RoMa</td><td>100
150
200</td></tr>
<tr><td>6</td><td>1</td><td colspan="3">PnP</td><td>100
150
200</td></tr>
<tr><td>7</td><td>1</td><td colspan="3">MCA</td><td>100
150
200</td></tr>
<tr><td>8</td><td>2</td><td>2nd LiHa</td><td>n.a.</td><td>LiHa</td><td>150
200</td></tr>
<tr><td>9</td><td>2</td><td>2nd LiHa with Te-Fill option</td><td>n.a.</td><td>LiHa</td><td>200</td></tr>
<tr><td>10b
10c</td><td>2</td><td>2nd LiHa</td><td>n.a.</td><td>LiHa with Te-Fill option</td><td>200</td></tr>
</table>

Tab. 3-10 Possible arm configurations (cont.)

Conf. code[a)]	Number of arms	Arm position on instrument			Possible instrument sizes
		Left	**Middle**	**Right**	
10e 10f	2	2nd LiHa with MultiSense option	n.a.	LiHa	150 200
11	2	LiHa	n.a.	RoMa	100 150 200
12	2	LiHa with MultiSense option	n.a.	RoMa	100 150 200
13	2	LiHa with Te-Fill option	n.a.	RoMa	100 150 200
14	2	LiHa	n.a.	PnP	100 150 200
15	2	LiHa with MultiSense option	n.a.	PnP	100 150 200
16	2	LiHa with Te-Fill option	n.a.	PnP	100 150 200
17	2	LiHa	n.a.	MCA	150 200
18	2	LiHa with Te-Fill option	n.a.	MCA	150 200
19	2	RoMa	n.a.	LiHa	100 150 200
20	2	RoMa	n.a.	LiHa with MultiSense option	100 150 200
21	2	RoMa	n.a.	LiHa with Te-Fill option	100 150 200
22	2	RoMa	n.a.	RoMa	100 150 200
23	2	RoMa	n.a.	PnP	100 150 200
24	2	RoMa	n.a.	MCA	100 150 200

Tab. 3-10 Possible arm configurations (cont.)

Conf. code[a)]	Number of arms	Arm position on instrument			Possible instrument sizes
		Left	Middle	Right	
25	2	PnP	n.a.	LiHa	100 150 200
26	2	PnP	n.a.	LiHa with MultiSense option	100 150 200
27	2	PnP	n.a.	LiHa with Te-Fill option	100 150 200
28	2	PnP	n.a.	RoMa	100 150 200
29	2	PnP	n.a.	PnP	100 150 200
30	2	MCA	n.a.	LiHa	150 200
31	2	MCA	n.a.	RoMa	100 150 200
32	3	2nd LiHa	LiHa	RoMa	150 200
33	3	2nd LiHa with Te-Fill option	LiHa	RoMa	200
34	3	2nd LiHa	LiHa with Te-Fill option	RoMa	200
35	3	2nd LiHa	LiHa	PnP	150 200
36	3	2nd LiHa with Te-Fill option	LiHa	PnP	200
37	3	2nd LiHa	LiHa with Te-Fill option	PnP	200
38	3	LiHa	RoMa	RoMa	150 200
39	3	LiHa with MultiSense option	RoMa	RoMa	150 200
40	3	LiHa with Te-Fill option	RoMa	RoMa	150 200
41	3	LiHa	RoMa	PnP	150 200

Tab. 3-10 Possible arm configurations (cont.)

Conf. code[a)]	Number of arms	Arm position on instrument			Possible instrument sizes
		Left	Middle	Right	
42	3	LiHa with MultiSense option	RoMa	PnP	150 200
43	3	LiHa with Te-Fill option	RoMa	PnP	150 200
44	3	LiHa	PnP	RoMa	150 200
45	3	LiHa with MultiSense option	PnP	RoMa	150 200
46	3	LiHa with Te-Fill option	PnP	RoMa	150 200
47	3	LiHa	PnP	PnP	150 200
48	3	LiHa with MultiSense option	PnP	PnP	150 200
49	3	LiHa with Te-Fill option	PnP	PnP	150 200
50	3	LiHa	MCA	RoMa	150 200
51	3	LiHa with Te-Fill option	MCA	RoMa	150 200
52	3	LiHa	RoMa	MCA	150 200
53	3	LiHa with Te-Fill option	RoMa	MCA	150 200
54	3	RoMa	2nd LiHa	LiHa	150 200
55	3	RoMa	2nd LiHa with Te-Fill option	LiHa	200
56	3	RoMa	2nd LiHa	LiHa with Te-Fill option	200
57	3	RoMa	LiHa	RoMa	150 200
58	3	RoMa	LiHa with MultiSense option	RoMa	150 200
59	3	RoMa	LiHa with Te-Fill option	RoMa	150 200
60	3	RoMa	LiHa	PnP	150 200

Tab. 3-10 Possible arm configurations (cont.)

Conf. code a)	Number of arms	Arm position on instrument			Possible instrument sizes
		Left	Middle	Right	
61	3	RoMa	LiHa with MultiSense option	PnP	150 200
62	3	RoMa	LiHa with Te-Fill option	PnP	150 200
63	3	RoMa	RoMa	LiHa	150 200
64	3	RoMa	RoMa	LiHa with MultiSense option	150 200
65	3	RoMa	RoMa	LiHa with Te-Fill option	150 200
66	3	RoMa	RoMa	PnP	150 200
67	3	RoMa	PnP	LiHa	150 200
68	3	RoMa	PnP	LiHa with MultiSense option	150 200
69	3	RoMa	PnP	LiHa with Te-Fill option	150 200
70	3	RoMa	PnP	RoMa	150 200
71	3	RoMa	PnP	PnP	150 200
72	3	RoMa	MCA	RoMa	150 200
73	3	RoMa	LiHa	MCA	150 200
74	3	PnP	2nd LiHa	LiHa	150 200
75	3	PnP	2nd LiHa with Te-Fill option	LiHa	200
76	3	PnP	2nd LiHa	LiHa with Te-Fill option	200
77	3	PnP	LiHa	RoMa	150 200
78	3	PnP	LiHa with MultiSense option	RoMa	150 200
79	3	PnP	LiHa with Te-Fill option	RoMa	150 200

TECAN.

Tab. 3-10 Possible arm configurations (cont.)

Conf. code[a)]	Number of arms	Arm position on instrument			Possible instrument sizes
		Left	Middle	Right	
80	3	PnP	LiHa	PnP	150 200
81	3	PnP	LiHa with MultiSense option	PnP	150 200
82	3	PnP	LiHa with Te-Fill option	PnP	150 200
83	3	PnP	RoMa	LiHa	150 200
84	3	PnP	RoMa	LiHa with MultiSense option	150 200
85	3	PnP	RoMa	LiHa with Te-Fill option	150 200
86	3	PnP	RoMa	RoMa	150 200
87	3	PnP	RoMa	PnP	150 200
88	3	PnP	PnP	LiHa	150 200
89	3	PnP	PnP	LiHa with MultiSense option	150 200
90	3	PnP	PnP	LiHa with Te-Fill option	150 200
91	3	PnP	PnP	RoMa	150 200
92	3	MCA	LiHa	RoMa	150 200
93	2	LiHa with MultiSense option	n.a.	MCA	150 200
94	3	LiHa with MultiSense option	RoMa	MCA	150 200
96 97	2	LiHa with MultiSense option	n.a.	LiHa	150 200
98	3	2nd LiHa with MultiSense option	LiHa	RoMa	150 200
100	3	2nd LiHa with MultiSense option	LiHa	PnP	150 200
102	3	RoMa	2nd LiHa with MultiSense option	LiHa	150 200

Tab. 3-10 Possible arm configurations (cont.)

Conf. code a)	Number of arms	Arm position on instrument			Possible instrument sizes
		Left	Middle	Right	
103	3	PnP	2nd LiHa with MultiSense option	LiHa	150 200
104	3	MCA	LiHa	RoMa	150 200
105	3	RoMa	MCA	LiHa	150 200
106	3	PnP	RoMa	MCA	150 200
107	3	MCA	RoMa	LiHa	150 200
120 121 122	1	Air LiHa			100 150 200
124 125	2	2nd Air LiHa	n.a.	LiHa	150 200
126 127 128	2	Air LiHa	n.a.	RoMa	100 150 200
129 130 131	2	Air LiHa	n.a	PnP	100 150 200
132 133 134	2	RoMa	n.a.	Air LiHa	100 150 200
135 136 137	2	PnP	n.a.	Air LiHa	100 150 200
138	3	Air LiHa	RoMa	RoMa	150 200
139	3	Air LiHa	RoMa	PnP	150 200
140	3	Air LiHa	PnP	RoMa	150 200
141	3	Air LiHa	PnP	PnP	150 200
142	3	RoMa	Air LiHa	RoMa	150 200
143	3	RoMa	Air LiHa	PnP	150 200

Tab. 3-10 Possible arm configurations (cont.)

Conf. code[a)]	Number of arms	Arm position on instrument			Possible instrument sizes
		Left	**Middle**	**Right**	
144	3	RoMa	RoMa	Air LiHa	150 200
145	3	RoMa	PnP	Air LiHa	150 200
146	3	PnP	Air LiHa	RoMa	150 200
147	3	PnP	Air LiHa	PnP	150 200
148	3	PnP	RoMa	Air LiHa	150 200
149	3	PnP	PnP	Air LiHa	150 200
150	3	2^{nd} Air LiHa	LiHa	RoMa	150 200
152	3	2^{nd} Air LiHa	LiHa	PnP	150 200
154	3	RoMa	2^{nd} Air LiHa	LiHa	150 200
155	3	PnP	2^{nd} Air LiHa	LiHa	150 200
157 158	2	2^{nd} LiHa	n.a.	Air LiHa	150 200
160 161	2	2^{nd} LiHa with Te-Fill option	n.a.	Air LiHa	200
163 164	2	2^{nd} Air LiHa	n.a.	LiHa with Te-Fill option	200
165	3	2^{nd} Air LiHa	LiHa with Te-Fill option	RoMa	200
167	3	RoMa	2^{nd} Air LiHa	LiHa with Te-Fill option	200
168	3	2^{nd} LiHa with Te-Fill option	Air LiHa	RoMa	200
170	3	RoMa	2^{nd} LiHa with Te-Fill option	Air LiHa	200
171	3	2^{nd} Air LiHa	LiHa with Te-Fill option	PnP	200
173	3	PnP	2^{nd} Air LiHa	LiHa with Te-Fill option	200
174	3	2^{nd} LiHa with Te-Fill option	Air LiHa	PnP	200

Tab. 3-10 Possible arm configurations (cont.)

Conf. code[a)]	Number of arms	Arm position on instrument			Possible instrument sizes
		Left	Middle	Right	
176	3	PnP	2nd LiHa with Te-Fill option	Air LiHa	200
177 178	2	Air LiHa	n.a.	MCA	150 200
179 180	2	MCA	n.a.	Air LiHa	150 200
181	3	Air LiHa	RoMa	MCA	150 200
182	3	Air LiHa	MCA	RoMa	150 200
183	3	MCA	RoMa	Air LiHa	150 200
184	3	RoMa	MCA	Air LiHa	150 200
185	3	MCA	Air LiHa	RoMa	150 200
186	3	RoMa	Air LiHa	MCA	150 200

a) Configuration codes: Missing numbers stand for special configurations which are not available as standard products

Note: *If there are two LiHas, the one on the right side is always the "first" (standard) LiHa. Consequently, the one on the left side is looked upon as the "second" LiHa.*

- *Refer to section 3.5.1.2 "Instrument with two LiHas", 2 3-42*
- *Refer to section 3.5.1.3 "Limitations on Instruments with two LiHas", 2 3-42.*

General Notes

Note: *Pay attention to the following:*

- *Configurations other than listed in the above table are either not standard or not possible.*
- *If there is a RoMa installed on the left side, its rotation range is mirrored as compared to a RoMa on the right side.*
  However, this combination can be changed by a Tecan authorized field service engineer.

Upgradeability

An existing Freedom EVO instrument can be upgraded with a liquid handling arm, an air (displacement) liquid handling arm, a multichannel arm, a robotic manipulator arm or a pick and place arm.

Also a **Pos**itive **Id**entification (PosID; barcode scanner) or any other optional module can be installed at a later date after the initial installation.

Field upgrades can be performed by Tecan authorized field service engineers, FSEs, only.

Optionally, the Freedom EVO platform can be placed onto a cabinet, and a microplate centrifuge and/or microplate reader can be installed as follows:

- Centrifuge: In cabinet underneath the worktable.
- Possible locations for reader: On the worktable extension on the right side of the instrument (extension to main cabinet required in this case, e.g. an external cabinet or another suitable table).

3.3.1.1 Air LiHa Configuration

The Air LiHa can be used on:

- Freedom EVO 100, 150, 200

Note: *Instruments with two liquid handling arms: Only one of the liquid handling arms can be an Air LiHa (see also explanations at the beginning of section* *3.3.1 "Arm Configuration", 2 3-15**).*

The Air LiHa is always equipped with a lower DiTi eject device and features the Air LiHa MultiSense functions.

3.3.1.2 LiHa MultiSense Configurations

The MultiSense option can be used with:

- Freedom EVO 100, 150, 200

LiHa MultiSense Configurations

A LiHa equipped with the MultiSense option must have at least 4 liquid handling channels. The following configurations are available:

Tab. 3-11 *LiHa configurations with MultiSense option*

LiHa configuration	8 channels	4 channels
Total number of LH channels:	8	4
Number of LH channels that can be equipped with the MultiSense option:	4 or 8	4

Two LiHa Arms

Limitations for instruments with two liquid handling arms when using the MultiSense option:

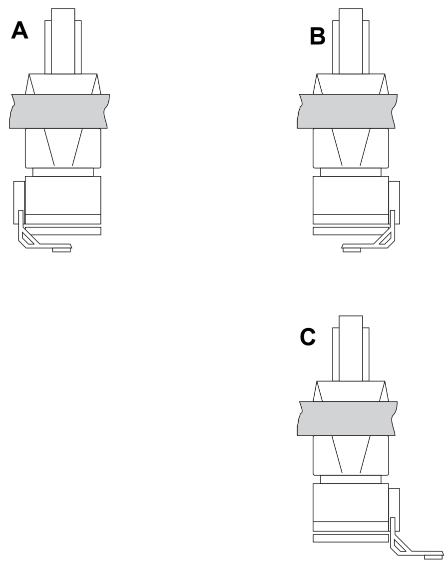
- No third arm (RoMa, PnP) can be in between the two LiHa arms.

Upgradeability

The MultiSense option will be factory installed when ordered with the instrument. Existing instruments can be upgraded at the user's site by a Tecan authorized field service engineer.

3.3.1.3 MCA96 Gripper Configurations

The gripper module (option) and the gripper fingers can be mounted to the MCA96 in different ways.



The figure shows all possible gripper configurations on the MCA96.

Note: *The user can change the gripper configuration from B to C (or vice versa) by him/herself. Refer to 5.1.3 "Mounting MCA96 Gripper Fingers", 2 5-3.*

- ***A*** *Gripper module on the left Gripper fingers inwardly mounted*
- ***B*** *Gripper module on the right Gripper fingers inwardly mounted*
- ***C*** *Gripper module on the right Gripper fingers outwardly mounted*

Fig. 3-10 *MCA96 gripper configurations*

Note: *According to the gripper configuration, there are restrictions to the plate handling abilities of the MCA96. These must be considered when defining the configuration.*

3.3.2 Reader Configurations

The table shows the possible reader configurations with regard to the reader's location:

Tab. 3-12 *Reader locations*

Reader Type	Infinite F50	Infinite 200	Infinite 500/1000	Spark	Sunrise
Installation on workta-ble extension[a)]	possible	possible	possible	possible	possible
Installation on workta-ble[b)]	possible	possible	not possible	not possible	possible

a) On the right of the instrument
b) In the rear of the worktable

Note: *For the implementation of a reader the corresponding adapter plate must be available. The reader must be installed and set up by an authorized field service engineer. If the reader is to be installed on an existing instrument, it may be necessary to upgrade the instrument first.*

Note: *The Sunrise reader can be placed on the worktable of the instrument. An adapter plate is not needed for this reader type.*

3.3.3 Optional Equipment

The following optional equipment is available and described in this Operating Manual:

Tab. 3-13 *Optional equipment*

Designation	Abbreviation
Liquid handling arm with 2 channels	LiHa/2
Liquid handling arm with 4 channels	LiHa/4
Liquid handling arm with 8 channels	LiHa/8
Air displacement pipetting arm with 4 channels	Air LiHa/4
Air displacement pipetting arm with 8 channels	Air LiHa/8
Multichannel arm with 96 channels	MCA96
Multichannel arm with 96 channels and gripper module	MCA96/G
Multichannel arm with 384 channels	MCA384
Multichannel arm with 384 channels and MCA384 Gripper	MCA384/G
Robotic manipulator arm	RoMa
Robotic manipulator arm	RoMa long

Tab. 3-13 Optional equipment (cont.)

Designation	Abbreviation
Pick and place arm	PnP
Positive identification option	PosID
Active worktable with loading interface	–
Low volume option	LVO
Large volume dispense module	Te-Fill
Monitored pump option, MPO	MPO
Sensored pump option, SPO	SPO
Fast wash option	FaWa
Lower disposable tip eject option	DiTi eject
Flask flipper	–
Standard tips	–
Low volume tips	LV tips
Disposable tips	DiTi
Tecan positioning system	Te-PS
Shuttle carrier	Te-Link

Te-PS Option

The Te-PS option is designed to ensure precise access to 1536-well microplates (according to ANSI/SLAS-standards) placed on a special Te-PS carrier for dispensing and aspirating liquids. It comprises:

- Te-PS carrier
- Te-PS tips
- Te-PS sensor plate

Compatibility

The Te-PS option is compatible to standard installations, including PosID (no barcode identification on microplates).
The Te-PS option is compatible with standard instrument operation including RoMa, PnP, and incubator (MIO).

ATTENTION

Possible malfunction, mechanical imprecision. When using the Te-PS system, do not pierce any microplate seals. The resulting strain on tips and LiHa can lead to a loss of precision critical for the Te-PS system.

Te-PS Option General Specifications

Tab. 3-14 Te-PS option specifications

Specification	Description
Calibration check	System check (reliability of access to 1536-well microplates with current setup) duration < 3 min. including user information
Liquid level detection	No liquid level detection is possible for aspiration from 1536-well microplates.
Operating conditions	Calibration sufficient for operation in temperature zones equivalent to 5 °C.
Precision	Access to wells in supported 1536-well microplates with well diameter of: 1.6 to 1.8 mm without tip contact on plate surface or walls 1.4 to 1.6 mm with slight tip contact allowed on inner well walls
Supported microplates	Greiner and Matrix 1536 microplates

Te-PS Sensor Plate Specifications

Tab. 3-15 Te-PS sensor plate specifications

Specification	Description
Dimensions	Basic shape: microplate format according to ANSI/SLAS-standards Length: 127.75 ± 0.25 mm Width: 85.5 ± 0.25 mm Height: 34 ± 0.5 mm
Sensor	– 1 measurement position – 2 crossed light barriers, arranged orthogonally – coordinate system of light barriers twisted 45° relative to worktable coordinate system – measurement position arranged in a groove in parallel and close to one short edge of the basic plate
Accuracy	Sensor accuracy: ± 0.05 mm Signal processing: ± 0.05 mm Total: ± 0.1 mm
Calibration	± 0.02 mm

Te-PS Carrier Specifications

Tab. 3-16 Te-PS carrier specifications

Specification	Description
Dimensions	Carrier for 3 microplates, landscape orientation, width: 6 grid positions (150 mm/5.9 in.)
Accessibility	– by RoMa – by LiHa – by Air LiHa
Accuracy	Clamping mechanism, referencing to well A1 MP retainer (X, Y): ±0.05 mm surface flatness (Z): ± 1 mm
Adjustment	Adjustable parallelism to: – Y-axis (LiHa) – Z-plane
Cabling	retainer for the CAN cable of the Te-PS sensor plate, for permanent placement of the Te-PS sensor plate on microplate positions 1 or 3

Te-PS Tip Specifications

Tab. 3-17 Te-PS Tip specifications

Specification	Description
Pipetting volume range	0.5 to 85 µl (sample stays inside stainless steel tip) or syringe volume (sample in contact with stainless steel and FEP tubing). Example: 250 µl syringe: for multi pipetting (24*10 µl), resolution: 83.3 nl, i.e. 16.7% of 500 nl
Coating	The coating, as well as the whole tip, is designed for the following liquid samples: water, aqueous solutions, DMSO, acetonitrile, alcohols (ethanol, isopropanol), and strong acids/ alkali 0.1 M.
Dimensions:	
– usable length	50 mm (1.97 in.) (access to deep-well plates for aspiration)
– total length	70 mm (2.75 in.)
– lower tip diameter	0.5 mm outer, 0.3 inner diameter
Adjustment	Lock nuts comprising adjustment screws for X-Y adjustment

Pipetting in 1536-well Microplates

For pipetting in 1536-well Microplates with Te-PS Tips:
Best results are obtained when very slow speeds are applied.
Contact or minimal distance, together with retract should be used for dispensing.

Te-Link

Te-Link Specifications

Tab. 3-18 Te-Link specifications

Specification	Description
Outer dimensions	Length: 710 mm (28 in.) Width: 149 mm (5.9 in.) [160 mm (6.3 in.) with acrylic glass cover] Height: 67 mm (2.64 in.) [115 mm (4.53 in.) with acrylic glass cover]
Operating X-range	557 mm (22 in.)
Maximum X-speed	500 mm/sec.
Resolution	0.1 mm
Positioning accuracy	± 0.5 mm
Accessibility	RoMa standard, RoMa long, LiHa
Max. load	350 g (0.77 lbs)
Power consumption	5 W

3.4 Requirements

3.4.1 Computer Requirements

- USB port (standard)
  Required if instrument is equipped with MultiSense option or Air LiHa
- or RS232 port (optional)

Also refer to the Instrument Software Manual and to the Freedom EVOware Software Manual for details on minimal computer requirements.

3.4.2 Software Requirements

If you use an Application Software other than those listed in Tab. 3-19, 2 3-30, please ensure that this Application Software has been released for use with the Freedom EVO.

Tab. 3-19 Software requirements

Instrument Software	V6.2 or higher
Freedom EVOware Freedom EVOware Plus	V2.2 or higher
EVO Logic Software	V3.0 or higher

3.4.3 System Liquid Requirements

System Liquid

System liquid refers to a liquid which fills the liquid system and is used as wash fluid.

- Standard liquid
  - Deionized or distilled water with a conductivity between 0.5 µS/cm and 10 µS/cm
- Special system liquid
  - DMSO: Special resistant tubing needs to be installed
- The system liquid must be free of particles.
- Make sure that the system liquid container is clean.
- The system liquid must be free of air bubbles and must be room temperature.
- To reach the pipetting performance we recommend degassing the system liquid. For further information on this issue, please contact your responsible application specialist.
- In order to ensure that during operation no air bubbles form in the pipetting tubing, a sufficient quantity of system liquid must circulate in the system. We recommend at least 60 ml per hour.

Any additives to the system liquid must be validated to evaluate the influence on the pipetting performance and the overall analytical process.

3.4.4 Sample Requirements

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Sample preparation	See section 6.3.4.3 “Preparation of Samples”, 2 6-19

The instrument is validated for pipetting deionized water. Other liquids are only allowed after validation according to laboratory practice and state-of -the art by the kit manufacturer or operator of the system.
For sample preparation refer to cross references above.

3.5 System Modules

The system modules are briefly introduced in the following sections. According to your order configuration, some of these options might be installed.

3.5.1 Liquid Handling Arm (LiHa)

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Disposable tips, DiTis	See section 11.9.2 “Disposable Tips and Accessories”, 2 11-24
Carry over	See section 6.4.2.2 “Liquid Handling With LiHa”, 2 6-28
Gravimetric precision test	See Tab. 3-27 “Pipetting precision, tested with Setup & Service Software”, 2 3-36 and 7.4.1 “Liquid Handling Performance Verification Testing”, 2 7-80

The Freedom EVO instrument can be equipped with up to two liquid handling arms.
The LiHa arm is used for pipetting actions in different volume ranges, depending on the tip types used and the features of the liquid system.
The Freedom EVO instrument can be equipped with one or two liquid handling arms with 2, 4 or 8 tips, depending on the desired configuration.

LiHa Operating Ranges

Tab. 3-20 *LiHa operating ranges (relative movement)*

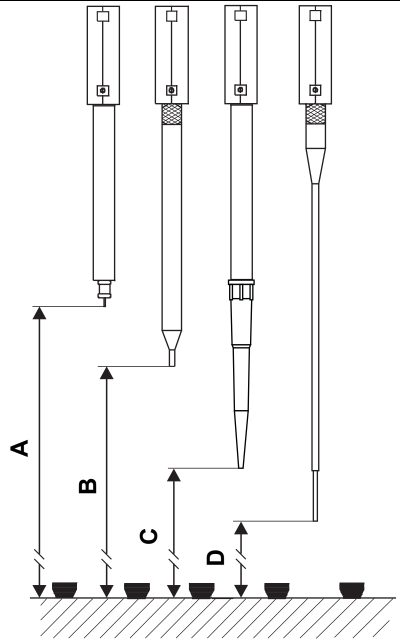
Axis	LiHa type	Freedom EVO
X-axis	All	Refer to Tab. 3-5 , 2 3-6
Y-axis	2-tip LiHa	409 mm (16.1 in.)
	4-tip LiHa[a)]	409 mm (16.1 in.)
	8-tip LiHa[a)]	373 mm (14.7 in.)
Z-axis[b)]	All	210 mm (8.27 in.)

a) at 9 mm spacing
b) each channel individually, no tips installed

Tip Clearance

The tip clearance is the maximum space between the worktable surface and the mounted tip (initial position).

Tab. 3-21 *Tip clearance*

Distance tip to worktable[a)]	Tip type	Tip clearance
	DiTi adapter (A)	260 mm (10.24 in.)
	Reference tip (B)	210 mm (8.27 in.)
	DiTi 10 µl (C)	242 mm (9.53 in.)
	DiTi 50 µl (C)	216 mm (8.50 in.)
	DiTi 200 µl (C)	215 mm (8.46 in.)
	DiTi 350 µl (C)	215 mm (8.46 in.)
	DiTi 1000 µl (C)	178 (7.01 in.)
	DiTi 5000 µl (C)	164 mm (6.46 in.)
	Standard tip (D)[b)]	171 mm (6.73 in.)
	Te-PS tip	237 mm (9.33 in.)

a) Illustration not to scale, tip clearance shortened
b) Fixed tip, standard and low volume, 384 standard and low volume

LiHa Precision

Tab. 3-22 *LiHa positioning accuracy at 9 mm spacing, with all 8 tips simultaneously*

Axis	Accuracy
X	±0.4 mm (0.016 in.)
Y	±0.4 mm (0.016 in.)
Z	±0.4 mm (0.016 in.)[a)]

a) Worn parts may result in deterioration of accuracy

Tab. 3-23 *LiHa repeatability at 9 mm spacing, with all 8 tips simultaneously*

Axis	Repeatability
X	±0.15 mm (0.006 in.)
Y	±0.15 mm (0.006 in.)
Z	±0.3 mm (0.012 in.)[a)]

a) Worn parts may result in deterioration of repeatability

Tip Configuration

Each channel of a liquid handling arm can be equipped with any type of tip, i.e. disposable tips (all sizes), fixed tips (all sizes, different coatings, different lengths), and Te-PS tips. Any combination can be used on a single liquid handling arm. However, only certain combinations can be tested with the gravimetric test (refer to cross references above).

Some software packages assume that for mixed tip configurations, the disposable tips are mounted on the front channels.

Original Tecan tips must be used exclusively.

Equidistant Tip Movement

The equidistant movement of sampling tips in Y direction is:

- from 9 mm ± 0.4 mm
- to 38 mm ± 1 mm

Fixed Tip Coatings

The tips are made of stainless steel, in standard and low volume size, and are quite hydrophilic and porous. To increase the hydrophobicity, several coatings are used:

- Soft PTFE outside coating for aqueous solutions,
- Hard PTFE outside coating for aqueous solutions to improve durability of the tips
- Hard PTFE outside coating for DMSO resistant tips.

The outer tip coating is either soft or hard PTFE (DMSO resistant). Two tip types designed to solve special carry over problems are available with either PTFE or ceramic inner coating. However, where no carry over is tolerable, the use of disposable tips with filters is strongly recommended.

Disposable Tips

Use only Tecan disposable tips. Conductive disposable tips are available with or without filter, in following volumes:

- 5000 µl
- 1000 µl
- 350 µl
- 200 µl
- 50 µl
- 10 µl (low volume disposable tip)

Refer to cross references above for details.

DiTi Carrier

A DiTi Carrier holds up to three trays of 96 disposable tips.

Syringe Volumes

The table below gives an overview of instruments and recommended application of syringe volumes.

Tab. 3-24 Syringe Volumes

Syringe volumes	Standard system	Low volume option	Te-PS
25 µl	—	—	25 µl
50 µl	—	—	50 µl
250 µl	—	250 µl	250 µl
0.5 ml	—	500 µl	—
1.0 ml	1000 µl	—	—
2.5 ml	2500 µl	—	—
5.0 ml	5000 µl	—	—

Free Dispense Volumes

The following minimum free dispense volumes can be achieved with the various tip types.

Tab. 3-25 Minimum free dispense volumes in single pipetting mode with deionized water

Tip type	Min. volumes
Fixed tip standard	10 µl[a)]
Fixed tip low volume with low volume option	1 µl
Disposable tip 200 µl	10 µl[a)]
Disposable tip 10 µl with low volume option	1 µl
Te-PS tips	1 µl

a) *Also for plasma and serum*

Pipetting Precision

QC Test with Setup & Service Software

Based on Tecan quality control requirements, the values in the tables below are only valid if maintenance instructions and schedule have strictly been followed. The precision test procedure provided by the instrument software uses a dedicated parameter setting for each tip type. So all tips of the same type are tested together, resulting in individual CVs, i.e. CVs for each channel, as well as in a CV comprising all measurements.

Depending on the tip type, the following rated volumes are tested:

Tab. 3-26 *Volume ranges*

Tip type	Volume range	Volumes examined	
Fixed tip	Standard	10 µl	100 µl
Fixed tip	Low volume	1 µl	10 µl
DiTi 200 µl	Standard	10 µl	100 µl
DiTi 200 µl	Low volume	10 µl	100 µl[a)]
DiTi 10 µl	Low volume	1 µl	10 µl

a) If 500 µl syringe is used, but no low volume option

Test Conditions

General conditions for QC test, carried out with the **Setup & Service Software**:

- For mixed configurations, the procedure has to be repeated for each tip type.
- For improved comparison, special tips and non-standard syringe sizes are replaced by standard tips and appropriate syringe sizes for the determination of the pipetting precision.
- Pipetting conditions Temp. 20°C to 27°C/68°F to 80.6°F, relative humidity 30% to 60% (non-condensing).
- Tap water with a conductivity of 0.3 mS/cm to 1 mS/cm
- Standard liquid class parameters
- Free dispense; single pipetting mode
- 8 channels, 12 replicates, CV and accuracy calculated over each channel and complete 96 well plate
- According to the QC procedure the following limits apply:
  - CV field: Limits for QC in the field, which any instrument in use is expected to meet.

Tab. 3-27 *Pipetting precision, tested with Setup & Service Software*

Volume	CV field	Tip type	Syringe
1 µl	≤ 10%	Low volume[a)]	500 µl
1 µl	≤ 10%	DiTi 10 µl[a)]	500 µl
1 µl	≤ 10%	Te-PS	250 µl
10 µl	≤ 3.5%	Te-PS	250 µl
10 µl	≤ 3.5%	Low volume	500 µl
10 µl	≤ 3.5%	DiTi 10 µl	500 µl

Tab. 3-27 Pipetting precision, tested with Setup & Service Software

10 µl	≤ 3.5%	Standard[b)]	1000 µl
10 µl	≤ 3.5%	DiTi 200 µl	1000 µl
100 µl	≤ 0.75%	Standard[b)]	1000 µl
100 µl	≤ 0.75%	DiTi 200 µl	1000 µl
25 µl	≤ 3.5%	Standard Fixed Tip	2500 µl
200 µl	≤ 1.0%	Standard Fixed Tip	2500 µl
25 µl	≤ 7.0%	DiTi 1000 unfiltered	2500 µl
200 µl	≤ 2.5%	DiTi 1000 unfiltered	2500 µl
25 µl	≤ 5.0%	Standard Fixed Tip	5000 µl
200 µl	≤ 2.0%	Standard Fixed Tip	5000 µl
25 µl	≤ 8.0%	DiTi 1000 unfiltered	5000 µl
200 µl	≤ 3.0%	DiTi 1000 unfiltered	5000 µl

a) *using low volume option*
b) *PTFE coated outside*

Pipetting Precision in the Application

The table below shows the CV values that can be expected in the actual application.

General conditions, using **Freedom EVOware** as application software:

- Liquid: Deionized water; standard liquid class parameters
- Free dispense, single pipetting mode
- 1000 µl syringe

Tab. 3-28 Pipetting precision, achievable in the application

Tip type	Volume	CV[a)]
Fixed tip [b)]	25 µl	≤ 3.5%
Fixed tip [b)]	100 µl	≤ 0.75%
Fixed tip [b)]	200 µl	≤ 0.75%
Fixed tip [b)]	500 µl	≤ 0.75%
Fixed tip [b)]	900 µl	≤ 0.75%
Fixed tip [b)]	10 µl	≤ 3.5%
Fixed tip [b)]	2445 µl	≤ 0.5%
Fixed tip [b)]	4900 µl	≤ 0.5%
DiTi 200 µl	10 µl	≤ 3.5%
DiTi 200 µl	25 µl	≤ 2%
DiTi 200 µl	100 µl	≤ 0.75%
DiTi 200 µl	197 µl	≤ 0.4%

Tab. 3-28 *Pipetting precision, achievable in the application*

Tip type	Volume	CV[a]
DiTi 350 µl	10 µl	≤ 3.5%
DiTi 350 µl	25 µl	≤ 2%
DiTi 350 µl	100 µl	≤ 0.75%
DiTi 350 µl	350 µl	≤ 0.5%
DiTi 1000 µl	25 µl	≤ 5%
DiTi 1000 µl	100 µl	≤ 1%
DiTi 1000 µl	200 µl	≤ 0.75%
DiTi 1000 µl	500 µl	≤ 0.5%
DiTi 1000 µl	750 µl	≤ 0.5%
DiTi 1000 µl	973 µl	≤ 0.5%
DiTi 5000[c]	300 µl	≤ 2.5%
DiTi 5000[c]	500 µl	≤ 2.5%
DiTi 5000[c]	4500 µl	≤ 0.5%
DiTi 5000 unfiltered	2500 µl	≤ 1%
DiTi 5000 unfiltered	3500 µl	≤ 0.5%
DiTi 5000 unfiltered	4500 µl	≤ 0.5%
DiTi 5000 unfiltered	4850 µl	≤ 0.5%

a) *CV calculated for each channel and across all eight tips*
b) *PTFE coated outside*
c) *5000 µl Syringe*

Note: *Only Tecan disposable tips guarantee attainment of the performance specified for the Tecan pipetting instruments.*

Liquid Level Detection

Each tip can individually detect the surface of a conductive liquid by measurement of changes in capacitance. Each channel has an individual liquid detection. Generally, detection of conductive liquids of following volumes is possible:

- ≥ 50 µl: low-conductive liquid in microplates with round bottoms, for fixed tips and DiTis
- ≥ 100 µl: conductive liquid in sample tubes with a diameter of 10 or 13 mm
- ≥ 150 µl: conductive liquid in sample tubes with a diameter of 16 mm
- ≥ 5 ml: conductive liquid in reagent trough

Note: *In 1536-well microplates, liquid detection is not possible*

Wetted Materials

The standard liquid system components that come into contact with either system or sample liquid are of the following materials:

Tab. 3-29 *Liquid system components: materials*

Component	Material
Pipetting tubing	FEP
Tubing (waste, part of aspirating tubing)	Silicone
Distributor 1:4	POM
Aspirating tubing	PVC
Disposable tips, Wash stations, Y-connectors	PP
FaWa	FFPM (membrane), PP (body)
Pressure relief valve	PP
Valves (diluters)	PCTFE (Kel-F)
Syringes	Borosilicate glass
Syringes, seals	PTFE
Tips	Stainless steel, PTFE[a)]
Tips	Ceramic (if special coating “Ceramic tips)[b)]
Low volume valve	ETFE
Liquid containers	HD-PE

a) Coating
b) Coated inside/outside

Also refer to section **3.7 “Chemical Resistance”, 2 3-85**.

3.5.1.1 5 ml DiTi, Prerequisites and Limitations

Syringes

5 ml syringes must be used with 5 ml DiTis.

Pipetting Tubing

Because the pipetting tubing must hold 5000 µl aspirated volume the following tubing is required:
Pipetting tubing for Freedom EVO 200.

DiTi Eject

Due to the size and weight of the 5ml LiHa DiTi, only the lower DiTi eject Option will provide reproducible and reliable disposal of the 5 ml DiTi.

DiTi Waste

For waste chute only the wide standard DiTi waste **without cover** does work (see section 4.8.6 "Lower DiTi Eject Option", 2 4-81). The 5 ml DiTi is too long for the throat of the narrow DiTi waste.

Number of Channels usable

Due to a spacing of 18 mm (instead of 9 mm in regular 96 well format) only 4 channels can be used in parallel on every second channel (e. g. 1, 3, 5 and 7 or 2, 4, 6 and 8). 8 channels in parallel should not be used with the 5 ml DiTi and will lead to crashes (Reason: during movement in x-axis, the LiHa will reduce the spread to regular 9 mm spacing and with a fixed spread of 18 mm, eject of the DiTis with the lower DiTi eject is not possible).

Mixed Configurations

Every second channel can be equipped with a 5 ml syringe.
Example: channels 1,3,5,7 can be used with 1 ml syringes, channels 2, 4, 6, 8 can be equipped with 5 ml syringes.

Pipetting Volumes

The following volumes of liquid can be pipetted with the 5 ml DiTi (Single pipetting in free dispense):

Tab. 3-30 *5 ml DiTi pipetting volumes*

DiTi	Min. Pipetting Volume	Max. Pipetting Volume
5ml LiHa DiTi without filter	300 µl	4850 µl
5ml LiHa DiTi with filter	300 µl	4800 µl

Note: *There are Liquid Classes available for water, ethanol and serum in EVOware which include all the necessary air gaps and calibration (factor & offset).*

Accessible Tip Positions

On a fully loaded MP 4Pos Carrier the LiHa can pickup DiTis from all possible positions with the following exceptions (compare to pipetting into 96 well plate):

- Site 1, Pos 1 -> pickup with Channel 8 not possible
- Site 4, Pos 4 -> pickup with Channel 1, 2, 3 not possible

Liquid Classes and Labware

Liquid classes and Labware are defined in EVOware. There are liquid classes for water, ethanol and serum (Physiogel) defined. The labware and liquid classes for the 5ml tip will be supported with Freedom EVOware V2.4 SP2 or higher.

Tab. 3-31 *Labware compatibility*

Labware	Tecan 5 ml DiTi		Comment
	Aspirate[a)]	Dispense[a)]	
100 ml trough	Y	Y	
25 ml trough	Y	Y	
50 ml Falcon tube	Y	Y	
15 ml Falcon tube	N	Y	Tip is too short to aspirate from bottom, ~2.5 ml residual volume
6 well plate	Y	Y	
24 well plate	Y	Y	
48 well plate	Y	Y	
96 well plate	Y	Y	
96 deep well plate	N	Y	Tip diameter is too big to reach the bottom
1.5 ml tube	N	Y	Tip diameter is too big to reach the bottom
13 mm (4 ml) tube	N	Y	Tip diameter is too big to reach the bottom
13 mm (6 ml) tube	N	Y	Tip diameter is too big to reach the bottom
16 x 75 ml tube	Y	Y	
16 x 100 mm (8.5-10 ml) tube	N	Y	Tip is too short to aspirate from bottom, ~2.5 ml residual volume

a) Y = Yes, compatible
N = No, not compatible

Compatible Carriers

The 5 ml LiHa DiTi box is compatible with the following ANSI/SLAS flat carriers (see section 11.7.1 “Carriers for Microplates”, 2 11-10):

- Carrier for microplates, flat, RoMa, 3 pos., landscape orientation
- Carrier for microplates, flat, 4 pos., landscape orientation, low profile

Re-Racking

Re-racking is not recommended, as the tips are for single use only. Re-racking is possible with lower DiTi eject. There is a small reservoir for droplets below every tip. However, the pipetting quality can only be guaranteed with single use. If re-racking is being done, use the standard SW commands.

RoMa Compatibility

The 5 ml LiHa DiTi ANSI/SLAS box is not compatible with the standard RoMa fingers. The box is too heavy for the standard steel clamp fingers. However, there are new RoMa gripper fingers including rubber clamp fingers, that work with the 5 ml DiTi box and most other Labware (see section 11.5.5 “Robotic Manipulator Arm (RoMa)”, 2 11-8). Please note: the rubber clamp fingers are not available separately, only complete with the RoMa gripper fingers.

The transparent lid of the 5 ml LiHa DiTi ANSI/SLAS box can be removed and placed back with both RoMa finger types; the standard RoMa clamp fingers and the rubber clamp fingers.

The 5 ml LiHa DiTi box is not transportable with the “Transfer Labware” command. For the transport of the box with the RoMa you have to use “Robot Vectors”.

Carousel Compatibility

The 5 ml LiHa DiTi ANSI/SLAS box is not compatible with the Tecan Carousel.

Te-Stack Compatibility

The 5 ml LiHa DiTi ANSI/SLAS box is not compatible with the Te-Stack.

Re-Use of 5 ml DiTi Box

The 5 ml DiTi Box cannot be autoclaved.

3.5.1.2 Instrument with two LiHas

Pay attention to the following if the instrument is equipped with two LiHas:

- Te-PS carriers that are adjusted to one of the LiHa arms cannot be accessed by the other LiHa arm for accuracy reasons, i.e. each Te-PS carrier must be assigned and adjusted to a specific liquid handling arm.
- Each LiHa needs its own sensor plate for real-time position check.

3.5.1.3 Limitations on Instruments with two LiHas

If the instrument is equipped with two LiHas, mind that the following limitations apply:

- Only the 1st (right) LiHa can be equipped with high-resistance tubing (hard tubing).
- The low volume wash station can only be used for the 1st (right) LiHa.
- The Te-Fill option can only be installed on one of the two LiHas.
- Two Air LiHas are not possible.
- A combination of one LiHa with MultiSense option and one Air LiHa is not possible.

3.5.1.4 Tip Adapter

Tip Adapter Dimensions

Tab. 3-32 Standard/MultiSense tip adapter dimensions

Dimension[a)]	Standard tip adapter	MultiSense tip adapter	Difference
X	26.9 mm	37.1 mm	10.2 mm
Y	20.0 mm	21.6 mm	1.6 mm
Z	10.0 mm	9.1 mm	- 0.9 mm

a) *See Fig. 3-12 , 2 3-44*

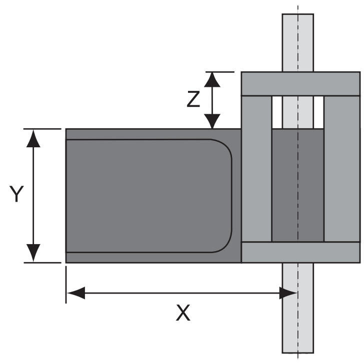


Fig. 3-11 Insulation block dimensions

Limitations on the Workspace

The dimensions of the MultiSense tip adapter affect the workspace as follows:

- The Z-offset (not range) is smaller by 7 steps (0.7 mm) for instruments equipped with the MultiSense option.

Labware

- The maximum permissible height of labware placed on the adjacent grid position (on the left of the accessed grid position) is 3 mm smaller for LH channels equipped with MultiSense tip adapter than for LH channels with standard tip adapter. This limitation applies when pipetting is done at minimum Z-height.

Magnetic Racks

- A Te-MagS module with magnetic plate or another magnetic rack must not be placed on the adjacent grid position on the left of the grid position accessed by MultiSense tip adapters or Standard tip adapters.

ATTENTION

A magnetic field too close to the MultiSense tip adapter or Standard tip adapter may interfere with the reed switch in the tip adapter and lead to unexpected switching with the result e.g. of a “DiTi not fetched” error.

3.5.1.5 MultiSense Option

What is MultiSense?

The MultiSense option is installed on the liquid handling arm. In addition to the capacitive sensor, which is standard for all LiHas, the MultiSense LiHa includes a pressure sensor that measures the pressure changes in the tip.

Note: *The MultiSense option only works with disposable tips.*

The MultiSense LiHa supports three functionalities, which can be selected independently or in combination in the application software.

- Capacitive liquid level detection (cLLD) – This is standard equipment of all LiHas.
- Pressure based liquid level detection (pLLD) – a feature of the MultiSense option.
  – A level detection mode that can be used instead of cLLD or in combination with cLLD.
- Pressure monitored pipetting (PMP) – a feature of the MultiSense option.
  – A process control feature, allowing a verification of the liquid transfer quality.

Delivery, Installation

The MultiSense option is factory installed when ordered with the instrument. For upgrading existing instruments, the MultiSense option can be installed at the user's site by a Tecan authorized field service engineer.

MultiSense Tip Adapter

The tip adapter of the MultiSense option includes the electronics for both capacitive and pressure sensing.

Tip Adapter Dimensions

Tab. 3-33 *Standard/MultiSense tip adapter dimensions*

Dimension[a)]	Standard tip adapter	MultiSense tip adapter	Difference
X	26.9 mm	37.1 mm	10.2 mm
Y	20.0 mm	21.6 mm	1.6 mm
Z	10.0 mm	9.1 mm	- 0.9 mm

a) See Fig. 3-12 , 2 3-44

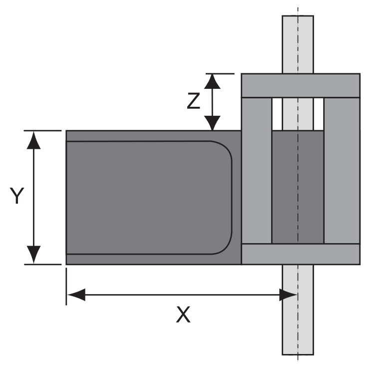


Fig. 3-12 *Insulation block dimensions*

Limitations on the Workspace

The dimensions of the MultiSense tip adapter affect the workspace as follows:

- The Z-offset (not range) is smaller by 7 steps (0.7 mm) for instruments equipped with the MultiSense option.

Labware

- The maximum permissible height of labware placed on the adjacent grid position (on the left of the accessed grid position) is 3 mm smaller for LH channels equipped with MultiSense tip adapter than for LH channels with standard tip adapter. This limitation applies when pipetting is done at minimum Z-height.

Magnetic Racks

- A Te-MagS module with magnetic plate or another magnetic rack must not be placed on the adjacent grid position on the left of the grid position accessed by MultiSense tip adapters.

ATTENTION

A magnetic field too close to the MultiSense tip adapter may interfere with the reed switch in the tip adapter and lead to unexpected switching with the result e.g. of a “DiTi not fetched” error.

Labware requirements

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Approved DiTis for the PMP function	See section 11.9.2.3 “Disposable Tips for PMP Function”, 2 11-30
Approved DiTis for the pLLD function	See section 11.9.2.4 “Disposable Tips for cLLD and pLLD Function”, 2 11-30

DiTi Requirements

Use only approved disposable tips for the MultiSense option.
For the PMP function, special DiTis with very small orifice tolerances are needed. Refer to cross references above.

Note: *If capacitive liquid level detection (cLLD) is used, the DiTi requirements for the standard tip adapters apply as well.*

Container Requirements

The MultiSense option works in combination with any labware.

3.5.1.6 Te-Fill Option

What is Te-Fill?

The Te-Fill option is used to dispense/aspirate liquid into/from containers, e.g. when the liquid volumes are greater than the dispense volume of the diluter or when a large number of containers need to be filled by means of multiple dispense cycles. The Te-Fill option consists mainly of a bidirectional pump and valves that connect the pump to the pipetting tubing of the instrument's liquid system.

General Data

Tab. 3-34 *Te-Fill specifications*

Function for standard (fixed) tips	Dispense/aspirate
Function for disposable tips	Dispense
Number of channels	1 to 8, individually controlled
Number of different liquids (with optional selector valve)	6 (sequentially)
Size of pump box (width x length x height)	245 mm x 208 mm x 116 mm (9.65 in. x 8.19 in. x 4.57 in.)
Weight of pump box without selector valve	3.5 kg (7.7 lbs)
Size of pump box with selector valve (width x length x height)	245 mm x 316 mm x 116 mm (9.65 in. x 12.44 in. x 4.57 in.)
Weight of pump box with selector valve	5 kg (11 lbs)
Size of valve block with 4 valves (width x length x height)	40 mm x 93 mm x 66 mm (1.57 in. x 3.66 in. x 2.60 in.)
Weight of valve block with 4 valves	0.35 kg (0.77 lbs)
Max. power consumption of pump and selector valve	80 W
Max. power consumption of valve block	4 W per valve
Pump speed (dispense and aspirate)	max 80 ml/min
Dispense speed	1 to 10 ml/min[a)]
Dispense volume range	0.1 to 1000 ml (Typical use: Up to 50 ml)
Dispense accuracy	<5% for >1 to 50 ml (all tips together) <15% for 0.1 to 1 ml (all tips together)
Dispense CV	<4% for >1 to 50 ml (all tips together) <10% for 0.1 to 1 ml (all tips together)

Tab. 3-34 Te-Fill specifications

Aspirate speed	1 to 10 ml/min [a)]
Aspirate volume range	1 to 1000 ml (Typical use: Up to 50 ml)
Wetted materials	Tubing: FEP Distributors, pump head: PP Pump membrane, valve membranes: FFPM Valve body (3/2-way valve): PEEK Valves: PTFE Selector valve stator: PPS Selector valve rotor: Valcon E2
Dead volume (volume from the 3/2-way valve to the end of the tip or DiTi cone)	Approx. 2.5 ml

a) Volume per tip when 8 tips dispense/aspirate liquid simultaneously

Configuration Data

The Te-Fill option is available for four or eight channels (one or two valve blocks). Depending on the instrument size and LiHa configuration the Te-Fill option can be installed for four or eight channels. The table shows the possible configurations:

Tab. 3-35 Te-Fill compatibility with instruments and LiHa types

	2-tip LiHa	4-tip LiHa	8-tip LiHa
Freedom EVO 100	n.a.	Te-Fill with 4 channels	Te-Fill with 4 or 8 channels
Freedom EVO 150 with 1 LiHa	n.a.	Te-Fill with 4 channels	Te-Fill with 4 or 8 channels
Freedom EVO 150 with 2 LiHas	n.a.	n.a.	n.a.
Freedom EVO 200 with 1 LiHa	n.a.	Te-Fill with 4 channels	Te-Fill with 4 or 8 channels
Freedom EVO 200 with 2 LiHas [a)]	n.a.	Te-Fill with 4 channels	Te-Fill with 4 or 8 channels

a) Te-Fill only on the 1st or the 2nd LiHa. However, not on both LiHas.

Selector Valve

Optionally, the Te-Fill option can be equipped with a 6-position selector valve. This is used to select one from up to 6 different liquids.

Instrument Requirements

The following requirements must be fulfilled for making use of the Te-Fill option:

- Syringe size: 1000 µl or smaller
- Tips: Standard fixed tips or DiTi cones

Restrictions

The following restrictions apply to the Te-Fill option:

- The Te-Fill option cannot be installed on a LiHa equipped with MultiSense
- The Te-Fill option cannot be installed on a LiHa equipped with Low Volume option

3.5.2 Air Displacement Pipetting Arm (Air LiHa)

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Disposable tips, DiTis	See section 11.9.2 “Disposable Tips and Accessories”, 2 11-24
Pipetting precision	See Tab. 3-41 “Air LiHa Pipetting Precision; best values”, 2 3-53 Tab. 3-42 “Air LiHa Pipetting Precision; typical values”, 2 3-54 Tab. 3-44 “Air LiHa Pipetting Precision; factory and field verification values”, 2 3-55

What Is Air LiHa?

The Air LiHa is a liquid handling arm used for pipetting tasks. It’s working principle is based on air displacement technology. The Air LiHa is intended for disposable tips only.

Delivery, Installation, Configuration

For upgrading existing instruments, the Air LiHa can be installed at the user’s site by a Tecan authorized field service engineer.
The Freedom EVO can be equipped with a maximum of one Air LiHa (see also section 3.3.1 “Arm Configuration”, 2 3-15)

General Data

Tab. 3-36 Air LiHa specifications

Usable tips	Disposable tips All sizes: • Conductive • With or without filter	10 µl 50 µl 200 µl 350 µl 1000 µl
Number of channels	4 or 8	
Tip spreading	Distance from tip to tip	9 to 38 mm (0.31 to 1.5 in.)
Volume range	0.5 µl to 1000 µl (1 ml)	
Theoretical resolution	0.1 µl	
Dispense speed	1000 µl	less than 2 seconds
Dispense modes	0.5 µl to max. volume	Free (non-contact) dispense for single pipetting or contact dis-pense
	5 µl to max. volume	Free (non-contact) dispense for multi pipetting
DiTi pickup force	23 N +/- 4 N	
Pipetting Precision	See Tab. 3-41, 2 3-53, Tab. 3-42, 2 3-54 and Tab. 3-44, 2 3-55.	
Special functions	Liquid level detection pLLD and PMP Lower DiTi eject	See sections , 2 3-39, 4.7.1, 2 4-67, 4.3.2.1, 2 4-12 See section 4.3.2.1, 2 4-12 See section 4.8.6, 2 4-81

Air LiHa Operating Ranges

Tab. 3-37 Air LiHa operating ranges (relative movement)

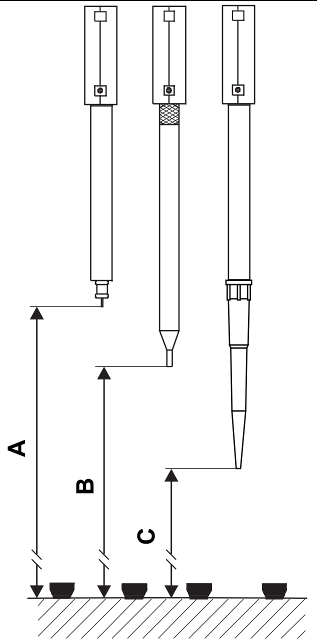
Axis	LiHa type	Freedom EVO
X-axis	All	Refer to Tab. 3-5 , 2 3-6
Y-axis	4-tip LiHa[a)]	409 mm (16.1 in.)
	8-tip LiHa[a)]	373 mm (14.7 in.)
Z-axis[b)]	All	210 mm (8.27 in.)

a) at 9 mm spacing
b) each channel individually, no tips installed

Tip Clearance

The tip clearance is the maximum space between the worktable surface and the mounted tip (initial position).

Tab. 3-38 Air LiHa Tip clearance



Distance tip to worktable[a)]	Tip type	Tip clearance
	DiTi adapter (A)	260 mm (10.24 in.)
	Reference tip (B)	210 mm (8.27 in.)
	DiTi 10 µl (C)	242 mm (9.53 in.)
	DiTi 50 µl (C)	216 mm (8.50 in.)
	DiTi 200 µl (C)	215 mm (8.46 in.)
	DiTi 350µl (C)	215 mm (8.46 in.)
	DiTi 1000 µl (C)	178 (7.01 in.)
	DiTi 5000 µl (C)	164 mm (6.46 in.)
	Te-PS tip	237 mm (9.33 in.)

a) Illustration not to scale, tip clearance shortened

Air LiHa Accuracy/ Precision

The positioning accuracy of the Air LiHa allows for the following applications:

- Air LiHa can be used in combination with 96-well microplates.
- Air LiHa can be used in combination with 384-well microplates (ANSI/SLAS) under the following constraints:
  - Usage of Tecan-branded DiTis 10 µl
  - Usage of Tecan-branded 384 microplate carrier
- Air LiHa can be used in combination with 1536 well microplates (ANSI/SLAS) under the following constraints:
  - Usage of Tecan-branded DiTis 10 µl
  - Usage of Te-PS sensor plate
  - Usage of Te-PS carrier

Tab. 3-39 Air LiHa repeatability (precision) at 9 mm spacing, with all 8 tips simultaneously

Axis	Repeatability
X	±0.15 mm (0.006 in.)
Y	±0.15 mm (0.006 in.)
Z	±0.3 mm (0.012 in.)[a)]

a) Worn parts may result in deterioration of repeatability

Equidistant Tip Movement

The equidistant movement of sampling tips in Y direction is:

- from 9 mm ± 0.4 mm
- to 38 mm ± 1 mm

Disposable Tips

Use only Tecan disposable tips. Conductive disposable tips are available with or without filter, in following volumes:

- 1000 µl
- 350 µl
- 200 µl
- 50 µl
- 10 µl (low volume disposable tip)

Refer to cross references above for details.

DiTi Carrier

A DiTi Carrier holds up to three trays of 96 disposable tips.

Air LiHa Tip Adapter

The Air LiHa is equipped with a special type of tip adapters, which contain a pressure sensor, the electronics for the Air LiHa MultiSense functions and a user replaceable Inline filter.

Tip Adapter Dimensions

The dimensions of the Air LiHa tip adapter and the MultiSense tip adapter are the same (see "MultiSense Tip Adapter", 2 3-44).

Tab. 3-40 *Standard / Air LiHa tip adapter dimensions*

Dimension[a)]	Standard tip adapter	Air LiHa tip adapter	Difference
X	26.9 mm	37.1 mm	10.2 mm
Y	20.0 mm	21.6 mm	1.6 mm
Z	10.0 mm	9.1 mm	- 0.9 mm

a) See Fig. 3-13, 2 3-51

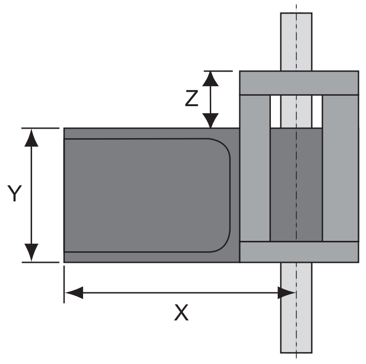


Fig. 3-13 *Insulation block dimensions*

Limitations on the Workspace

The dimensions of the Air LiHa tip adapter affect the workspace as follows:

- The Z-offset (not range) is smaller by 7 steps (0.7 mm) for instruments equipped with the Air LiHa.

Labware

- With the Air LiHa tip adapter the maximum permissible height of labware placed on the adjacent grid position (on the left of the accessed grid position) is 3 mm smaller compared to a standard tip adapter. This limitation applies when pipetting is done at minimum Z-height.

Magnetic Racks

- A Te-MagS module with magnetic plate or another magnetic rack must not be placed on the adjacent grid position on the left of the grid position accessed by Air LiHa tip adapters.

ATTENTION

A magnetic field too close to the Air LiHa tip adapter may interfere with the reed switch in the tip adapter and lead to unexpected switching with the result e.g. of a “DiTi not fetched” error.

Pipetting Precision

Prerequisites

Based on Tecan quality control requirements, the values in the tables below are only valid if maintenance instructions and schedule have strictly been followed.

Precision Definition

Precision is calculated as coefficient of variance (CV%).

Typical pipetting precision is defined as the median value of the CV (calculated over all channels) of all tested instruments.

Pipetting Tips

Note: *Only Tecan disposable tips guarantee attainment of the performance specified for the Tecan pipetting instruments.*

Air LiHa Pipetting Precision

Best Values

The pipetting precision values listed in Tab. 3-41, 2 3-53 below are based on the following criteria:

- OPTIMIZED liquid handling precision data
(proven on 3 independent Air LiHas)
- For small volumes a single channel calibration is necessary
(see footnotes in table)
For details on single channel calibration refer to the EVOware Software Manual (see 1.1 “Reference Documents”, 2 1-2)
- Custom liquid class in EVOware
- Pipetting conditions Temp. 20°C to 27°C/68°F to 80.6°F, relative humidity 30% to 60% (non-condensing).
- Tap water with a conductivity of 0.3 mS/cm to 1 mS/cm
- Free dispense; single pipetting mode, complete range from 0.5 µl to 1000 µl
- 8 channels, 12 replicates, CV and accuracy calculated over each channel and complete 96 well plate

Tab. 3-41 *Air LiHa Pipetting Precision; best values*

DiTi Type	Volume	Precision (CV)	Accuracy
DiTi10	0.5 µl[a]	≤ 6.0%	± 9.5%
	1 µl[a]	≤ 4.0%	± 7.0%
	10 µl	≤ 1.0%	± 1.5%
DiTi50	1 µl[a]	≤ 4.0%	± 10.0%
	5 µl[a]	≤ 1.0%	± 2.0%
	10 µl	≤ 1.5%	± 2.0%
DiTi200	3 µl	≤ 4.0%	± 10.0%
	100 µl	≤ 0.5%	± 1.0%
DiTi350	3 µl	≤ 3.0%	± 7.0%
	5 µl	≤ 1.5%	± 5.0%
	350 µl	≤ 0.5%	± 1.0%
DiTi1000	100 µl	≤ 0.5%	± 1.0%
	1000 µl	≤ 0.5%	± 1.0%

a) *Single channel calibration necessary*

Typical Values

The pipetting precision values listed in Tab. 3-42, 2 3-54, are so called typical values. They can be achieved in EVOware with default liquid classes without further optimization of the liquid class.

- Worst CV or accuracy value of at least three tested instruments in production (standard liquid classes; for 10 µl and 50 µl DiTis single channel calibration required below 5 µl).

The values were calculated the following way:

- Single pipetting mode, tap water with a conductivity of 0.3 mS/cm to 1 mS/cm, 8 channels, 12 replicates, CV and accuracy calculated over each channel and complete 96 well plate unless otherwise stated.

Note: *Compared with **Best Values**, no single channel calibration is necessary.*

Tab. 3-42 *Air LiHa Pipetting Precision; typical values*

Tip	Volume	Precision (CV)	Accuracy
DiTi10	10 µl	1.0%	± 1.5%
DiTi50	10 µl	1.5%	± 2.0%
	50 µl	0.5%	± 1.0%
DiTi200	3 µl	4.0%	± 10.0%
	5 µl	2.0%	± 8.0%
	100 µl	0.5%	± 1.0%
DiTi350	3 µl	3.0%	± 7.0%
	5 µl	1.5%	± 5.0%
	100 µl	0.5%	± 1.0%
	350 µl	0.5%	± 1.0%
DiTi1000	10 µl	1.5%	± 13.0%
	100 µl	0.5%	± 1.0%
	500 µl	0.5%	± 1.0%
	1000 µl	0.5%	± 1.0%

Tab. 3-43 *Water Free Dispense: Multi Dispense*

Tip	Volume	Precision (CV)	Accuracy
DiTi50	4 x 10 µl	7.0%	± 3.0%
DiTi200	12 x 10 µl	10.0%	± 4.0%
	6 x 20 µl	3.5%	± 3.0%
DiTi350	12 x 10 µl	9.0%	± 3.0%
	6 x 20 µl	5.0%	± 3.0%
DiTi1000	12 x 50 µl	2.5%	± 2.0%
	6 x 100 µl	2.5%	± 2.0%

Factory and Field Verification Values

Test Conditions

General test conditions, carried out with the **Setup & Service Software**:

- All liquid handling values have been verified under controlled laboratory environment at temperatures between 20°C and 27°C and a humidity between 30 % and 60 % at 25°C.
- Liquid: water
- Pipetting mode: single pipetting, free dispense
- New DiTi for each sample

The pipetting precision values listed in Tab. 3-44, 2 3-55 below are based on the following criteria:

- Liquid handling precision data tested for each produced Freedom EVO
- Values are for pipetting water with disposable tips
- Default liquid class in EVOware
- No single channel calibration required

Tab. 3-44 *Air LiHa Pipetting Precision; factory and field verification values*

Volume	DiTi Type	Precision (CV)
1 µl	10 µl DiTi[a)]	≤ 8.0%
10 µl	200 µl DiTi	≤ 2.0%
100 µl	200 µl DiTi[b)]	≤ 0.5%

a) non filtered DiTis
b) non filtered DiTis

Wetted Materials

In normal operation, the disposable tips are the only wetted parts. Other parts do not come into contact with the pipetted liquids except in case of a malfunction (too much liquid aspirated). However, other parts may be exposed to aerosols from the liquid.

The critical parts of the Air LiHa are made of the following materials:

- The parts that come into contact with sample liquid:
  - Disposable tips: PP
- The parts that may be moistened with aerosols:
  - Tip cone: Gold-plated brass
  - Inline filter: PE

Refer to section 3.7 “Chemical Resistance”, 2 3-85.

3.5.3 Multichannel Arm (MCA96)

What is MCA96?

The MCA96 is a robotic multichannel pipetting arm designed for high-speed, high-precision liquid pipetting between standard microplates (MP) with 96 or 384 wells.

It can be equipped with an optional gripper for microplate handling.

Tab. 3-45 *MCA96 technical data*

Number of pipetting channels	96
Force in Z-direction	300 N (during get DiTi procedure) 240 N (during get tip block procedure)
Y-range	310 mm (12.20 in.)
Z-range	210 mm (8.7 in.)

MCA96 Configuration Data

Configuration

The table shows the possible variants of the MCA96 configuration:

Tab. 3-46 *Basic components and consumables for MCA96*

Components/ Disposables	Configuration/Variants
Pipetting head	96 channels Pipetting volume: 1 to 200 µl
Fixed Tip block	Standard 96 multichannel fixed tip block; long tips, uncoated/ coated, pipetting range 5 to 200 µl, for 96- and 384-well microplates and deep well plates Minimum diameter of the wells: 3 mm (0.118 in.) **Variant:** High precision 96 multichannel fixed tip block; short tips, uncoated/coated, pipetting range 1 to 44 µl, for 96-, 384- and 1536-well microplates (no deep well plates) Minimum diameter of the wells: 1.7 mm (0.067 in.)
Disposable tips (DiTis)	**Variants:** 50 µl, with filter, pipetting range 1 to 45 µl 50 µl, without filter, pipetting range 1 to 55 µl 100 µl, with filter, pipetting range 1.5 to 84 µl 100 µl, without filter, pipetting range 1.5 to 103 µl 150 µl, with filter, pipetting range 2 to 150 µl 150 µl wide bore, with filter, pipetting range 10 to 150 µl 200 µl wide bore, without filter, pipetting range 10 to 200 µl 200 µl, without filter, pipetting range 2 to 200 µl 500 µl, with filter, pipetting range 25 to 200 µl 500 µl, without filter, pipetting range 25 to 200 µl The aforementioned pipetting ranges are applicable with Tecan Pure and Tecan Sterile MCA96 DiTis.
Carriers	MP standard carriers (landscape-oriented) Service carrier Nested DiTi flat carriers

Fixed Tip Block Variants

The table below specifies the different fixed tip blocks with regard to fixed tip variants:

Tab. 3-47 *Data of fixed tip block variants*

Fixed Tip block type	Max range[a)]	Max volume[b)]	Tip length [1/10 mm]	Tip orifice inner diameter	Tip air gap[c)]	Total air gap[d)]
Uncoated standard fixed tip block	230 µl	200 µl	675 (see Fig. 3-14 , 2 3-60)	0.40 $^{\pm 0.03}$ mm (0.016 in.)	300 µl	430 µl
Coated standard fixed tip block	230 µl	200 µl	675 (see Fig. 3-14 , 2 3-60)	0.40 $^{\pm 0.03}$ mm (0.016 in.)	300 µl	430 µl
Uncoated high precision fixed tip block	50 µl	44 µl	430 (see Fig. 3-14 , 2 3-60)	0.40 $^{\pm 0.03}$ mm (0.016 in.)	90 µl	220 µl
Coated high precision fixed tip block	50 µl	44 µl	430 (see Fig. 3-14 , 2 3-60)	0.40 $^{\pm 0.03}$ mm (0.016 in.)	90 µl	220 µl

a) *Leading air gap + trailing air gap + sample*
b) *Trailing air gap + sample*
c) *Only tip air gap (without leading air gap)*
d) *Tip air gap + pipetting head air gap + leading air gap*

DiTi Variants

The table below specifies different disposable tips:

Tab. 3-48 *Data of DiTi variants*

DiTi (disposable tip) type	Max volume	Tip length [1/10 mm]	Tip orifice inner diameter	Total air gap
50 µl DiTis[a)]	55 µl	296 (see Fig. 3-14 , 2 3-60)	0.41 $^{\pm 0.03}$ mm (0.016 in.)	210 µl
100 µl DiTis, not sterile	103 µl	431 (see Fig. 3-14 , 2 3-60)	0.46 $^{\pm 0.03}$ mm (0.018 in.)	310 µl
100 µl DiTis, sterile	103 µl	431 (see Fig. 3-14 , 2 3-60)	0.46 $^{\pm 0.03}$ mm (0.018 in.)	310 µl
100 µl DiTis, filtered, sterile	84 µl	431 (see Fig. 3-14 , 2 3-60)	0.46 $^{\pm 0.03}$ mm (0.018 in.)	270 µl
200 µl DiTis, not sterile	200 µl	431 (see Fig. 3-14 , 2 3-60)	0.51 $^{\pm 0.03}$ mm (0.02 in.)	390 µl
200 µl DiTis, sterile	200 µl	431 (see Fig. 3-14 , 2 3-60)	0.51 $^{\pm 0.03}$ mm (0.02 in.)	390 µl
200 µl DiTis, filtered, sterile	150 µl	431 (see Fig. 3-14 , 2 3-60)	0.51 $^{\pm 0.03}$ mm (0.02 in.)	350 µl

Tab. 3-48 *Data of DiTi variants*

DiTi (disposable tip) type	Max volume	Tip length [1/10 mm]	Tip orifice inner diameter	Total air gap
200 µl wide bore DiTis, non-sterile, non-filtered	200 µl	431 (see Fig. 3-14, 2 3-60)	1.45 $^{\pm 0.03}$ mm (0.06 in.)	390 µl
200 µl wide bore DiTis, sterile, filtered	175 µl	431 (see Fig. 3-14, 2 3-60)	1.45 $^{\pm 0.03}$ mm (0.06 in.)	350 µl
500 µl DiTis, filtered, sterile	400[b)] µl	540 (see Fig. 3-14, 2 3-60)	0.50 $^{\pm 0.03}$ mm (0.02 in.)	n.a.
500 µl DiTis, non-filtered, non-sterile	500[b)] µl	540 (see Fig. 3-14, 2 3-60)	0.50 $^{\pm 0.03}$ mm (0.02 in.)	n.a.

a) *Not intended for deep-well plates*
b) *Maximum volume of 500 µl (400 µl filtered) on the MCA384 with the Extended Volume Adapter (EVA)*

Tip Lengths

The figure shows the MCA96 pipetting head equipped with the different tip types and their lengths:

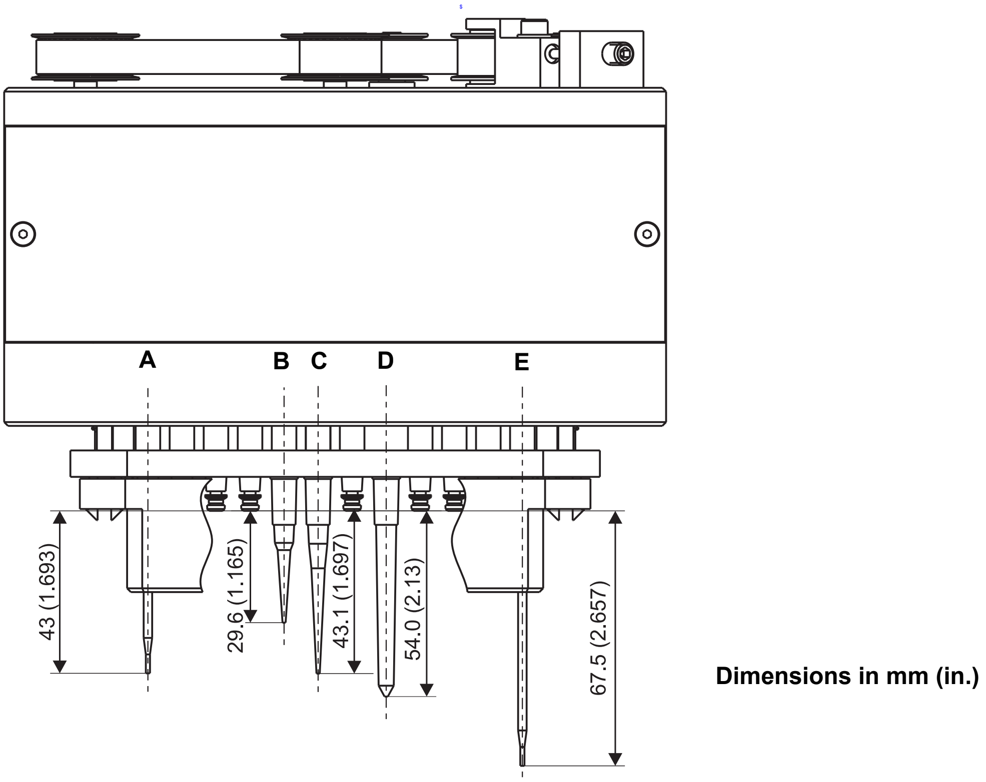


Fig. 3-14 *Pipetting head/tip lengths*

A	*High precision fixed tip block*	***D***	*Disposable tip 500 µl*
B	*Disposable tip 50 µl*	***E***	*Standard fixed tip block*
C	*Disposable tip 100/150/200 µl (wide-bore tips have the same length)*		

Note: *DiTis tend to back by some distance after being picked up.*

- *Therefore, they may "get longer" than their theoretical value [typ. 0.25 mm (0.01 in.)].*
- *Also manufacturing tolerances of the DiTis account for deviations in length.*

The figure shows the tip clearance for the different tip types:

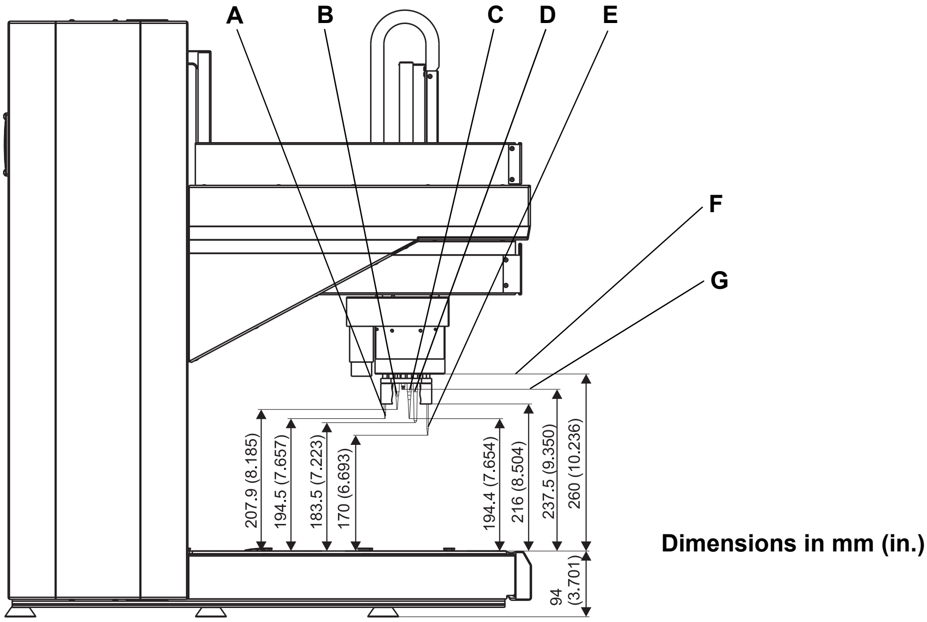


Fig. 3-15 *Tip clearance (distance to worktable)*

A	*High precision fixed tip block*	***D***	*Disposable tip 500 µl*
B	*Disposable tip 50 µl*	***E***	*Standard fixed tip block*
C	*Disposable tip 100/150/200 µl (wide-bore tips have the same tip clearance)*	***F***	*Fixed tip block body edge*
		G	*Tip length zero line*

Note: *The top positions shown in the figure take 1 mm (0.04 in.) initialization offset into account.*

Options and Accessories

Several options and accessories are available for the MCA96:

Tab. 3-49 *Options and accessories*

Option/Accessory	Configuration/Variants
Transfer rack	Used with DiTis Used with fixed tip block
Reagent trough	Volume: 300 ml **Variants:** **With or without inset** **Inset 250 ml and 125 ml**
Racks (meeting the standards of the Society of Bio-molecular Screening)	Microplates (MP): 96, 384 wells Deep Well Plates (DWP): 96, 384 wells
Wash system	Consisting of: – WRC tower (wash unit and control unit) – wash block, tubing, fittings and filter Can be used with fixed tip blocks.

MCA96 Performance Data

Capacity and Throughput

The table below specifies the performance in terms of theoretical throughput:

Tab. 3-50 *Throughput*

Theoretical throughput (depending on the application)	Approx. 30[a)] 384-well Microplates per hour (pipetting a 1 to 1 copy)

a) *Assumption: A cycle of aspirate and dispense plus three wash steps is repeated four times (4x96) per plate*

Precision (LH)

The table specifies the pipetting volume range and the maximum deviation:

Note: *Precision and accuracy depend on the characteristics of the specific liquid and the DiTis or the tip block used.*

Tab. 3-51 *MCA precision (coefficient of variation [CV})*[a)]

Tip type	**Disposable Tips (DiTis)**			**Steel tips**[b)]	
Volume	**50 µl**	**100 µl**	**200 µl**	**50 µl**	**200 µl**
1 µl	< 6%	–	–	< 10%	–
1.5 µl	–	< 6%	–	–	–
2 µl	< 6%	< 6%	< 6%	< 6%	–
5 µl	< 4%	< 4%	< 4%	< 4%	< 4%
10 µl	< 3%	< 3%	< 3%	< 3%	< 3%
>10 µl	< 3%	< 3%	< 3%	< 3%	< 3%

a) *Contact dispense, photometric measurement of color solution, CV calculated over complete 96 well plate, three replicates, typical pipetting precision/accuracy are defined as the worst CV/ accuracy value of at least three tested instruments (standard liquid classes)*
b) *Fixed tips, uncoated, washable*

IQ/OQ Procedures

During installation and operation qualification (IQ/OQ) procedures the lowest volume from the table above (see shaded cells in table) will be tested in order to prove the performance characteristic of the MCA at the customer's site.

Note: *Values are only achieved if maintenance has been performed on schedule and the instructions have been strictly followed.*

Tecan recommends you to check the precision and the accuracy with the specific liquid and pipetting device (DiTi or tip block) used in your application to verify the corresponding calibration factors and to adjust them, if necessary.
Refer to the Freedom EVOware Software Manual.

- In the application software, default calibration factors are predefined for contact dispense with DMSO and water.
- Tecan recommends you to verify the calibration factors and the accuracy with the liquids used in each application.

Disposable Tips

Note: *The shape of tips or inappropriate material properties can have considerable adverse effects on pipetting results. The risk of pipetting errors dramatically increases if tips do not fit properly or if the tip outlet geometry is inadequate. The use of Tecan disposable tips guarantees optimal performance of all Tecan pipetting platforms.*

Highly Viscous Liquids

Note: *Highly viscous liquids as well as liquids with insoluble particles can cause the pipetting system to behave differently than assumed by the controlling software. The software can adapt its behavior by means of different settings. In such cases, consult the manufacturer to assess the feasibility of the application with regard to liquid handling.*

MCA96 Options

Wash System

The table specifies the weight and dimensions of the wash system components:

Tab. 3-52 *Physical specifications (weight and dimensions)*

	Weight (kg/lbs)	Dimensions [mm/in.] (Width x Depth x Height)
WRC tower	approx. 12 kg (26.5 lbs)	285 x 480 x 610 mm (11.2 x 18.9 x 24 in.)
Wash block for 96 channels	approx. 560 g (1.23 lbs)	170 x 90 x 65 mm (6.7 x 3.5 x 2.6 in.)

Gripper

The table specifies the technical data of the MCA96 gripper:

Tab. 3-53 *Gripper technical data*

G-range (gripper)	Usable range: 58 mm (2.28 in.) (Mechanical range: 62 mm (2.44 in.)
Gripper force	10 N
Gripper space range	Usable range: 69 to 127 mm (2.72 to 5.00 in.) (Mechanical range: 67 to 129 mm (2.64 to 5.08 in.)

The figure shows the gripper clearance:

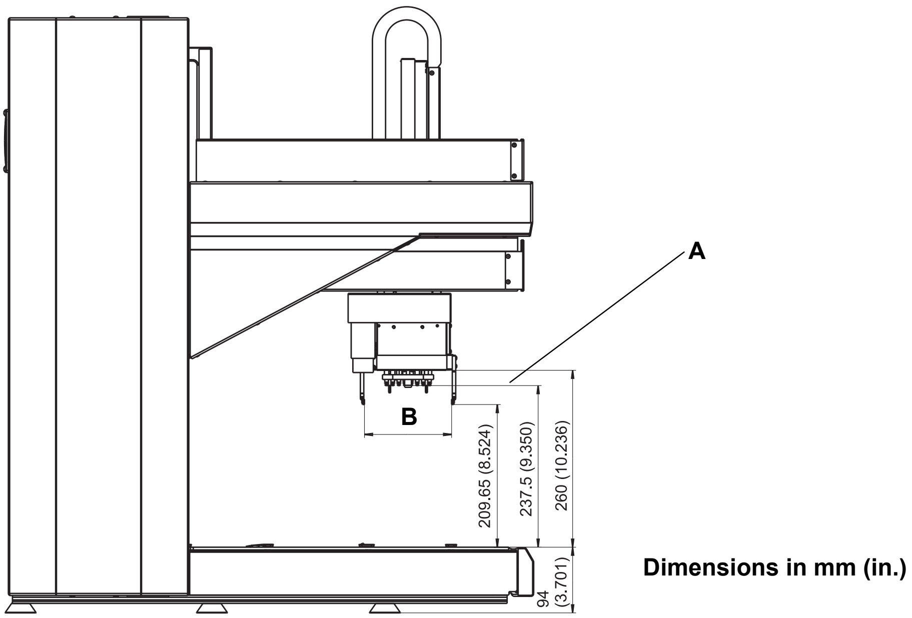


Fig. 3-16 *Gripper clearance (distance to worktable)*

A	*Tip length zero line*	***B***	*Gripper range (see Tab. 3-53 , 2 3-63)*

Note: *The top positions shown in the figure take 1 mm (0.04 in.) initialization offset into account.*

MCA96 Materials

Parts and Their Resistance

The following parts of the system are more or less exposed to the liquids which are pipetted:

Tab. 3-54 *Exposed parts, used materials*

Part	Material	Exposure
Fixed tip (fixed tip block)	Stainless steel	Sample liquid
Disposable tip	PP	Sample liquid
Tip cone	Stainless steel	No direct exposure (air gap)
Seal	EPDM	No direct exposure (air gap)

Also refer to section 3.7.2 “Resistance of Special Materials”, 2 3-86.

Microplates

Microplates

Microplates with 96 or 384 wells can be used with DiTis or a fixed tip block. They must meet the standards of the Society of Bio-molecular Screening (ANSI/SLAS).

3.5.4 Multichannel Arm (MCA384)

What is MCA384?

The MCA384 is a robotic multichannel pipetting arm designed for high-speed, high-precision liquid pipetting between standard microplates (MP) with 96, 384 or 1536 wells.

Configuration

The table shows the possible variants of the MCA384 configuration:

Tab. 3-55 *Basic components and consumables for MCA384*

Components/Disposables	Configuration/Variants
Pipetting head	384 channels Pipetting volume: 0.5 to 125 µl (in 384 well format) 0.5 to 500 µl (in 96 well format)
Fixed tips	Mounted as fixed tip adapters Short or long washable tips, pipetting range 0.5 to 125 µl For 96-, 384- and 1536-well microplates and 96-deep-well microplates Minimum diameter of the wells: 1.7 mm (0.067 in.)
Disposable tips (DiTis)	Mounted with DiTi adapters **Variants:** 15 µl, 50 µl, 125 µl For 96-, 384- and 1536-well microplates Minimum diameter of the wells: 3 mm (0.118 in.)
Carriers	Freedom EVO System Carrier Freedom EVO DiTi Carrier Standard MP carrier (landscape) Nested DiTi flat carrier, 3 or 4 positions (landscape)

Adapter Types

Tab. 3-56 Fixed tip adapter types for 384 channel head

Adapter type	Min. volume	Max. volume	Tip length [1/10 mm]	Tip orifice Inner diameter
Adapter Fixed 125 µl MCA384	3 µl	125 µl	280	0.58 mm (0.023 in.)
Adapter Fixed 15 µl MCA384	1 µl	15 µl	280	0.43 mm (0.017 in.)
Adapter 96 Fixed 125 µl MCA384	5 µl	125 µl	440	0.58 mm (0.023 in.)
Adapter 96 Fixed 15 µl MCA384	1 µl	15 µl	280	0.43 mm (0.017 in.)

Tab. 3-57 DiTi Adapter types for 384 channel head

Adapter type	Min. volume	Max. volume	Tip length [1/10 mm]	Tip orifice Inner diameter
Adapter DiTi Combo MCA384	For tip data see Tab. 3-58 “DiTis for 384 channel head”, 2 3-66			
Adapter DiTi MCA384	For tip data see Tab. 3-58 “DiTis for 384 channel head”, 2 3-66			
Adapter 96 DiTi MCA384	For tip data see Tab. 3-58 “DiTis for 384 channel head”, 2 3-66			
Adapter 96 DiTi 1to1 MCA384	For tip data see Tab. 3-48 “Data of DiTi variants”, 2 3-58			
Adapter 96 DiTi 4to1 MCA384 (EVA)	For tip data see Tab. 3-48 “Data of DiTi variants”, 2 3-58			

DiTi types

for 384 Channels

Tab. 3-58 DiTis for 384 channel head

DiTi type	Min. volume	Max. volume	Tip length [1/10 mm]	Tip orifice
15 µl DiTi w/o filter	0.5 µl	15 µl	278.6	$0.23^{\pm 0.02}$ mm (0.009 in.)
50 µl DiTi w/o filter	1.0 µl	50 µl	407.4	$0.30^{\pm 0.02}$ mm (0.012 in.)
125 µl DiTi w/o filter	2.0 µl	125 µl	467.8	$0.45^{\pm 0.02}$ mm (0.018 in.)

for 96 Channels

refer to Tab. 3-48 “Data of DiTi variants”, 2 3-58.

Tip Length MCA384 Tips

The figure shows the MCA384 pipetting head equipped with the different MCA384 tip types and their lengths (mm / in.):

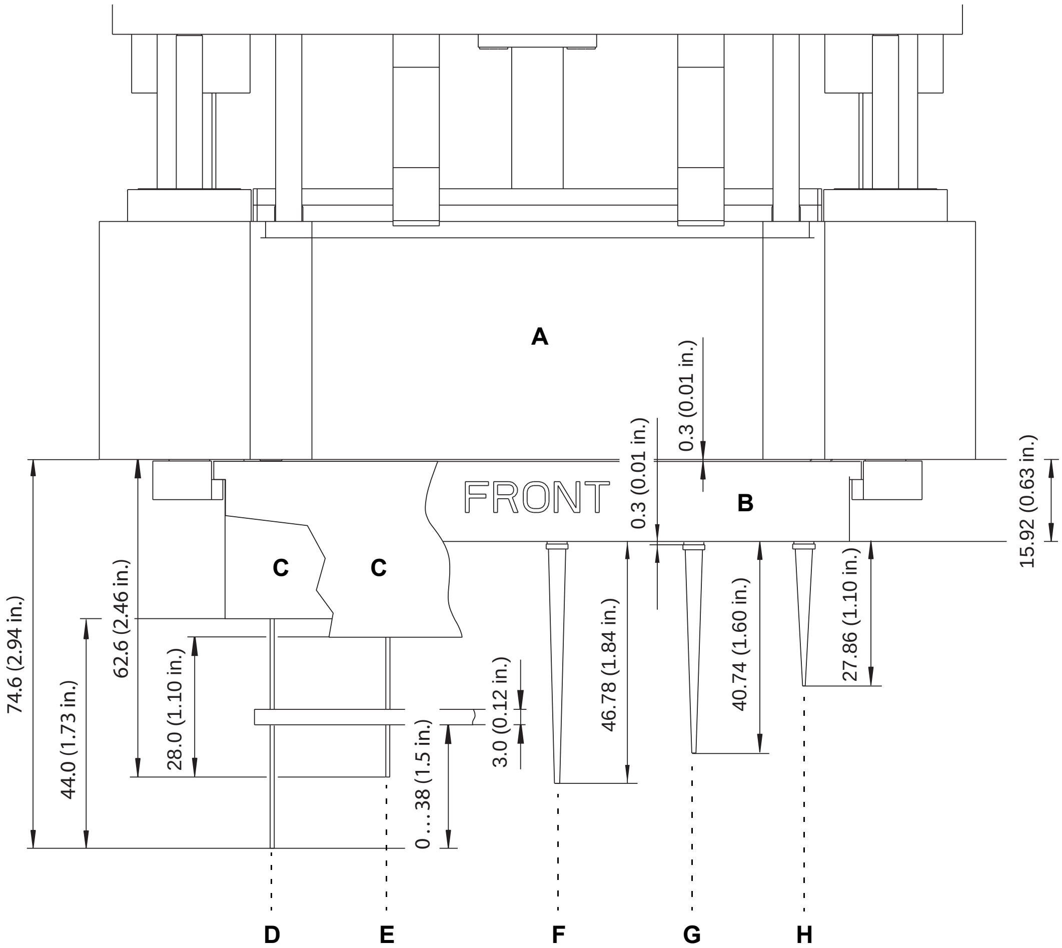


Fig. 3-17 *MCA384 pipetting head / tip length*

A	*384 channel head*	***E***	*Fixed tip short*
B	*DiTi adapter*	***F***	*125 µl DiTi*
C	*Fixed tip adapter*	***G***	*50 µl DiTi*
D	*Fixed tip long*	***H***	*15 µl DiTi*

Note: *DiTis tend to back by some distance after being picked up.*

– Therefore, they may “get longer” than their theoretical value [typ. 0.25 mm (0.01 in.)].
– Also manufacturing tolerances of the DiTis account for deviations in length.

Tip Clearance MCA384 Tips

The figure shows the tip clearance for the different MCA384 tip types:

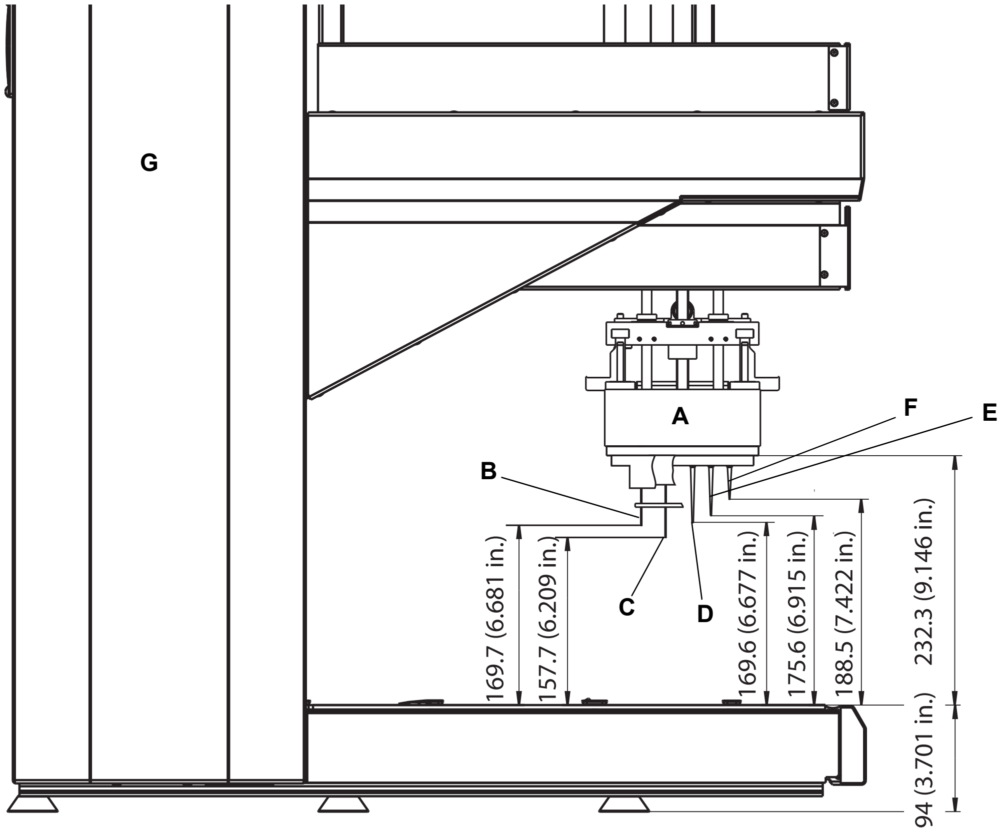


Fig. 3-18 *Freedom EVO tip clearance*

A	*384 channel head*	***D***	*125 µl DiTi*
B	*Fixed tip short*	***E***	*50 µl DiTi*
C	*Fixed tip long*	***F***	*15 µl DiTi*

Tip Length MCA96 DiTis

The figure shows the MCA384 pipetting head equipped with the different MCA96 DiTi types and their lengths (mm / in.):

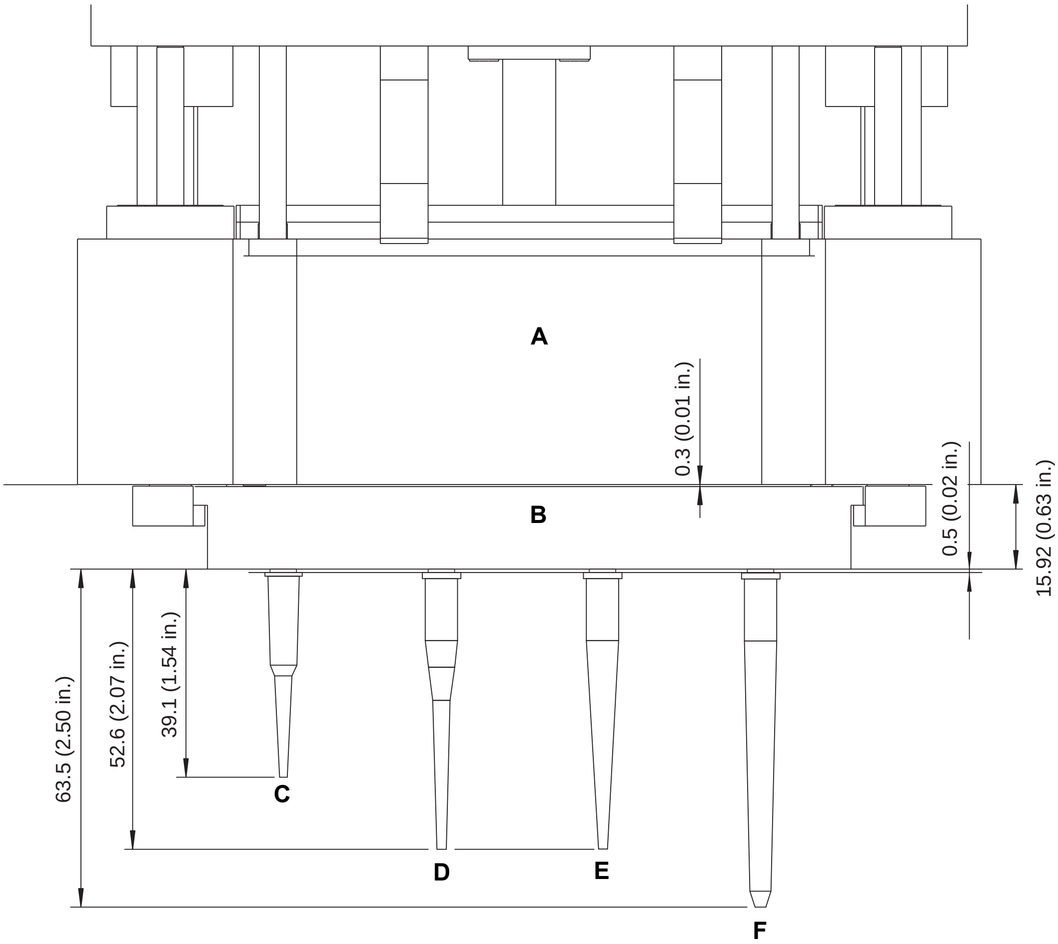


__Fig. 3-19__ MCA384 pipetting head / MCA96 DiTi length

A	*384 channel head*	***D***	*100 µl DiTi*
B	*DiTi adapter (1to1 or 4to1)*	***E***	*200 µl DiTi*
C	*50 µl DiTi*	***F***	*500 µl DiTi*

Note: *DiTis tend to back by some distance after being picked up.*

- Therefore, they may “get longer” than their theoretical value [typ. 0.5 mm (0.02 in.)].
- Also manufacturing tolerances of the DiTis account for deviations in length.

Tip Clearance MCA96 DiTis

The figure shows the tip clearance for the different MCA96 DiTi types:

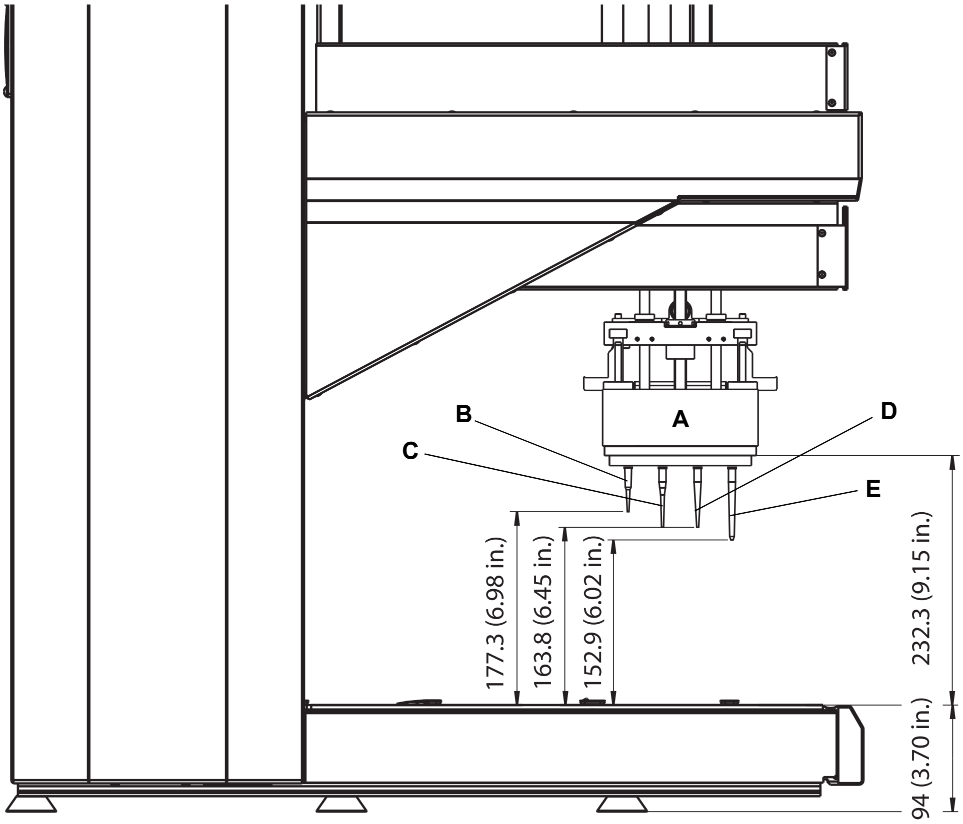


Fig. 3-20 *MCA384 pipetting head / MCA96 DiTi tip clearance*

A	*384 channel head*	***D***	*200 µl DiTi*
B	*50 µl DiTi*	***E***	*500 µl DiTi*
C	*100 µl DiTi*		

Options and Accessories

Several options and accessories are available for the MCA384:

Tab. 3-59 *Options and accessories*

Option / Accessory	Configuration / Variants
DiTi Carrier	Holds 2 DiTi boxes (for picking up DiTis) 6 grid pos. wide
System Carrier	3 positions, freely configurable for: • Rack adapters (MCA 384 head adapter plates or MCA 384 washable tip adapter plates can be placed on rack adapters) • ANSI/SLAS nests (DiTi boxes for row/column wise mounting of tips can be placed on ANSI/SLAS nests) • Wash blocks 6 grid pos. wide (+ 1 grid for tubing if wash station is installed)
MCA384 adapters	• Adapter DiTi MCA384 • Adapter DiTi Combo MCA384 (for fetching 384 DiTis or rows of 24 DiTis or columns of 16 DiTis) • Adapter 96 DiTi MCA384 (for fetching 96 DiTis or rows of 12 DiTis or columns of 8 DiTis) • Adapter DiTi 1to1 MCA384 for MCA96 disposable tips only (for fetching 96 DiTis or rows of 12 DiTis or columns of 8 DiTis) volume range: 0.5 to 125 µl • Adapter DiTi 4to1 MCA384 (EVA) for MCA96 disposable tips only (for fetching 96 DiTis or rows of 12 DiTis or columns of 8 DiTis) volume range: 1 to 500 µl • Adapter Fixed 125 µl MCA384 • Adapter Fixed 15 µl MCA384 • Adapter 96 Fixed 125 µl MCA384 • Adapter 96 Fixed 15 µl MCA384 • QC adapter
Reagent trough	Various volumes (e.g. 300ml, 60 ml, etc.) as available from appropriate suppliers
Labware	Microplates (MP): 96, 384, 1536 wells Deep Well Plates (DWP): 96, 384 wells
Wash system	Consisting of: – Wash Control Unit MCA – Wash block, tubing, fittings and filter
Optional MCA384 Gripper (CGM)	Mounted on the right side of the MCA384 Independent Y- and Z-movement Rotation angle: 360°

MCA384 Performance Data

Capacity and Throughput

The table below specifies the performance in terms of theoretical throughput:

Tab. 3-60 *Throughput*

Theoretical throughput (depending on the application)	Approx. 30[a)] 384-well Microplates per hour (pipetting a 1 to 1 copy)

a) Assumption per 384 plate: cycle: Pick up MCA384 fixed tip Adapter, 1x aspirate, 1x dispense, 1x wash, drop MCA384 fixed tip Adapter.

Speed / Timings

The table below shows the timings of some frequently used process steps:

Tab. 3-61 *Timings*

Liquid transfer	15 - 20 sec
Disposable tip mounting	8 - 12 sec
Disposable tip dropping	6 - 10 sec
Adapter mounting / exchanging	8 - 10 sec

Precision (LH)

The table below specifies the maximum deviation for:

Pipetting volume range	0.5 - 125 µl

Note: *Precision and accuracy depend on the characteristics of the specific liquid and the DiTis or the tip adapter used.*

Pipetting Notes

Note: *Values are only achieved if maintenance has been performed on schedule and the instructions have been strictly followed.*

Tecan recommends you to check the precision and the accuracy with the specific liquid and pipetting device (DiTi or fixed tip) used in your application to verify the corresponding calibration factors and to adjust them, if necessary.
Refer to the Freedom EVOware Software Manual.

- In the application software, default calibration factors are predefined for contact dispense with DMSO and water.
- Tecan recommends you to verify the calibration factors and the accuracy with the liquids used in each application.

Pipetting with COMBO Adapter Plate in 384 Well Format

Tab. 3-62 Freedom EVO pipetting precision

Tip type	Volume Range	Measured at	CV	Accuracy
Disposable Tips - Aqueous				
15 µl	0.5 -15 µl	0.5 µl	≤ 4%	± 10%
50 µl	1.0 - 50 µl	1.0 µl	≤ 4%	± 5%
125 µl	2.0 - 125 µl	2.0 µl	≤ 3%	± 5%
Disposable Tips - DMSO				
15 µl	0.5 - 15 µl	0.5 µl	≤ 4%	± 5%
50 µl	0.5 - 50 µl	0.5 µl	≤ 4%	± 5%
125 µl	2.0 - 125 µl	2.0 µl	≤ 3%	± 5%
Fixed Tip Adapters - Aqueous				
384 low volume fixed tip adapter (SC)	1.0 - 15 µl	1.0 µl	≤ 8%	± 10%
384 large volume fixed tip adapter (LC)	3.0 - 125 µl	3.0 µl	≤ 6%	± 5%
Fixed Tip Adapters - DMSO				
384 low volume fixed tip adapter (SC)	0.5 - 15 µl	0.5 µl	≤ 6%	± 10%
384 large volume fixed tip adapter (LC)	2.0 - 125 µl	2.0 µl	≤ 5%	± 5%

Contact dispense with COMBO adapter in 384 format, photometric measurement of color solution, CV calculated over complete 384 well plate, three replicates, typical pipetting precision/accuracy are defined as the worst CV/ accuracy value of at least three tested instruments (standard liquid classes).

Pipetting with EVA Adapter Plate in 96 Well Format

Tab. 3-63 Freedom EVO pipetting precision

Tip type	Volume Range	Measured at	CV	Accuracy
Disposable Tips				
500 µl	25 - 500 µl	25 µl	≤ 5%	± 5%
500 µl	25 - 500 µl	200 µl	≤ 2%	± 5%
Disposable Tips - DMSO				
500 µl	25 - 500 µl	25 µl	≤ 5%	± 5%
500 µl	25 - 500 µl	200 µl	≤ 2%	± 5%

Contact dispense with EVA adapter in 96 format, photometric measurement of color solution, CV calculated over complete 96 well plate, three replicates, typical pipetting precision/accuracy are defined as the worst CV/ accuracy value of at least three tested instruments (standard liquid classes).

Disposable Tips

Note: *The shape of tips or inappropriate material properties can have considerable adverse effects on pipetting results. The risk of pipetting errors dramatically increases if tips do not fit properly or if the tip outlet geometry is inadequate. The use of Tecan disposable tips guarantees optimal performance of all Tecan pipetting platforms.*

Highly Viscous Liquids

Note: *Highly viscous liquids as well as liquids with insoluble particles can cause the pipetting system to behave differently than assumed by the controlling software. The software can adapt its behavior by means of different settings. In such cases, consult the manufacturer to assess the feasibility of the application with regard to liquid handling.*

MCA384 Options

Wash System

The table specifies the weight and dimensions of the wash system components:

Tab. 3-64

	Weight (kg / lbs)	Dimensions [mm / in.] (Width x Depth x Height)
Wash System MCA	approx. 12 kg (26.5 lbs)	285 x 480 x 610 mm (11.2 x 18.9 x 24 in.)
Wash block for MCA384	approx. 457 g (1.01 lbs)	140 x 120 x 71 mm (5.5 x 4.7 x 2.8 in.)

MCA384 Materials

Parts and Their Resistance

The following parts of the system are more or less exposed to the liquids which are pipetted:

Tab. 3-65 *Exposed parts, used materials*

Part	Material	Exposure
Fixed tip	Stainless steel	Sample liquid
Disposable tip	PP	Sample liquid
Gasket	Silicone	No direct exposure (air gap)

Also refer to section 3.7 “Chemical Resistance”, 2 3-85.

Microplates

Microplates

Microplates with 96, 384 or 1536[1)] wells can be used with DiTis or a fixed tip adapter. They must meet the standards of the Society of Bio-molecular Screening (ANSI/SLAS).

3.5.5 MCA384 Gripper

The table specifies the technical data of the MCA384 Gripper:

Tab. 3-66 *MCA384 Gripper technical data*

Gripper force (Z-axis)	up: max. 19 N down: max. 40 N
Gripper force (G-axis)	max. 20 N
Transportable mass	max. 0.45 kg (0.99 lbs)
Z-range	Total range: 260 mm (10.2 in.)
G-range (gripper)	146 mm (5.75 in.)
Gripper space range	25 to 171 mm (0.98 to 6.73 in.)
Rotator space range	0° - 360°

The figure shows the MCA384 Gripper clearance:

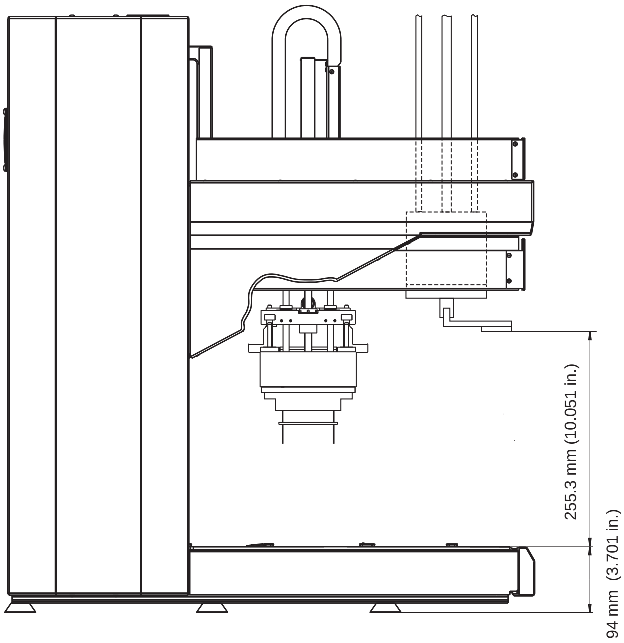


Fig. 3-21 *MCA384 Gripper max. clearance (distance to worktable)*

Note: *The top positions shown in the figure take 1 mm (0.04 in.) initialization offset into account.*

3.5.6 Robotic Manipulator Arm Standard (RoMa Standard)

The Freedom EVO instrument can be equipped with up to two robotic manipulator arms.

1) with 15 µl DiTis or 15 µl fixed tips only

The robotic manipulator arm is used to transport objects of the format of microplates, such as reagent blocks, deep well plates, etc. from one to another position on the worktable or for storage onto the shelf.

Tab. 3-67 *RoMa standard technical data*

Force in Z-direction	60 N
Z-range	Total range: 259 mm (10.2 in.) Work range: 257 mm (10.12 in.)
Transportable mass	max. 0.4 kg (0.88 lbs)
Gripper force	10 N
Gripper space range	58 to 140 mm (2.28 to 5.51 in.)
Rotation angle	270° (left or right oriented)

ATTENTION

Improper transport of labware (microplates, etc.)
Use only labware that is rigid enough not to be deformed by the gripper force.

3.5.7 Robotic Manipulator Arm Long (RoMa Long)

The Freedom EVO instrument can be equipped with up to two robotic manipulator arms with long Z-axis.
The robotic manipulator arm with long Z-axis, RoMa long, is used to transport objects of the format of microplates, such as reagent blocks, deep well plates, etc. from one to another position on or underneath the worktable or for storage onto the shelf.

Tab. 3-68 *RoMa long technical data*

Force in Z-direction	60 N
Z-range	Total range: 610 mm (24.0 in.) Work range: 608 mm (23.94 in.)
Transportable mass	max. 0.4 kg (0.88 lbs)
Gripper force	10 N
Gripper space range	58 to 140 mm (2.28 to 5.51 in.)
Rotation angle	270° (left or right orientated)

ATTENTION

Improper transport of labware (microplates, etc.)
Use only labware that is rigid enough not to be deformed by the gripper force.

3.5.8 Pick and Place Arm (PnP)

The Freedom EVO instrument can be equipped with up to two pick and place arms.
The PnP arm is used to transport tubes or other cylindrical containers from one to another position on the worktable.

Tab. 3-69 *Pick and place arm technical data*

Force in Z-direction	In “up” direction 30 N In “down” direction 50 N
Z-range	386 mm (15.2 in.)
Transportable mass	Max. 100 g (0.22 lbs)
Gripper force	15 ±5 N[a)]
Possible tube diameter	11 to 18 mm (0.43 to 0.71 in.)[b)]
Rotation angle	360° (unlimited rotation)

a) *Can be adapted by means of firmware commands (increased gripper force may reduce the life expectancy of the PnP)*
b) *With adapted gripper parameters up to 25 mm (0.98 in.)*

3.5.9 Positive Identification (PosID)

What Is PosID?

The PosID (positive identification module) reads barcodes on carriers and containers e.g. sample tubes, microplates, etc.

Performance Data

The PosID is able to read horizontal and vertical barcodes.

Tab. 3-70 *General PosID performance data*

Number of different container code types per application	Up to 6 different container code types can be used at the same time
Reading positions on carrier	Up to 24 container positions
Max weight of a carrier to be handled by PosID	2.2 kg (4.85 lbs)
Immunity against external light sources	External light below 8000 lux is harmless
Work range for carriers (clear worktable, i.e. no elements, such as incubators that restrict the PosID access range, present)	The PosID can read the carrier ID in any grid position[a)]
Work range for containers on the worktable (clear worktable, i.e. no elements, such as incubators that restrict the PosID access range, present)	Restriction: The PosID cannot read the container IDs of carriers in the two rightmost grid positions[a)]
Throughput: Required time to read 10 strip racks (16 positions)	Max. 90 s (including carrier ID)

a) Restrictions due to additional elements on the worktable, e.g. incubators.

ATTENTION

Barcodes cannot be read due to the influence of strong light sources (direct sunlight, artificial lighting, etc.).

- Make sure that the PosID is not exposed to direct sunlight.
- Do not install strong light sources near the PosID.

Reading Characteristics

The following typical read and detection rates can be expected:

Tab. 3-71 *Reading/detection data*

Item to be detected	Reading speed	Read rate[a)]	Detection rate[b)]
Carrier ID barcode	300 mm/s	99.9%	-
Container ID barcode, tubes of 16 mm diameter in carrier with 16 positions	300 mm/s	99.8%	99.98%
Container ID barcode, tubes of 10 mm diameter in carrier with 16 positions	300 mm/s	99.8%	99.98%
Container ID barcode, tubes of 10 mm diameter in carrier with 24 positions	200 mm/s	99.8%	99.98%
Container ID barcode, 3 microplates on carrier, landscape position	300 mm/s	99.8%	-
Container ID barcode, 100 ml trough on carrier	100 mm/s	99.8%	-

a) Barcode scanner
b) “No Tube” sensor, glass or plastic tube, filled or empty, with or without barcode

Barcode Symbology Types

The PosID recognizes a number of different barcode types. Not all types provide for sufficient reading security.
For that reason, the following considerations must be taken into account when defining the barcode types to be used for container identification:

Tab. 3-72 *Barcode symbology types*

Symbology	Characteristics	Recommendation
Code 128	Variable length, high density, alphanumeric symbology. Three different character sets can encode • upper case and ASCII control characters, • upper and lower case characters, • or numeric digit pairs. Employs a check digit for data security.	Recommended[a]. Widely used and good reading security.
Code 39 Standard[b]	Variable length, alphanumeric symbology. The character set can encode upper case, numeric, and the characters -.*$/+%. The asterisk (*) is reserved as start / stop character. Allows for a (modulo 43) check digit.	Use only with check digit (modulo 43).
Code 39 Full ASCII[b]	Same as code 39 standard, but can encode the complete 128 ASCII character set (including asterisk).	Use only with check digit (modulo 43).
Codabar[b]	Variable length symbology. The character set is restricted to numerics and the characters -$:/.+ABCD, whereas A, B, C and D are used as start and stop characters. Allows for a (modulo 16) check digit.	Not recommended (reading security). May only be used with defined code length and check digit (modulo 16).
Interleaved 2 of 5[b]	Variable length, high density, numeric symbology. Pairs of digits can be encoded in an interleaved manner (bars and spaces). **If partially scanned, there is the possibility of a barcode being decoded as a valid (but shorter) number.** Optionally allows for a (modulo 10) check digit.	Do not use (reading security insufficient). May only be used with defined code length and check digit (modulo 10). At least 6 characters are necessary.

a) Also used for standard carrier ID barcodes
b) The application SW may restrict the use of barcode types.
See section “Permissible Barcode Types” below.

Barcode Label Quality

Barcode Label Specifications

The barcode labels must fulfil the following specifications:
- Module width: 5 to 15 mils (0.127 to 0.381 mm)
- Quiet zone (QZ): ≥ 5 mm
- Barcode height: min. 7 mm
- Barcode length: Max. 64 mm (without quiet zone)
- Number of characters: Max. 32
- Black symbols on white background

Standards define the quality of the barcode labels regarding symbol contrast, reflectance and edge determination, etc.
To avoid misreadings, the quality of the barcode labels must be graded **A**, **B** or **C** according to **ANSI X3.182** and **DIN EN 1635**. Tecan recommends using grade **A** for best reading performance.
A quality system in the production of barcode labels must be employed to ensure the conformity to the quality grades mentioned above.

Recommendations

To ensure good reading results, pay attention to the following recommendations:
- Use barcode testing device to verify the barcode quality.
- Print quality: Use barcodes printed by means of a thermal-transfer or photographic printer.
- Barcode label surface must be mat and clean.
- Do not use yellowed, stained, creased, wet or damaged barcode labels.

Barcode Label Positioning

Note: *The legibility of the barcodes can be increased by positioning the barcode labels accurately.*

Barcode Label on Tubes

The figure shows the dimensions for barcode label positioning on tubes.

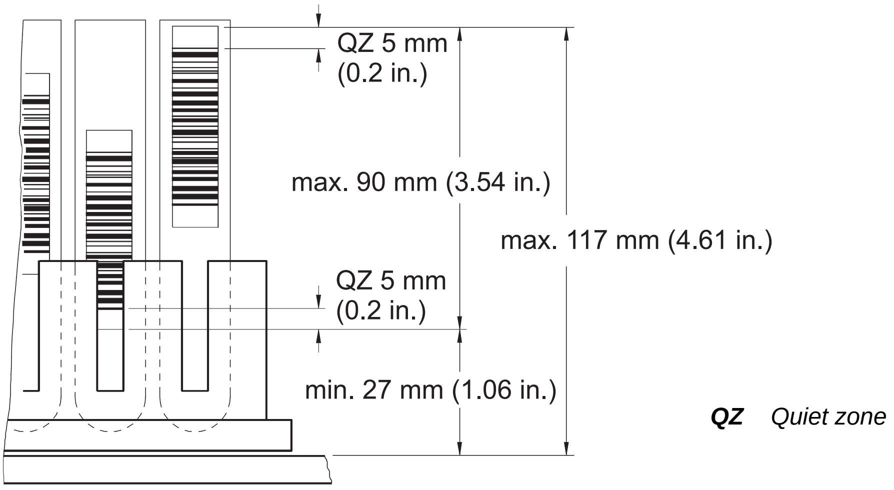
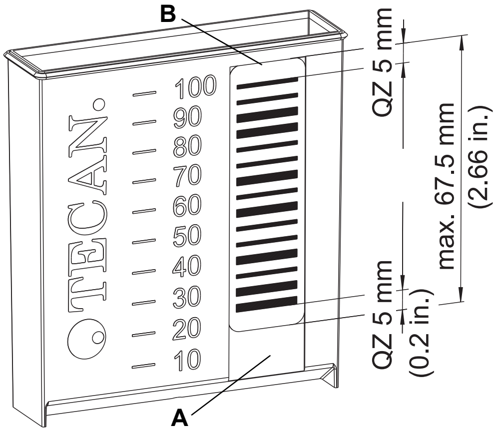


Fig. 3-22 *Barcode label on tubes*

Barcode Label on Trough

The figure shows how to position the barcode labels on reagent troughs.



A	*Recess for barcode label*
B	*Edge of barcode label must be flush with upper end of recess*
QZ	*Quiet zone*

Fig. 3-23 *Barcode label on trough*

Barcode Label on Microplate

The figure shows the dimensions for barcode label positioning on microplates.

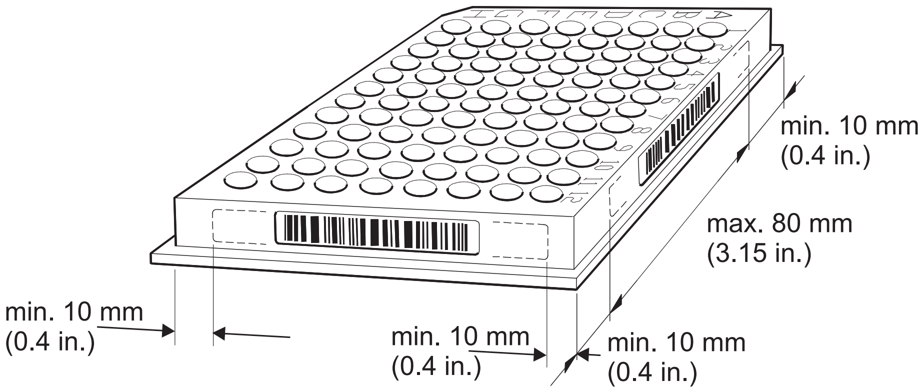
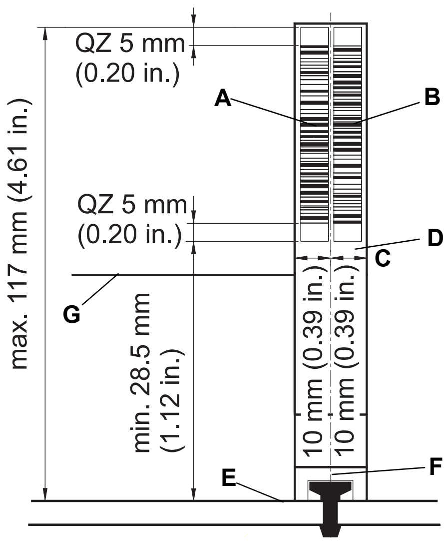


Fig. 3-24 *Barcode label on microplate*

Barcode Label on Carrier

The figure shows the dimensions for barcode label positioning on carriers:



A	*Carrier ID code 1*
B	*Carrier ID code 2 (used for verification)*
C	*Max. distance from pin center*
D	*Carrier barcode label support*
E	*Worktable surface*
F	*Center of positioning pin*
G	*Carrier body*
QZ	*Quiet zone*

Fig. 3-25 *Barcode label on carrier*

3.5.9.1 Permissible Barcode Types

Note: *Depending on the application software, not all barcode types readable by the PosID may be supported.*

Refer to your Application Software Manual to find out the permissible barcode types.

3.6 Optional Modules

3.6.1 Available Options

The following further options are available for the Freedom EVO:

Tab. 3-73 *Options*

Designation	**Abbreviations**
Tecan DiTi and plate stacker for Freedom EVO (2 or 4 base units, 1 or 2 transfer stations)	Te-Stack
Tecan vacuum separation module	Te-VacS
Tecan magnetic separation module	Te-MagS
Tecan shaker	Te-Shake
Monitored incubator option (4 or 6 slots with/without shaking)	MIO
Carousel	–
GenePaint	Te-Flow
Water bath for Te-Flow	–
Symbol BC scanner	–
Tecan washers (various types)	–
Tecan readers (e.g. Sunrise, Infinite series, Spark)	–
Input/output option (4 digital inputs/4 digital outputs/RS485)	I/O Option

Note: *Refer to the separate documentation of these options.*

3.6.2 Available OEM Options

The following options from original equipment manufacturers are available:

Tab. 3-74 *OEM options*

Designation	Manufacturer
Hettich centrifuge	Andreas Hettich GmbH
Mettler balance	Mettler Toledo GmbH
Reader: Luminex 100/200, FLEXMAP 3D, MAGPIX	Luminex Corporation
Variomag magnetic stirrer	H+P Labortechnik AG

Note: *For detailed information refer to the documentation of the respective manufacturer.*

3.6.3 Centrifuge

Note: *A new version of the Hettich Rotanta Centrifuge was introduced in 2010. Main difference between the new and previous model:*

- *New operating panel*
- *Hex head wrench to open lid (emergency release; centrifuge with power off)*
- *New large grip bar to hold and move the centrifuge*
- *Different dimensions and more weight than previous model (see below)*

Tab. 3-75 *Centrifuge specifications*

Specification	Description	
Type	Hettich Rotanta 460 Robotic centrifuge	
Dimensions	New model (as of mid 2010)	Previous model (until mid 2010)
• Depth **• Width** **• Height**	697 mm (27.5 in.) 554 mm (21.8 in.) 723 mm (28.5 in.)	685 mm (27.0 in.) 580 mm (22.8 in.) 722 mm (28.4 in.)
Weight	approx. 159 kg (350 lbs)	approx. 110 kg (242 lbs)
Power supply input	The Hettich centrifuge can be delivered in two versions, a European version with fixed supply ratings and an international version. Power cables are available with German, Swiss, UK and US plugs.	

Centrifuge Power Supply Input

Tab. 3-76 *Centrifuge power supply input*

Version	Voltage	Frequency	Remarks
European	230 VAC	50 Hz	
International	115 VAC	60 Hz	US supply ratings
International	110 VAC	50 Hz	Japanese supply ratings depending on region
International	110 VAC	60 Hz	Japanese supply ratings depending on region

3.7 Chemical Resistance

3.7.1 Standard Materials Resistance Table

Chemical Resistance

In the following the chemical resistance of the used (standard) materials is specified:

Tab. 3-77 *Chemical resistance table*

Material	FEP	PVC	Silicone	POM	PVDF	PP	PTFE	FFPM	PCTFE[a)]	ETFE
Acetone	o	/	o	x	/	o	o	o	o	o
Acetonitrile (C_2H_3N)	o	/	/	/	x	o	nd	nd	nd	o
Formic acid 100 %	o	x	x	/	x	o	o	x	o	o
Ammonium hydroxide 25 %	o	x	o	/	o	o	o	nd	o	o
Chloroform	o	/	/	x	o	x	o	x	x	/
Dimethyl-formamide	o	/	/	/	/	o	o	o	o	/
DMSO	o	/	x	o	/	o	nd	nd	nd	o
Acetic acid 96 %	o	/	x	/	o	x	o	o	o	x
Acetic acid ethyl-ester	o	/	/	x	/	x	nd	nd	nd	x
Ethanol 96 %	o	x	x	o	o	o	o	o	o	o
Formaldehyde 40 %	o	x	x	x	o	o	o	x	o	o
Sulfuric acid 40 %	o	x	/	/	o	o	o	o	o	o
Sulfuric acid 96 %	o	/	/	/	/	x	o	o	o	o
Isopropanol	o	/	x	o	o	o	o	o	o	o
Diluted bleach, NaOCl	o	x	x	/	o	x	o	o	o	o
Methanol	o	x	o	x	o	o	o	o	o	o
Methylene chlo-ride	o	/	/	x	/	/	o	o	o	/
Sodium hydroxide 10M	o	x	o	/	x	o	nd	nd	nd	o

Tab. 3-77 Chemical resistance table (cont.)

Material	FEP	PVC	Silicone	POM	PVDF	PP	PTFE	FFPM	PCTFE[a)]	ETFE
Perchloric acid 60 %	o	/	/	x	o	x	o	x	x	/
Petroleum ether 30/50	o	x	/	x	o	/	nd	nd	nd	x
Hydrochloric acid 32 %	o	x	/	/	o	o	o	o	o	o
Trichloroacetic acid 40 %	o	/	/	o	o	/	o	o	o	x

a) Kel-F

Legend:

o	resistant
x	partly resistant, use is possible with frequent replacements
/	not resistant, unsuitable for use
nd	not determined

3.7.2 Resistance of Special Materials

3.7.2.1 Tygon Tubing

The tubing manufacturer specifies the chemical resistance of the tubing used in the “FWO with DMSO-resistant soft tubing” and in the “MCA96 Wash System” as follows:

- Type: Tygon 2075 Ultra Chemical Resistant Tubing
  – Resistance against ethanol: Excellent
  – Resistance against DMSO: Good

For more details please refer to **http://www.tygon.com**

3.7.2.2 EPDM Seals

The tip cone seals of the MCA96 pipetting head are made of EPDM. They are not resistant against CH_3CN (acetonitrile).

ATTENTION

Damage to the tip cone seals (leaking DiTis or fixed tip block)

- If you use CH_3CN with the MCA96, make sure that the seals are not moistened.
- Also vapors may corrode the seals. Check the condition of the seals more frequently, if you use CH_3CN.

3.7.2.3 Silicone Gaskets

The gaskets of the MCA384 pipetting head are made of silicone. They never get into contact with any liquid except by a malfunction.

ATTENTION

Damage to the gaskets (leaking DiTis or fixed tips)

- If you use CH_3CN with the Freedom EVO, make sure that the gaskets are not moistened.
- Also vapors may corrode the gaskets. Check the condition of the gaskets more frequently, if you use CH_3CN.

3.7.2.4 MCA384 Gripper

The MCA384 Gripper finger is furnished with a coating of EPDM to increase the frictional force between the gripper and the handled object. Be aware of the fact that EPDM is less resistant against certain chemicals than stainless steel.

ATTENTION

Damage to the gripper finger if the EPDM coating comes in contact with aggressive chemicals, such as HCl, NaOH, chloroform or hexane.

- Make sure that no spillage of such chemicals occurs.
- Use only the recommended decontamination solutions that do not affect the EPDM coating (see 7.1.1 “Cleaning Agents”, 2 7-1).

3.7.2.5 Air LiHa Tip Cone

The Air LiHa tip cone and the inline filter may be moistened with aerosols from the sample liquid.
The chemical resistance of the gold-plated brass tip cone depends on temperature and exposure time. The inline filter is made of polyethylene, its chemical resistance is comparable with the one of polypropylene (PP).
When pipetting aggressive liquids or strong solvents, check the Air LiHa tip cone for corrosion and replace the inline filter if it’s not clean any more.

4 Description of Function

Purpose of This Chapter

This chapter explains the basic principle of the Freedom EVO, shows how it is structured and gives a functional description of the assemblies.

4.1 Introduction

Main Parts

The instrument consists of a platform that includes worktable, frame, housing, main electronic boards and power supply.

The platform is available in three different sizes.

- Instrument size (approximate instrument length: 100 cm (39.37 in.))
- Instrument size (approximate instrument length: 150 cm (59.06 in.))
- Instrument size (approximate instrument length: 200 cm (78.74 in.))

The platform can be placed onto a cabinet and can be equipped with up to three robotic arms (two for instrument size 100) in several combinations.

Robotic Arms

It can be equipped with

- up to two liquid handling arms (LiHa). The LiHa includes a liquid system with diluters.
  – The LiHa is used for liquid handling (pipetting, diluting, etc.)
- one Air displacement pipetting arm (Air LiHa).
  – The air LiHa is used for liquid handling (pipetting, diluting, etc.)
- one multichannel arm with (MCA96/G) or without gripper (MCA96).
  – The MCA96 is used for multichannel liquid handling in microplates.
  – The gripper is used to transport racks, such as microplates.
- one multichannel arm MCA384.
  – The MCA384 is used for multichannel liquid handling in microplates.
- up to two robotic manipulator arms (RoMa).
  – The RoMa is used to transport racks, such as microplates.
- up to two pick and place arms (PnP).
  – The PnP serves to transport containers, such as sample tubes.

Sample/Carrier Identification

A positive identification module (PosID) is available to automatically identify carriers and containers on the worktable by means of a barcode scanner.

Options

A variety of options is available for the Freedom EVO, e.g.

- Multichannel pipetting option
- MultiSense option
- Plate stacker
- Vacuum separation module
- Magnetic separation module
- Centrifuge
- Balance
- Shaker
- Incubator
- Microplate reader
- Microplate washer

Control

The operator controls the system via a personal computer, on which the instrument software as well as the relevant application software are installed.

4.2 Structure

4.2.1 Mechanical Structure

The figure shows the main parts of the Freedom EVO:

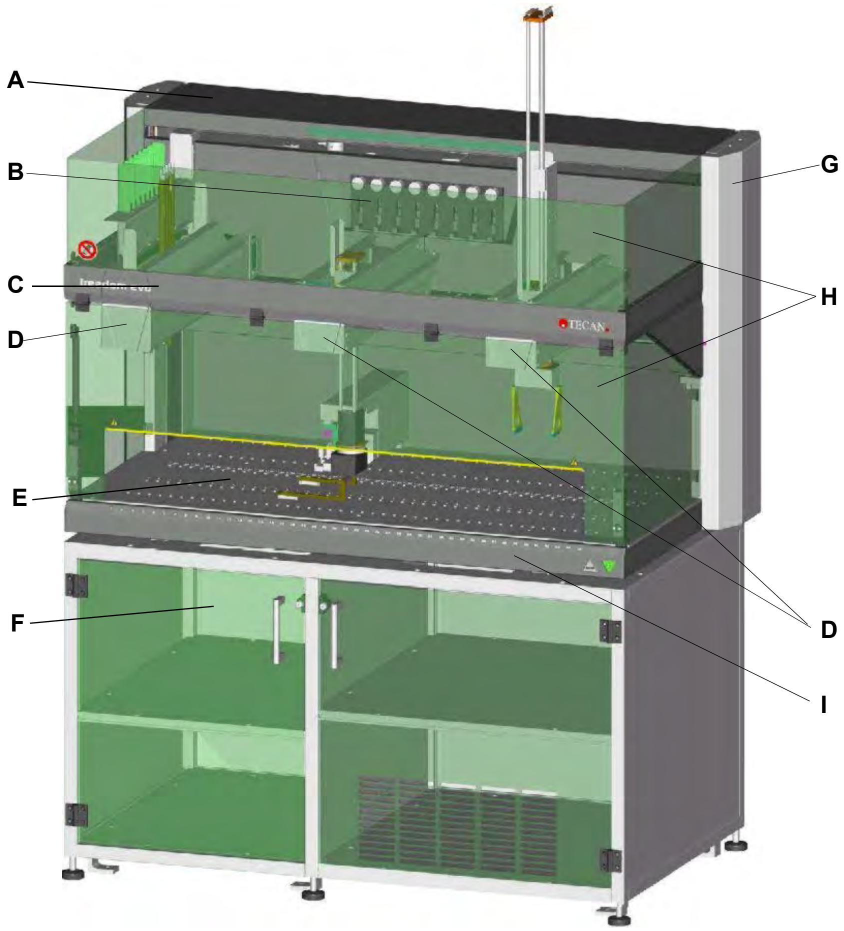


Fig. 4-1 Freedom EVO instrument overview

A	*Housing*
B	*Diluters with syringes*
C	*Frame*
D	*Robotic arms*
E	*Worktable with positioning pins*
F	*Cabinet, containing e.g. the system liquid container, the waste container, or a centrifuge*
G	*Electronic boards behind lateral covers*
H	*Safety panels*
I	*Front access panel*

Multichannel Arm

***Note:** If the instrument is equipped with an MCA96, the frame is reinforced by means of struts in the front corners. The struts serve to carry the weight of the arm and to absorb the force in Z-direction (e.g. when the MCA96 picks up DiTis).*

4.2.2 The Freedom EVO Worktable

Positioning Pins

On the Freedom EVO worktable, evenly spaced positioning pins ensure proper positioning of all carriers according to the grid represented within the software. One grid position defines the minimal width of carriers, e.g. wash stations and strip racks for tubes. The positioning pins also enable the sliding of carriers/racks in Y-direction.

Sliding Carriers and Racks

Sliding carriers and racks are needed for:

- Replacement (loading/unloading) of carriers or racks during operation,
- The identification of tubes, microplates, troughs etc. on carriers by the PosID.

4.2.3 Liquid System Structure

Liquid System refers to all instrument modules and parts which contain or directly influence liquid. The figure shows an example for an eight-tip configuration with one liquid handling arm.

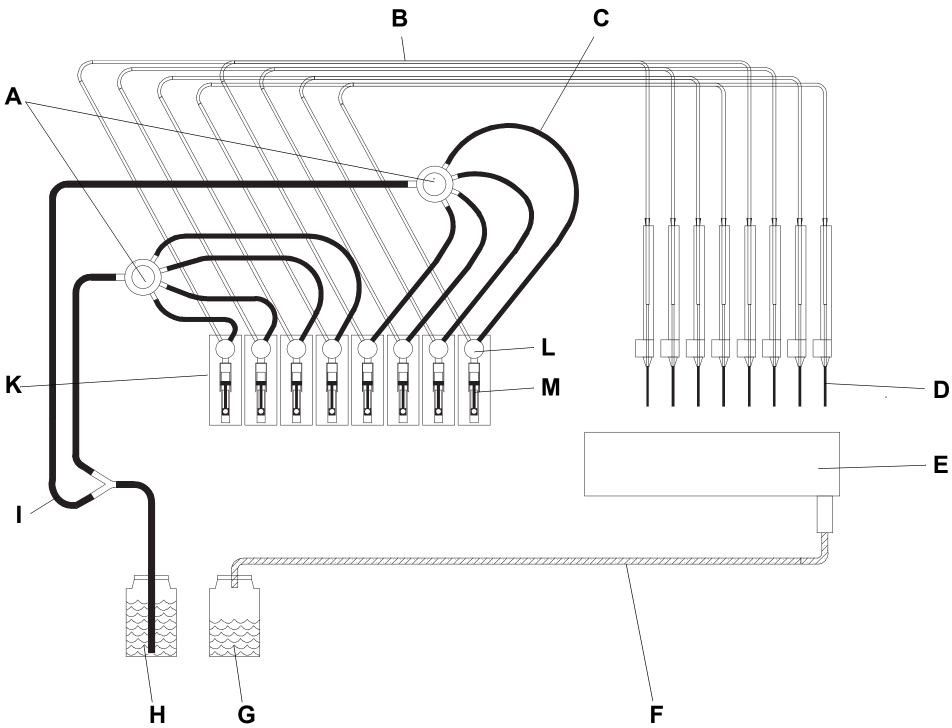


Fig. 4-2 *Liquid system: principal components*

A	*Distributors 1 to 4*	***G***	*Waste container*
B	*Pipetting tubing*	***H***	*System liquid container*
C	*Interconnecting tubing*	***I***	*Aspirating tubing*
D	*Tips*	***K***	*Diluters*
E	*Wash station*	***L***	*3-way valve*
F	*Waste tubing*	***M***	*Syringe*

In case of a second liquid handling arm, each LiHa is equipped with its own parts, i.e. the two liquid systems are independent.

4.3 Function

4.3.1 Liquid Handling Arm (LiHa)

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Tip types	See section "Tip Configuration", 2 3-34
Fixed tips volumes	See section "Pipetting Precision", 2 3-36
Fixed tips details	See section 11.9.1 "Fixed Tips and Accessories", 2 11-23
Disposable tips, DiTis	See section 4.8.6 "Lower DiTi Eject Option", 2 4-81

Overview

The liquid handling arm is part of the liquid system and is used for pipetting tasks.

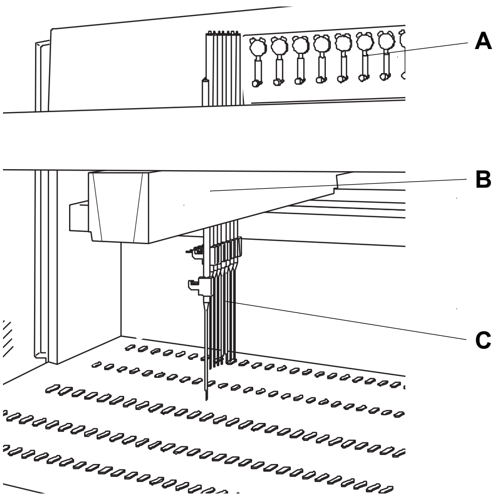


Fig. 4-3 *The liquid handling arm, LiHa*

A	*Syringes*	*C*	*Tips*
B	*Liquid handling arm*		

Function

LiHa Movements

The liquid handling arm moves left and right driven by a servo motor.

Tip Movements

Each sampling tip is raised or lowered by a servo motor within the LiHa.

Two additional servo motors inside the liquid handling arm drive the tips forward and backwards and control the Y-spacing of the tips.

Two, four or eight sampling tips are arranged on one liquid handling arm. The tips can be moved independently in Z-direction. In Y-direction equidistant tip spreading of 9 - 38 mm (0.31 - 1.5 in.) is possible.

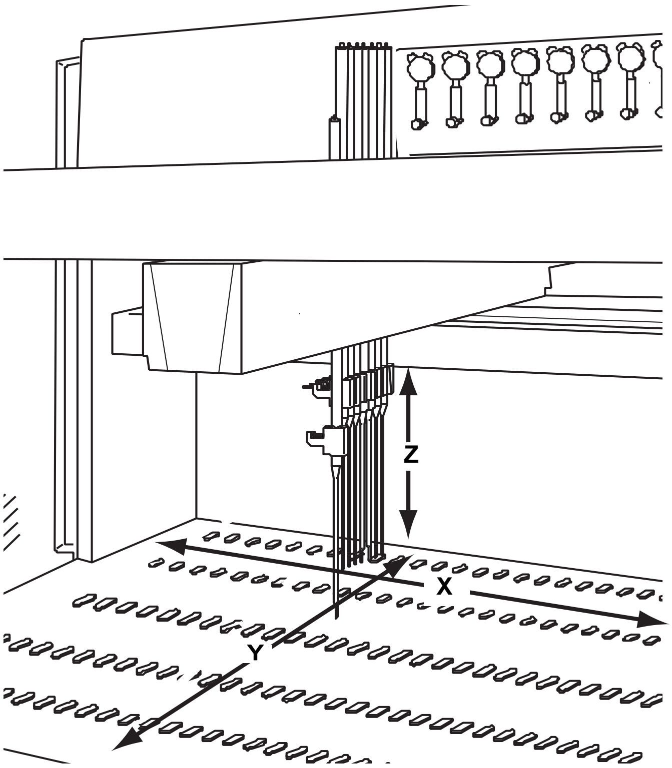


Fig. 4-4 Liquid handling arm movement

X	*X-range liquid handling arm movement left and right*	*Z*	*Z-range for tip movement up and down*
Y	*Y-range for tip movement and tip spacing front and rear*		

Tip Types

Tips serve to pipette liquids in different volume ranges. A variety of tip types is available, depending on the application to be run. Tip types are grouped into:

- Fixed tips
- Te-PS tips (special fixed tips)
- Disposable tips

A universal tip type that could be generally used for every type of liquid and every application does not exist. For the possible combinations of standard tips, low volume tips and disposable tips, refer to cross references above.

Fixed Tips

The fixed tips serve to pipette liquids in different volume ranges (also refer to cross references above):

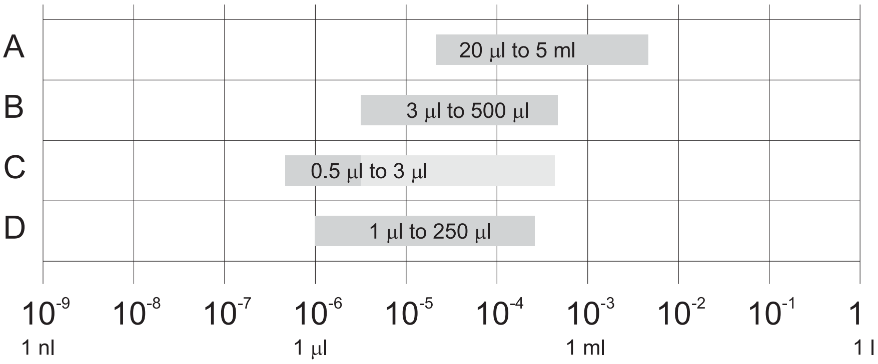


Fig. 4-5 *Fixed tips: Recommended volume ranges*

A *Standard tips*
B *Low volume tips*
C *Low volume tips with low volume option (free dispense)*
D *Te-PS tips*

Some tips are adjustable to enable pipetting into 384-well microplates. Te-PS tips are also adjustable and designed to pipette into 1536-well microplates and other high density plates.

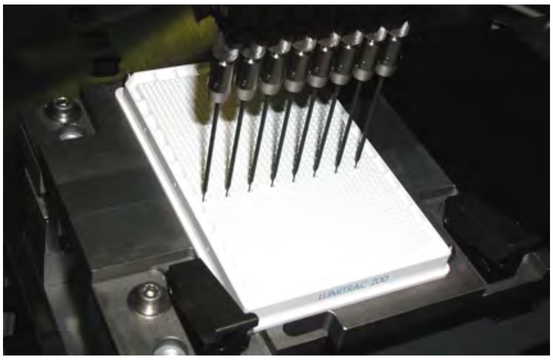


Fig. 4-6 *Te-PS tips and 1536-well microplate*

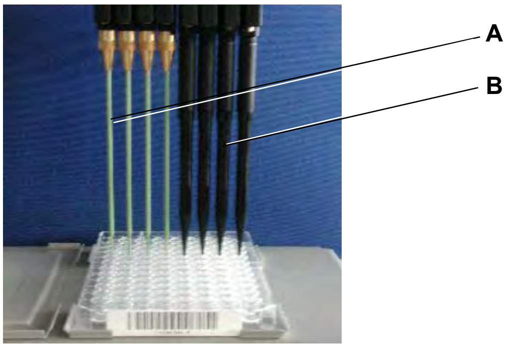


Fig. 4-7 Fixed tips and disposable tips

A	*Fixed tips*	***B***	*Disposable tips*

Disposable Tips

Disposable tips are intended for one single transfer cycle, i.e. one aspiration and one or more dispense steps.

Disposable tips are automatically picked up from a disposable tip tray (10 µl - 1000 µl DiTis) or ANSI/SLAS (50 µl - 5000 µl DiTis) format rack. After use, DiTis are discarded into a waste bag via the optional disposable tip waste slide. Refer also to cross references above.

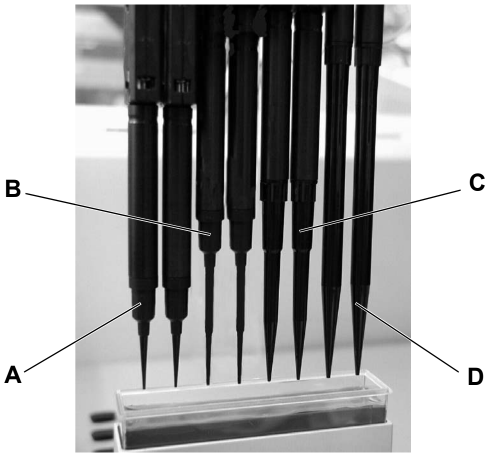


Fig. 4-8 Disposable tips

A	*Disposable tip 10 µl*	***C***	*Disposable tip 200 µl*
B	*Disposable tip 50 µl*	***D***	*Disposable tip 1000 µl*

Disposable Tip 350 µl

The new disposable tip 350 µl is not shown in the graphic, but it is equal to the 200 µl disposable tip.

Liquid Level Detection

The LiHa arm holds electronics to detect the level of liquids in plate wells, tubes and liquid containers. For details refer to section 4.7.1 “Capacitive Liquid Level Detection”, 2 4-67.

4.3.2 Air Displacement Pipetting Arm (Air LiHa)

Purpose of Air LiHa

The Air LiHa is a pipetting arm for general pipetting tasks. Aspiration and dispense of liquids is based on air displacement.

Tip Movements

Servo motors move the tips in X, Y or Z-direction.

The pipetting tips can be moved independently in Z-direction. In Y-direction, equidistant tip spreading is possible. This enables the arm to pipette e.g. from vessels with a small cavity spacing (such as a microplate) to vessels with a larger cavity spacing (such as a tube rack) with all tips simultaneously.

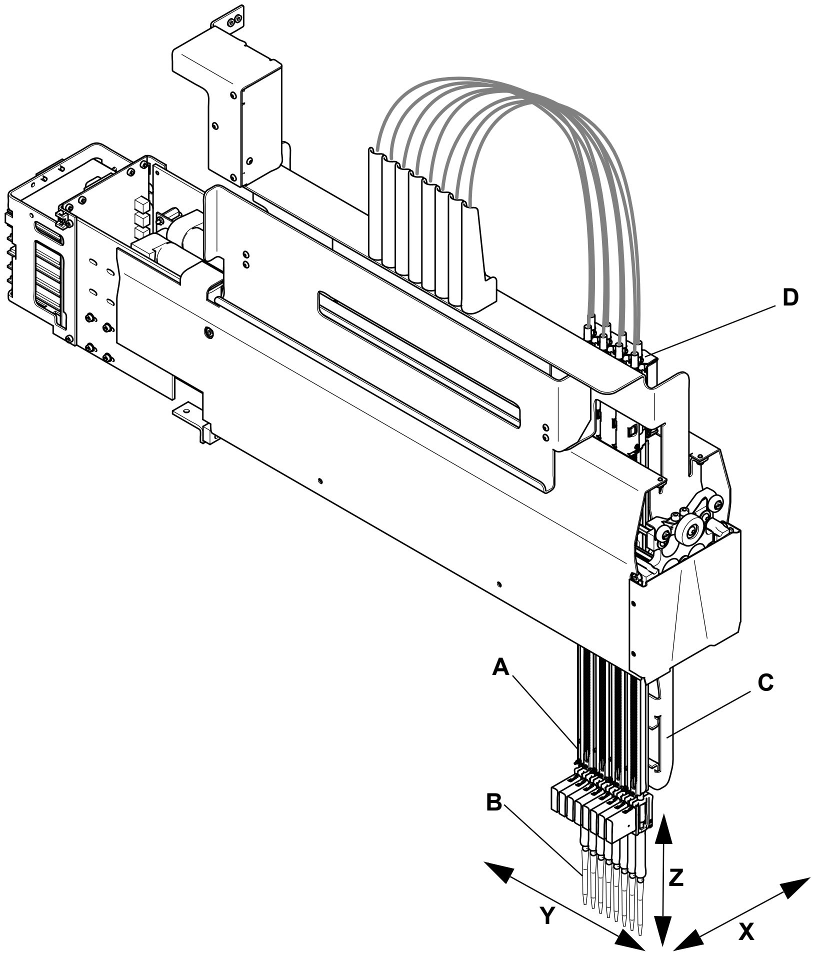


Fig. 4-9 Air LiHa arm overview

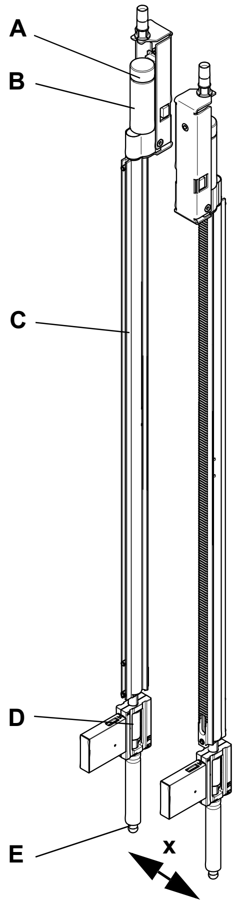
A	*Air chamber in Z-rod*	*X*	*Axis from left to right of worktable*
B	*Disposable tip*	*Y*	*Axis from front to back of worktable*
C	*Lower DiTi eject device*	*Z*	*Vertical axis above worktable*
D	*Plunger drive*		

Tip Types

The Air LiHa is intended for disposable tips only. Different DiTi sizes are available. The maximum volume of the air chamber (1250 µl) matches the largest DiTi type (1000 µl).

The Pipetting System

Each pipetting channel of the Air LiHa is equipped with an individual plunger drive to vary the volume of the air chamber in the Z-rod.



The figure shows two Z-rods in spread position to show how they are arranged.

The plunger drives are alternately mounted on the right or left side for odd an even-numbered channels.

This arrangement allows for moving the Z-rods completely together (to minimum spreading distance “x”), while the drives overlap each other.

A	*Encoder*
B	*Motor*
C	*Z-rod*
D	*Tip adapter*
E	*DiTi cone*

Fig. 4-10 *Air LiHa Z-rod*

Z-Brake

Since each Z-rod of the Air LiHa has its own plunger drive the Z-rod’s weight may cause the channel to move down when the instrument is switched off. For that reason, the Air LiHa is equipped with a Z-brake that inhibits the Z-rod from moving down by its own weight.

Note: *If the Z-rods are blocked in their uppermost Z-position by the Z-brake, the axes cannot initialize anymore. In that case the Z-brake needs to be released so that the Z-rods can be moved down manually.*

For moving the Z-rod manually, the Z-brake needs to be released. See section 8.2.4 “Releasing the Z-brake of the Air LiHa”, 2 8-13.

Function

The figure shows the main parts and the work principle of the Air LiHa's air chamber and plunger drive.

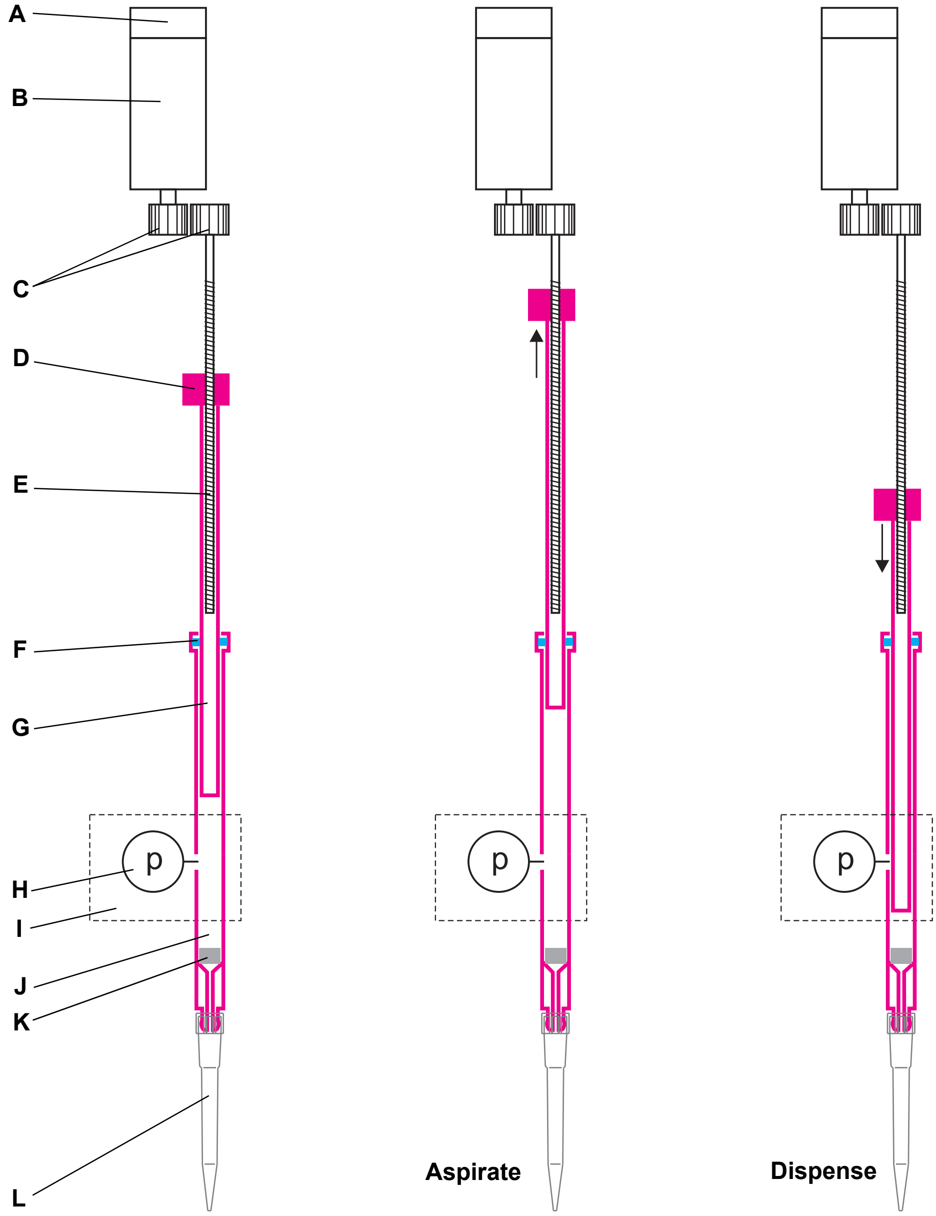


Fig. 4-11 Principle of the Air LiHa plunger drive

A	*Encoder*	*G*	*Plunger*
B	*Motor*	*H*	*Pressure sensor*
C	*Gears*	*I*	*Tip adapter*
D	*Nut*	*J*	*Air chamber*
E	*Threaded spindle*	*K*	*Inline filter*
F	*Seal*	*L*	*Disposable tip*

Plunger Drive

A motor drives a threaded spindle via a gear pair. To aspirate liquid, the spindle rotates and the thread moves the nut and the attached plunger upwards. The vacuum in the chamber sucks the liquid into the disposable tip.

During dispense, the spindle rotates in reverse direction, the plunger moves down and presses the liquid out of the tip.

Air Chamber

In the lowest position, the plunger end is close to the disposable tip to keep the dead volume in the air chamber low.

The sealing between the plunger and the air chamber seals the chamber gas-tight against ambient air.

The controlled variation of the volume in the air chamber enables precise aspirate and dispense actions. A sophisticated electronic motor control moves the plunger accordingly.

Tip Adapter

The pressure sensor and electronics in the tip adapter are used for the Air LiHa MultiSense functions (see 4.3.2.1 "Air LiHa Multisense Functions", 2 4-12).

To prevent inner contamination by sample liquid, a replaceable inline filter is inclosed in the tip adapter. In case of an erroneous aspiration action, e.g. if a wrong disposable tip is mounted and, as a result, too much liquid is aspirated, the liquid reaches the filter. This effects a pressure change in the air chamber and the pressure sensor causes the plunger movement to stop.

If the inline filter got contact with sample liquid, it needs to be replaced.

DiTi Eject Device

The lower DiTi eject device allows to eject disposable tips at a low position. Together with the optional DiTi waste cover and the DiTi waste slide, it prevents from spilling sample liquid onto the worktable, minimizes spreading of aerosols and thus minimizes contamination risks.

4.3.2.1 Air LiHa Multisense Functions

Purpose of the MultiSense Functions

The Air LiHa MultiSense functions are used for pipetting tasks with Air LiHa and disposable tips (DiTis). They include:

- cLLD (capacitive liquid level detection)
- pLLD (pressure based liquid level detection)
- PMP (pressure monitored pipetting)

Capacitive Liquid Level Detection

The cLLD function measures the capacitance between the tip and the carrier containing the labware with the sample. As soon as the tip touches the liquid surface the change in capacitance triggers a detection signal. cLLD records the height of the tip at the time of the trigger signal. This only works with conductive liquids and conductive DiTis.

***Note:** This function is not limited to the Air LiHa MultiSense functions. It is the same with the standard tip adapters.*

Pressure-Based Liquid Level Detection

The pLLD function measures the pressure changes in the tip as the tip moves down. As soon as the tip touches the liquid surface the pressure change triggers a detection signal. pLLD records the height of the tip at the time of the trigger signal.

pLLD can be used as an alternative to the capacitive liquid level detection (cLLD), e.g. for detecting non-conductive liquids, or it can be used in combination with cLLD for conductive liquids.

Pressure-Monitored Pipetting

The PMP function monitors the pressure changes in the air gap between the sample and the system liquid during aspiration and dispense. PMP is able to detect errors, such as clots and air aspiration, by comparing recorded and modeled (real-time simulated) pressure signals.

4.3.3 Positioning System (Te-PS) Option

The Te-PS option is primarily designed to ensure precise access to 1536-well microplates for dispensing and aspirating. However, it can also be used to check alignments in general.

The Te-PS option consists of the following parts:

- Te-PS sensor plate
- Te-PS carrier
- Te-PS tips
- Te-PS lock nuts

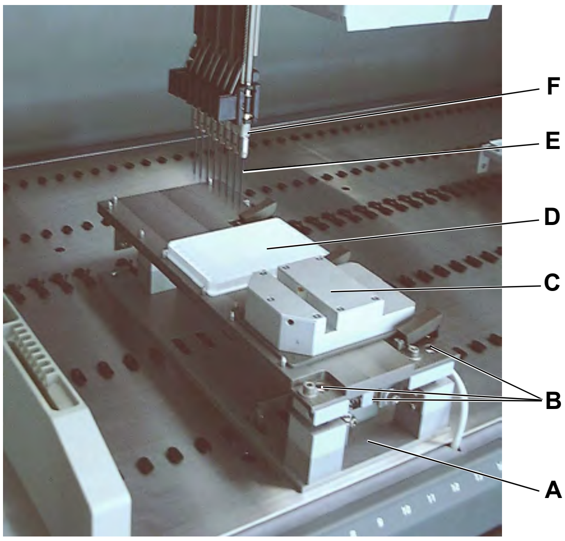


Fig. 4-12 *Te-PS option, overview*

A	*Te-PS carrier*	***D***	*1536 microplate*
B	*Te-PS carrier adjustment screws*	***E***	*Te-PS tip*
C	*Te-PS sensor plate*	***F***	*Te-PS lock nut*

Te-PS Sensor Plate

The Te-PS sensor plate is used for the precision measurement of the LiHa (tips as well as X- and Y-axes), for the alignment procedure of all adjustable tip types, i.e. 384-tips or Te-PS tips and to check the alignment of the tips (including DiTis). The Te-PS sensor plate is placed onto the Te-PS carrier on the worktable.

The Te-PS sensor plate has microplate format according to ANSI/SLAS standards. It is equipped with two crossed light barriers allowing for precision measurement by means of a reference tip or pipetting tips, depending on the purpose. The light barriers are arranged orthogonally and twisted 45° relative to the worktable coordinate system.

It can be installed on the Te-PS carrier:

- Only when it is needed to adjust the Te-PS carrier and/or Te-PS tips.
- Permanently, to check the tip alignment routinely during operation, or even to correct any misalignment “on the fly” (for non-adjustable tips and DiTis).

Te-PS Carrier

The Te-PS carrier has the purpose of carrying the Te-PS sensor plate or 1536-well microplates. It is installed on the worktable and aligned by means of adjustment screws. The Te-PS sensor plate facilitates the alignment procedure.

Te-PS Tips

The Te-PS tips are made out of stainless steel, have a reduced diameter at their lower end and allow for a pipetting volume range of 0.5 to 85 µl (corresponding to the minimal inner tip volume) or a volume identical with the syringe volume.

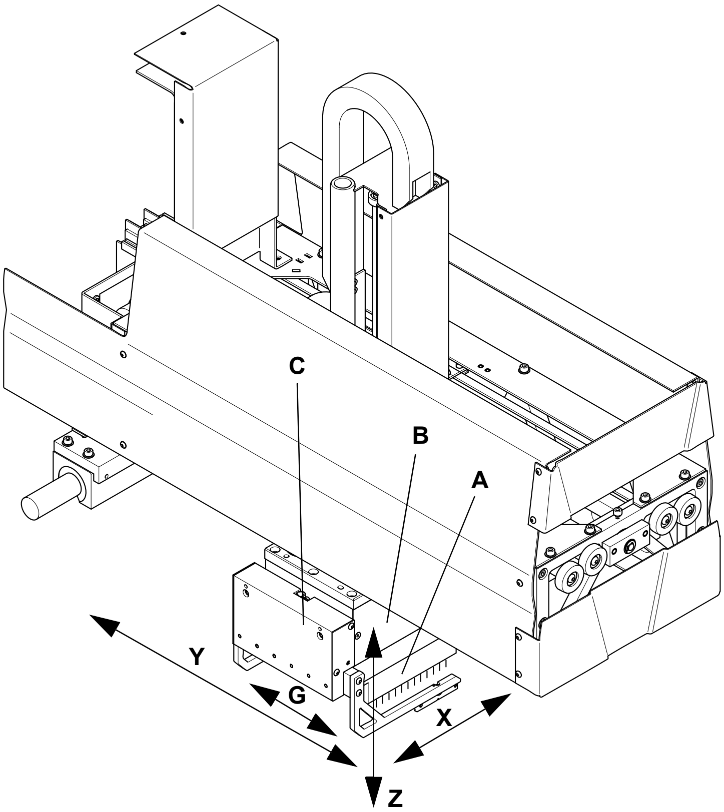
Note: *For improved cleaning of the Te-PS tips, the use of a low volume wash station is recommended. In the low volume wash station, the surplus system liquid generated by the FaWa/SPO/MPO is redirected into the cleaner, thereby increasing the turnover in the cleaner and improving the circumfluent cleaning.*

Coating

The coating renders the tips more hydrophobic, preventing adhesion of droplets or collars and improving free dispenses and dispenses at or even below liquid level, due to optimized tip retraction.

4.3.4 Multichannel Arm (MCA96)

The multichannel arm MCA96 is used for high-speed, high-precision liquid pipetting tasks and, with the optional gripper, for restricted plate handling on the instrument's worktable. With its 96 channels, it can (simultaneously) pipette from and into 96-well and 384-well microplates.



A	*Fixed tip block (or DiTis)*	***G***	*Axis for gripper movements*
B	*Pipetting head*	***X***	*Axis from left to right of worktable*
C	*Gripper module (option)*	***Y***	*Axis from front to back of worktable*
		Z	*Vertical axis above worktable*

The Pipetting System

The MCA96 is a pipetting system with a pipetting head using 96 cylinders to simultaneously aspirate and dispense liquid from/to a 96-well micro plate. The liquid is handled with disposable tips (DiTis) or with a fixed tip block equipped with 96 fixed tips.

96 plungers, which are moved simultaneously, are used to vary the volume of the cylinders. When the volume of the cylinders is decreased, the liquid is aspirated into the tips and can, when the volume expands, be dispensed all at once or in steps. By means of a control software, the movement of the plungers is controlled very accurately.

The plungers are always separated from the liquid to be handled by an air gap. Therefore, only the tips and the inner part of the fixed tip block body are in contact with the liquid. Other parts of the pipetting head are not contaminated.

Pipetting Modes

The following three modes can be used:

- Single pipetting:
  A sample of a liquid volume (one aliquot) is aspirated from a source position and the entire volume is dispensed to one destination position.
- Multi pipetting:
  A sample is aspirated from a source position and fractions of it are sequentially dispensed to different destination positions (multiple aliquots).
- Dispense-together mode:
  Two samples of a liquid volume are sequentially aspirated from a source position each and are dispensed together to one destination position.

Washing the Tips

A wash block serves to wash the tips of a fixed tip block after each pipetting cycle. Disposable tips are intended for one single pipetting cycle, i.e. one aspiration step followed by one dispense step. DiTi's are usually not washed but disposed after the pipetting cycle.

Pipetting Head

The pipetting head incorporates the p-(plunger) drive, which actuates all 96 plungers simultaneously. The lower ends of the cylinders are called tip cones. Here, disposable tips (DiTis) or the fixed tip block are attached.

Pipetting Head Cover

A pipetting head cover protects the user from reaching into the danger zone of the plunger drive. The plunger cover prevents access to the moving plunger plate.

4.3.4.1 Pipetting Head

Pipetting and Microplates

The pipetting head is a 96-channel pipetting system to aspirate and dispense liquids from/to a micro plate.

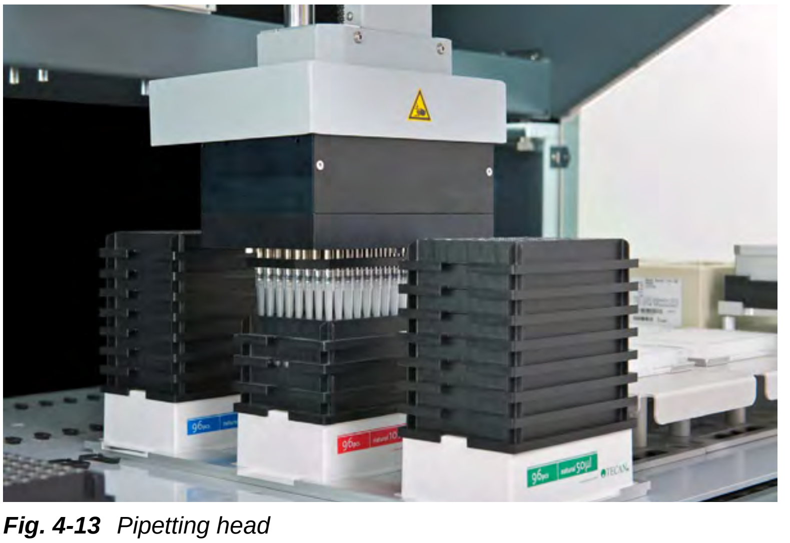


Fig. 4-13 *Pipetting head*

Principle

The pipetting head employs the air displacement technique as a working principle.

Note: *Liquid level detection is not possible with the pipetting head of the MCA96.*

Function

One Channel

The figure shows the plunger/cylinder arrangement for one channel:

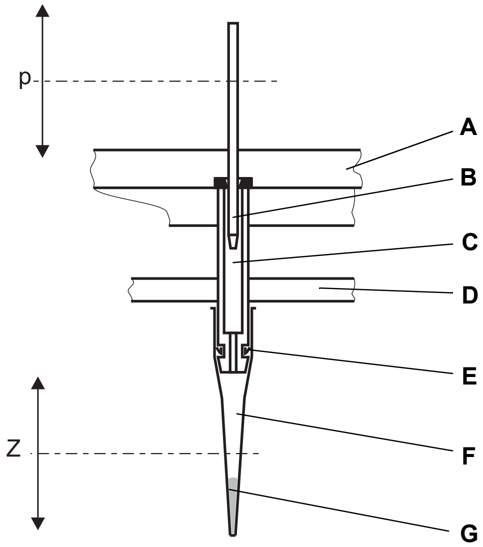


Fig. 4-14 *Functional principle of the pipetting head*

A	*Pipetting head base structure*	***F***	*Tip (DiTi)*
B	*Plunger*	***G***	*Aspirated liquid*
C	*Cylinder*		
D	*Tip eject plate*	***p***	*Movement of the p-axis (plungers)*
E	*Tip cone seal*	***Z***	*Movement in Z-axis direction*

Plunger / Cylinder

A computer-controlled drive moves the plungers (p-axis). The tip cones at the open end of the cylinders are shaped in such a way that each tip cone can receive a DiTi, or all 96 tip cones together can receive the fixed tip block.

When the plunger moves up, liquid can be aspirated into the tip. There is always an air gap between the liquid and the plunger, therefore the plunger room remains dry. To dispense the liquid the plunger moves down.

Seals

The plungers are sealed against the cylinder with special elastomer sealing rings. The tips are sealed with the tip cone seals (O-ring), which is a gasket made of elastomer.

Tip Adapter and Tip Ejection

The lower part of the pipetting head, i.e. the tip cones with tip cone seals, the fixed tip block lock and the tip eject plate is called the tip adapter. The tip adapter positions and holds the DiTis or the fixed tip block.

Fig. 4-15 *Tip adapter*

A	*Tip cone seal*	***C***	*Tip eject plate*
B	*Tip cone*		

The entire pipetting head moves down in Z-direction to receive the DiTis or the fixed tip block.

After a pipetting process, the pipetting head moves to the appropriate rack for the DiTis or the fixed tip block and the tip eject plate moves downwards to drop the DiTis or park the fixed tip block. The plate is actuated by the p-axis, i.e. when the plungers are in the bottommost position.

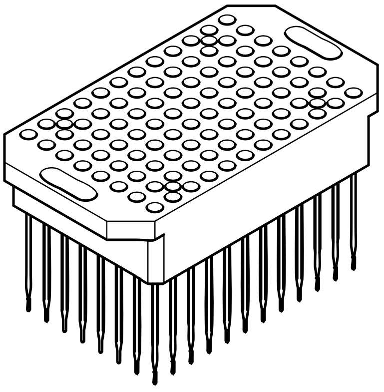


Fig. 4-16 *Fixed tip block*

Disposable Tips

DiTis

DiTis are handled by means of the ANSI/SLAS DiTi box, which contains 96 disposable tips.

The DiTis are delivered and discarded together with the ANSI/SLAS DiTi box.

Fig. 4-17 *ANSI/SLAS DiTi box*

ATTENTION

500 µl DiTis are longer than the 200 µl, 100 µl and 50 µl DiTis and therefore might collide with high DiTi carriers.

- Check for tip clearance when using the 500 µl DiTis

Fig. 4-18 *non ANSI/SLAS format DiTi box*

Note: To use the non ANSI/SLAS format DiTi boxes (see left) the DiTi eject plate on the MCA96 pipetting head has to be replaced by the non ANSI/SLAS format eject plate.
With the non ANSI/SLAS format eject plate the ANSI/SLAS and Nested DiTi boxes cannot be used anymore.

Nested DiTi

The Nested DiTi system allows to have on the same rack position up to eight special DiTi inserts with non-filtered, non-sterile DiTis stacked (8 X 96 DiTis). Nested DiTi boxes with only one insert (1 x 96 DiTis) with non-filtered non-sterile, non-filtered sterile or filtered sterile DiTis can be used instead of single ANSI/SLAS DiTi boxes. To dispose of the used DiTis after a pipetting step there is a Waste Option for Nested DiTi available. The nested DiTis come with tip volume sizes of 50 µl, 100 µl and 200 µl.

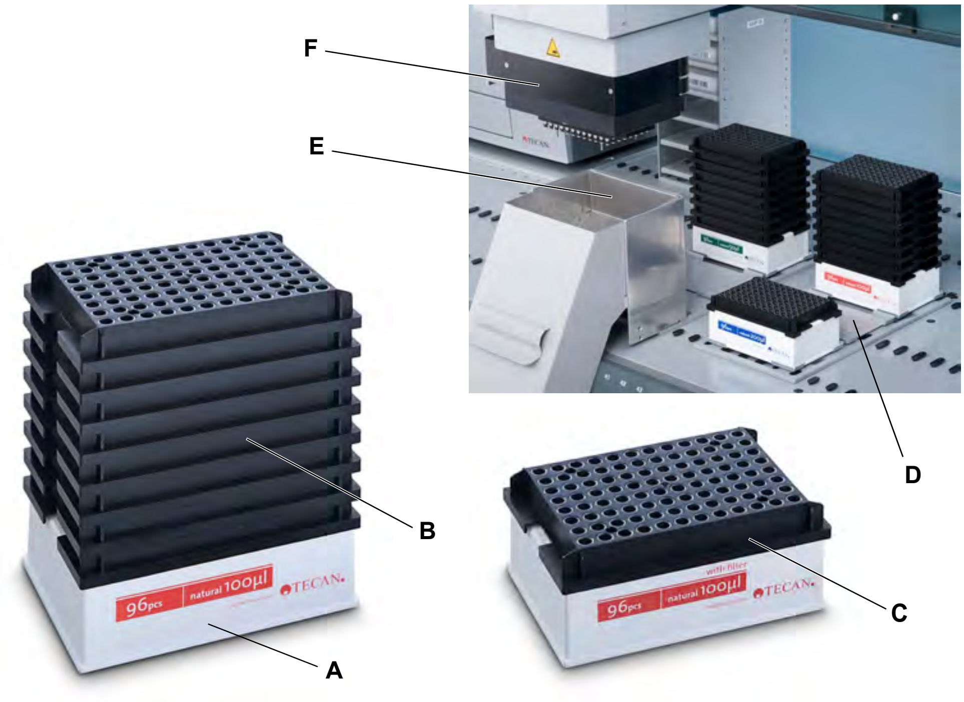


Fig. 4-19 *Nested DiTi*

A	*Nested DiTi box with ANSI/SLAS footprint*	***C***	*Single DiTi insert (e.g. filtered DiTis)*
B	*8 DiTi inserts stacked (non-filtered DiTis)*	***D***	*Nested DiTi flat carrier*
		E	*Waste Option for Nested DiTi*
		F	

Differences between nested and non-nested DiTi Boxes

Fig. 4-20 *ANSI/SLAS DiTi box without insert*

The single non-nested ANSI/ SLAS DiTi box has four pins (see red circles) to fix the black DiTi insert to the box.

The Nested DiTi box does not have the pins and the black DiTi insert is kind of loose on the box to easily remove it.

Nested DiTi boxes can hold only non-filtered DiTis.

Fixed Tip Block

The fixed tip block is equipped with 96 fixed pipetting tips that are arranged in the standard 96-well micro plate.

Standard Fixed Tip Block

Fig. 4-21 *Standard fixed tip block*

The configurable fixed tip block consist of 96 single steel needles that are arranged in a fixed tip block.

The tips are fastened in a block made of aluminium with a lid on the top. In case that a steel needle needs to be exchanged the operator can open the lid and exchange the needle on its own. Also customer specific needles pattern can be arranged in the same way.

The steel needle length allows usage of the configurable fixed tip block in deep well microplates.

High Precision Fixed Tip Block

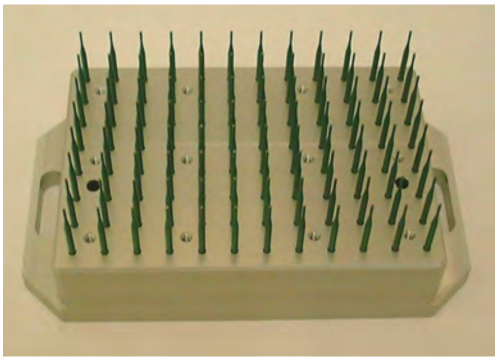


Fig. 4-22 High precision fixed tip block

For pipetting into 384-well microplates, special high precision fixed tip blocks are available (precision here does primarily refer to positioning).

In this case, the pipetting takes place sequentially (4 times 96 wells).

The tips are fastened in a block made of aluminum and polymer (PEEK).

The tips are short for precision reasons.

4.3.4.2 Service Carrier

Apart from the standard ANSI/SLAS microplate carriers the MCA96 makes use of the service carrier.

The service carrier is a special carrier for the MCA96 to access reagent troughs, transfer racks (for fixed tip blocks and “old” DiTi boxes), wash block or microplates.

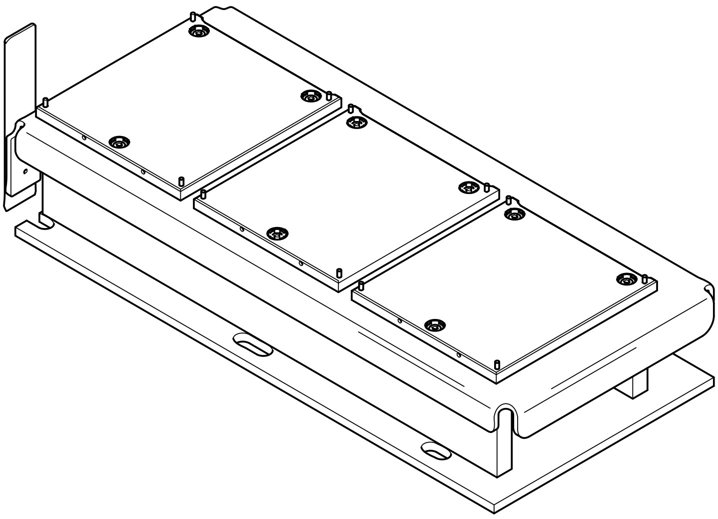


Fig. 4-23 *Service carrier*

The service carrier offers three carrier positions (sites). The site plates are mounted on the three carrier positions and are adjusted at the manufacturer’s with regard to their height and rotational position.

The following elements can be placed on the service carrier:

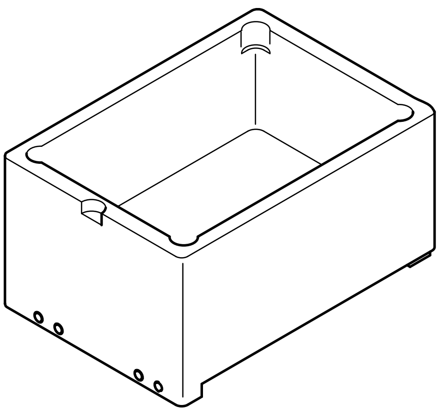
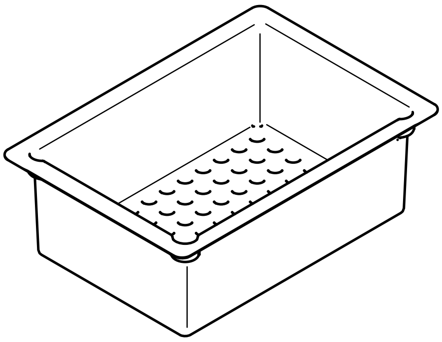


Fig. 4-24 *Reagent trough*

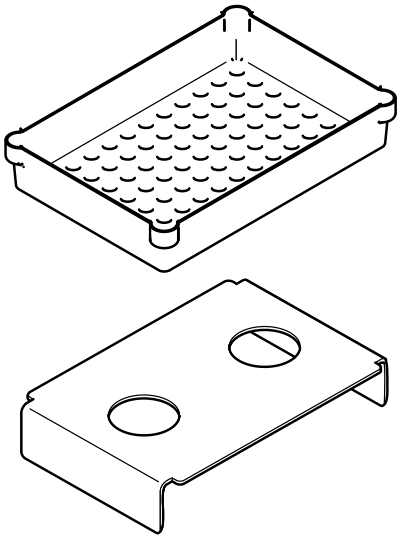
The reagent trough is placed on the service carrier. The trough is a container made of polypropylene (PP).

To reduce the contents of the trough, or to prevent the reagent from having contact with the trough material, blister insets are used (250 ml or 125 ml).



The figure shows a 250 ml blister inset for the reagent trough.

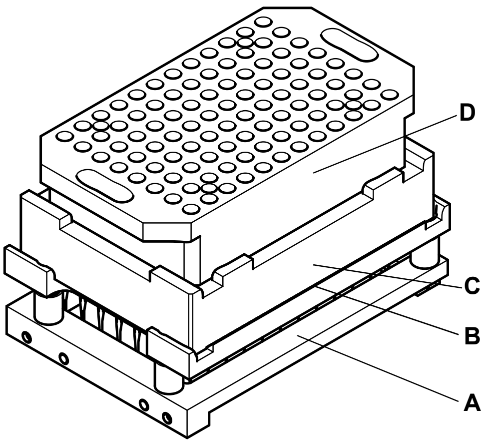
Fig. 4-25 *Blister inset 250 ml*



The figure shows a 125 ml blister inset for the reagent trough.

The 125 ml blister is used with an additional support, which is placed under the blister.

Fig. 4-26 *Blister inset 125 ml and support*



The optional transfer rack is placed on the service carrier.

The adapter block on the transfer rack is the parking position for fixed tip blocks.

The optional plastic blister for transfer rack (drip tray) is placed between the adapter block and the transfer rack and serves to protect the rack from aggressive liquids.

Fig. 4-27 *Transfer rack with fixed tip block*

A	*Transfer rack*
B	*Plastic blister for transfer rack*
C	*Adapter block*
D	*Fixed tip block*

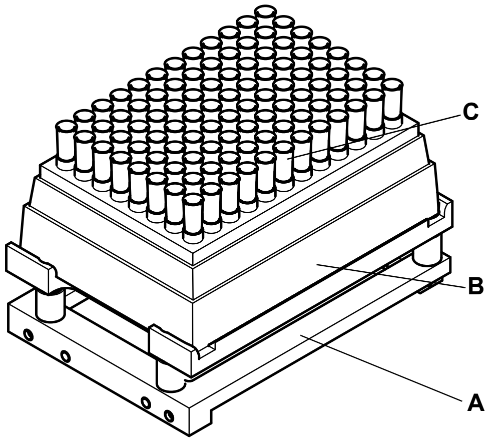


Fig. 4-28 Transfer rack with "old" DiTi box

The optional transfer rack is placed on the service carrier. "Old" DiTi boxes, if used, are placed on this rack to pick up DiTis.

(see also Note: , 2 4-19)

A Transfer rack
B "old" DiTi box (non-ANSI/SLAS)
C Disposable tips

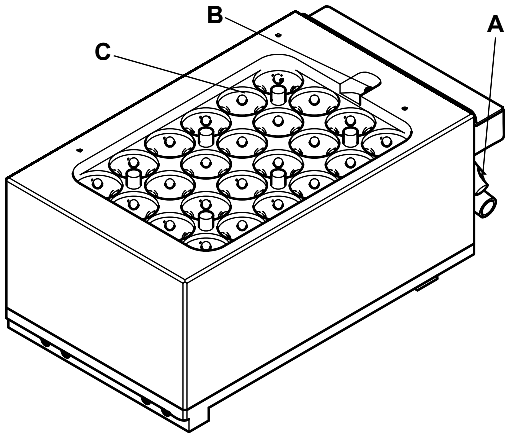


Fig. 4-29 Wash block

The wash block is placed on the service carrier. The wash block is part of the optional wash system.

A Tube connectors
B Level sensor
C Wash well

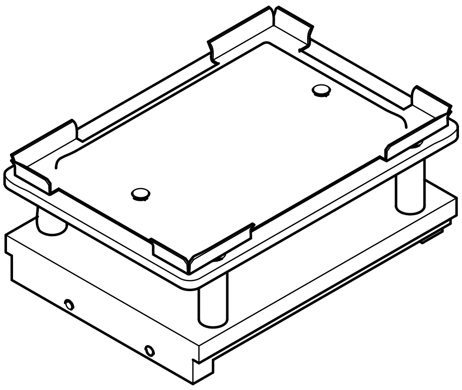


Fig. 4-30 MP carrier

The microplate carrier is placed on the service carrier.

It is used in case the user wants to access a microplate on the service carrier.

4.3.4.3 Flat Carrier, Multiple Positions

To place Nested DiTi boxes or single ANSI/SLAS DiTi boxes on the worktable the following flat carriers are available:

- Nested DiTi flat carrier, 3 positions (with or without DiTi waste)
- Nested DiTi flat carrier, 4 positions (with or without DiTi waste)
- Nested DiTi flat carrier, 3 positions, individual access (with or without DiTi waste)

For details on the carriers see sections:
Tab. 11-10 “Multichannel arm (MCA96) carriers and racks”, 2 11-5 and
Tab. 11-14 “Multichannel Arm (MCA384), carriers and accessories”, 2 11-7

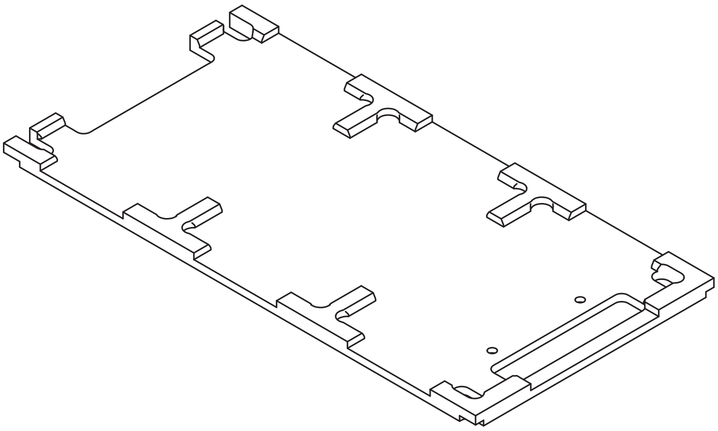


Fig. 4-31 *Nested DiTi flat carrier, 3 positions (without DiTi waste)*

Note: *It is not recommended that you place microplates on this carrier. As the carrier does not contain any elevation, the cLLD signals will be different compared to the ones on the regular microplate carrier.*

Note: *It is not recommended to use a flat microplate carrier instead of a DiTi flat carrier, as the elevations on the microplate carrier can cause a DiTi box to turn over, when a single row or column of DiTis is being picked up.*

4.3.4.4 Wash System

Function

The wash system fulfills the following functions:

- Cleaning of the fixed tips of the fixed tip block or cleaning of DiTis
- Selection of a wash liquid (liquid 1 or 2)
- Monitoring the level of the wash liquid in the wash block
- Control of the flow rate of the liquids

Main Components

The main components of the wash system are:

- Wash block with 96 channels; mounted on the service carrier

- Wash System MCA, including:
  – Control unit WRC 96
  – Wash unit 96

A *Control unit*
B *Wash unit*

Fig. 4-32 *Wash System MCA*

- Peripheral parts, such as filters, tubing, fittings, wiring

Diagram The figure shows a diagram of the wash system components:

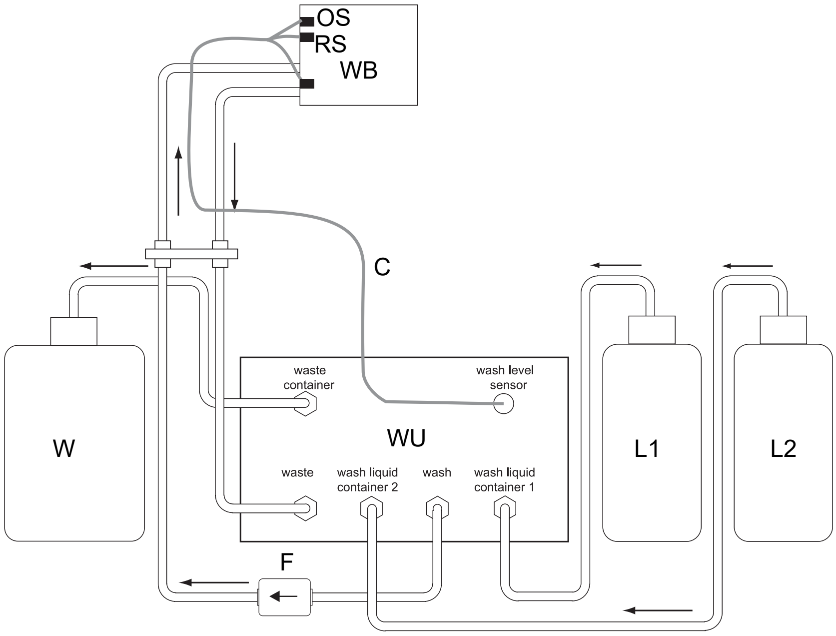


Fig. 4-33 *Te-MO 96 wash system*

WB	*Wash block 96*	***L1***	*Wash liquid container 1*
OS	*Overflow sensor*	***L2***	*Wash liquid container 2*
RS	*Ready sensor*	***W***	*Waste container*
WU	*Wash unit*	***C***	*Connection cable for level sensors*
→	*Liquid flow direction*	***F***	*Filter*

The heart of the system is the wash unit (WU) which is equipped with the valves and pumps that pump wash liquid from the wash bottles (L1) or (L2) through the wash liquid tubes into the wash block (WB). The wash block (WB) is equipped with two level sensors (RS, OS), which control the fill level of the wash block and prevent it from overflowing. Liquid that flows from the wash block back to the wash it is pumped into the waste container (W).

4.3.5 Multichannel Arm (MCA384)

The MultiChannel Arm 384 for the Freedom EVO liquid handling workstations, offers higher productivity to automated liquid handling processes. The arm can be mounted onto Freedom EVO 100, 150 or 200 platforms, increasing the efficiency and speed of pipetting processes for higher throughput as well as delivering a greater level of flexibility.

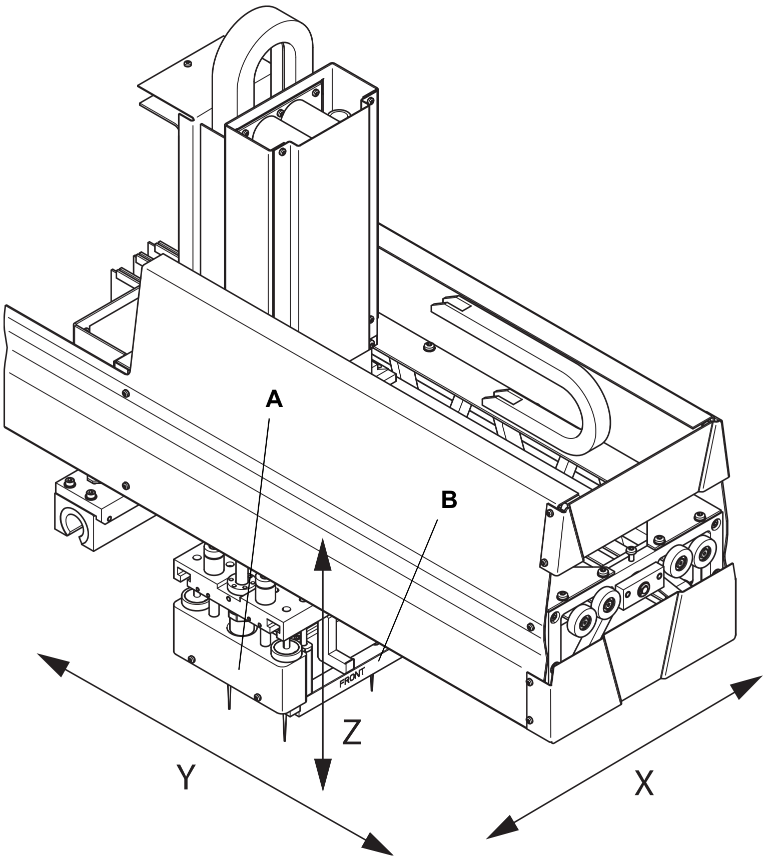


Fig. 4-34 *Freedom EVO arm complete*

A	*384 channel pipetting head*	***X***	*Axis left to right across worktable*
B	*Head adapter for DiTis or fixed tips*	***Y***	*Axis front to back across worktable*
		Z	*Vertical axis above worktable*

Pipetting System

The 384 channel pipetting head features a broad volume range with disposable or fixed tips:

- 0.5 µl to 125 µl in the 384 well format
- 0.5 µl to 500 µl in the 96 well format

The washable fixed tips and the disposable tips can be interchanged during a run. The 384 channel pipetting head can be used to pipette with 384, 96, 32, 24, 16, 12 or 8 disposable tips. The head can rapidly change during a run between DiTis and fixed tips by picking up an appropriate adapter.

384 plungers, which are moved simultaneously, are used to vary the volume of the cylinders. When the volume decreases, the liquid is aspirated into the tips. By expanding the volume, the liquid can be dispensed all at once or in steps. By means of a control software, the movement of the plungers is controlled very accurately. The channels which are used for pipetting are defined by the type of adapter and / or the DiTis picked up (384, 96, 32, 24, 16, 12 or 8). The plungers are always separated from the liquid to be handled by an air gap. Therefore, only the tips and the inner part of the fixed tip adapter are in contact with the liquid. Other parts of the pipetting head are not exposed to possible contamination.

4.3.5.1 Pipetting Head

The pipetting head incorporates the p-(plunger) drive, which actuates all 384 plungers simultaneously when pipetting. The plungers are also used for dropping DiTis. Controlled by the application software, the head can be equipped with appropriate adapter plates for pipetting with fixed tips or DiTis.

Fixed tips:

- The head fetches the appropriate fixed tip adapter.

DiTis:

- The head fetches in a first step the appropriate DiTi adapter and picks up the DiTis in a second step or
- The head fetches in one step an appropriate DiTi adapter with already mounted DiTis (see also “System Carrier”, 2 4-45).

(for the various adapter plates refer to section 11 “Spare Parts and Accessories”, 2 11-1)

Fig. 4-35 *384 channel pipetting head*

Principle

The pipetting head employs the air displacement technique as a working principle.

Note: *Liquid level detection is not possible with the pipetting head of the MCA384.*

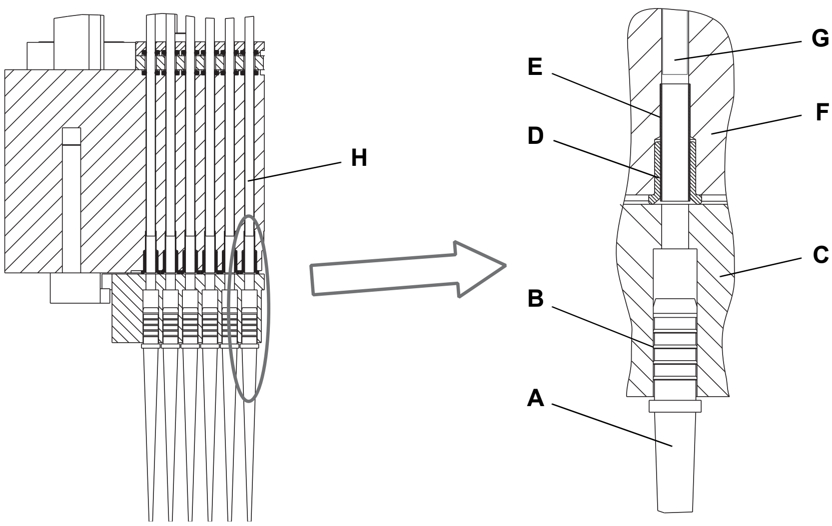


Fig. 4-36 *Cross section DiTis / gaskets*

A	*DiTi*	***E***	*Blunt tube*
B	*Self sealing DiTi shaft*	***F***	*Pipetting head*
C	*DiTi adapter plate*	***G***	*Plunger*
D	*Gasket*	***H***	*Cylinder*

Plunger / Tip

A computer-controlled drive moves the plungers (p-axis). The tips are inserted into appropriate holes in the adapter which are aligned with the 384 cylinders in the pipetting head. When the plungers move up, liquid can be aspirated into the tips. There is always an air gap between the liquid and the plunger, therefore the plunger room remains dry. To dispense the liquid the plunger moves down.

Sealing

The plungers are sealed against the cylinder and adapter with special gaskets. The DiTis have a special shaped shaft which is self sealing when inserted into the adapter. Fixed tips are liquid-tight mounted in the adapter.

4.3.5.2 Adapters

MCA384 Adapters

The 384 channel head can be configured with various MCA384 adapters. The head can pick up and replace automatically an MCA384 adapter from an adapter rack mounted on the System Carrier during a pipetting run. The following MCA384 adapter types are available:

- Adapter DiTi MCA384
- Adapter DiTi Combo MCA384
- Adapter 96 DiTi MCA384
- Adapter 96 DiTi 1to1 MCA384
- Adapter 96 DiTi 4to1 MCA384
  (EVA=Extended Volume Adapter)
- Adapter Fixed 15 µl MCA384
- Adapter Fixed 125 µl MCA384
- Adapter 96 Fixed 15 µl MCA384
- Adapter 96 Fixed 125 µl MCA384
- Adapter QC MCA384

Adapter Types

Adapter DiTi MCA384

Features and application:

– Allows to pick up 384 DiTis from a DiTi box placed on the DiTi Carrier.
– Used to pipette into 384 or 1536 well microplates.
– No row- or column-wise DiTi picking possible

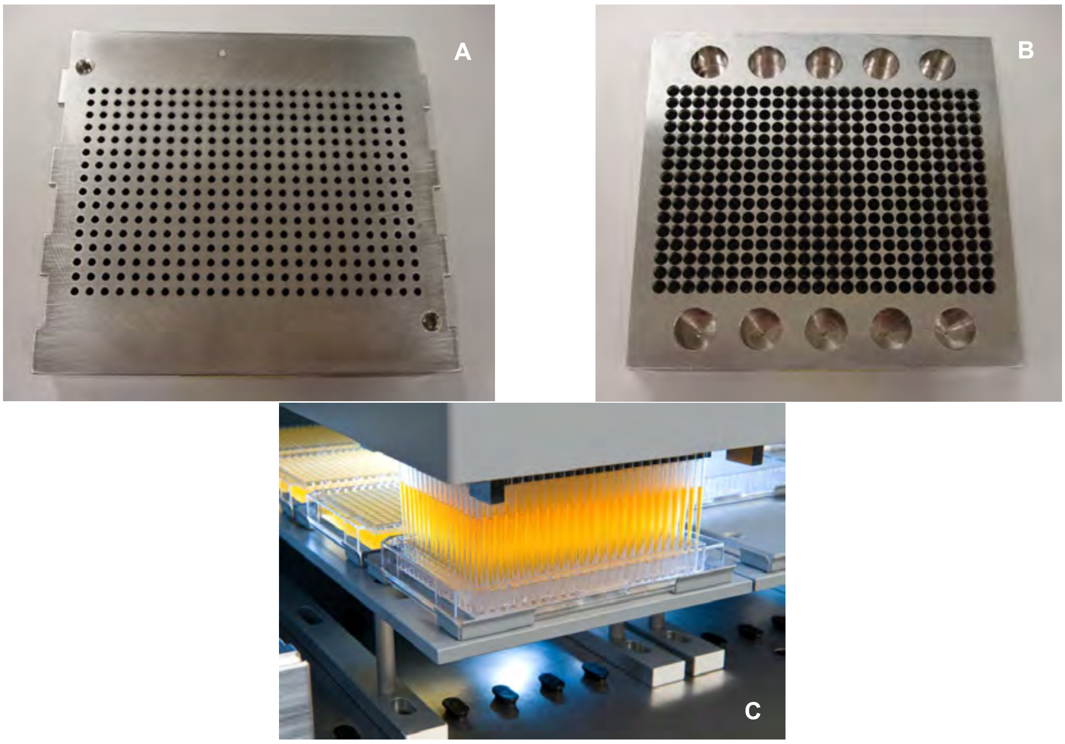


Fig. 4-37 *Adapter DiTi MCA384*

A	*Top view*	***C***	*Operational*
B	*Bottom view*		

Adapter DiTi Combo MCA384

Features and application:

- Allows to pick up 384 DiTis from a 384 DiTi box placed on the DiTi carrier.
- Allows to pick up one row of 24 DiTis or one or two columns of 16 or 32 DiTis from a 384 DiTi box placed the ANSI/SLAS nest on the System carrier.
- Used to pipette into 384 or 1536 well microplates.

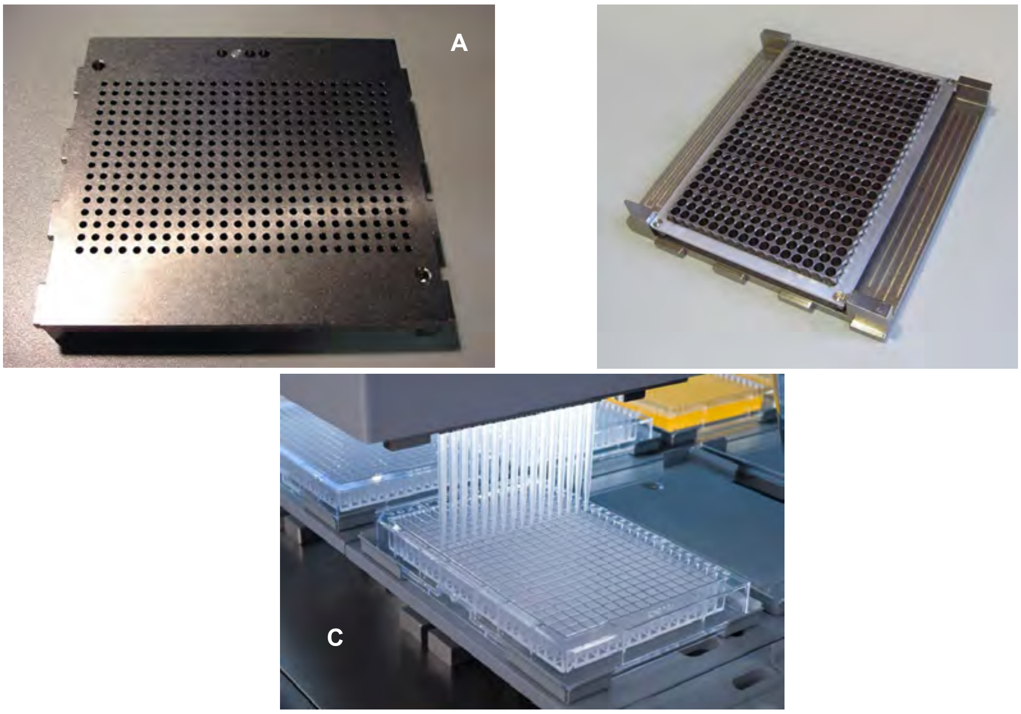


Fig. 4-38 *Adapter DiTi Combo MCA384*

A	*Top view*	***C***	*Operational*
B	*Bottom view*		

Adapter 96 DiTi MCA384

Features and application:

- Allows to pick up 96 DiTis from a 384 DiTi box placed on the DiTi Carrier. *Picks up 4 times 96 DiTis from the same 384 DiTi box (X- and Y-position indexed)*
- Allows to pick up one or two rows of 12 or 24 DiTis or one or two columns of 8 or 16 DiTis from a 384 DiTi box placed the ANSI/SLAS nest on the System carrier.
- Used to pipette into 96, 384 or 1536 well microplates.

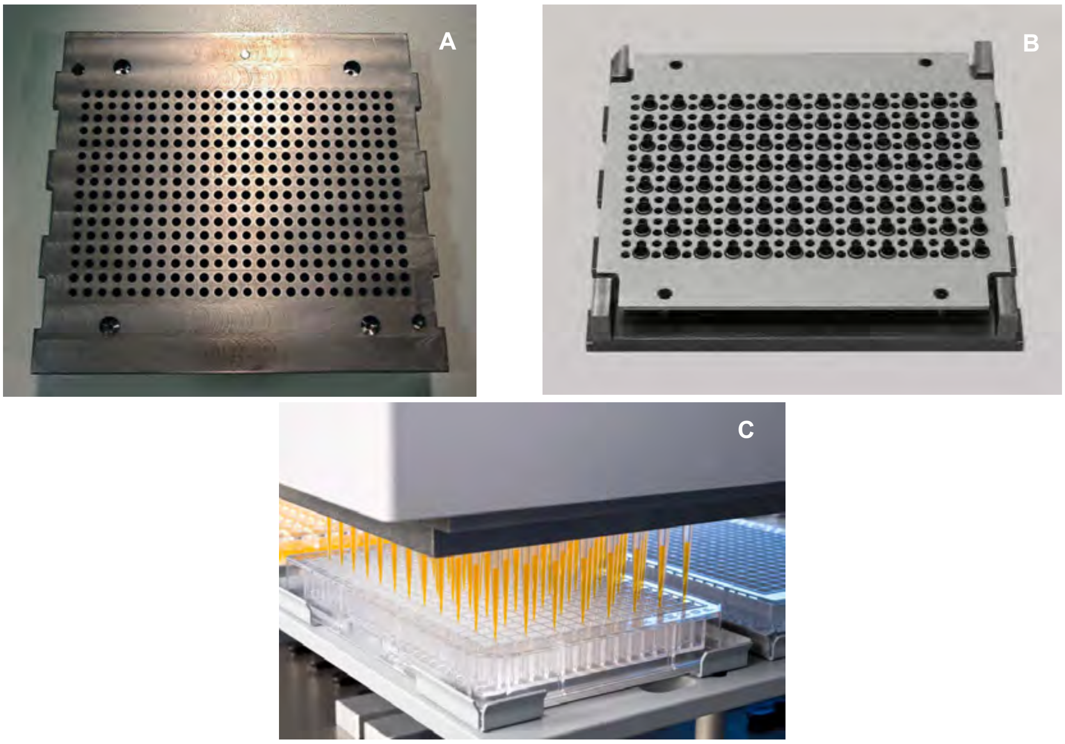


Fig. 4-39 *Adapter 96 DiTi MCA384*

A	*Top view*	***C***	*Operational*
B	*Bottom view*		

Adapter 96 DiTi 1to1 MCA384

Features and application:

- Works only with MCA96 DiTis in ANSI/SLAS format.
- Allows to pick up 96 DiTis or one row of 12 DiTis or one column of 8 DiTis from an MCA96 ANSI/SLAS DiTi box placed on the System carrier or Nested DiTi flat carrier.
- Used to pipette into 96 well microplates.
- Volume range: 0.5 to 125 µl

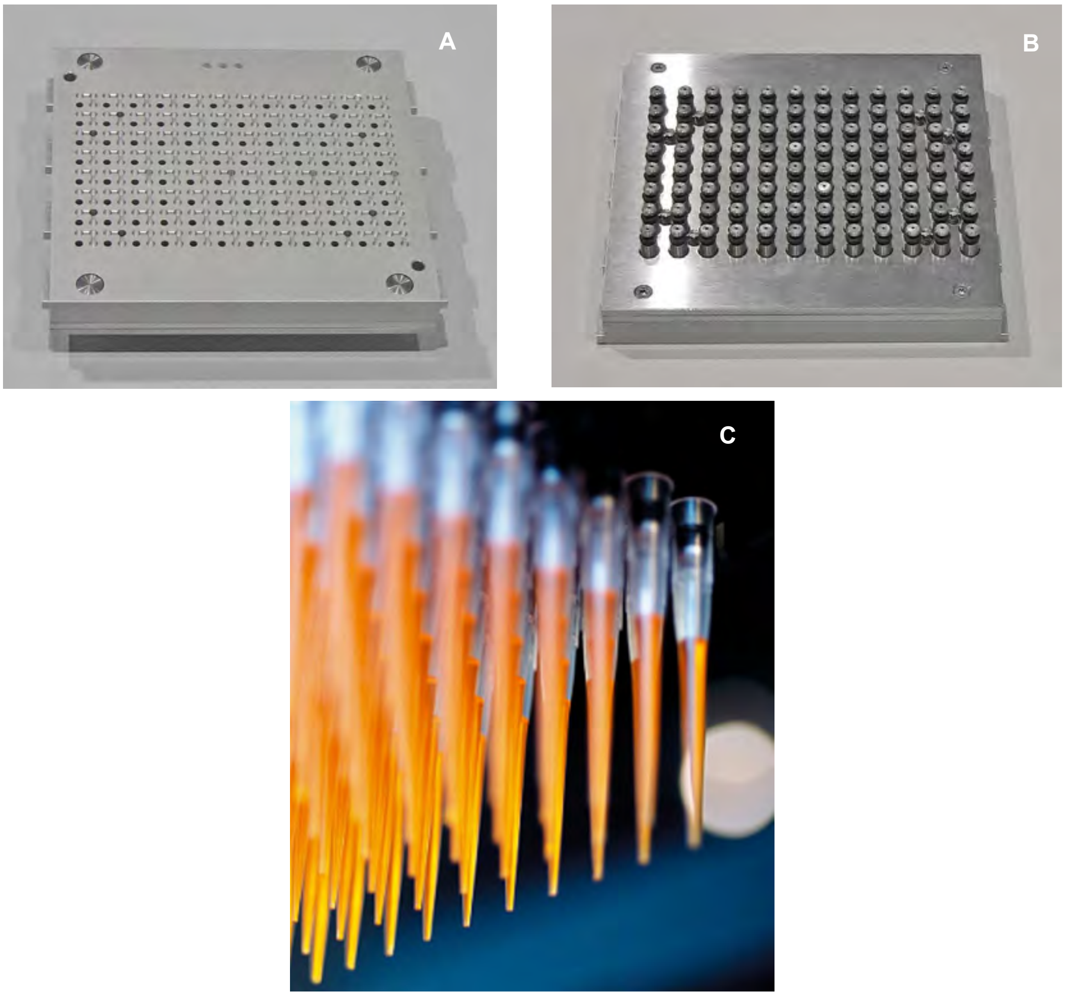


Fig. 4-40 *Adapter DiTi 1to1 MCA384*

A	*Top view*	*C*	*Operational*
B	*Bottom view*		

Adapter 96 DiTi 4to1 MCA384 (EVA)

Features and application:

– Works only with MCA96 DiTis in ANSI/SLAS format.
– Allows to pick up 96 DiTis or one row of 12 DiTis or one column of 8 DiTis from an MCA96 ANSI/SLAS DiTi box placed on the System carrier or Nested DiTi flat carrier.
– Used to pipette into 96 well microplates.
– Four input channels are mapped into one output channel which allows to pipette in a volume range of 1 to 500 µl.

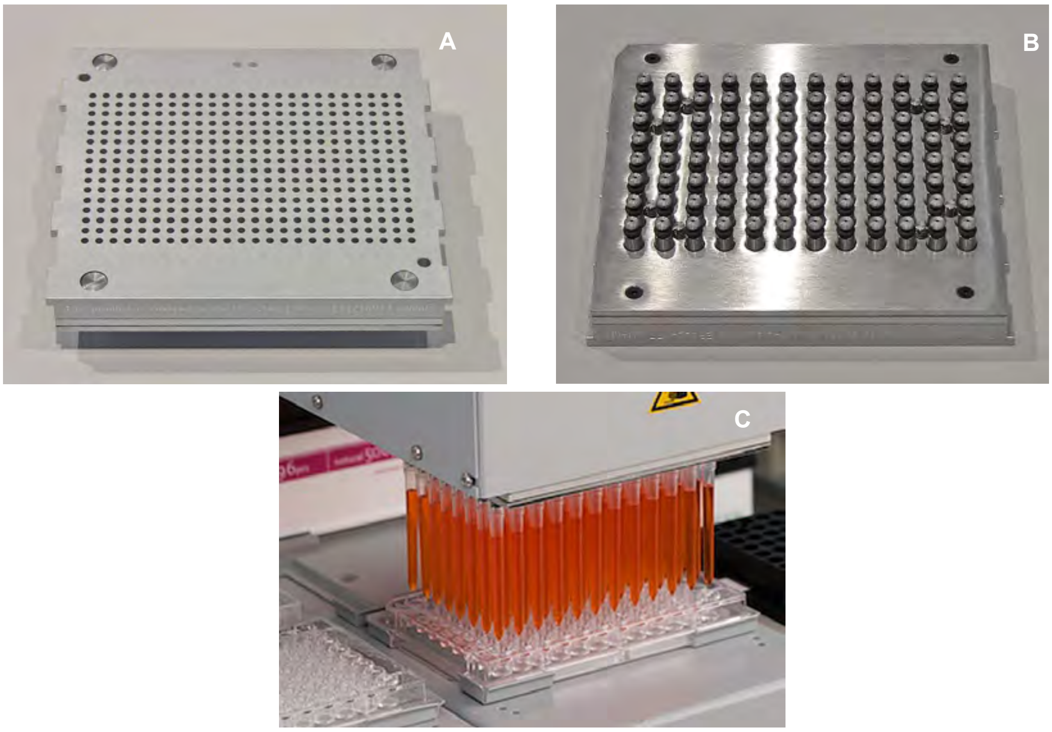


Fig. 4-41 *Adapter DiTi 1to1 MCA384*

A *Top view*
B *Bottom view*
C *Operational*

Adapter Fixed 15 µl MCA384

Fixed Tip Adapters

Features and application:

- Incorporates 384 fixed tips, stainless steel, washable.
- Tip length 28 mm
- Volume range: 0.5 - 15 µl (DMSO)
- Volume range: 1.0 - 15 µl (water)
- Used to pipette into 384 or 1536 well microplates.

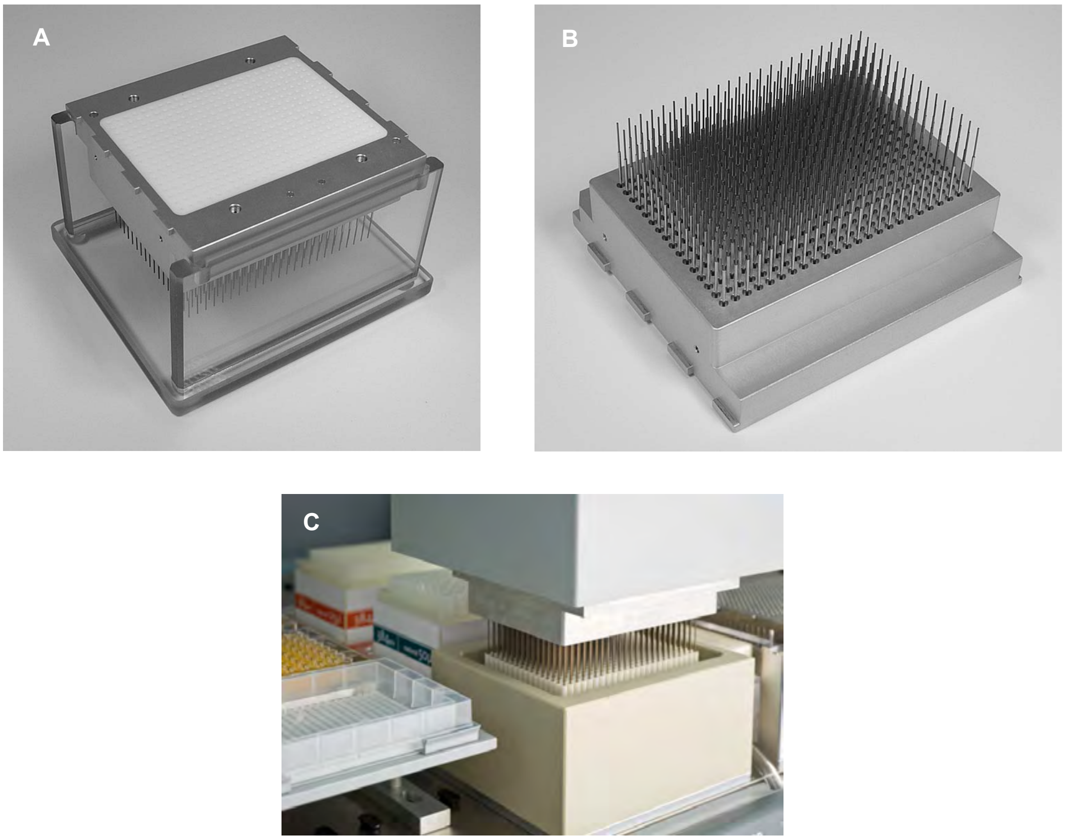


Fig. 4-42 *Adapter Fixed 15 µl MCA384*

A	*Adapter top view*	***C***	*Operational*
B	*Adapter bottom view*		

Adapter Fixed 125 µl MCA384

Fixed Tip Adapters

Features and application:

- Incorporates 384 fixed tips, stainless steel, washable.
- Tip length 28 mm
- Volume range: 2 - 125 µl (DMSO)
- Volume range: 3 - 125 µl (water)
- Used to pipette into 384 well microplates.

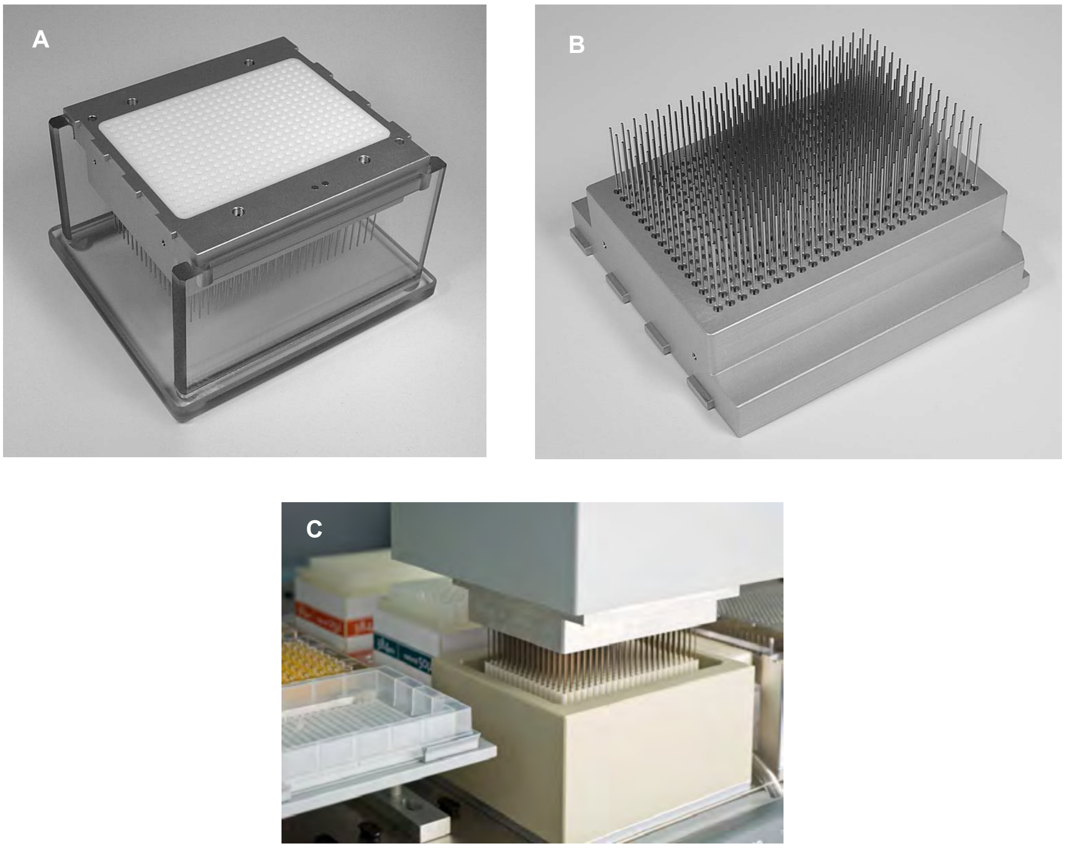


Fig. 4-43 *Adapter Fixed 125 µl MCA384*

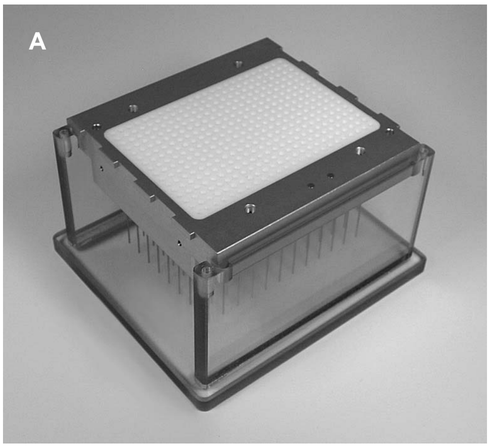
A	*Adapter top view*	***C***	*Operational*
B	*Adapter bottom view*		

Adapter 96 Fixed 15 µl MCA384

Fixed Tip Adapters

Features and application:

– Incorporates 96 fixed tips, stainless steel, washable.
– Tip length 28 mm
– Volume range: 0.5 - 15 µl (DMSO)
– Volume range: 1.0 - 15 µl (water)
– Used to pipette into 384, 96 or 1536 well microplates.



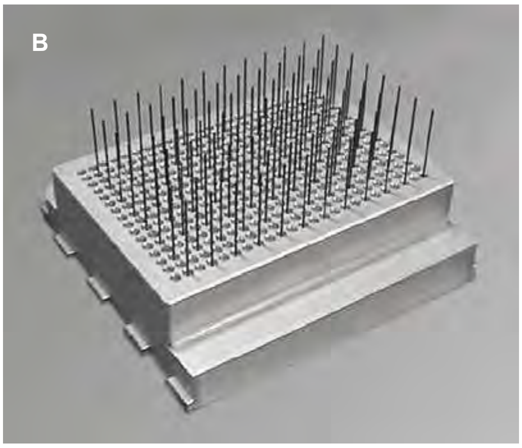


Fig. 4-44 *Adapter 96 Fixed 15 µl MCA384*

A *Adapter top view*

B *Adapter bottom view*

Adapter 96 Fixed 125 µl MCA384

Fixed Tip Adapters

Features and application:

- Incorporates 96 fixed tips, stainless steel, washable.
- Tip length 44 mm
- Volume range: 5 - 125 µl (DMSO and water)
- Used to pipette into 384 or 96 well microplates.

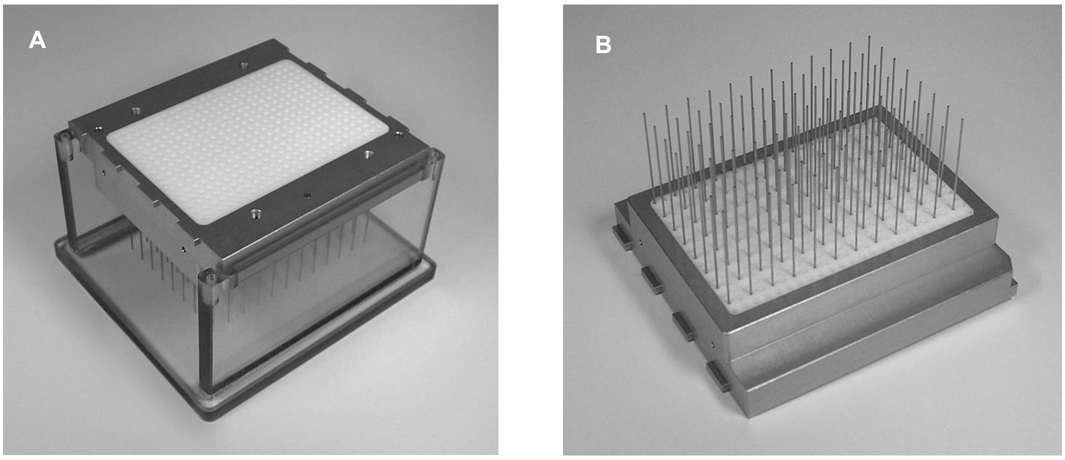


Fig. 4-45 *Adapter 96 Fixed 125 µl MCA384*

A *Adapter top view* ***B*** *Adapter bottom view*

Adapter QC MCA384

Features and application:

- Has a cutout on the top side in the area of the plunger seals and four holes (C) on the bottom side to take up reference pins (corresponding to position A1, P1, A24, P24 on a 384-well MP).
- Used for setups with reference pins and for covering the gaskets area when the pipetting head is not in use or during transportation.

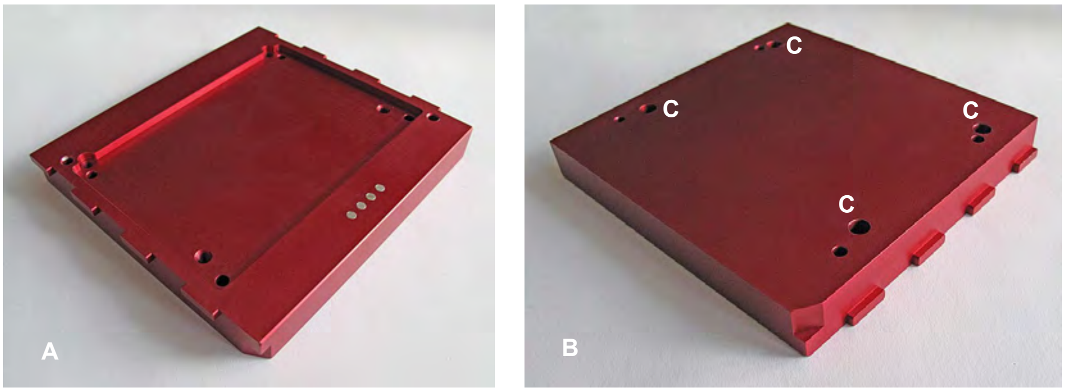


Fig. 4-46 *Adapter QC MCA384*

A *Top view*

B *Bottom view*

4.3.5.3 Tips

Fixed Tips

Fixed Tips

See:
"Adapter Fixed 15 µl MCA384", 2 4-38
"Adapter Fixed 125 µl MCA384", 2 4-39
"Adapter 96 Fixed 15 µl MCA384", 2 4-40
"Adapter 96 Fixed 125 µl MCA384", 2 4-41

Disposable Tips (DiTis)

MCA384 DiTis

DiTis are available in ANSI/SLAS boxes with 384 DiTis of the following volumes: 15 µl[1)], 50 µl, 125 µl

Fig. 4-47 *DiTi boxes with 15 µl, 50 µl and 125 µl DiTis*

1) See section 11.9.2.2 "Disposable Tips for MCA384", 2 11-29

MCA96 DiTis

With special adapters MCA96 DiTis can be used on the MCA384 pipetting head. The DiTis are available in ANSI/SLAS boxes with 96 DiTis of the following volumes:

50 µl, 100 µl, 200 µl and 500 µl.

Fig. 4-48 *DiTi boxes with 50 µl, 100 µl, 200 µl and 500 µl DiTis*

Picking up MCA96 DiTis

The MCA96 DiTis are picked up by the MCA384 pipetting head from the System carrier or Nested DiTi flat carrier, in the same way as the MCA96 pipetting head picks them up.

4.3.5.4 Consumables

Troughs

Troughs from individual suppliers can be placed on standard ANSI/SLAS microplate carriers. Volumes: 65 ml and 300 ml.

4.3.5.5 Carriers

Apart from the standard ANSI/SLAS microplate carriers the Freedom EVO makes use of a DiTi carrier and a System carrier specially designed for the MCA384.

MCA 384 DiTi Carrier

Features and application:

– Dedicated carrier for picking up 384 or 96 DiTis with the pipetting head.
– The carrier can hold two DiTi boxes.
– Hooks allow the head to engage with the carrier for the DiTi fetch process.
– Retainers activated by a built-in solenoid keep the DiTi boxes in place during the DiTi fetch process.

MCA384 DiTi Carrier Adapter

Adapter block to be placed on the MCA 384 DiTi carrier to lift the 15 µl DiTis to the same height like 50 µl or 125 µl DiTis.
The necessary settings in EVOware software are explained in an “Enclosed Note” supplied with the adapter.

Note: *In order to transport DiTis with a RoMa to and from the DiTi carrier one grid next to the DiTi carrier must stay empty. The optional MCA 384 DiTi carrier adapter for 15 µl DiTis reduces the number of empty grids to the minimum of one grid next to the MCA DiTi carrier for RoMa / CGM access.*

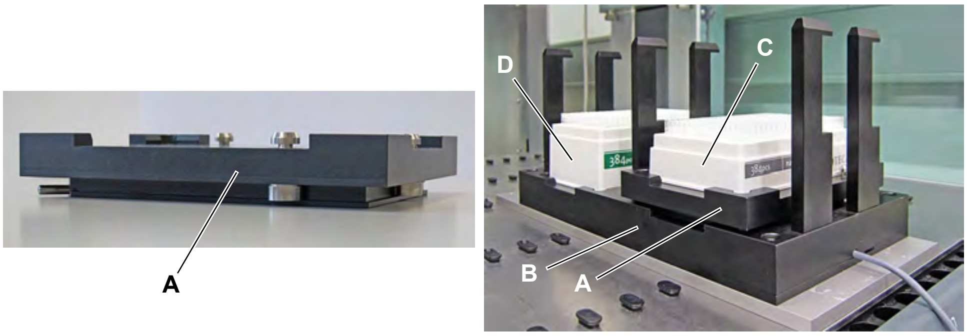


Fig. 4-49 *MCA384 DiTi carrier adapter*

A	*MCA384 DiTi carrier adapter*	***C***	*DiTi box with 15 µl DiTis*
B	*MCA384 DiTi carrier*	***D***	*DiTi box with 50 µl DiTis*

Picking up MCA384 DiTis

The MCA384 DiTis are picked up from the DiTi Carrier. The special mechanical design applies the force for taking up the DiTis only between the head and the DiTi Carrier (worktable and Freedom EVO arm are not stressed when picking up DiTis):

1. The head moves its hooks (D) to the left underneath the DiTi Carrier hooks (C).
2. The plunger plate moves up, engages the hooks and then presses the **Adapter DiTi MCA384** down to pickup the DiTis.

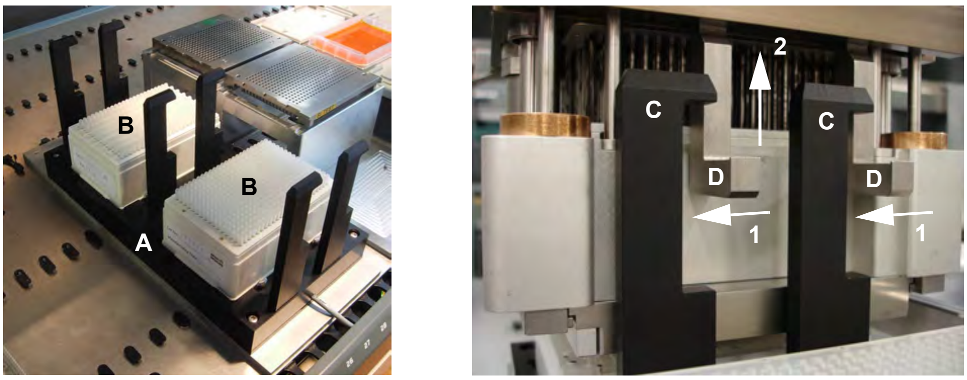
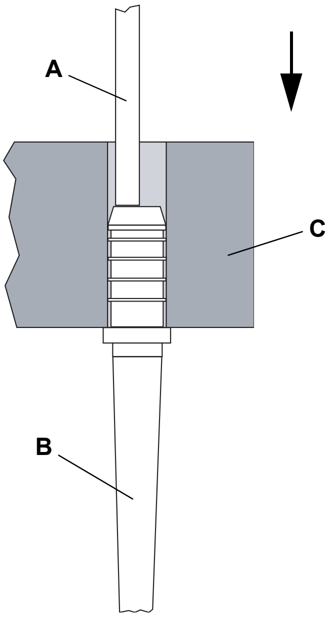


Fig. 4-50 *DiTi pickup mechanism*

Picking up DiTis row- or column-wise

Depending on the Adapter type it is possible to pick up DiTis from a DiTi box row- or column-wise. In this case the DiTi box is placed on a special DiTi box rack (ANSI/SLAS nest for DiTi box) on the System Carrier (see Fig. 4-54, 2 4-48).

DiTi Ejection



DiTis are ejected by an eccentric plunger movement where the plunger presses on the rim of the DiTi shaft.

A	*Plunger*
B	*DiTi*
C	*DiTi adapter*

Fig. 4-51 *DiTi eject*

System Carrier

Features and application:

- Dedicated carrier (A) with three positions to hold (in any combination):
  - Wash station
  - Tip adapters
  - DiTi boxes.
- Rack (D) is used for parking MCA384 adapters (see note below)
- ANSI/SLAS nest (B) is used to place DiTi boxes in the correct height (see "ANSI/SLAS Nest for DiTi Boxes and Plates", 2 4-48)

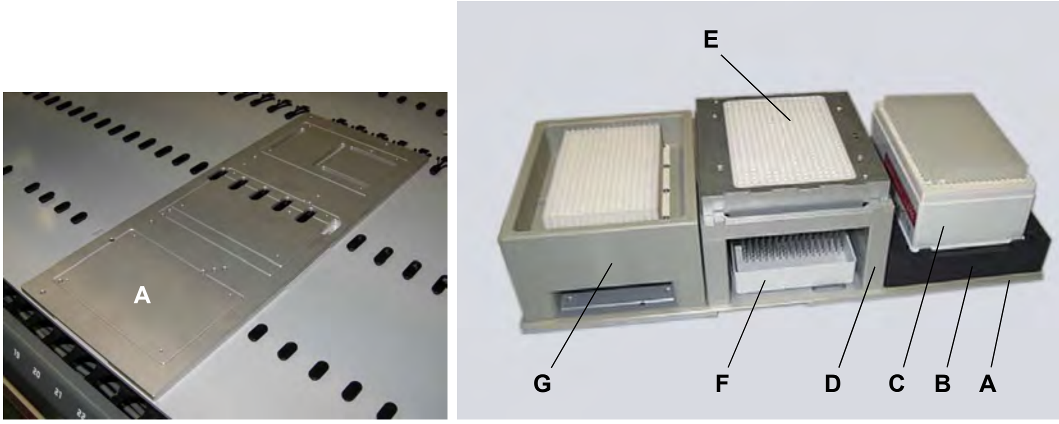


Fig. 4-52 *System Carrier*

A	*System Carrier*	***E***	*Adapter plate*
B	*ANSI/SLAS nest for DiTi box or microplate*	***F***	*Lid of a DiTi box used as drip tray*
C	*ANSI/SLAS DiTi box*	***G***	*Wash block*
D	*Rack for adapter plates*		

Note: *On the rack for adapter plates you can park:*

- any of the fixed tip adapters or
- any of the DiTi adapters without DiTis or
- any of the DiTi adapters with mounted DiTis (for repeated use of the DiTis)

4.3.5.6 Racks for System Carrier

MCA384 Adapters and DiTi boxes are placed on the System Carrier using appropriate racks.

Rack Types

Adapter Rack for MCA384 Adapters

Features and application:

– This type of adapter rack holds any of the MCA384 adapters

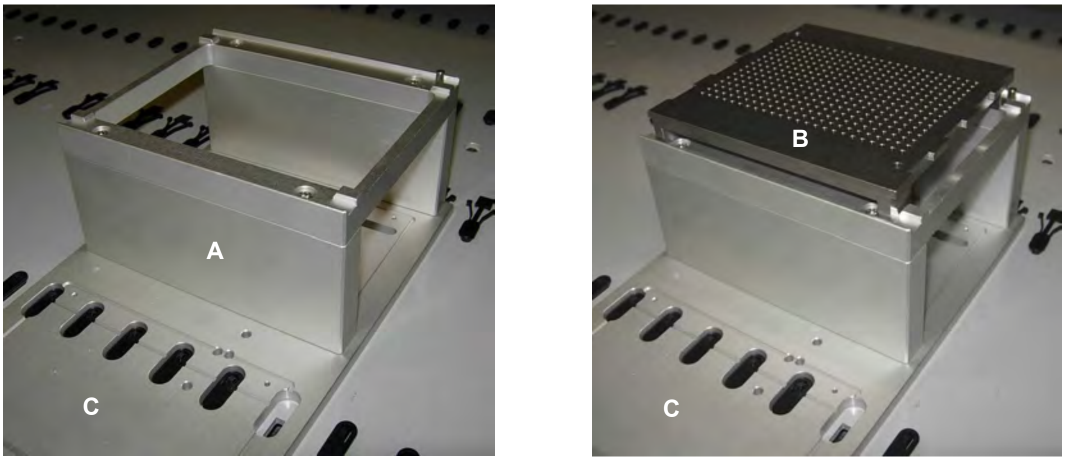


Fig. 4-53 *Adapter rack for MCA384 adapter*

A	*Adapter rack for MCA384 adapters*	***C***	*System Carrier*
B	*MCA384 adapter*		

ANSI/SLAS Nest for DiTi Boxes and Plates

Features and application:

– The ANSI/SLAS nest with intermediate plate holds any of the ANSI/SLAS DiTi boxes or microplates in the correct height
– In order to pick up DiTis from a DiTi box, row or column-wise, the DiTi box has to be placed on the ANSI/SLAS nest.

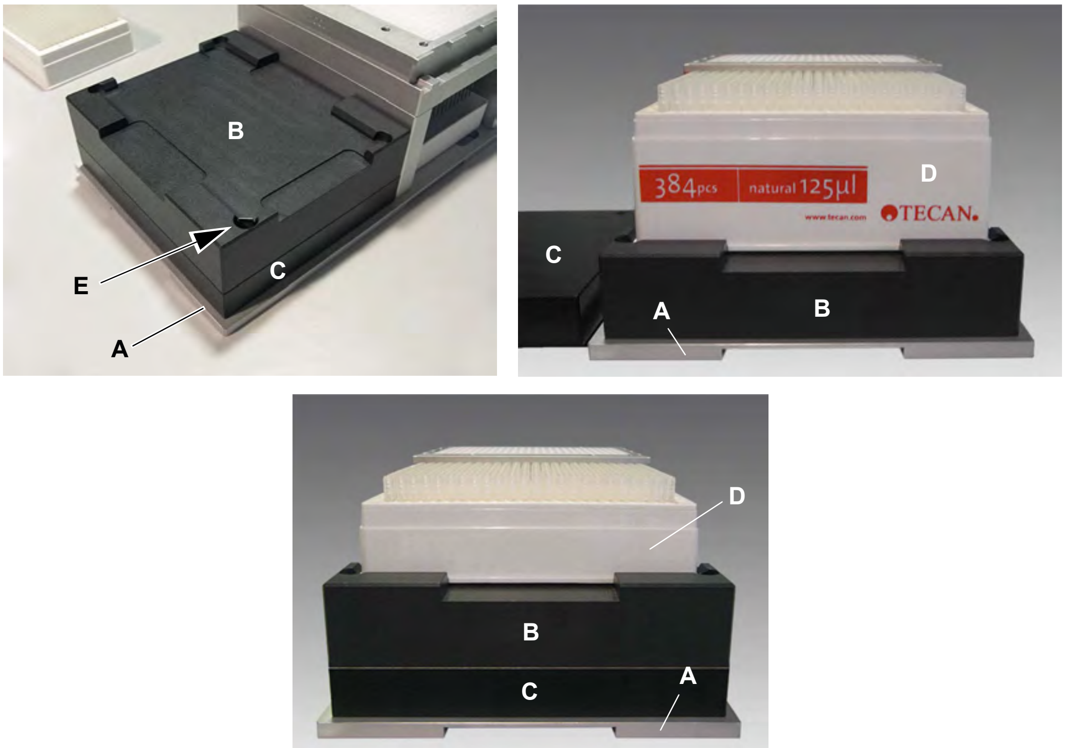


Fig. 4-54 *ANSI/SLAS nest for DiTi Boxes*

A	*System Carrier*	*D*	*ANSI/SLAS DiTi boxes of different heights*
B	*ANSI/SLAS nest*	*E*	*Spring loaded positioning lock*
C	*Intermediate plate*		

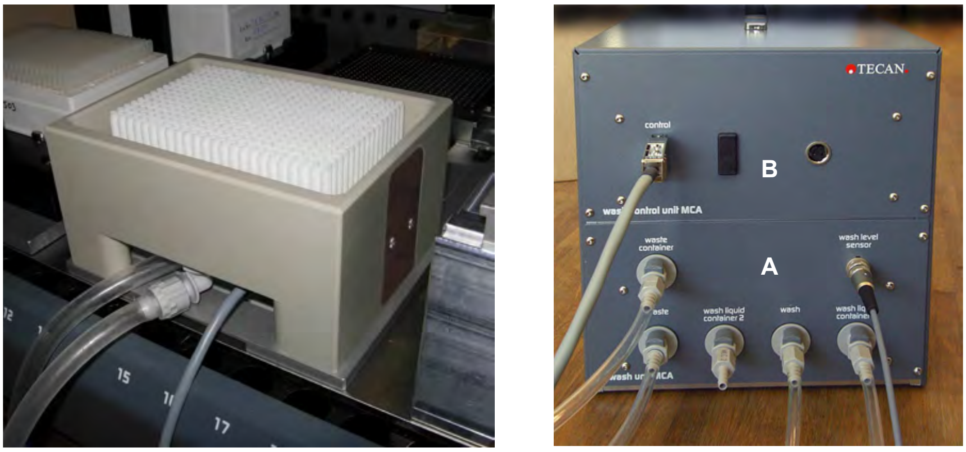
4.3.5.7 Flat Carrier

See section 4.3.4.3 “Flat Carrier, Multiple Positions”, 2 4-26.

4.3.5.8 Wash System

A wash block, installed on a System Carrier, serves to wash the tips of a fixed tip adapter after each pipetting cycle. The wash cycles in the wash block are controlled by the Control Unit MCA of the wash system. The Wash Unit MCA holds the appropriate electronics and pumps and is connected with tubings to the wash block, wash liquid container and waste container.

Note: *Disposable tips are intended for one single pipetting cycle, i.e. one aspiration step followed by one dispense step. DiTi’s are usually not washed but disposed after the pipetting cycle.*



Wash block **Wash System MCA**

Fig. 4-55 *Wash block and Wash Unit MCA*

A *Wash unit MCA* ***B*** *Control unit MCA*

Diagram

The figure shows a diagram of the MCA384 wash system and its components:

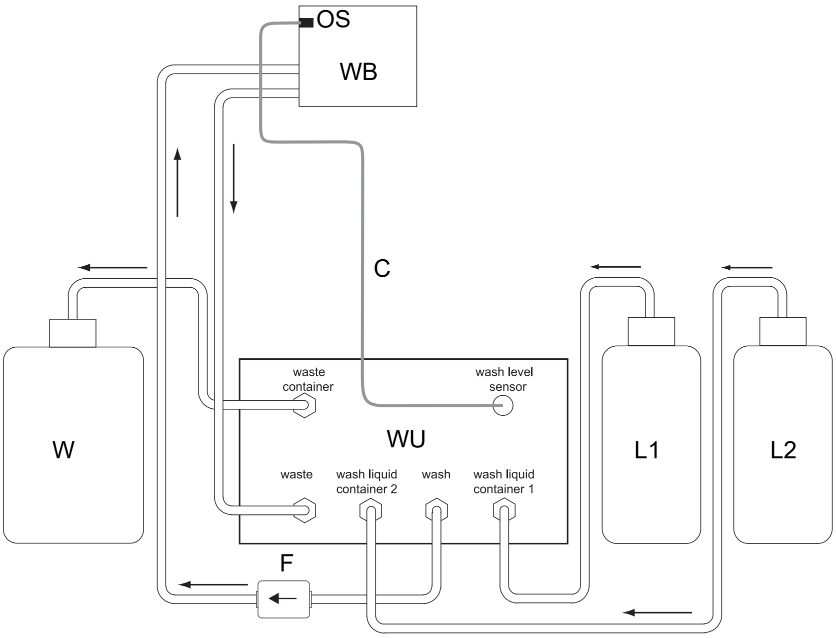


Fig. 4-56 *MCA384 wash system diagram*

WB	*Wash block MCA384*	***L2***	*Wash liquid container 2*
OS	*Overflow sensor*	***W***	*Waste container*
WU	*Wash unit MCA*	***C***	*Connection cable for overflow sensor*
→	*Liquid flow direction*	***F***	*Filter for wash liquid*
L1	*Wash liquid container 1*		

The heart of the wash system is the wash unit MCA (WU) which is equipped with the valves and pumps that pump wash liquid from the wash bottles (L1) or (L2) through the wash liquid tubes into the wash block (WB). The wash block (WB) is equipped with an overflow sensor (OS), which prevents from overflowing. Liquid that flows from the wash block back to the wash unit is pumped into the waste container (W).

4.3.6 MCA384 Gripper (CGM)

The optional MCA384 Gripper can be added to the MultiChannel Arm 384. This module allows transporting microplates from and to pipetting position, bringing a fresh tip box whenever necessary or simply de-lidding a plate for the duration of a pipetting step. With its 360 degree rotation capability the MCA384 Gripper has access to hotels and incubators on the back or on the side of the Freedom EVO platform and can load and unload microplates from a reader at the side of the instrument. Its individual Y- and Z-axes make this gripper a resource for on the spot labware manipulations and can be very useful in extraction processes using vacuum separation.

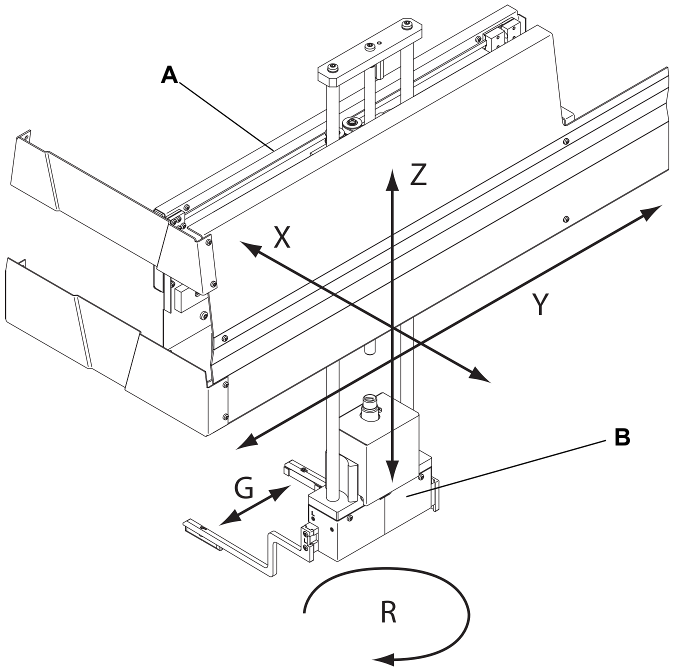


Fig. 4-57 *MCA384 Gripper*

A	*MCA384 Gripper unit*	***X***	*Axis left to right across worktable*
B	*Gripper rotator*	***Y***	*Axis front to back across worktable*
G	*Horizontal axis (gripper fingers)*	***Z***	*Vertical axis above worktable*
R	*Rotational axis (gripper rotator)*		

Note: *A Freedom EVO instrument with MCA384 can be field upgraded with an MCA384 Gripper by a Tecan FSE.*

4.3.7 Robotic Manipulator Arm Standard (RoMa Standard)

The robotic manipulator arm is used to transport microplates, reagent blocks, deep well plates, etc. to different positions on the worktable or for storage in the microplate shelf.

The RoMa standard coordinate system consists of five axes; the X-axis, the Y-axis and the Z-axis defining linear movements and the R-Axis defining rotational movements. The grippers can move in horizontal direction (G-axis).

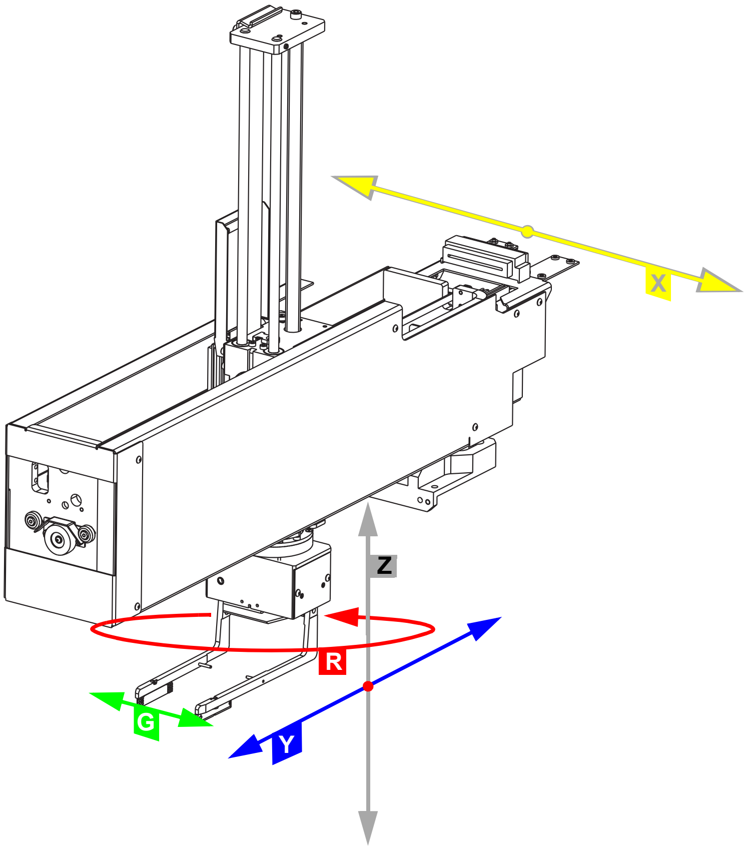


Fig. 4-58 *Robotic manipulator arm RoMa*

G	*Axis for gripper movements*
R	*Rotational axis*
X	*Axis from left to right of worktable*
Y	*Axis from front to back of worktable*
Z	*Vertical axis above worktable*

4.3.8 Robotic Manipulator Arm Long (RoMa Long)

The robotic manipulator arm with long Z-axis is used to transport microplates, reagent blocks, deep well plates, etc. to different positions on and underneath the worktable.

The RoMa Long coordinate system consists of five axes; the X-axis, the Y-axis and the Z-axis defining linear movements and the R-Axis defining rotational movements. The grippers can move in horizontal direction (G-axis).

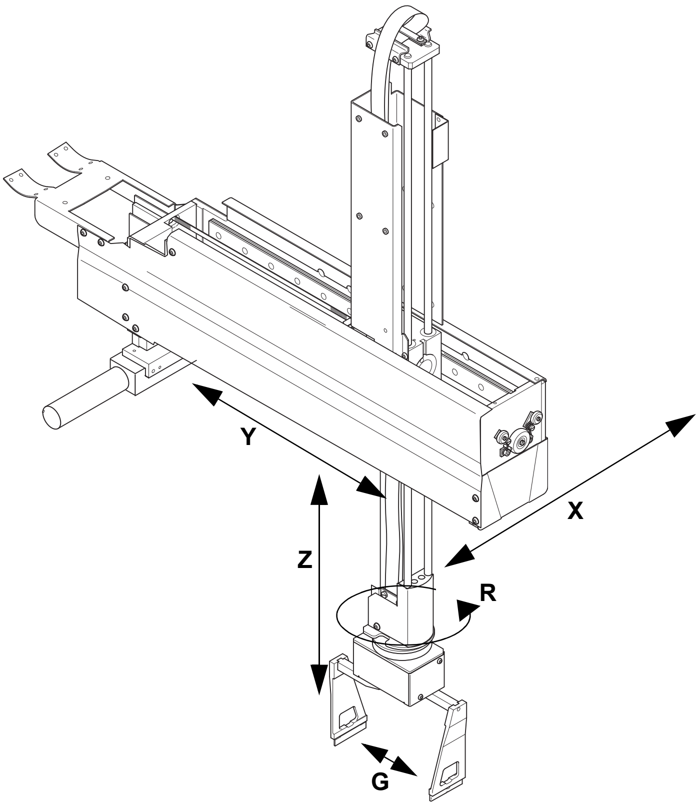


Fig. 4-59 Robotic manipulator arm with long Z-axis, RoMa long

G	*Axis for gripper movements*	***X***	*Axis from left to right of worktable*
R	*Rotational axis*	***Y***	*Axis from front to back of worktable*
		Z	*Vertical axis above worktable*

4.3.9 Gripper Fingers for RoMa Standard and RoMa Long

The RoMa standard and the RoMa long can be equipped with two types of gripper fingers:

- Centric gripper fingers (e.g. for top loading)
- Eccentric gripper fingers (e.g. for accessing a hotel or stacked configurations)

Fig. 4-60 *RoMa gripper fingers*

A *Centric gripper fingers* ***B*** *Eccentric gripper fingers*

4.3.10 Pick and Place Arm (PnP)

The pick and place arm is used to transport tubes with a diameter between 11 mm (0.43 in.) and 18 mm (0.71 in.) [25 mm (0.98 in.), under special conditions] from one to another position on the worktable.

Furthermore, gripped tubes can be rotated (e.g. for barcode identification) during transport.

The PnP arm executes the following movements:

- X: Left, right
- Y: Forward, backward
- Z: Up, down
- G: Open and close the gripper
- R: Rotation (unlimited)

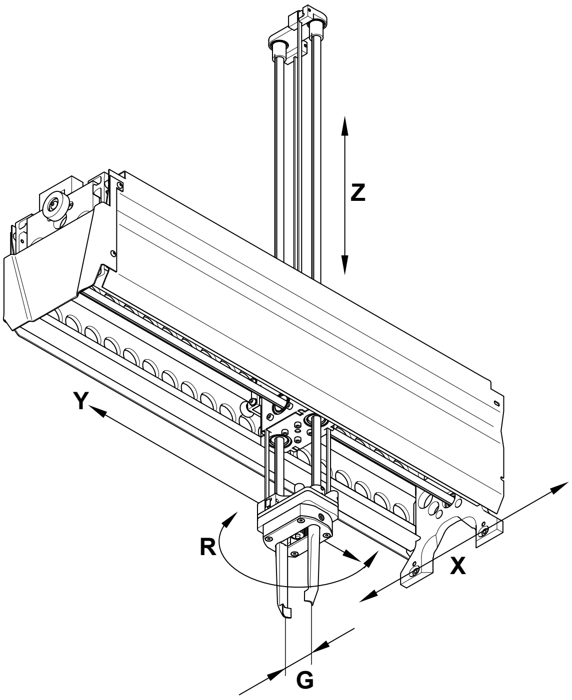


Fig. 4-61 *Pick and Place arm (PnP), view from below*

G	*Axis for gripper movements*	***X***	*Axis from left to right of worktable*
R	*Rotational axis*	***Y***	*Axis from front to back of worktable*
		Z	*Vertical axis above worktable*

4.3.11 Safety Elements

Front Safety Panel

The front safety panel is secured in closed position with the door locks.
According to the size of the Freedom EVO and the kind of front safety panel, one or two gas springs facilitate the opening of the panel.

Standard Front Safety Panel

Functions of Safety Panel

The standard front safety panel has the following function:

- Restrict access to moving parts (moving parts, mechanical hazards)
- Protection from spilling sample or reagent

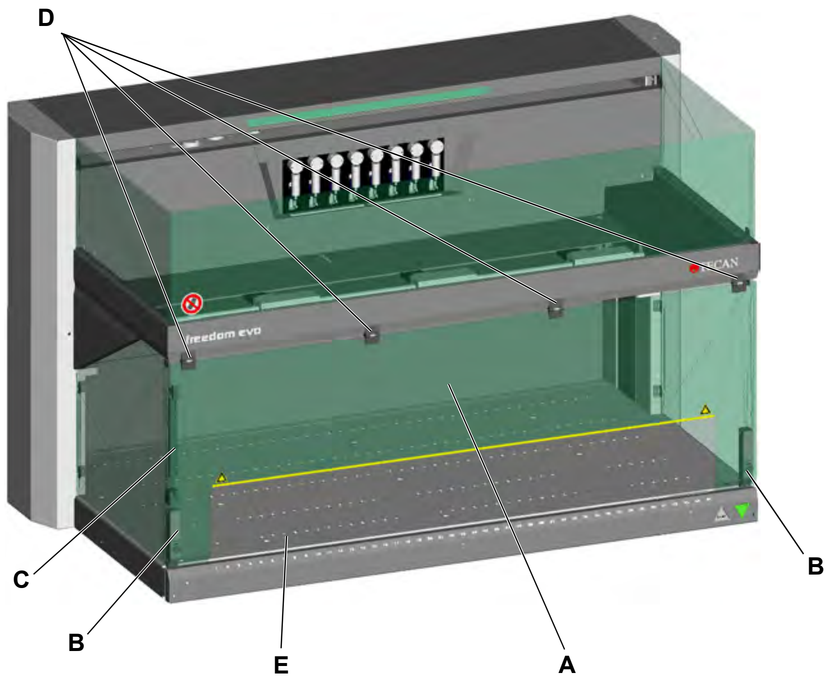


Fig. 4-62 *Freedom EVO with standard safety panel*

A	*Standard (open) front safety panel*	***D***	*Hinge*
B	*Door lock*	***E***	*Loading interface (optional)*
C	*Gas spring*		

Note: *With this safety panel, loading and unloading of carriers is possible without opening.*

Closed Front Safety Panel (Option)

Functions of Safety Panel

The closed front safety panel has the following functions:

- No access to moving parts (moving parts, mechanical hazards)
- Protection of the samples against outside influence (process safety)
- Protection from spilling sample or reagent

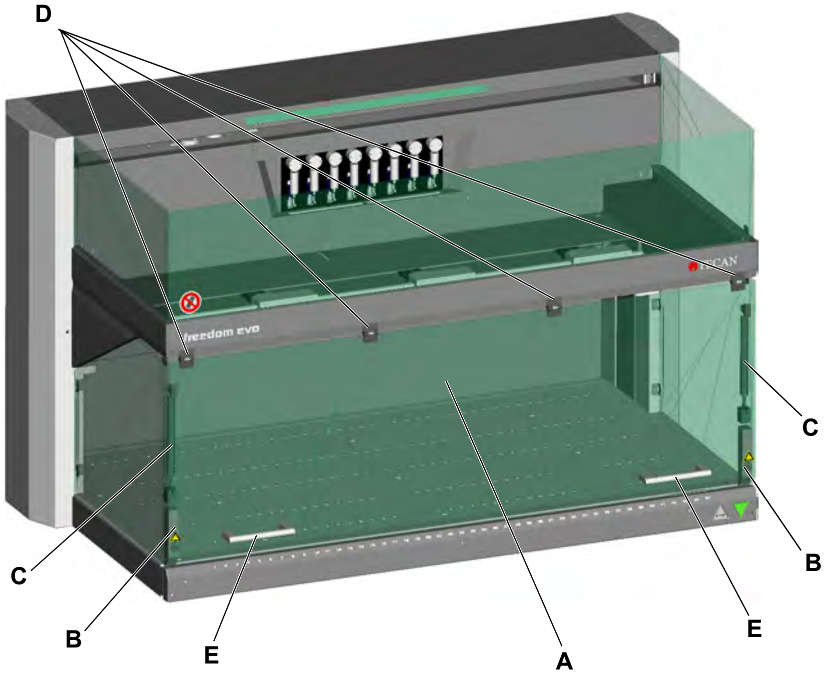


Fig. 4-63 *Freedom EVO with closed front safety panel (option)*

A	*Closed front safety panel*	***D***	*Hinge*
B	*Door lock*	***E***	*Handle*
C	*Gas spring*		

Note: *With this safety panel, only batch-wise loading is possible.*

Front Safety Panel With Adjustable Access Window (Option)

Functions of Safety Panel

The front safety panel with adjustable access window has the following functions:

- Prevent direct access to moving parts (moving parts, mechanical hazards)
- Protection from spilling sample or reagent

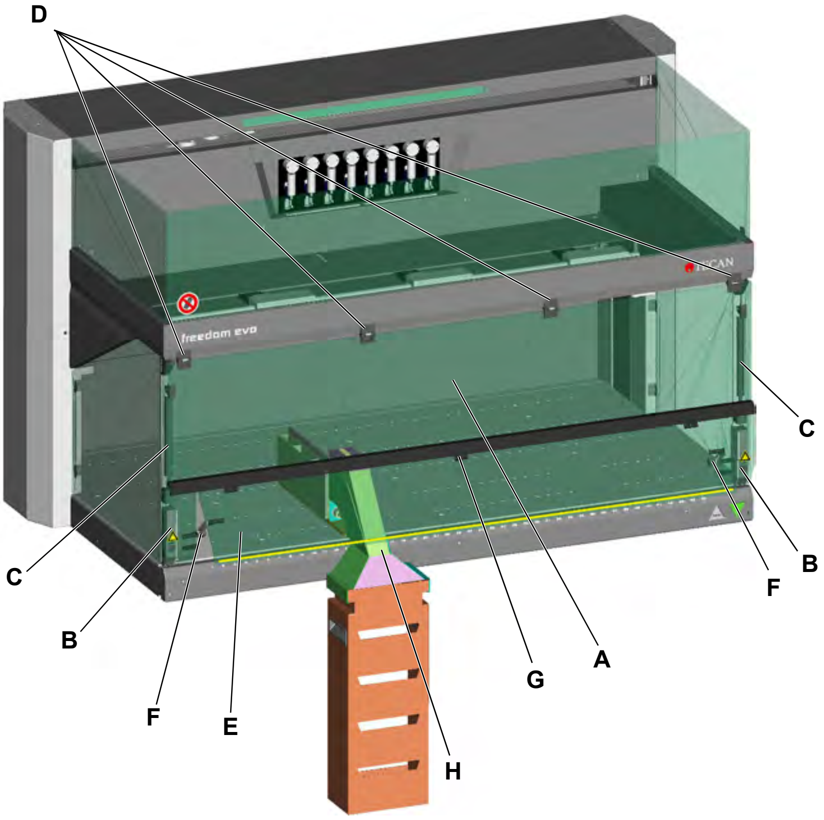


Fig. 4-64 Freedom EVO with adjustable front safety panel (option)

A	*Front safety panel*	*E*	*Adjustable access window*
B	*Door lock*	*F*	*Window locking screw*
C	*Gas spring*	*G*	*Hinge of access window*
D	*Hinge*	*H*	*DiTi waste slide*

This front safety panel is used when elements with a higher mechanical risk potential, such as an MCA96 or MCA384, are used and a DiTi waste slide needs to be installed at the same time (which cannot be used together with the closed front safety panel).

Note: *With this safety panel, only batch-wise loading is possible.*

Door Locks

How do the Door Locks Work?

The door locks actively lock the front safety panel during operation of the Freedom EVO. This is achieved with a software command from the application software.

Application Software

The application software is programmed in such a way that

- if the safety panel is open the process cannot be started.
- the door locks can only be unlocked when the process is stopped or in pause mode.

The figure shows the door locks in connection with the standard and closed safety panel:

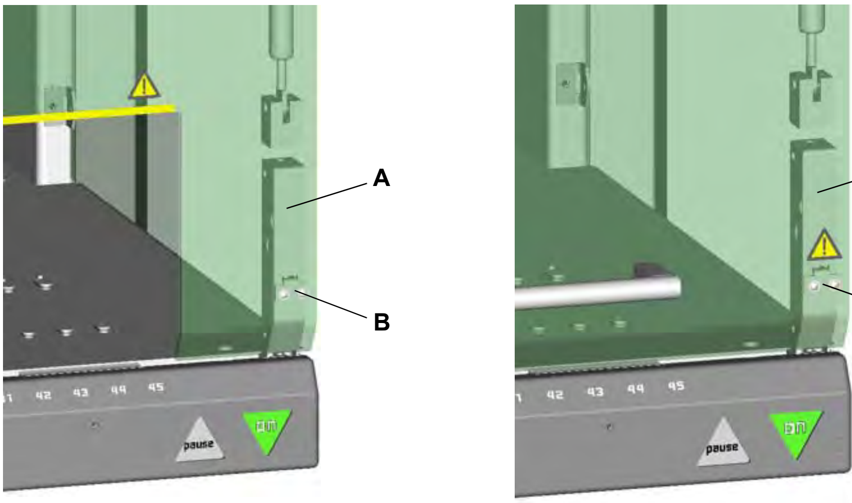


Fig. 4-65 *Door locks*

The door locks consist of a locking device (A) with an electromagnetic actuator on each side of the worktable and a catch (B), which is mounted to the safety panel. A switch in the locking device monitors if the safety panel is open or closed.

Loading Interface (optional)

The loading interface of the Freedom EVO detects the presence of carriers on the worktable. It can differentiate between:

- carrier present at the defined loading position
- carrier not present at the defined loading position

Furthermore, the loading interface indicates the carrier status by means of LEDs.

4.4 Positive Identification (PosID)

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Barcode types and labels	See section 3.5.9 “Positive Identification (PosID)”, 2 3-78

What Does PosID Mean?

PosID stands for positive identification, i.e. whenever necessary an identification step for carriers or containers (tubes, microplates, reagent bottles and troughs) can be programmed in the application software in order to ensure that the correct labware is processed.

The PosID can automatically scan barcodes on carriers and containers by means of a built-in barcode laser scanner. Barcodes can be read on both the primary side (e.g. sample tube), and the secondary side (e.g. microplates). To enable identification with the PosID, all carriers and containers must be labeled with barcodes.

How Does it Work?

The PosID body runs past the carriers to scan the carrier ID barcode (through the front aperture). With its gripper, the PosID pulls the carriers towards the rear of the instrument (passing the barcode scanner) for barcode identification on containers and then shifts the carriers back into operating position.

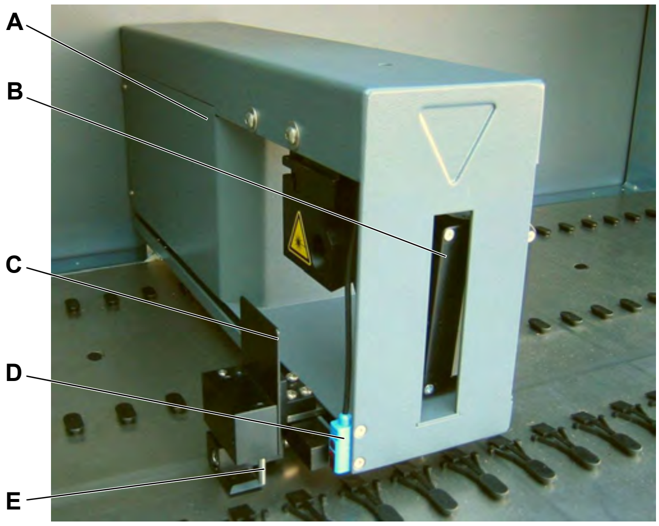


Fig. 4-66 *PosID*

A	*PosID body*	***D***	*“No Tube” sensor*
B	*Barcode scanner*	***E***	*Gripper*
C	*Barcode flag (alignment barcode for verification)*		

The barcode scanner is suspended in such a way that it can identify vertical and horizontal aligned barcodes.

Before each container scan the PosID scans the alignment barcode on the barcode flag, which is attached to the gripper, to verify that the barcode scanner and the gripper are in the correct position. This improves identification security for the containers.

Reading Positions

The figure shows how the barcodes for the carrier identification are scanned.

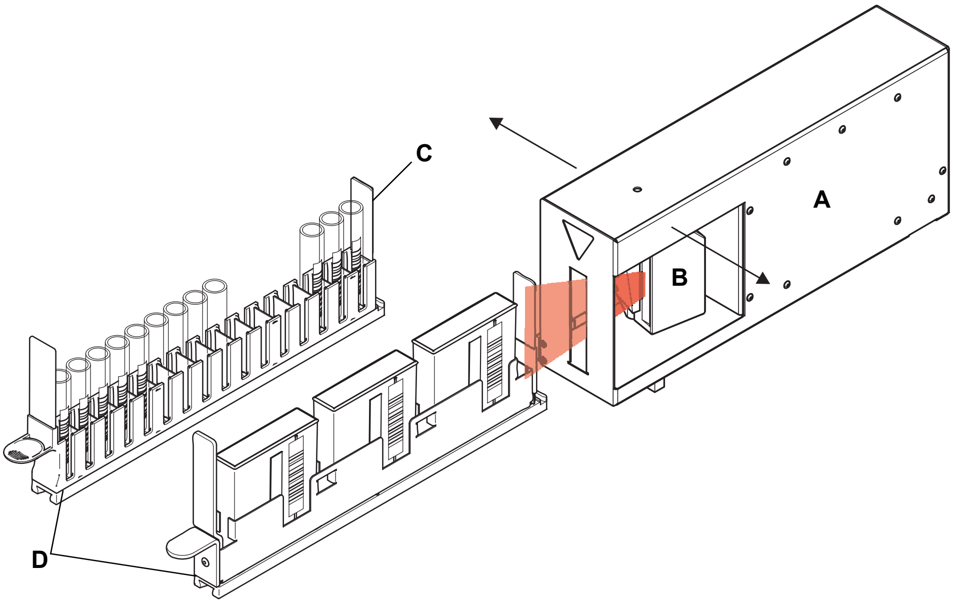


Fig. 4-67 Barcode scanner position for scanning carrier ID

A	*PosID body*	*C*	*Carrier ID barcode label*
B	*Barcode scanner*	*D*	*Carrier*

The figure shows how vertical barcodes (e.g. on tubes or reagent troughs) are scanned.

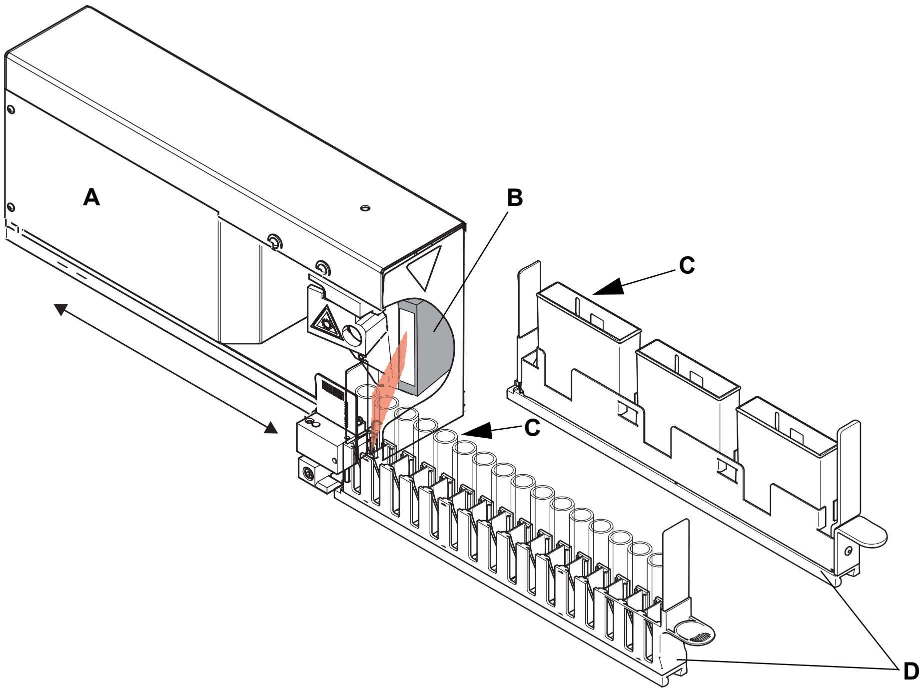


Fig. 4-68 Barcode scanner position for scanning vertical barcodes

A	*PosID body*	*C*	*Container barcode label*
B	*Barcode scanner*	*D*	*Carrier*

The figure shows how horizontal barcodes (e.g. on microplates) are scanned.

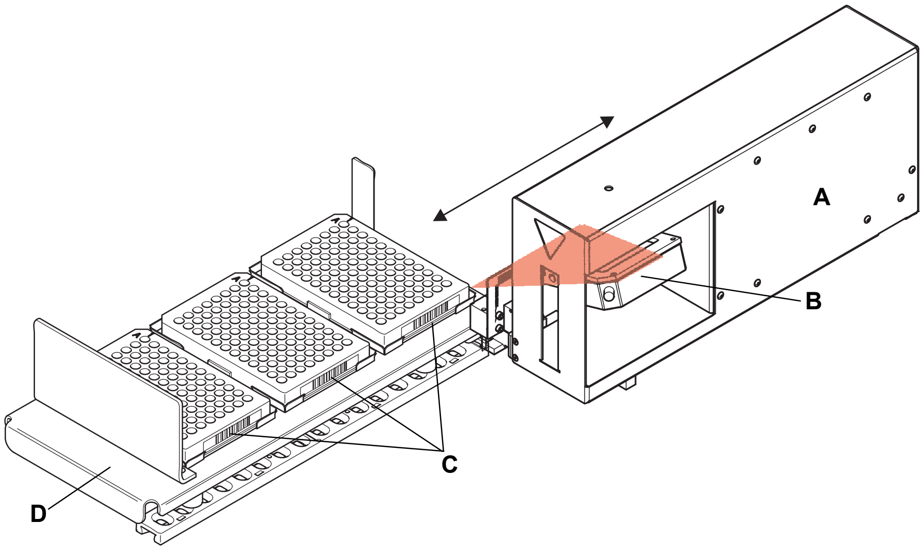


Fig. 4-69 Barcode scanner position for scanning horizontal barcodes

A	*PosID body*	***C***	*Container barcode label*
B	*Barcode scanner*	***D***	*Carrier*

"No Tube" Sensor

The "No Tube" sensor checks if a carrier is actually transported when the gripper moves. Furthermore, it monitors the presence of the tubes in the rack. This is necessary, because the barcode scanner cannot distinguish between a tube with missing or incorrectly positioned barcode and a missing tube.

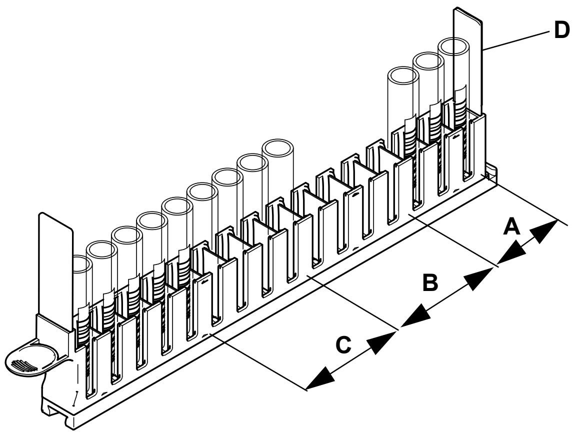
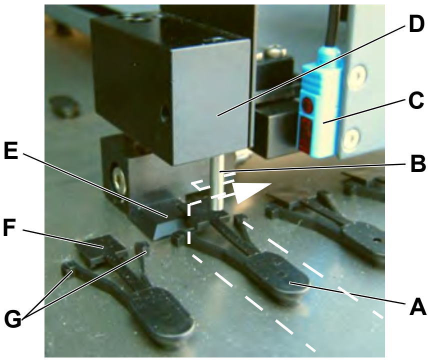


Fig. 4-70 Detectable situations in a tube rack

A	*Tubes with readable barcode*	***C***	*Tubes without barcode (or incorrect positioned barcode)*
B	*No tubes present*	***D***	*Carrier ID barcode*

How the Gripper Works

The figure shows how the gripper engages in the carrier to pull the containers past the barcode scanner.



A	*Lock pin*
B	*Pin (carrier transport)*
C	*“No Tube” sensor*
D	*Gripper*
E	*Wedge*
F	*Latch*
G	*Retainer*

Fig. 4-71 *PosID gripper and lock pin*

During normal operation the carriers (see dashed line) are positioned at the lock pin (A). The retainers (G) act as a stop for the carrier, because they are locked by the latch (F).

For barcode identification of the containers, the gripper (D) moves next to the carrier, then moves in X-direction (see arrow) to engage the pin (B) in the slot at the rear end of the carrier. At the same time the wedge (E) lifts the latch. The retainers give way and the carrier can be pulled to the rear.

Barcode Value Verification

The PosID verifies the barcode value before transmitting it to the application software. As a standard setting the barcode scanner requires two consecutive identical decoded values to transmit it as a valid result.

Barcode Types

Barcodes on Containers

There is a variety of different barcode types. Not all types are suitable for container identification for data security reasons. Only barcode types that employ a check digit are considered to yield sufficient reading security.

Up to six different container code types per application can be used at the same time.

Barcodes on Carriers

Tecan standard carriers are identified by means of two carrier barcodes (code 128). The second barcode is used to verify the carrier ID (the information on the two barcodes is identical except for one character). This improves identification security for the carriers.

The dimensions of the carrier are stored in the software. After matching the carrier ID with the database, the software is able to identify the carrier’s properties.

Barcode Labels

For detailed information on barcode types and proper positioning of barcode labels on carriers and containers refer to cross references above.

4.5 Centrifuge

The Hettich ROTANTA 460 Robotic centrifuge is placed in the cabinet underneath the worktable. The centrifuge and the cabinet are connected to the ground in a such a way that their positions are fixed.

The rotor of the Hettich ROTANTA 460 Robotic centrifuge stops at a fixed position. The centrifuge can be loaded and unloaded by the RoMa long, which reaches into the centrifuge through a cutout in the worktable.

For more information, refer to the manual delivered with the centrifuge.

***Note:** It is recommended to lock the cabinet doors with additional door locks if a centrifuge is placed in the cabinet under the worktable.*

4.6 Reader

The following microplate reader types can be installed on top, or on the side of the instrument:

- Sunrise
- Infinite F50, 200, 500, 1000
- Spark

The readers can be, depending on the reader type, installed

- on the worktable extension that is placed on the workbench.
- on an external cabinet on the right side of the instrument.
- on the instrument's worktable (in the rear).

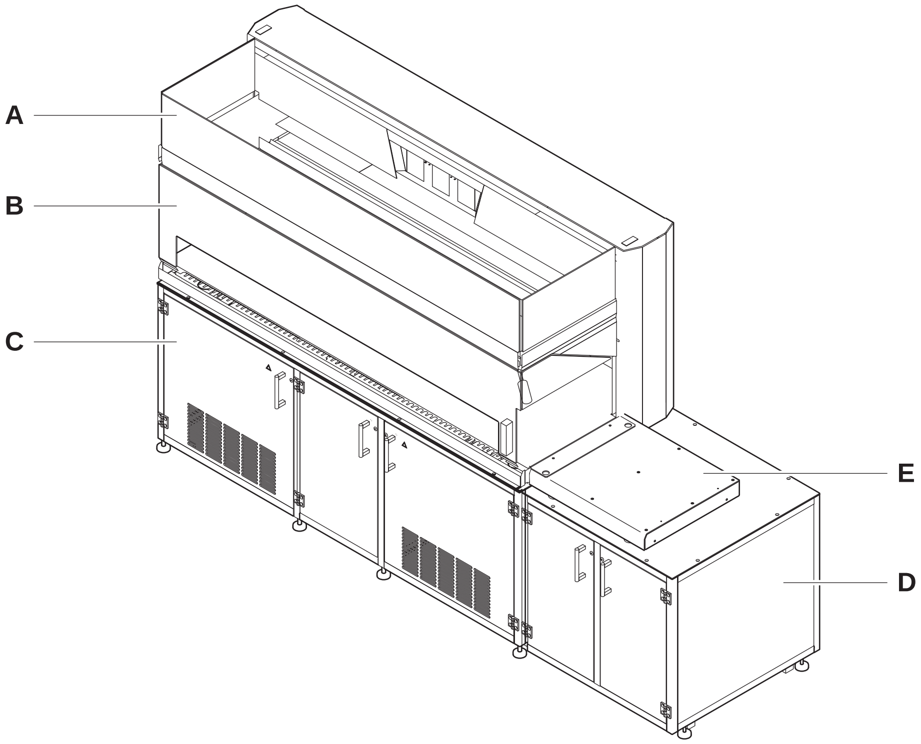


Fig. 4-72 *Installation of a reader*

A	*Instrument*	***D***	*External cabinet*
B	*Front safety panel*	***E***	*Worktable extension*
C	*Cabinet*		

Refer to section 3.3.2 "Reader Configurations", 2 3-26.

If the reader is installed directly on the worktable or on the worktable extension, it is loaded and unloaded by means of a RoMa with eccentric grippers.
For more information about the microplate reader, refer to the reader's documentation.

4.7 Liquid System

Introduction

The liquid system is a central component of the pipetting function. It transmits the precise movement of the diluter pistons to the tips through the system liquid.

Liquid System Function

The system liquid is delivered to the system in a container and is aspirated and distributed in the whole system via tubes, valves and connectors. The distribution of the system liquid is effected by the movement of the diluter pistons in one or several strokes.

The figure shows the schematic diagram of the standard liquid system:

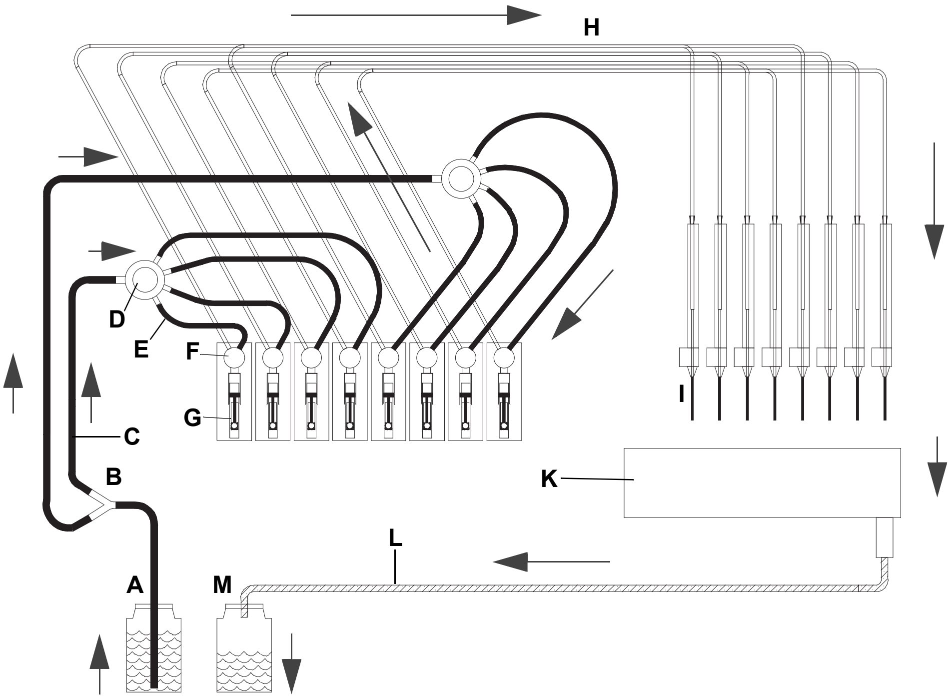


Fig. 4-73 *Liquid system diagram*

Parts in contact with system liquid only

A	*System liquid container*
B	*Distributor 1:2 (8-tip instrument only)*
C	*Aspirating tubing*
D	*Distributor 1:4 (1:2 for 2-tip instrument)*
E	*Interconnecting tubing*
F	*3-way valve*
G	*Syringe*

Parts in contact with system liquid and/ or sample

H	*Pipetting tubing*
I	*Tips*
K	*Wash station*
L	*Waste tubing*
M	*Waste container*

Note: *The arrows indicate the direction of flow.*

Fast Wash Pump

The liquid flow can be considerably accelerated, e.g. for wash cycles, with the installation of a fast wash pump in the liquid system.

FWO/SPO/MPO Option

The fast wash pump is part of the FWO (Fast Wash Option), SPO (Sensored Pump Option) or MPO (Monitored Pump Option).

The figure shows the schematic diagram of a liquid system with fast wash pump:

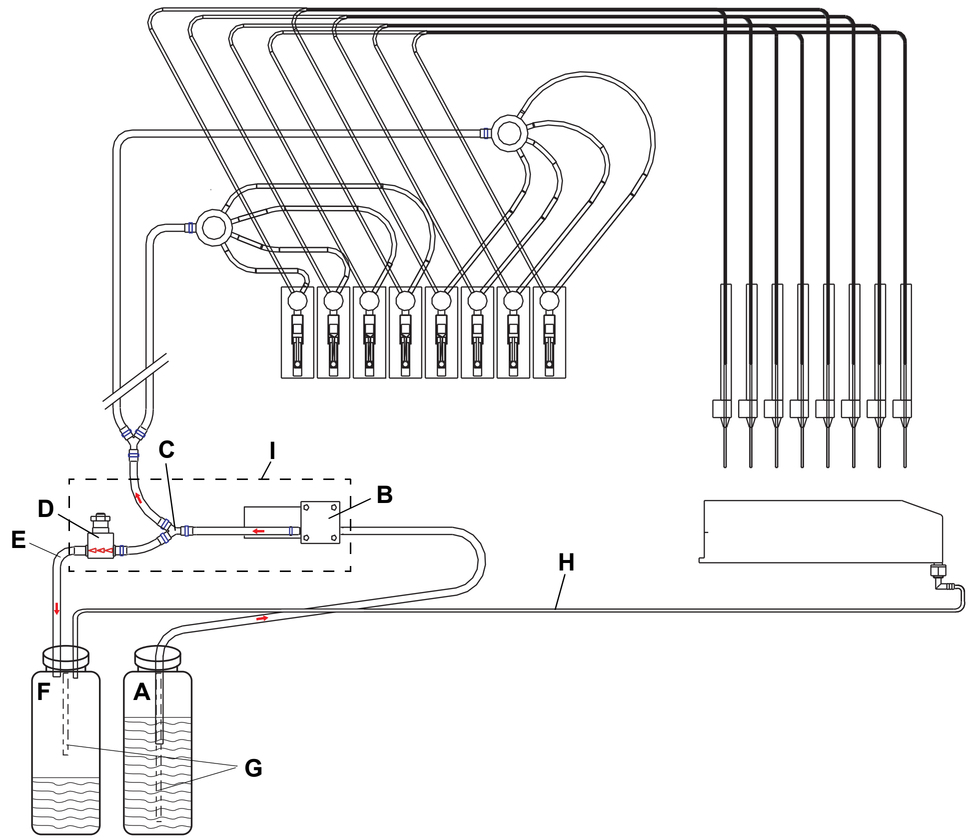


Fig. 4-74 Liquid system diagram (with FaWa)

A	*System liquid container*	*F*	*Waste container*
B	*Fast wash pump (FaWa)*	*G*	*LICOS tubes (SPO/MPO)*
C	*Distributor 1:2*	*H*	*Waste tubing from wash station*
D	*Pressure relief valve*	*I*	*FWO/SPO/MPO (optional)*
E	*Bypass tubing (from pressure relief valve)*		

Note: *All other parts are identical with the ones of the standard liquid system.*

FaWa Function

The fast wash pump (B) accelerates the liquid flow to the tips. During pump actions the 3-way valves of the diluter enable direct flow to the tips.

The pressure relief valve serves to limit the pressure in the liquid system. To avoid overpressure, e.g. in case of clogged tips, the valve bypasses excessive liquid to the waste container.

Note: *To minimize the contamination risk, Tecan recommends you to connect the bypass tubing from the pressure relief valve (E) to the waste container as shown in the figure.*

In exceptional cases (e.g. if very expensive system liquids are used) the bypass tubing from the pressure relief valve may be directed back to the system liquid container.

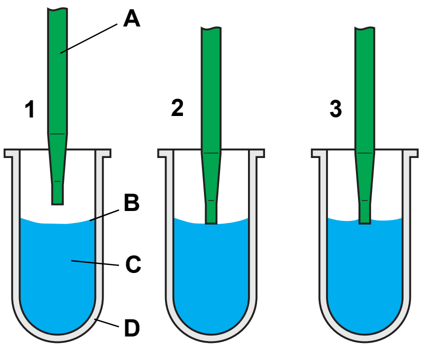
Instrument With 2 LiHas

In case the instrument is equipped with two liquid handling arms, each LiHa has its own liquid system.

4.7.1 Capacitive Liquid Level Detection

How Does it Work?

The integrated capacitive liquid level detection (cLLD) measures the capacitance between the tip and the instrument worktable; i.e. the corresponding carrier. As soon as the tip touches the liquid surface, the change in capacitance serves to trigger a detection signal.
The conductivity of the liquid and the labware type have influence on the detectability.



1 The tip moves downwards to detect liquid.
2 The tip is at detection level.
3 The tip has contact to the liquid surface after detection.

A *Tip*
B *Liquid level*
C *Sample*
D *Tube*

Fig. 4-75 *Liquid level detection*

The liquid level detection evaluates both the liquid detection signal (when the tip moves into the sample liquid) and the exit signal (when the tip retracts).
Each channel has an individual liquid detection.

Influencing Variables

The application software offers the following adjustments of influencing variables:

- The sensitivity of the liquid level detection can be adjusted.
- In order to improve the detection, “Double Detection” is used; i.e. the detection is performed once, then the tip retracts by a short distance and a second detection is performed. The results are only considered valid if the measured detection levels are within a specified limit. This is useful, e.g. if there are bubbles on the liquid surface.
  – The first detection run detects the surface of the bubble.
  – The bubble bursts at the latest when the tip retracts.
  – A second detection run will measure a different detection level.
  – The first value is rejected and the detection is repeated.

Advantages

Advantages due to the liquid detection feature:

- **Minimum submerge depth** of the tip
- **Reduced tip contamination** and accordingly less washing effort for tip
- Appropriate **message if no liquid or not enough liquid available** for sampling
- Software controlled, **constant submerge depth** during aspiration and dispensing
- Enabling **clot detection**

4.7.2 Clot Detection

How Does it Work?

The clot detection is based on the liquid level detection. The application software monitors the exit signal while the tip is retracted after aspiration of a liquid and compares the level at which the exit signal appears with the liquid level detection value.
In the following the function of the clot detection and its limits are scrutinized.

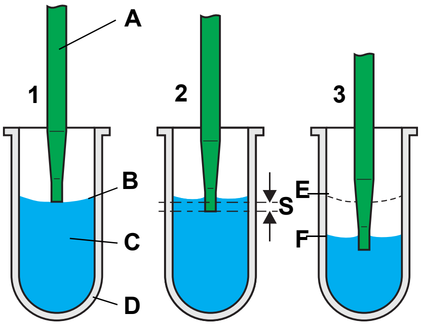


Fig. 4-76 Sample aspiration

1. The tip detects the liquid level.
2. The tip moves down into the liquid to the specified submerge depth (S).
3. The tip aspirates a sample while continuously maintaining the submerge depth (called “tracking”).

   The application software calculates the theoretical level of the liquid surface after aspiration.

A	*Tip*
B	*Liquid level*
C	*Sample*
D	*Tube*
E	*Original liquid level*
F	*Liquid level after aspiration*
S	*Submerge depth*

If There Are No Clots

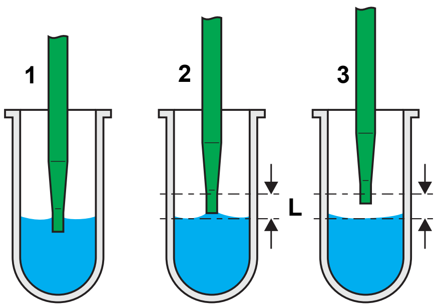


Fig. 4-77 No clot detected

After aspiration:

1. The tip retracts from the sample.

   Normally, i.e. if there is no clot, the exit signal is detected shortly after passing the level of the calculated liquid surface.

   This delay is caused by adhesion forces that make the liquid stick to the tip.
2. The clot detection checks if the exit signal is within a predefined limit (L).
3. The tip is still within the limit after detection of the exit signal.

   No error message will be generated.

If There Is a Clot Detected

There are two situations in which the clot detection generates an error message during retraction of the tip. In both situations a clot sticking to the tip or clogging the tip is the most possible cause for the non-appearance of the exit signal within the limit.

Situation 1

Clot Sticking to the Tip

A clot sticking to the tip may be the cause for the delayed exit signal.

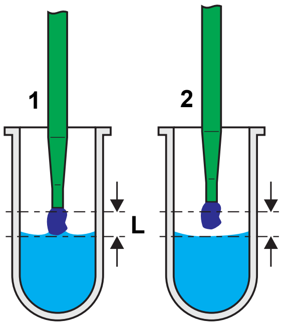


Fig. 4-78 *Clot detected*

1 The tip is beyond the limit (L) and there is still no exit signal.

2 When the exit signal appears the tip is out of the limit.

An error message will be generated.

Situation 2

Expected Volume not Aspirated

Alternatively, a clogged tip or other problems may be the cause for the fact that no or too little liquid is aspirated.

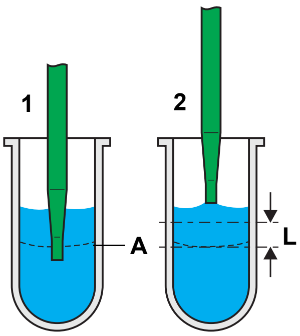


Fig. 4-79 *No liquid aspirated*

1 There is an attempt to aspirate liquid, but the liquid level remains the same (e.g. because the tip is clogged).

The liquid surface is expected to be at level (A) after aspiration.

2 The tip retracts and there is no exit signal within the limit (L).

An error message will be generated.

A *Theoretical liquid level after aspiration*

This error situation is only given when larger volumes in relation to the geometry of the vessel are to be aspirated. At very low volumes the expected difference of the liquid surface level before and after aspiration is not sufficient for the detection.

Limits of the Clot Detection

The following critical situation may occur if the sample has not been centrifuged properly.

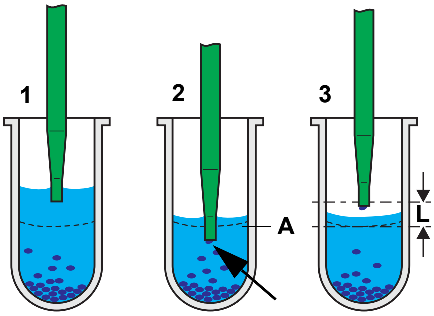


Fig. 4-80 *Sample not completely aspirated*

1. There are floating particles in the sample. The tip aspirates liquid.
2. During aspiration (in the worst case shortly before the end of the aspiration process) a particle clogs the tip (see arrow).

   The liquid surface is expected to be at level (A) after aspiration.
3. The tip retracts and the exit signal appears within the limit (L).

   No error message will be generated though the tip is clogged.

A *Theoretical liquid level after aspiration*

Though a certain amount of liquid has been aspirated, the expected difference of the liquid surface level before and after aspiration is too small for proper functioning of the clot detection.

IMPORTANT
For that reason it is very important that the samples are properly centrifuged and handled carefully to avoid floating particles.

4.7.3 Tubing Systems

Flexible tubing connects the liquid system container(s), pumps, valves and tips.

Precision Diluters

Precision diluters assure accurate aspiration and dispensing of liquids and air gaps, the latter to separate the various liquids.

Depending on your application and liquids used, tubing systems are available for 2-tip, 4-tip and 8-tip instruments with optional features, in different materials and with suitable accessories.

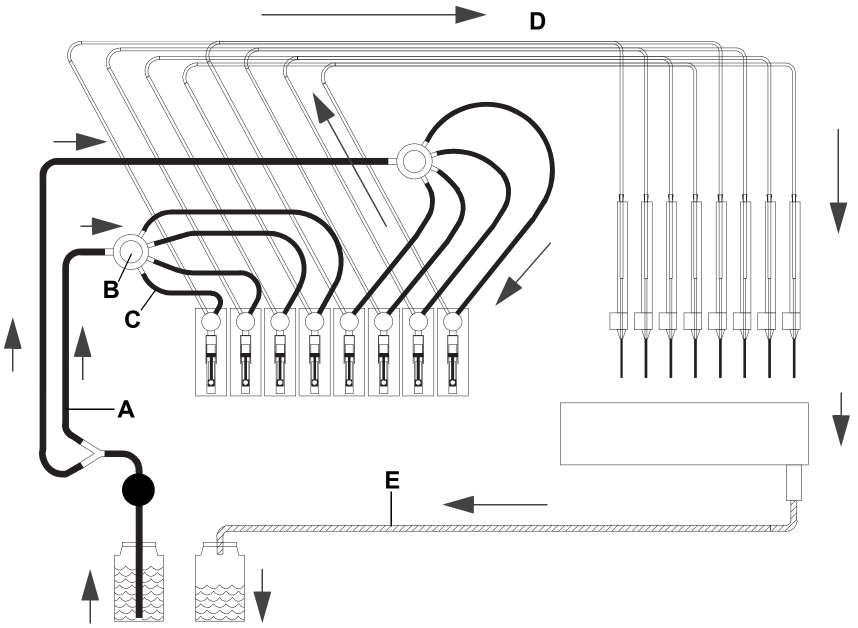


Fig. 4-81 *Liquid system flow direction and tubing*

Aspirating tubing

A *Aspirating tubing*

B *Distributor 1:4*
(1:2 for 2-tip configuration)

C *Interconnecting tubing*

Pipetting tubing

D *Pipetting tubing*

Waste

E *Waste tubing*

TECAN.

Aspirating Tubing

Tab. 4-1 Aspirating tubing features

Tubing System	Features
Standard	Standard tubing system composed of PVC/silicone/PP/POM
Standard with fast wash pump (FaWa)	Standard tubing with fast wash pump (FaWa)
DMSO-resistant soft tubing	Tubing system composed of Tygon/PP, with high chemical resistance, allows for using DMSO
High resistance type A [a)] (only with FaWa)	Tubing system composed of FEP/PVDF, with high chemical resistance, allows for using a wide range of system liquids
High resistance type B [a)] (only with FaWa)	Tubing system composed of FEP/PP, with high chemical resistance, allows for using a wide range of system liquids

a) *High resistance tubing type A and B can be equipped with the low volume option*

Note: *The choice of the aspirating tubing type depends on the system liquid's chemical composition.*

Pipetting Tubing

With all tubing systems, the pipetting tubing is made of FEP, which is resistant against a wide range of liquids.

Tab. 4-2 Pipetting tubing features

Tubing System	Features
Standard/regular tubing	For the standard volume range
Low volume pipetting tubing (fits to low volume option)	For low volume range, used with: – low volume tips – low volume DiTis
Te-PS tubing	For low volume range, used with: – Te-PS

Note: *The choice of the pipetting tubing type depends on the volume range and the sample.*

Te-Fill Option

The Te-Fill option is equipped with additional tubing from the valves to the pump. For more formation refer to section 4.8.5 "Te-Fill Option", 2 4-79.

4.8 Optional Equipment and Modules

Cross References

List of cross references to information provided in other sections:

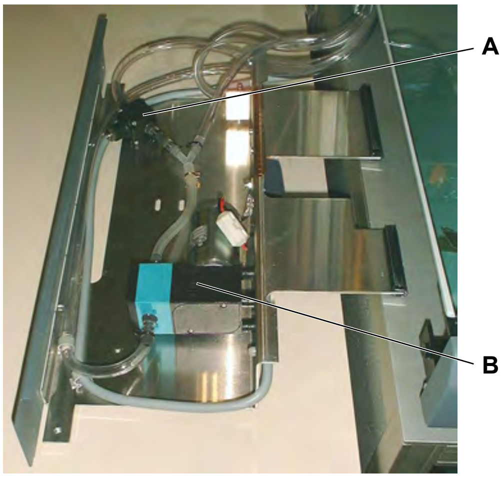
Subject	Reference
Complete list with order numbers	See section 11 "Spare Parts and Accessories", 2 11-1

4.8.1 Fast Wash Option (FWO)

Fast Wash Option

The fast wash option (FWO) consists of a fast wash pump (FaWa) that is built in liquid system between the system liquid container and the diluters. It is able to pump a greater amount of system liquid with higher speed through the system than it would be possible with the diluters alone. It is used to improve e.g. wash cycles, tip flushing, etc.

The figure shows the fast wash option as it can be pulled out on the left side of the instrument:



A *Pressure-relief valve*
B *Fast wash pump*

Fig. 4-82 *FWO assembly*

A pressure-relief valve avoids the building-up of too much pressure in the system (e.g. in case of clogged tips). In case of overpressure it bypasses the liquid to the corresponding container.

Note: *With the fast wash option the liquid levels in the containers are not monitored.*

2-LiHa Instruments

Instruments with two LiHas are equipped with a special FWO with a dual pump, i.e each LiHa has its own fast wash pump.

4.8.2 Pump Options

Both pump options (MPO and SPO) consist of a fast wash pump (FaWa) and optional sensors for monitoring the liquid level in the containers. FaWa is located at the bottom left of the worktable and is used to fill and flush the liquid system.
Monitored Pump Option (MPO)
To monitor the system liquid and waste liquid level in the containers, the MPO uses LICOS sensors. The LICOS sensors measure the air pressure generated by the liquid column in the containers. The figure below shows how the LICOS checks the liquid level in the system liquid and in the waste container.

Sensored Pump Option (SPO)

The SPO monitors the system liquid and the waste liquid level in the containers by means of a liquid level switch or LICOS sensors. For the liquid level switch, the filling height is polled every 30 seconds and reported as full or empty respectively, when the corresponding status is notified for three minutes or longer.

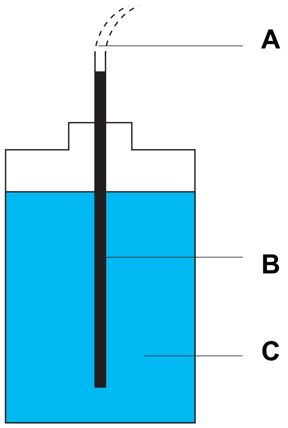
Monitoring Liquid Levels

To monitor the system liquid and waste liquid level in the containers, the monitored pump option (MPO) and the sensored pump option (SPO) are equipped with liquid level sensors:

Pump Option	Sensors
MPO:	• LICOS (liquid container supervisor)
SPO	• LICOS (liquid container supervisor) or • Floating sensors

LICOS

The LICOS sensors measure the air pressure generated by the liquid column in the containers. The figure below shows how the LICOS checks the liquid level in the system liquid and in the waste container:



A	*LICOS tubing (to SPO/MPO)*
B	*LICOS sensor tube*
C	*System/waste liquid*

Fig. 4-83 *LICOS SPO/MPO tubing*

Floating Sensors

The floating sensors monitor the liquid levels by means of a liquid level switch. The filling height is polled every 30 seconds and reported as full or empty respectively, when the corresponding status is notified for three minutes or longer.

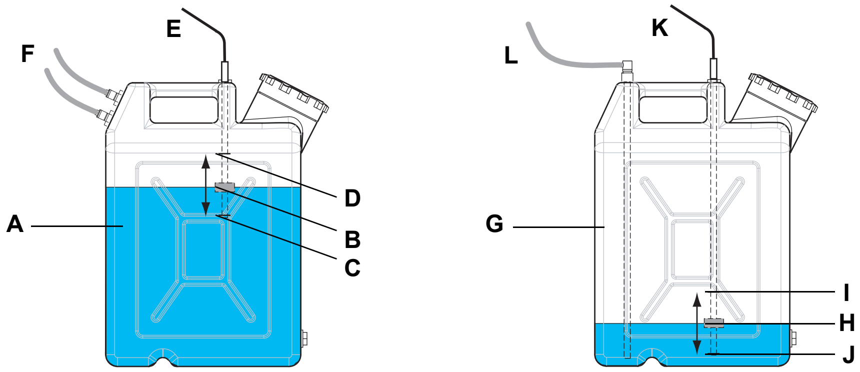


Fig. 4-84 Bottles with floating sensors

A	*Waste liquid bottle (20 liters)*	*G*	*System liquid bottle (20 liters)*
B	*Floating sensor*	*H*	*Floating sensor*
C	*Lower waste liquid level (warning)*	*I*	*Upper system liquid level (warning)*
D	*Upper waste liquid level (alarm)*	*J*	*Lower system liquid level (alarm)*
E	*Cable to SPO-board*	*K*	*Cable to SPO-board*
F	*Tube connections*	*L*	*Tube connection*

Both the waste liquid bottle (A) and the system liquid bottle (G) are equipped with a floating sensor (B and H, respectively) with an integrated permanent magnet. Depending on the liquid level, the sensor moves up and down along an immersion tube between an upper and a lower stop. Inside the immersion tube there are two reed contacts located near the stops. These reed contacts are actuated when the floating sensor reaches the upper or lower stop.

The states of each contact is evaluated by the application software that triggers the appropriate action when the liquid reaches a warning or alarm limit:

- The contacts near the stops (C) and (D) are used to notify the application software when the waste liquid level oversteps the warning level (C) or the alarm level (D).
- Likewise, the contacts near the stops (I) and (J) are used to notify the application software when the system liquid level falls below the warning level (I) or the alarm level (J).

2-LiHa Instruments

Instruments with two LiHas can be equipped with a special MPO with a dual pump, i.e each LiHa has its own fast wash pump.

4.8.3 Low Volume Option

Low Volume Option Features

The low volume option allows pipetting of volumes as small as 0.5 µl with free dispense, i.e. the tips do not touch the liquid.

Components of Low Volume Option

The main components of the low volume option are:

- The solenoid valve, its impulse driving the tiny droplets out of the tip
- The low volume pipetting tubing
- The low volume tips
- The pressure-relief valve reducing the pressure built up by the fast wash pump (FaWa) in the tubing system
- The low volume wash station

The materials in contact with the system liquid ensure a broad chemical resistance. This permits the use of an extended range of system liquids and offers superior durability of materials. The actual performance is strongly dependent on liquid handling and the physical properties of the liquid used.
Due to the flanged connections to the valve, the tubing shows better tightness and improved handling during maintenance.

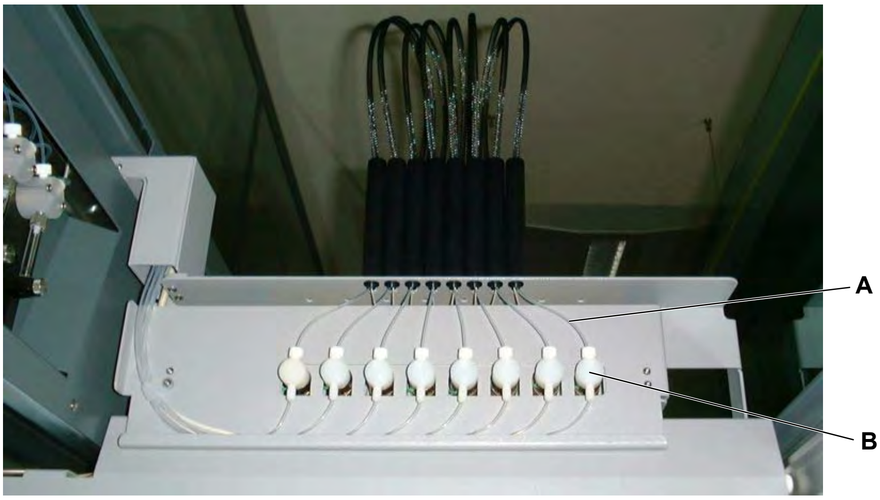


Fig. 4-85 *Low volume option*

A *Low volume pipetting tubing* ***B*** *Solenoid valves*

Note: *If you plan to use other system liquids than de-ionized water, the chemical resistance as well as the compressibility — which should be minimal to pass on the impulse — should be verified.*

Note: *For the low volume option the following restrictions apply:*

- *Instruments with two LiHas: Only the first LiHa can be equipped with the low volume option.*

Low Volume Wash Station

The low volume wash station has two liquid connections. It is fastened to the worktable by means of a clamp plate and a screw.

Fig. 4-86 *Low volume wash station on worktable*

The diagram shows the part of the liquid system that includes the low volume wash station:

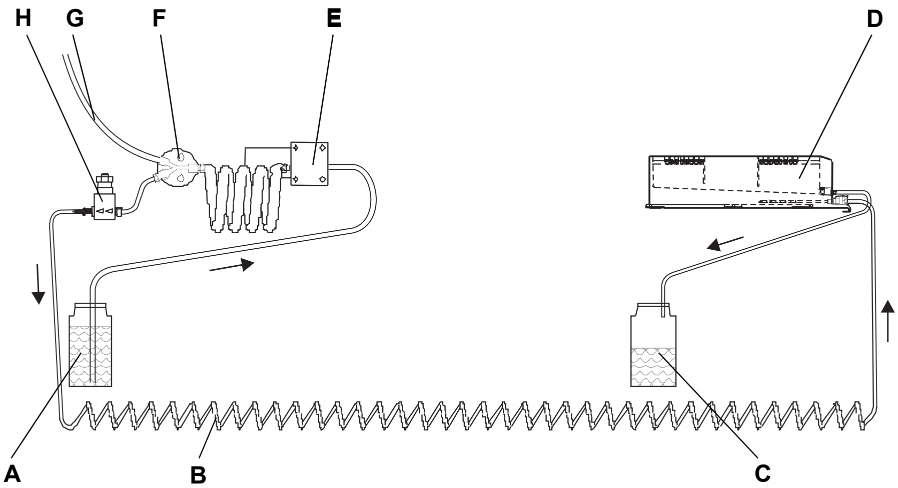


Fig. 4-87 *Part of liquid system with low volume wash station*

A	*System liquid container*	*E*	*Fast wash pump*
B	*Fill tubing (from pressure relief valve)*	*F*	*1 to 2 distributor*
C	*Waste container*	*G*	*Tubing to diluters*
D	*Low volume wash station*	*H*	*Pressure relief valve*

Purpose of the Low Volume Wash Station

The low volume wash station enables active washing of the outside of the tips. For this purpose, the bypass from the pressure relief valve is led to the wash station (fill tubing). The fill tubing provides system liquid to the cleaners in the wash station, where the tips are flushed from below. The overflowing system liquid from the cleaners flows into the waste container.

4.8.4 MultiSense Option

Purpose of the MultiSense Option

The MultiSense option is used for pipetting tasks with LiHa and disposable tips (DiTis). It includes the functions

- cLLD (capacitive liquid level detection)
- pLLD (pressure based liquid level detection)
- PMP (pressure monitored pipetting)

Capacitive Liquid Level Detection

The cLLD function measures the capacitance between the tip and the carrier containing the labware with the sample. As soon as the tip touches the liquid surface the change in capacitance triggers a detection signal. cLLD records the height of the tip at the time of the trigger signal. This only works with conductive liquids and conductive DiTis.

***Note:** This function is not limited to the MultiSense option. It is the same with the standard tip adapters.*

Pressure-Based Liquid Level Detection

The pLLD function measures the pressure changes in the tip as the tip moves down. As soon as the tip touches the liquid surface the pressure change triggers a detection signal. pLLD records the height of the tip at the time of the trigger signal.

pLLD can be used as an alternative to the capacitive liquid level detection (cLLD), e.g. for detecting non-conductive liquids, or it can be used in combination with cLLD for conductive liquids.

Pressure-Monitored Pipetting

The PMP function monitors the pressure changes in the air gap between the sample and the system liquid during aspiration and dispense. PMP is able to detect errors, such as clots and air aspiration, by comparing recorded and modeled (real-time simulated) pressure signals.

Structure

Hardware

The MultiSense option is mounted on the liquid handling arm of the instrument.

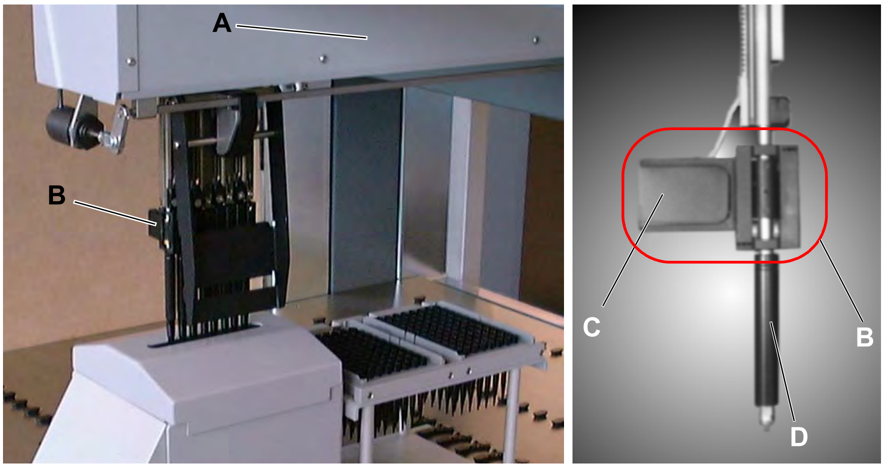


***Fig. 4-88** LiHa and MultiSense tip adapter*

The option consists of control electronics mounted behind the right side cover (A) of the arm, and special tip adapters (B), which include each a capacitive sensor and a pressure sensor plus electronics (C).
The DiTi kit MultiSense (D) consists of dedicated parts for MultiSense, seals and a special DiTi cone.

See also section 7.6.2 “MultiSense Option”, 2 7-87).

4.8.5 Te-Fill Option

The Te-Fill option allows to dispense or aspirate liquids into/from containers on the worktable. The option is used when the liquid volumes to be handled are greater than the dispense volume (syringe volume) of the diluter.
The pipetting tips can be connected to the bidirectional pump of the Te-Fill option instead of the diluters. The switching over from the diluters to the pump and the determination of the pump direction are performed by a number of valves.
The figure shows a diagram of the Te-Fill option installed on an 8-tip LiHa.

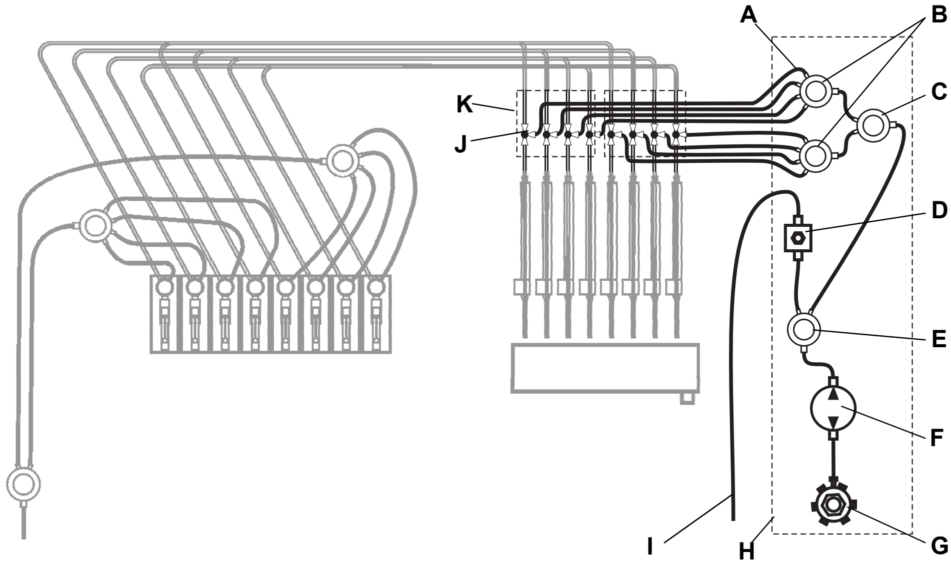


Fig. 4-89 Te-Fill diagram (example for 8 channels)

A	*Dispensing tubing*	*G*	*6-position selector valve (option)*
B	*Distributor 1 to 4*	*H*	*Pump box*
C	*Distributor 1 to 2*	*I*	*Waste tubing*
D	*Pressure relief valve*	*J*	*3/2-way valve*
E	*Distributor 1 to 2*	*K*	*Valve block*
F	*Bidirectional pump*		

***Note:** The grey elements in the figure belong to the standard liquid system of the instrument.*

Function of the Components

The components of the Te-Fill option have the following functions:

- Valve block
  - The valve block (K) integrates four 3/2-way valves, the solenoids and the valve connections to form a unit. Up to two valve blocks (8 channels) can be installed on the LiHa of an instrument.
- 3/2-way valves
  - In the normal (non-actuated) position of the 3/2-way valve (J) the pipetting tubing is connected to the diluters of the standard liquid system. In this position pipetting is performed by means of the diluters and the Te-Fill option cannot be used for liquid handling.
  - When the Te-Fill option is active, the 3/2-way valve changes over to connect the pipetting tubing leading to the tips to the bidirectional pump via the distributors.
  - The 3/2-way valve of each channel can be controlled individually.
- Pump box
  - The distributors, the bidirectional pump, the pressure relief valve and the optional 6-position selector valve are mounted in the pump box. The pump box is located in the space left to the diluters.
- Distributors
  - For the Te-Fill option with 4 channels (one valve block only), one of the 1 to 4 distributors (B) is omitted and the outlet of the distributor 1 to 2 (C) is closed with a screw plug.
- Bidirectional pump
  - This is a membrane pump with actively switched valves to enable the pump to work in both directions, i.e. it can be used for dispense and aspirate jobs in a process.
- Pressure relief valve
  - If overpressure in the system occurs, the pressure relief valve directs the liquid to the waste container via the waste tubing.
- 6-position selector valve (option)
  - If more than one liquid needs to be handled, the Te-Fill option can be equipped with a 6-position selector valve. Up to 6 different liquids can be selected. The valve connects the corresponding container with the bidirectional pump.
  - Only one liquid can be handled at a time, i.e. if different liquids need to be dispensed into the same container, this must be carried out sequentially.

4.8.6 Lower DiTi Eject Option

The lower DiTi eject option enables disposable tip ejection at a lower position. With the optional cover DiTi waste and the DiTi waste slide, it allows to avoid risks of projection from elevated positions and thus minimizes contamination risks.

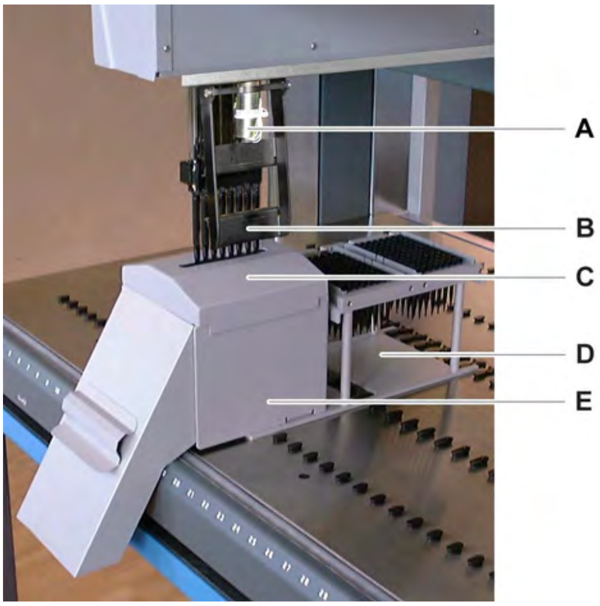


Fig. 4-90 *Lower DiTi eject 3 with cover and waste slide*

A	*DiTi ejector solenoid*
B	*DiTi ejector (rocker)*
C	*Cover for DiTi waste*
D	*Carrier for 2 x 96 disposable tips, with waste slide*
E	*DiTi waste slide and bag holder*

The Lower DiTi eject 3 is available for 2, 4 or 8-tip LiHas. Accordingly, the rocker (B) spreads over the corresponding number of tips.

4.8.7 Flask Flipper

The flask flipper can hold 1 to 4 flasks and is located on the right side of the worktable.

The flask flipper is used for:

- Holding flasks vertically while piercing flask septa with LiHa tips and pipetting liquids.
- Rotating to a horizontal position and releasing holding mechanism to load and unload flasks.
- Shaking flasks for distributing and mixing liquids.
- Knocking flasks to remove cells from growth surface.

The flipper is controlled by the application software which allows controlling:

- Hold and release flasks.
- Move to pipetting position.
- Shake flasks (including adjustment of parameters: shaking angle, speed, acceleration and shaking cycles).
- Knock flasks (including adjustment of knock parameters: number of knocks).

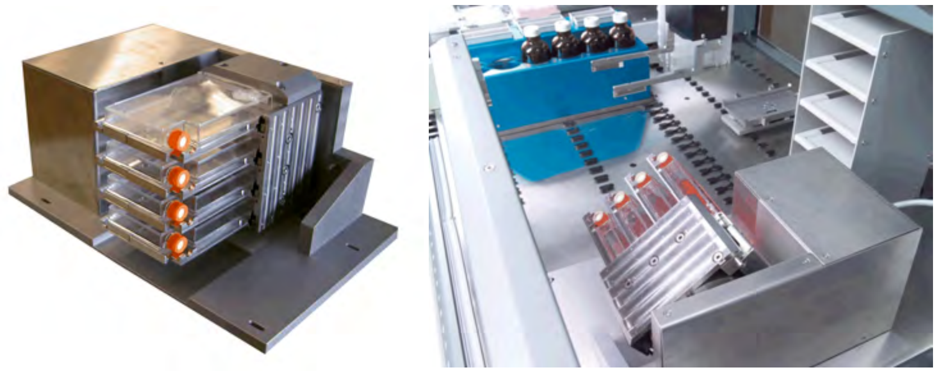


Fig. 4-91 *Flask flipper in horizontal position and when shaking flasks*

Fig. 4-92 *Flask flipper in vertical position for septum piercing and pipetting*

4.8.8 384-well Microplate Option (Carrier, Tips)

384-Well Microplates

This option allows to adjust tip positioning for pipetting into the narrow wells of 384-well type microplates. Additionally, a 384-well microplate carrier is needed.

The tips are adjustable at their base.

They are aligned by means of a sensor plate and the Instrument Software.

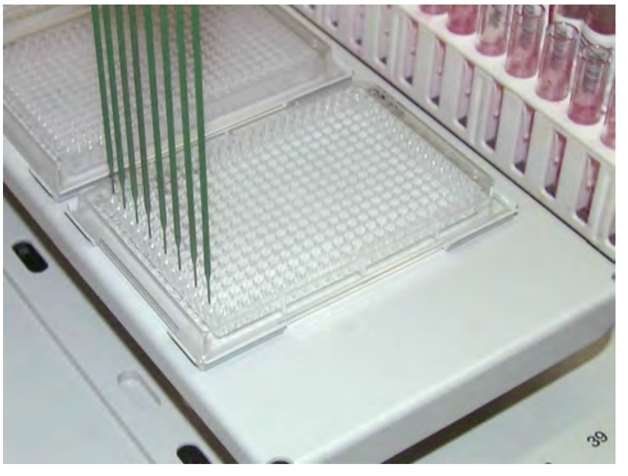


Fig. 4-93 *384-well microplate*

Note: *For accuracy reasons the carrier is hold in a fixed position by means of positioning pins on the worktable. Consequently, barcodes on microplates cannot be read by PosID.*

4.8.9 Balance

The pipetting precision can be verified by means of a precision balance.

The balances AG 285, SAG 285 and WXS from Mettler Toledo are validated with the Instrument Software. In principle other balances (AG 245 from Mettler, Sartorius BP 110S, Denver DI 100) can also be used. Please note:

- The AG 285 from Mettler Toledo was delivered until the end of 2003 and is no longer available.
- The SAG 285 was introduced in 2004. This balance consists of a weighing module and a separate display unit. The weighing module is placed on an appropriate adapter plate on the worktable, while the display unit is usually placed on a table beside the instrument.
- The WXS was introduced in 2008. This balance consists of a weighing module and a control unit. It has no separate display unit. The weighing module is placed on an appropriate adapter plate on the worktable.

For detailed information about the balance, its installation and setup and the gravimetric test refer to the following documents:

- Operating Manual Balance Kit
- Operating Manual of the balance itself (e.g. provided by Mettler Toledo)
- Instrument Software Manual

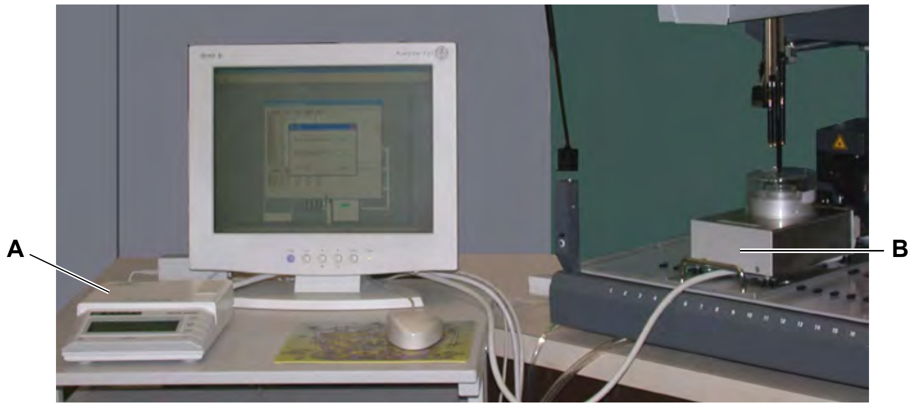


Fig. 4-94 Balance SAG 285

A	*Display unit*	*B*	*Weighing module on adapter plate*

Adapter Plate for Balance

The adapter plate for balance allows accurate positioning of the balance on the instrument worktable. Note that the SAG 285 and WXS requires a different adapter plate than the older models.

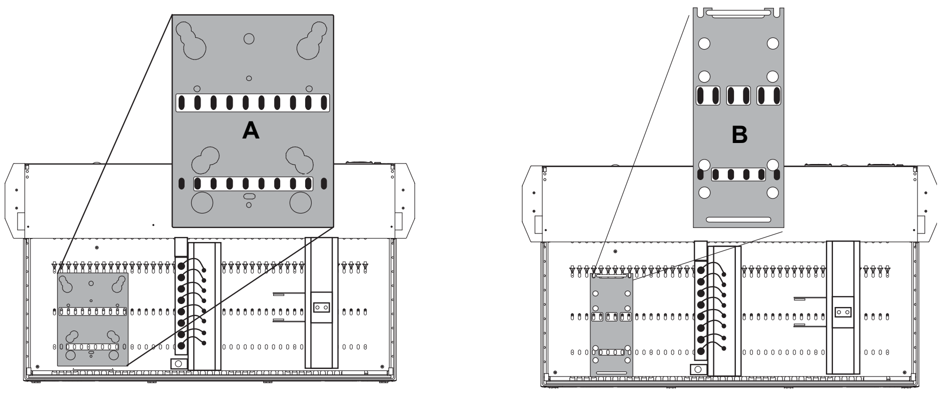


Fig. 4-95 Adapter plate for balance

A	*Adapter plate for AG 285/245, Sartorius BP110S, Denver DI-100*	*B*	*Adapter plate for SAG 285/01 and WXS*

4.8.10 Carriers and Racks

Cross References

List of cross references to information provided in other sections:

Subject	Reference
List of carriers, racks and troughs	See section 11.7 "Carriers, Racks, Troughs", 2 11-10
Function of PosID	See section 4.4 "Positive Identification (PosID)", 2 4-59

What Are Carriers and Racks?

Carriers are supports that hold racks - which contain tubes or other containers - and are placed at precisely definable positions on the worktable.

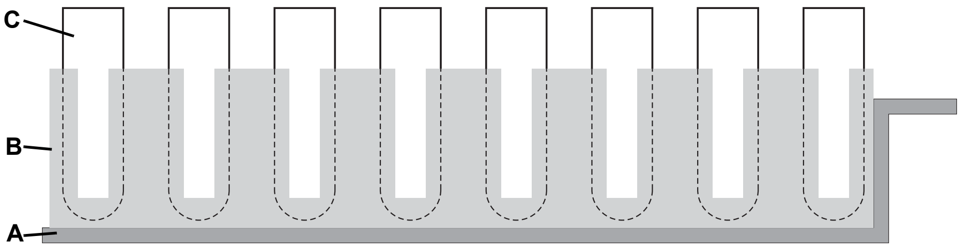


Fig. 4-96 *Example of typical carrier/rack/container assembly*

A	*Carrier (can slide on worktable)*	***C***	*Container (here: Tube)*
B	*Rack (here: Tube rack)*		

Note: *For a list of carriers and racks, refer to the cross reference above.*

Carrier Positioning

Racks can be placed and handled by the software at almost any position on the worktable.

Before deciding on the positions of carriers on the worktable, especially before installing wash stations or other stationary carriers, the handling concepts of the application software and the consequences of the carrier positioning for the application run must be considered.

Carefully plan the application and study the relevant sections in the Application Software Manual before deciding on the placement of carriers and racks.

Barcode Identification

Barcodes on the carriers and on most of the individual containers can be identified by the PosID.

Refer to cross references above.

4.8.11 Custom Carrier

What Is a Custom Carrier?

The custom carrier kit is an adapter permitting the use of customer-specific carriers on the instrument.

There is also a solid block custom carrier available, which can be adapted to the user's requirements by drilling holes into the body to hold the corresponding containers.

4.8.12 Te-Link

Definition

The Te-Link is a device for transporting microplates from one instrument to another, or across the worktable of one system, either along the instrument's X-axis or Y-axis.

Microplates to be moved to a neighboring instrument are placed on the carrier of the Te-Link and then moved to the neighboring system for further processing.

This can be done in different ways:

- A RoMa places the microplate on the Te-Link on one instrument, another RoMa picks it up when it arrives at the destination.
- It is also possible to pipette directly from/into a 96-well microplate on one side and to load and unload it on the opposite end of the Te-Link.

The Te-Link accommodates one single microplate in portrait or landscape position and has one movement axis only, referred to as X-axis. It enhances access for double RoMa applications and prevents LiHa collision avoidance movements.

Master Instrument

The instrument to which the Te-Link is electrically connected and by which it is controlled is the master instrument. In practice, all movements and loading/unloading cycles are controlled and coordinated by the application software of the master instrument.

Liquid level detection on the Te-Link is allowed only by the master instrument.

Note: *Do not confuse the X-axis of the instrument and the X-axis of the Te-Link.*

- ***Instrument:*** *The X-axis of the instrument refers to left/right movements (parallel to the instrument front) of arm devices.*
- ***Te-Link:*** *Depending on the arrangement of the linked instruments, the X-axis can be parallel to an instrument's X-axis (parallel to the instrument front) or to the Y-axis (at an angle of 90° to the instrument front).*
  The Te-Link movement direction is not described with "left" and "right". Instead it is described as either "towards" or "away from" the home position.

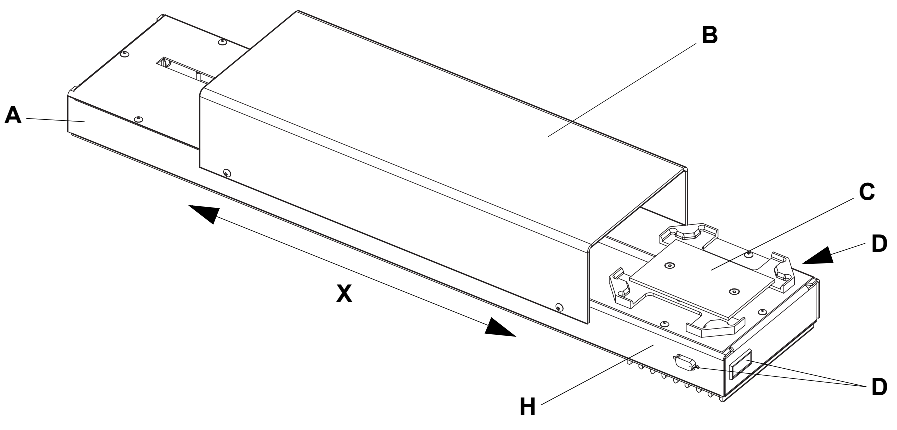


Fig. 4-97 *Te-Link*

A	*Chassis*	***D***	*Places for the connector*
B	*Protective cover*	***H***	*Home position*
C	*Carrier*	***X***	*X-axis (movement of carrier C)*

Plate Transfer Range

The Te-Link home and end positions are accessible by:

- the robotic manipulator arm, RoMa, so that the RoMa or two RoMas can load and unload the microplates.
- the liquid handling arm, LiHa, so that they are accessible for direct pipetting into 96-well microplates only.

The Te-Link moves on a base whose ends can be placed at practically any grid position on the right, left, front or back side of the Freedom EVO.

Two systems between which the Te-Link transports microplates can be placed:

- Front to rear
- Rear to rear
- Side by side
- Front corner to front corner.

5 Putting into Operation

Purpose of This Chapter

This chapter describes how the Freedom EVO is installed and gives instructions on initial operation.

5.1 Installation

5.1.1 Initial Installation of the Instrument

The initial installation of the instrument may be done by a qualified Tecan service person only.

Modifications on the Safety Panels

Some options for the Freedom EVO require modifications on the safety panels. These modifications must be performed by an authorized Tecan FSE (field service engineer) when the option is installed.

WARNING

If the options which require modifications on the Freedom EVO are installed improperly, the safety concept may be impaired.
Always make sure that the options are installed in compliance with the instructions given by the manufacturer.

5.1.2 Installing an MCA384 DiTi Carrier

Installing an MCA384 DiTi Carrier

To install an MCA384 DiTi Carrier on the Freedom EVO, proceed as follows:

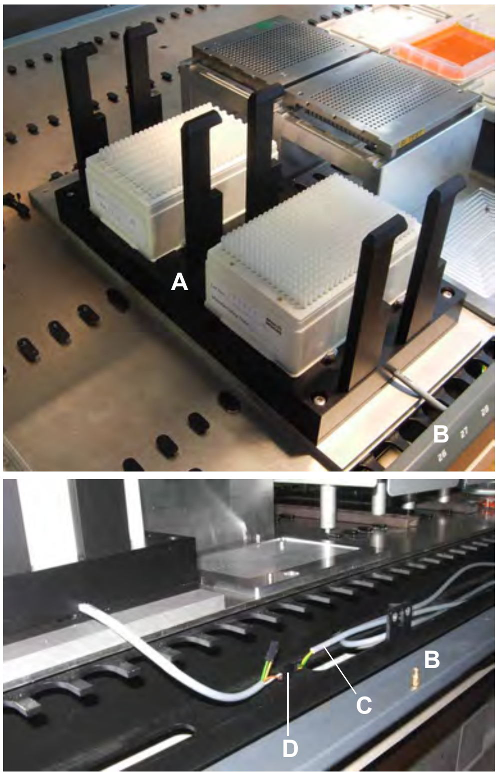


Fig. 5-1 MCA384 DiTi Carrier

1. Place the MCA384 DiTi Carrier (A) on the worktable.
2. Open the front panel (B) of the worktable.
3. Connect the solenoid control cable (C) with one of the two connectors (D) of the MCA384 DiTi Carrier.

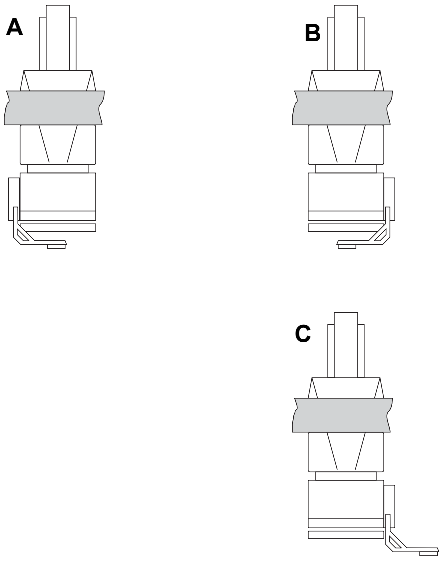
Note: *The second connector on the MCA384 DiTi Carrier is designated for daisy chaining a second MCA384 DiTi Carrier. During a DiTi pick up command the two DiTi Carriers are in this case locked simultaneously.*

Note: *If the solenoid control cable is missing call a Tecan FSE for installing the cable.*

5.1.3 Mounting MCA96 Gripper Fingers

The following section describes how to mount and adjust the MCA96 gripper fingers, e.g. in case you want to change the gripper configuration or when a crash occurred:

Gripper Configuration



The figure shows the possible gripper configurations on the MCA96.

Note: *The user cannot change the gripper configuration from A to B or C (or vice versa) by him/ herself. This adaptation must be carried out by a Tecan FSE.*

A	*Gripper module on the left* *Gripper fingers inwardly mounted*
B	*Gripper module on the right* *Gripper fingers inwardly mounted*
C	*Gripper module on the right* *Gripper fingers outwardly mounted*

Fig. 5-2 *MCA96 gripper configurations*

Changing the Gripper Configuration

To change the gripper configuration from B to C (or vice versa), proceed as follows:

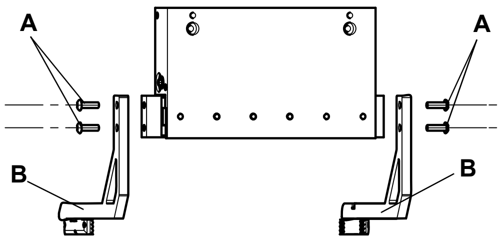


Fig. 5-3 *Removal of gripper fingers*

1. Remove the screws (A).
2. Exchange the gripper fingers (B).
3. Insert the screws.
4. Tighten the screws of the gripper finger with the round screw hole.

   One of the gripper fingers has slotted screw holes to allow for vertical adjustment.

5. Adjust the gripper fingers before tightening all screws as described below.

Adjusting the Gripper Fingers

To adjust the gripper fingers, proceed as follows:

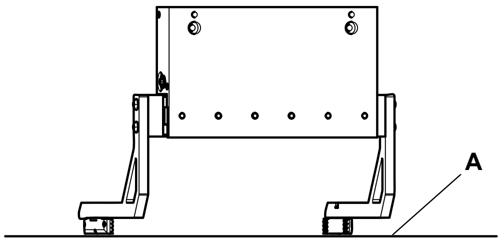


Fig. 5-4 Adjustment of gripper fingers

1 Move the pipetting head with the mounted gripper fingers down until the fixed gripper finger is just touching the worktable surface (A).
2 Adjust the height of the gripper finger with the slotted screw holes in such a way that it corresponds with the height of the other gripper finger.
3 Make sure that the gripper fingers are parallel.

   Check the gap to the worktable surface.
4 Tighten the screws.

Tests

To ensure operating readiness, perform the following test:
Refer to the Instrument Software Manual.

- MCA96 gripper test

5.1.4 Mounting the MCA384 Gripper Fingers

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Gripper finger alignment	See Instrument Software Manual (1.1 "Reference Documents", 2 1-2)

The following section describes how to install / remove and adjust the MCA384 Gripper fingers, e.g. during installation or after a crash occurred:

Install the Gripper Fingers

To install / remove the MCA384 Gripper fingers, proceed as follows:

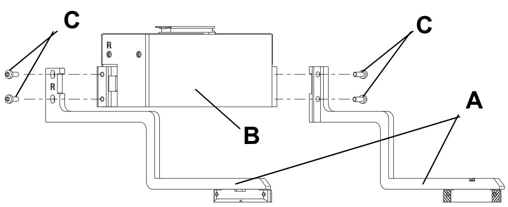


Fig. 5-5 Install / remove gripper fingers

1 Place the gripper fingers (A) according to the engraving (L and R) on the rotator (B).
2 Insert the screws (C) and tighten them.

   The right gripper finger has slotted screw holes to allow for vertical adjustment.

Remove the Gripper Fingers

1 Remove the gripper fingers in reverse order as described for installation.

Adjust the Gripper Fingers

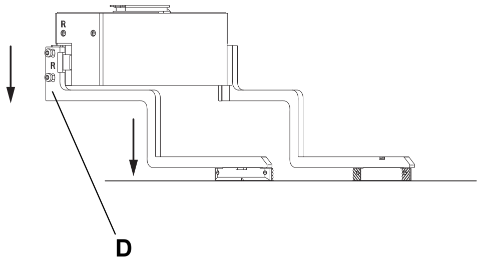


Fig. 5-6 Install / remove gripper fingers

2 Fix the right gripper finger (D) in the upper most position within the slotted screw holes.

3 Move the gripper carefully down until the left gripper finger touches the worktable on a free space.

4 Loosen the screws of the right gripper finger and move the gripper finger within the slotted holes also down onto the worktable.

5 Tighten the screws of the right gripper finger.

***Note:** During the setup of the MCA384 Gripper (CGM) the gripper fingers will be adjusted with the help of the SnS function **Gripper finger alignment and Z-range** as described in the Instrument Software Manual. This procedure is done by a Tecan FSE. Refer to cross references above.*

5.1.5 Installing the MCA96 Wash System

Installing the MCA96 Wash System (Option)

To install the MCA96 wash system on the Freedom EVO, proceed as follows:

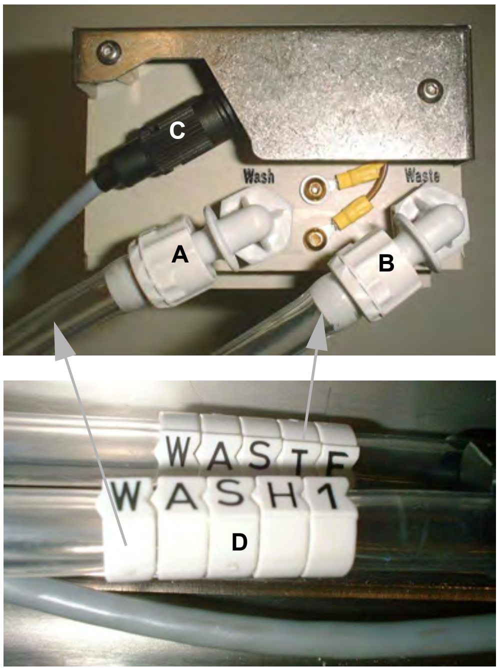


Fig. 5-7 Connections of the wash block

1 Put the wash system into place.

2 Place wash block in the specified position.

3 Connect wash tube (A) and waste tube (B) with the corresponding fittings of the wash unit and the wash block (mind the tube labelling, D).

– Also refer to Fig. 5-8, 2 5-6.

Fig. 5-8 *Wash unit MCA*

4 Plug the wash level sensor cable into the corresponding connectors on the wash unit (C) and the wash block (C, Fig. 5-7, 2 5-5).

5 Connect the different containers with wash liquid (D) and the waste container (E) with the corresponding fittings of the wash unit.

Fig. 5-9 *Control unit MCA*

6 Connect the CAN port wrc-control No. 1 (F) to a free CAN connector on the option board of the instrument.

5.1.6 Installing the MCA384 Wash System

Installing the MCA384 Wash System (Option)

To install the MCA384 wash system on the Freedom EVO, proceed as follows:

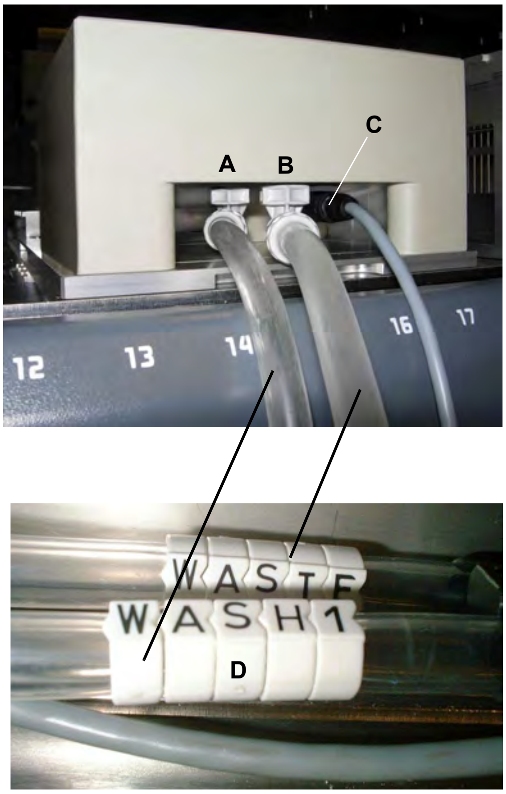


Fig. 5-10 Connections of the wash block

1. Put the wash system into place.
2. Place the MCA384 wash block in one of the three positions on the System Carrier.
3. Make sure that the wash system filter is installed correctly in the wash tubing (see section 7.6.3.2 “Replacing the Wash System Filter”, 2 7-95)
4. Connect wash tube (A) and waste tube (B) with the corresponding fittings of the wash unit and the wash block (mind the tube labelling, D).
   – Also refer to Fig. 5-11, 2 5-7.

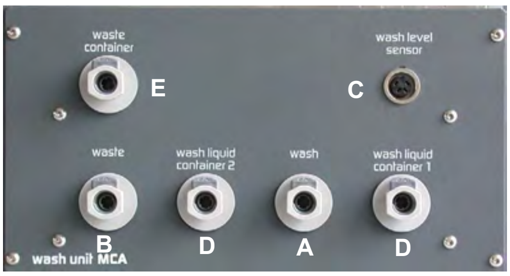


Fig. 5-11 Wash unit MCA

5. Plug the wash level sensor cable into the corresponding connectors on the wash unit (C) and the wash block (C, Fig. 5-10, 2 5-7).
6. Connect the different containers with wash liquid (D) and the waste container (E) with the corresponding fittings of the wash unit.

Fig. 5-12 Control unit MCA

7 Connect the CAN port control (F) to a free CAN connector on the option board of the instrument.

5.2 Startup

The following section describes all operational steps, from switching the Freedom EVO on to switching it off.

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Daily maintenance	See section 7.2 “Maintenance Schedule”, 2 7-7
Start up the Freedom EVO instrument	See section 6.3.3 “Switching the Instrument On”, 2 6-9
Switch the instrument off	See section 6.3.7 “Switching the Instrument Off”, 2 6-23
Prepare other instrument hardware components	See section 6.3.4 “Instrument Preparation and Checks”, 2 6-11

WARNING

Automatically moving parts.
Injuries (crushing, piercing) possible if the safety panels are not in place.

- Before starting the Freedom EVO, make sure that the safety panel is closed.
- Never operate the instrument with the safety panels open.

WARNING

Automatically moving parts.
Injuries (crushing, piercing) possible when using the instrument with the standard front safety panel.

- Do not reach into the Freedom EVO through the aperture beneath the yellow line on the instrument front side.

Startup Procedure

Running the Freedom EVO involves the following **general** steps:

1 Perform daily maintenance.

2 Start up the Freedom EVO:
Refer to cross references above.

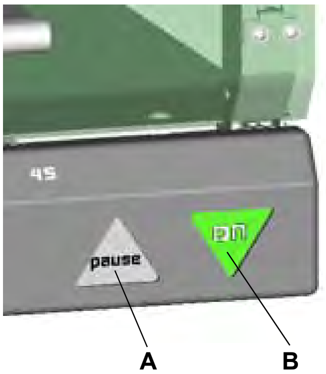


Fig. 5-13 Power switch/pause button

A	*Pause button*	*B*	*Power ON/OFF switch*

3 Start up the computer system connected with the Freedom EVO.

4 On the computer system, start up the application software.

5 In the application software, define the required application, if necessary.

6 In the application software, select the required application for execution.

7 Place the required carriers, racks or reagents in the required positions on the instrument worktable.

8 Prepare the other instrument hardware components, e.g. system liquid container, waste container or tips:
Refer to cross references above.

9 In the application software, start the initialization of the instrument.

10 Wait for the instrument initialization to terminate.

11 In the application software, start the application.
Refer also to cross references above.

12 At application termination, if you plan another application run, continue with step 6 of this procedure.

13 Perform the appropriate (e.g. daily or weekly, etc.) maintenance.

14 Exit the application software.

15 Switch the instrument off.
Refer to cross references above.

6 Operation

Purpose of This Chapter

This chapter explains the operating elements and possible operating modes. It gives instructions on how to operate the Freedom EVO properly and safely.

For the options used by your configuration, refer to the separate operating manuals.

6.1 Operating and Display Elements

6.1.1 Operating Elements

Apart from the power ON/OFF switch and the pause button there are no specific operating elements on the Freedom EVO instrument.

Power ON/OFF Switch

The power ON/OFF switch is located at the instrument's lower right corner. A status light in the switch indicates if the instrument is switched on.

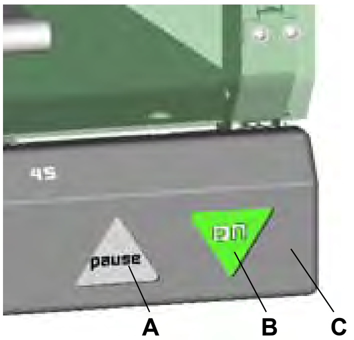


Fig. 6-1 *Power ON/OFF switch and pause button*

A	*Pause/resume button*	***C***	*Front access panel, closed*
B	*Power ON/OFF switch*		

Note: *The control for switching on or off is delayed to accept only definite commands.*

- *For switching on: Keep the power ON/OFF switch pressed for at least 0.5 seconds.*
- *For switching off: Keep the power ON/OFF switch pressed for at least 2 seconds.*

Pause/Resume Button

The pause/resume button allows the user to pause and later resume a test run for access on request.

Note: *During operation, keep the front access panel closed to have access to the switches.*

ATTENTION

Unintended pausing or switching off of the instrument.
To avoid unintended actuation, pay attention to the following:

- When opening or closing the front access panel, make sure that the **pause** button and the power **ON/OFF** switch are not pressed unintentionally.
- Before pressing the **pause** button or the power **ON/OFF** switch, make sure that you will press the intended button.
- Before pressing the **pause** button in order to pause a process, make sure that the instrument is running.
- Before pressing the **pause** button in order to resume a process, make sure that the instrument is pausing and that the safety panel is closed.

WARNING

Injuries caused by moving parts
A not completely opened front safety panel might close automatically.

- Open the front safety panel completely (more than 180°).

Internal Communication

Communication within the Freedom EVO, and also the communication between the instrument and its modules is achieved by means of cable connections between the respective control electronics.

User Interface

Display functions and controls are available in the software packages and user interfaces on the PC. Depending on your application, refer to the relevant separate documentation.

6.1.2 Display Elements

Status Lamp

The status lamp displays the instrument status and is combined with an acoustic alarm device (sound). It is installed in the top cover of the instrument.

The sound level (loudness) and mode (continuous or intermittent) can be selected during installation.

Fig. 6-2 *Status lamp*

The status lamp can indicate the following states:

Tab. 6-1 *Instrument status lamp signals*

Status lamp color:	**Instrument status:**
Lamp off	The instrument is in idle mode or switched off
Green continuous light	A process is running
Green flashing	The process has been paused; or user prompt; or door locks open
Red flashing, alarm sound is on	Process is in error state, software displays error message
Red continuously lit	Fatal error, system stops operation

Loading Interface

The optional loading interface of the Freedom EVO detects the presence of carriers on the worktable. It can differentiate between:

- carrier present at the defined loading position
- carrier not present at the defined loading position

Fig. 6-3 *Indicator LEDs of the loading interface*

A *Carrier*
B *Green/red LED*
C *Grid position number*

Furthermore, the loading interface indicates the carrier status by means of LEDs:

Tab. 6-2 *LED signals*

LED color:	Carrier status:
Green	Carrier is not in process and ready to be removed or no carrier is present on the corresponding position.
Green flashing[a)]	The user is expected to place or remove a carrier on or from the corresponding worktable position to continue the process.
Red	Carrier is in process and must not be removed or the corresponding position is blocked, so that no carrier must be placed on it.
Red flashing	An error occurred. The user is expected to place or remove a carrier on or from the corresponding worktable position to fix the problem and enable the process to continue.

a) In addition to this, the PC speaker emits a beep sound

6.2 Operating Modes

Possible Operating Modes

The Freedom EVO can be run in three different operating modes:

- Routine operation mode (operator)
  - This is the normal operating mode, in which the application is run.
  - In this mode, the Freedom EVO is controlled by the runtime controller of the corresponding application software.
    - Refer to cross references above.

- Process definition and service mode (application specialist, maintenance personnel)
  - Special tasks are performed in this operating mode, such as
    - adjustments to establish the process.
    - tests to ensure the operating readiness.
  - For these tasks, different software tools are used.
    - Refer to the “Freedom EVOware Software Manual”.
    - For service mode refer to the “Instrument Software Manual”.

- Setup and service mode (field service engineer)
  - Serves to set up the instrument, to make adjustments and to run tests.
  - In this mode, the Freedom EVO is controlled by the setup and service software.
    - Refer to the “Instrument Software Manual”.

6.3 Operating in Routine Operation Mode

6.3.1 Safety Instructions

WARNING

Automatically moving parts.
Injuries (crushing, piercing) possible if the safety panels are not in place or if the standard front safety panel is installed. The standard front safety panel is partially open, allowing access to the worktable and continuous load

- Before starting the Freedom EVO, make sure that the safety panel is closed.
- Never operate the instrument with the safety panels open.
- Do not reach into the instrument through the aperture beneath the yellow line on the instrument front side.


WARNING

Contamination risks through contamination of the worktable or frame. Hazardous liquids or samples can be spilled onto the worktable, due to the failure of the liquid system or a handling module, such as the RoMa.

- Visually inspect all hardware components, e.g. the worktable, the RoMa, etc., for possible spillage of hazardous liquids.
- Make sure that the containers are accurately positioned on the worktable.

Safe Worktable Layout

ATTENTION

Unsafe layout of the worktable can cause e.g.:

- Loss or dropping of DiTi
- Loss or dropping of microplates
- Spillage of hazardous liquids because of collisions or too high filling level (more than 80%) of cavities
- Spillage due to imprecise pipetting in 96-well microplates placed on the Te-Link
- Cross-contamination because critical elements are placed near the wash station or DiTi waste (splashes).

Before and during instrument use, check the worktable for the safety of its layout.

Liquid System / Liquids

ATTENTION

Leakage of the liquid system.

By the continuous up and down movements of the syringes during operation, the syringe and plunger lock screws may get loose, if not tightened properly. This causes leakage of the liquid system.

- Check the plunger lock screws and syringe screws and tighten manually before switching the Freedom EVO on.

ATTENTION

To ensure a proper liquid flow, make sure that the tubings are not twisted or inhibited from free flow.

ATTENTION

Instruments are intended for indoor operation with controlled temperatures. DiTis may leak due to pipetting liquids with high vapor pressure. It is important to maintain constant temperature plus air gaps.

Tips

ATTENTION

Two, four or eight tips are arranged on one Liquid Handling arm.

- Each tip must be exactly in line with the center of the tube to maximize the distance between wall and tip.
- When loading disposable tips, make sure that all disposable tips are straight in a line and in parallel to each other. If necessary, exchange disposable tips in rack.

ATTENTION

Possible malfunction due to tip clogging.
Using liquids with undissolved particles could lead to clogged tips and thus result in liquid not being dispensed.

- Clogging can also result if the tips have not been thoroughly washed.
- With Te-PS and Low volume tips, do not use liquids with undissolved particles.

Air Displacement Pipetting Arm (Air LiHa)

ATTENTION

Pipetting errors due to insufficient maintenance.
Leakage or malfunction of the Air LiHa might remain undetected if the maintenance has not been performed properly.

- Make sure to perform the necessary maintenance and tests according the maintenance schedule.

Applications

For all applications of the Tecan instrument, the user must ensure that the requirements of each protocol are carefully observed. Attention must be given to:

- Sample/reagent volumes and concentrations
- Test plate layout
- Sequence of steps
- Temperature restrictions
- Time limits

Controls, standards, or reference materials should be processed by the Freedom EVO in the same manner as test samples. Prior to any first time application, test runs should be made with the assay to allow optimization of all liquid handling parameters.

The Freedom EVO requires accurate positioning of all reagents, samples, racks, and plates on the instrument's worktable. The operator should verify these positions accordingly before executing any program.

In the event of power failure or an otherwise aborted run, all partially processed samples should be discarded. Do not attempt to restart an interrupted program unless the computer screen displays explicit instructions for resuming operation.

Chemical, Biological and Radioactive Hazards

WARNING

All samples and test kit components must be considered potentially hazardous agents.

- A potential risk can arise from the liquids being handled by the instrument, such as infectious biological samples, toxic or corrosive chemicals, or radioactive substances.
- Strictly apply appropriate safety precautions according to local, state and federal regulations.
- Handling and disposing of waste must be in accordance with all local, state and federal environmental, health, and safety laws and regulations.
- Use appropriate protective clothing, safety goggles and gloves.

6.3.2 Enclosed Work Area

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Detailed maintenance procedures	See chapter 7 “Preventive Maintenance and Repairs”, 2 7-1

WARNING

Unexpected, fast movements of arms and tips.
Interfering with the arm and tip movements can lead to serious injuries or equipment damaging.
Never operate the instrument while safety panels, covers or access doors are open or removed.
The operator will be prompted by the software when the worktable setup requires new racks or carriers. Any further interference in the work area is strictly prohibited.

The operator might need to open or remove the work area safety panels for instrument setup, cleaning and maintenance purposes. For detailed procedures refer to cross references above.

6.3.3 Switching the Instrument On

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Checks before starting a run	See section 6.3.4 “Instrument Preparation and Checks”, 2 6-11

Before switching the instrument on, check the following:

WARNING

Contamination of the pipetting head of the MCA96.
If the pipetting head is initialized with the tip block or DiTis mounted to it, the remaining liquid in the tips may be drawn into the head und thus contaminate the head (e.g. after a power failure or a crash).

- In this case, manually remove the tip block or the DiTis before switching on.

WARNING

Automatically moving parts.
If the safety panels are not in place, injuries (crushing, piercing) are possible.
Before starting the Freedom EVO, make sure that the safety panel is closed.
Never operate the instrument with the panel open.

To switch the Freedom EVO on, proceed as follows:

1 Press the power ON/OFF switch for 0.5 seconds to switch the instrument on.

2 Wait until the status light in the power ON/OFF switch is lit.

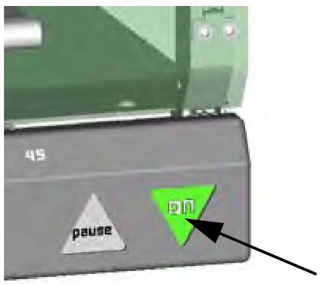


Fig. 6-4 *Lit power ON/OFF switch*

ATTENTION

Before starting an application, thoroughly flush the whole liquid system. Make sure that daily maintenance procedures have been performed. Make sure that there are no air bubbles in the tubing and that there are no liquid droplets on DiTi adapters or tips.

3 Start up the runtime controller of the application software.

The instrument is now ready to receive commands from one of the available application software packages.

4 Perform the necessary checks before starting a run.
Refer to cross references above.

6.3.3.1 After a Power Failure

Objects Held by PosID, RoMa

If you want to resume operation after a power failure, it is important that objects still held by the grippers of the PosID and the RoMa are removed manually before switching the instrument on. Otherwise, the objects will be dropped during instrument initialization, which may lead to a crash or spillage.

ATTENTION

In the event of power failure or an otherwise aborted run, all partially processed samples should be discarded. Do not attempt to restart an interrupted program unless the computer screen displays explicit instructions for resuming operation.

6.3.4 Instrument Preparation and Checks

Cross References

List of cross references to information provided in other sections:

Subject	Reference
User qualification	See section 2.4 “User Qualification”, 2 2-6
No air bubbles in the tubing	See section 7.3.1.2 “Flushing the Liquid System”, 2 7-20
No liquid droplets on DiTi adapters or tips	See section 7.3.1.1 “Checking for Leaks”, 2 7-19

General Information

This section contains instructions for routine use. It is intended as a guide to build your SOP (Standard Operating Procedure).
Any modifications of the implemented tests in your Application Software must be carried out by application specialists or expert operators.
Refer to cross references above.

Before starting a run, pay attention to the following:

Containers

1 Empty the waste liquid container if necessary.

The waste container must remain on floor level to provide for proper waste liquid flow.

2 Empty the disposable tip waste bag if necessary.

3 Check the system liquid container and refill if necessary.

If possible, place the system liquid container on worktable level to avoid pressure difference in the supply tubing.

Multichannel Arm

4 MCA96 / MCA384: If a wash system is installed:
- Check the wash liquid container and refill if necessary.
- Check the waste liquid container and empty if necessary.
- On an MCA96 wash system, disconnect the wash level sensor simulation plug (do not use the simulation plug in daily routine use).
- Send a “Wash” command.
- Check the fill level in the wash block and make sure that there is enough wash liquid in the wash block.

Consumables

5 Check the disposable tip rack and add tips if necessary.

6 Make sure that the reagent troughs are filled appropriately.

7 Ensure that the daily maintenance has been carried out according to the maintenance chapter.

8 Make sure that the splash protection of the DiTi waste and wash station unit is mounted.

ATTENTION

Unsatisfactory pipetting results, if MCA384 fixed tips are used in dry state.

- Always prime the fixed tips before pipetting.

ATTENTION

Risk of contamination by liquid splashing on the worktable during DiTi ejection.

- The cover for the DiTi waste slide must always be installed. This prevents liquid from splashing onto the worktable and thus minimizes contamination risks.

MCA96 500 µl DiTis

If you are using 500 µl DiTis on the MCA96 arm, pay attention to the following:

WARNING

500 µl DiTis are longer than the 200 µl, 100 µl and 50 µl DiTis and therefore might collide with high DiTi carriers.

- Check for tip clearance when using the 500 µl DiTis

Nested DiTi

If you are using Nested DiTis on the MCA96 arm, pay attention to the following:

ATTENTION

Using Nested DiTi may lead to crashes of the MCA96 if the prerequisites for Nested DiTi are not fulfilled.

- Make sure that the pipetting head is equipped with the correct DiTi eject plate for Nested DiTi (consult a Tecan FSE if necessary).
- Check that the Nested DiTi boxes are only placed on dedicated Nested DiTi flat carriers.
- Make sure that the covers are removed from the topmost inserts of the Nested DiTis when they are placed on the worktable.
- The used DiTis have to be disposed in the DiTi waste, only the empty inserts can be disposed using the Te-Stack waste option.

Furthermore, take the following notices into consideration:

Worktable

Regarding the worktable, pay attention to the following:

ATTENTION

Improper positioning of objects on the worktable may lead to disturbances or errors in the process, e.g. misinterpretation of barcodes. Do not use free space on the worktable to deposit any objects

ATTENTION

Improper initialization of robotic arms.
The robotic arms cannot initialize properly if there is an object, such as a lost sample tube or a tool, etc., between the arm and the initial stop position.

- Make sure that there are no unwanted objects present in the instrument.
- Check the arm position after the initialization command.

ATTENTION

Before starting an application, thoroughly flush the whole liquid system. Make sure that daily maintenance procedures have been performed. Make sure that there are no air bubbles in the tubing and that there are no liquid droplets on DiTi adapters or tips.
Refer to cross references above.

MCA384

Regarding gripper initialization of the MCA384, pay attention to the following:

WARNING

MCA384 Gripper cannot be initialized to the front because of risk of collision. Before the head and gripper will initialize in Y and then move 10 cm to the front to proceed with the rest of the initialization, the following conditions must be fulfilled:

- the MCA384 Gripper is located at a position where its Y-axis can be initialized without being blocked by any obstacle
- the gripper is docked
- head and gripper are in park position

RoMa, PnP, MCA96 and MCA384 Gripper

If the instrument is to be started up anew after a power failure, it is important that any objects still held by the grippers of the RoMa, PnP, MCA96 and MCA384 Gripper are removed before the start. Otherwise they will be dropped during the startup.

WARNING

Contamination risks through contamination of the worktable or frame. Hazardous system liquids or samples can be spilled onto the worktable, if tubes or microplates held by the grippers of RoMa, PnP, MCA96 and MCA384 are dropped after a restart.

- Visually inspect the arm devices whether they still hold any objects between their grippers.
- Remove such objects before starting up the instrument.

6.3.4.1 Carriers

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Carrier cleaning	See section 7.3.15 “Carriers and Racks”, 2 7-56
Positioning pin replacement	See section 7.6.1 “Positioning Pins”, 2 7-86

Carrier Positioning

Slide carriers over the positioning pins until they abut on the lock pins.

Make sure that the barcode on the carrier corresponds to the settings in the Application Software.

Carrier Fixation and Replacement

The positioning pins hold the carriers in defined positions, but still allow carriers to be exchanged during an application. A rail in the carrier base fixes the carrier in X-direction, the stop pins in the third row on the worktable fix the carrier in Y-direction. When prompted to do so by the software, the operator can replace a carrier during an application.

ATTENTION

Make sure that the stop pins limit the carrier movement correctly, otherwise crashes or incorrect pipetting may occur.

Positioning Pins

If a positioning pin is damaged, replace it immediately.
Refer to cross references above.

Place the carriers only on the provided positions as the instrument is adjusted to these positions. Carriers placed e.g. on the left of positioning pin 1 can cause mechanical problems (collision) or errors in the identification of barcoded samples.

Placing Carriers

All carriers must be in close contact with the worktable, so that the capacitive liquid level detection is guaranteed. For this purpose, clean the carriers and the worktable in regular intervals.
Refer to cross references above.

Make sure that the correct rack is used for the carrier.

If a carrier is damaged, replace it immediately.

Carrier ID

Each carrier ID must be unique.

Carriers Identification by PosID

Always place the carriers correctly on the worktable as shown in the figure (B):

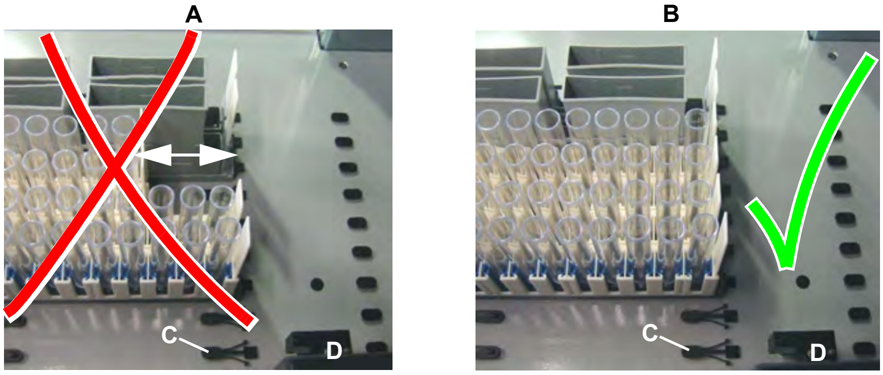


Fig. 6-5 *Carriers on worktable*

A *Incorrect position of carriers (offset of carriers indicated with arrows)*
B *Correct position of carriers*
C *Lock pin*
D *PosID barcode reader*

WARNING

Wrong identification of a carrier.
If carriers are not placed correctly on the worktable and if there are unfavorable circumstances (barcode labels not within specified limit, distance of the incorrectly placed carriers to the barcode reader still enables reading), the barcode reader might read the wrong carrier.

- When loading carriers, always slide them all the way to the stop at the lock pin.
- When carriers need to be removed, always remove them completely from the worktable.
- Never remove or place a carrier on the worktable while the PosID is reading.

6.3.4.2 Racks and Containers

If a rack is damaged, replace it immediately.
Make sure that the correct barcode is used for the rack.

Microplates

Microplates must be positioned correctly on the carrier, seating well in their holder. Make sure that the microplate does not rest on the holder rim in a slanting position.

Racks for Disposable Tips

Before positioning the new racks in the DiTi Carrier on the worktable, carefully check the DiTis for transport or storage damage (refer to the instructions enclosed in the outer package):

- The DiTis must not be damaged
- The DiTis must not be bent

Ensure that the DiTis to be loaded onto the carriers correspond to the ones indicated in the application software (size, with filter/without filter).

ATTENTION

Crash or erroneous pipetting results when the wrong tips are loaded on the worktable.

- If tips are longer than expected:
  Crash of the tips with the labware.
  Wrong pipetting results because the tips are pressed against the bottom of the container, which constricts the liquid flow through the tip orifice.
- If tips are shorter than expected:
  Aspiration of air instead of liquid, which may result in erroneous results.
- Make sure that the tip lengths of fixed tip block (MCA96), fixed tip adapter (MCA384) or DiTis, present on the worktable, correspond with the ones defined in the application software.

ATTENTION

DiTi crash/erroneous pipetting results due to incorrect DiTi types.

- Do not confuse the different DiTi types.
- Pay attention to the labels on the DiTi boxes/packaging.

ATTENTION

DiTis are not dropped properly (especially MCA96)
The 50 µl and the 100 µl DiTis may, under unfavorable circumstances (e.g. when used in a laboratory with low relative humidity [RH < 40%]), remain clinging to the pipetting head after the drop tip command. This phenomenon is due to electrostatic charge of the tips.

- The environmental conditions have a major effect on the electrostatic charge. Increased relative humidity usually results in less charge (surroundings of the instrument, DiTi storage conditions).
- Alternatively, the DiTis can be treated with an ionizer that neutralizes the electrostatic charge. In many cases this solution provides the desired effect. However, the ionizer has not proved to be effective in critical cases.
- Disposable tips must not be reused as this bears the risk of problems during the “drop DiTi” procedure. Reusing DiTis results in increased electrostatic charge.
- In critical cases Tecan recommends you to use conductive tips. Please contact your local service organization.

MCA and 1536-well plates

WARNING

Reproducibility of positioning 15 µl DiTis or a fixed tip adapter in a 1536-well plate will be unsatisfactory when using standard plate carriers.

- Use of Te-PS carrier and use of the positioning manifold is a must for accessing 1536-well plates
- Access of 1536-well plates is only recommended with 15 µl DiTis or fixed tip adapters. Using other tips may lead to unexpected contact between tips and labware, tip damage and interruption of a run.

Containers (Troughs, Bottles, etc.)

ATTENTION

Risk of mixing up containers during loading.
If you load containers without barcode identification, e.g. in a carrier that does not allow the containers to be identified by the PosID, pay attention to the following:

- Strictly follow the loading instructions provided by the software.
- Double-check all containers for correct placement on the carrier.

Use of Tubes

- For sample and reagent tubes, use the appropriate carriers (strip racks) according to the following list.

Tab. 6-3 *Racks for sample and reagent tubes*

Strip rack	Tube diameter, outside
with black insert	10 mm
with blue insert	12 to 13 mm
without insert (white)	15 to 16 mm

Note: *For parameters other than listed here, choose the strip rack the tubes best fit in and make sure they do not jam. The deviations in diameter must be adapted within the Application Software.*

- In each rack, use tubes of one size only. Tube height and diameter must be identical for all tubes.

ATTENTION

Make sure that all tubes are positioned correctly in the carrier and touch the rack bottom, otherwise liquid level detection and clot detection might not work properly.

ATTENTION

Incorrect identification of the carrier (strip rack).
The carrier barcode is associated with the corresponding tube size. Therefore, the carriers are not handled correctly if the inserts are exchanged.

- Do not change the strip rack inserts.
- Do not exchange the carrier barcode flags.

Note: *The filling level of tubes, troughs and containers must not exceed 80% to avoid spillage during PosID reading.*

Tab. 6-4 *Minimum inner diameter for primary sample tubes*

Tip type	Tube diameter, inside
DiTi 1000 µl	8 mm
DiTi 200 µl	8 mm
DiTi 350 µl	8 mm
Fixed tips	7 mm

6.3.4.3 Preparation of Samples

Visually inspect the samples before pipetting. They must be free of:

- Clots
- Foam
- Droplets on the tube wall

For this purpose we strongly recommend that you centrifuge the samples before pipetting. After the sample collection wait for at least 10 minutes before centrifuging the sample.

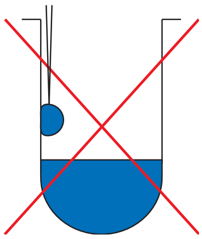


Fig. 6-6 *Droplet on wall*

- Maximally fill the sample tubes to 80%.
- The sample tubes must not contain any additional (non-conductive) inserts or have covers.
- When using monovettes with plunger, the plunger must first be retracted fully and only then be broken off. This method ensures a good contact to the worktable (liquid detection).
- If pipetting from gel monovettes is intended, make sure you use only sample tubes with a sufficient amount of supernatant.

Note: *For further information on sample preparation, please refer also to the recommendations given by your manufacturer and by the WHO.*

6.3.4.4 Connecting Liquid Containers

When connecting liquid containers, also pay attention to the maintenance instructions given in section 7.3.12 “Liquid Containers”, 2 7-52.

Tubing from Pressure Relief Valve

If your instrument is equipped with FWO/SPO/MPO, pay attention to the following:

Note: *To minimize the contamination risk, Tecan recommends you to connect the bypass tubing from the pressure relief valve to the waste container (not back to the system liquid container).*

ATTENTION

Liquid handling problems due to air in the liquid system

- If you direct the bypass tubing from the pressure relief valve back to the system liquid container, make sure that the bypass liquid flow does not cause bubbles in the system liquid.
- Separate the bypass tubing and the aspiration tube in such a way that no air bubbles can be aspirated.

Wash Station/Waste Tubing

Installing the Waste Tubing

When installing the waste tubing, pay attention to the following:

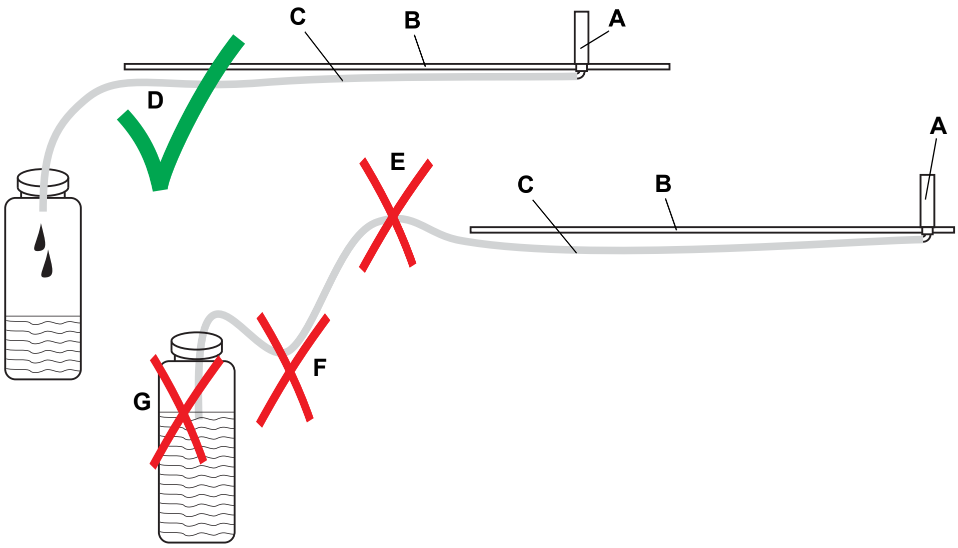


Fig. 6-7 Correct and disadvantageous course of waste tubing

Correct installation of waste tubing

A *Wash station*
B *Worktable*
C *Waste tubing*
D *Correct course of waste tubing*

Incorrect installation of waste tubing

E *Rising waste tubing*
F *Sagging waste tubing*
G *Waste tubing reaching into liquid*

ATTENTION

Liquid spillage on the worktable.
To prevent overflow of the wash station the waste tubing must be routed in such a way that the back pressure is as low as possible.

- The waste tubing must not be longer than necessary.
- The waste tubing must not be kinked or squeezed (reduction of clear cross section).
- The waste tubing must not rise after wash station (back pressure).
- The waste tubing must not sag (back pressure).
- The lower end of the waste tubing must not be in the liquid (back pressure).

6.3.5 Runtime Controller

The Freedom EVO is controlled by the runtime controller of the application software.

With the runtime controller the following tasks are performed:

- Login for lab operator, application specialist or administrator:
  - The software only allows authorized users with a valid login to perform any action on the instrument.
- Starting a script / process run.
- Performing maintenance.
- User management:
  - Allows the administrator to set up users with the corresponding access rights.

Refer to the Application Software Manual.

6.3.6 Checks and Terminating Tasks

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Empty/clean the waste container	See section 7.3.12 “Liquid Containers”, 2 7-52
Empty/clean wash block	See section 7.3.18.9 “Washing and Emptying the Wash Block”, 2 7-72
Empty/clean the wash liquid container	See section 7.3.18.12 “Emptying and Cleaning the Wash Liquid Containers”, 2 7-74

Performing the Checks and Tasks

1. Check if the run has been terminated without any error (check for error messages).
2. Empty and clean the reagent troughs.
3. Empty and clean the waste container and rinse it with ethanol.
   Refer to cross references above.

Multichannel Arm (MCA96 / MCA384)

Wash System

1. If a wash system is installed: Flush the wash block (e.g. at first with deionized water, then with 70% ethanol).
2. Empty and clean the wash block.
   Refer to cross references above for further details.

ATTENTION

Dried up residues in the wash block are difficult to clean.
Always empty and clean the wash block if the instrument is not used for more than two days.

3. Empty and clean the wash liquid containers.
   Refer to cross references above.

Fixed Tip Block / Tip Adapter

MCA96

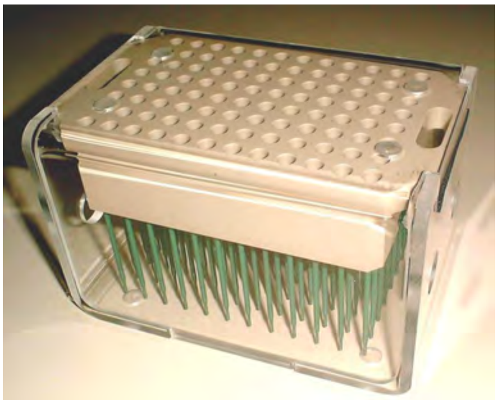


Fig. 6-8 Fixed tip block box

1. Check if the fixed tip block is parked or the DiTis are dropped.
2. Clean the fixed tip block.
3. Dry the fixed tip block and put it into the fixed tip block box.

MCA384

1. If a Fixed tip adapter was used, park the fixed tip adapter.
2. If a DiTi adapter was used, drop the DiTis from the DiTi adapter.
3. Leave a DiTi adapter (without DiTis) mounted on the head or pickup the Adapter QC MCA384.
   The adapter will cover the bottom surface of the head with the sealings and keep it clean and dust-free.

ATTENTION

Always handle the fixed tip block / fixed tip adapter in such a way that it will not be contaminated:

- It is important to store the fixed tip block / fixed tip adapter in a dust-free place.
- Never touch the tips with your fingers. When handling the fixed tip block / fixed tip adapter, always hold it by the PEEK block or by the adapter itself.
- Never put the fixed tip block / fixed tip adapter down with its tips resting on the table.

WARNING

Contamination of the pipetting head.

If the pipetting head is initialized with the fixed tip block or DiTis mounted to it, the remaining liquid in the tips may be drawn into the head und thus contaminate the head.

- Always park the fixed tip block or drop the DiTis before initializing the pipetting head, i.e. before switching the instrument off (each time the instrument is switched on, the head will be initialized again).

6.3.7 Switching the Instrument Off

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Maintenance tasks	See chapter 7 “Preventive Maintenance and Repairs”, 2 7-1

Before switching the instrument off, some maintenance tasks might need to be performed, e.g. tip cleaning.
Refer to cross references above.

Except in an emergency situation, switch the instrument off only after an application is completed.

To switch the instrument off:

1 Press the power ON/OFF switch and keep it pressed for at least 2 seconds.

ATTENTION

Wait until the status light in the power switch is off (for approx. 10 sec.) before switching the instrument on again.

6.3.8 When a Crash Occurred

When a crash occurred, consult chapter 8 “Troubleshooting”, 2 8-1 for possible corrective measures. Also check the log files generated by the application software.

ATTENTION

After a harsh crash some components of the instrument may be out of alignment or even defective.

- If a harsh crash occurred, contact your local service organization to have the instrument checked.

RoMa Crash

After a crash with the RoMa, check the gripper and the RoMa alignment. Refer to 8.2.7 “RoMa / Gripper Alignment”, 2 8-17.

MCA384 Fixed Tip Adapter

After a crash of the MCA 384 fixed tip adapter, pay attention to the following:

ATTENTION

After a crash with an MCA384 fixed tip adapter (e.g. with labware during teaching) some of the tips might be displaced (pushed up into the fixed tip adapter) and lead to undetected pipetting errors and contamination.

- Validate pipetting after teaching with an MCA384 fixed tip adapter (see 6.4 “Operating in Process Definition Mode”, 2 6-25).

6.4 Operating in Process Definition Mode

Recommendation

Before running an application for the first time, optimize all liquid handling parameters by means of test runs with a neutral liquid.

6.4.1 Process Validation

The device must be validated in the specific application according to laboratory practice and state-of-the-art before putting into service and after changes. Use of kits or kit components on Freedom EVO is only allowed after validation by Tecan, the kit manufacturer or operator of the system.

For all applications of the Tecan instrument, the user must ensure that the requirements of each protocol are carefully observed.

A systematic approach of risk analysis, validation of critical parameters and system validation should be followed to ensure that the system or combination with kit provides reliable and reproducible performance.

Make sure that the validation process is executed according to national laws and standards.

ATTENTION

Crash or erroneous process results

The Freedom EVO requires accurate positioning of all reagents, samples, racks, and plates on the worktable. The corresponding positions must be taught properly in the application software.

- Verify these positions accordingly before executing any program.

ATTENTION

Undetected pipetting errors (e.g. due to incorrect tip height)

Make sure that your test layout is set up as to detect potential pipetting errors, e.g. by means of integrated controls.

ATTENTION

Cross-contamination due to inefficient wash procedure

If wash steps are included in your process, verify the efficiency of your wash procedure (especially the wash efficiency for the MCA multiple tips must be verified).

6.4.2 Liquid Handling

6.4.2.1 General Instructions

Cross References

List of cross references to information provided in other sections:

Subject	Reference
System liquid requirements	See section 3.4.3 “System Liquid Requirements”, 2 3-31

System Liquid

Make sure that the requirements for the system liquid are met.
Refer to cross references above.

Use of Test Tubes

In the application software, the following rack parameters for test tubes are predefined:

Tab. 6-5 Racks for test tubes

Striprack	Test tube diameter, outside
with black insert	10 mm
with blue insert	13 mm
without insert (white)	16 mm

Note: *In the case of deviating parameters, these values must be adjusted in the application software.*

When using test tubes, pay attention to the following:

- In each rack, use test tubes of one size only. Tube height and diameter must be identical for all test tubes.
- Make sure that all test tubes are positioned correctly in the rack and touch the rack bottom.

Setting of Z-heights

Z-travel
A carrier’s Z-travel is the Z-height above any obstacles that go with this carrier.

Z-dispense
Z-dispense is the Z-height from which liquid is dispensed from the air. It should be adjusted to a height from which no droplets can fall into adjacent cavities.

Z-start
Z-start is the Z-height at which liquid detection is activated.

Z-start must be situated at least 1 mm below the cavity rim and above the liquid level. The microplate, for which Z-start is defined 1 mm above the cavity rim, is an exception to this rule.

Z-max

Z-max is the Z-height which lies as close as possible to the lowest cavity point without touching the cavity bottom.

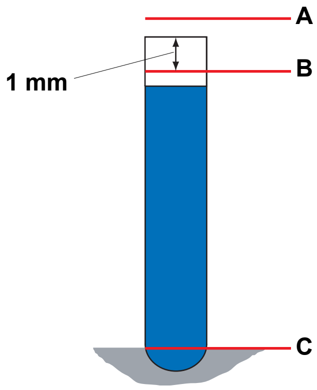


Fig. 6-9 Sample tube Z-heights

A	*Z-travel*	*C*	*Z-max*
B	*Z-start, Z-dispense*		

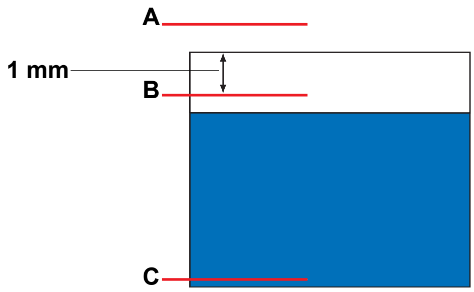


Fig. 6-10 Reagent trough Z-heights

A	*Z-travel*	*C*	*Z-max*
B	*Z-start, Z-dispense*		

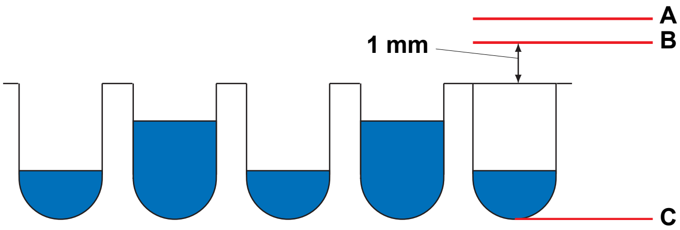


Fig. 6-11 Microplate Z-heights

A	*Z-travel*	*C*	*Z-max*
B	*Z-start, Z-dispense*		

Note: *The use of deviating parameter values must be discussed with the responsible application specialist.*

Cylindric or cuboid-shaped cavities allow for optimal tracking. When using differently shaped cavities, their inner dimensions and their immersion depth must be optimized.
The inner diameter of the cavities (or of test tubes) must be calibrated carefully and typed in the corresponding data fields.

Fill Level of Cavities

To ensure safe handling (e.g. movement by PosID, transport by means of RoMa, PnP, etc.) of the containers, make sure that the fill level of the cavities does not exceed the following limits:

- Fill the test tubes to a maximum of 80 %.
- Fill microplates to a maximum of 80 % of the cavity volume
- Fill reagent troughs at maximum to the specified volume (e.g. 100 ml trough: 100 ml equals approx. 90 % of the total trough volume)

6.4.2.2 Liquid Handling With LiHa

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Minimum pipetting volumes	See section "Free Dispense Volumes", 2 3-35
Minimum volume for liquid detection	See section "Liquid Level Detection", 2 3-39
Process validation	See section 6.4.1 "Process Validation", 2 6-25

This information applies to Tecan 2, 4 and 8 channel liquid handling arms and 1000 µl syringes (but not to MCA).

Minimum Volumes

Pay attention to the minimum volumes for the corresponding tip types.
Refer to cross references above.

Note: *Lower volumes can be dispensed with contact dispense. Please discuss the possibilities with the responsible application specialist.*

Aspiration Speed and Delay/Waiting Time

In order to obtain optimal pipetting results, the following settings for aspiration speed and delay/waiting time must be considered:

- Recommended slow aspirating speed between 30 and 200 µl/s.

Tab. 6-6 *Examples for recommended aspirating speed*

Aspiration speed	Pipetted volume
30 µl/s	**10 µl**
70 µl/s	**100 µl**
150 µl/s	**500 µl**
150 µl/s	**750 µl**
200 µl/s	**1000 µl**

- Sufficient delay after aspiration, recommended delay is between 300 and 1000 ms.
- When working with viscous samples and solutions like serums or highly concentrated reagents, observing a delay of ≥ 500 ms is recommended.
- Highly viscous liquids may require lower aspiration speed.

Submerge

If the liquid level is used as reference for the aspiration position, the submerge should be adapted to the container:

- Microplates: 1 mm
- Sample tubes: 2 mm
- Reagent troughs: 3 mm

Example: *In Freedom EVOware, this is achieved by adapting the setting for the offset of the expression “Aspiration Position”, e.g. liquid level ± offset 2 mm in the appropriate liquid class.*

Air gaps

The following table shows the recommended air gap volumes:

Tab. 6-7 *Recommended air gap volumes*

Tip Type	Mode	STAG	LAG	TAG
Standard tip	Single	Σ ≤ 30 µl		5 to 20 µl, 10 µl ideal
	Multi	Σ ≤ 30 µl		0 µl
Low volume standard tip	Single	Σ 5 to 15 µl		0.25 to 5 µl
	Multi	Σ 5 to 15 µl		0 µl
DiTi 10 µl	Single	20 µl	5 µl	10 µl
	Multi	10 µl	0 µl	0 µl

Tab. 6-7 Recommended air gap volumes

Tip Type	Mode	STAG	LAG	TAG
DiTi 200 µl	Single	Σ ≤ 40 µl		5 to 20 µl, 10 µl ideal
	Multi	Σ ≤ 30 µl		0 µl
DiTi 350 µl	Single	Σ ≤ 40 µl		5 to 20 µl, 10 µl ideal
	Multi	Σ ≤ 30 µl		0 µl
DiTi 1000 µl	Single	Σ ≤ 40 µl		5 to 20 µl, 10 µl ideal
	Multi	Σ ≤ 30 µl		10 to 20 µl

STAG *System trailing air gap*
LAG *Leading air gap*
TAG *Trailing air gap*

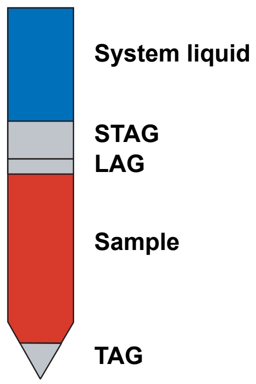


Fig. 6-12 *Air gaps in tip*

Dispense and Breakoff Speed and Waiting Time

In order to obtain optimal pipetting results using the standard pipetting method (free dispense), the following settings are recommended:

- Fast dispense speed is between 250 and 600 µl/s
  ideal dispense speed: ≥ 400 µl/s
- The ideal breakoff speed is 70% of the dispense speed.
  minimum breakoff speed: ≥ 150 µl/s
- Sufficiently long delay when using viscous samples and solutions like serums or highly concentrated reagents ≥ 200 ms.
- Highly viscous liquids may require lower dispense speed and dispense in contact mode.

Multi Pipetting

The term **Multi Pipetting** designates the pipetting method which aspirates once and then dispenses several aliquots. For this pipetting method, all the rules listed in this section apply. In addition, the following parameters are needed:

- A **conditioning volume** is needed, to attain for the first aliquot the same conditions as for all the following aliquots.
  The recommended conditioning volume is ≥ 30 µl, or is ideally of the same volume as one aliquot.
  The conditioning volume is dispensed back into the original container or into the wash station.
- An **excess volume** is used to attain for the last aliquot the same conditions as for all the preceding aliquots.
  The recommended excess volume is ≥ 30 µl. Ideally it amounts to 15% of the total volume.
  The excess volume is either dispensed back into the original container or into the wash station.

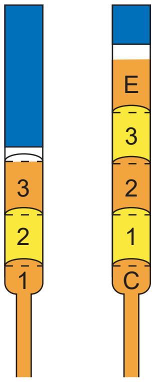


Fig. 6-13 *Conditioning and excess volumes*

1,2,3 *Aliquots* ***E*** *Excess volume*
C *Conditioning volume*

- Best precision is attained with 4 to 12 aliquots.
- Recommendation: When multi pipetting with aliquots of various volumes, dispense the smaller volumes earlier than the larger volumes. The largest volume is then the last to be dispensed.

Liquid Conductivity

Tab. 6-8 *Liquid conductivity*

Conductivity	Liquid	Sensitivity
Very good	Serum, DNA solution, buffer	medium
Good	Tap water	high
Bad	DMSO, ethanol, distilled water	very high

Clot Detection

- To generally prevent problems with clots (clogging of the tips and particles sticking to the tips) the sample containers must be properly centrifuged.
- The clot detection works properly if certain volumes of samples to be aspirated observed, see chapter “Technical Data”, table “Free Dispense Volumes” see cross references above).
- For the above mentioned reasons we recommend you to proceed with great care in the following cases:
  - During the preanalytic phase, in particular with the centrifugation step
  - During sample collection and distribution of the samples

ATTENTION

Malfunction of clot detection:

- Do not use labware with non-parallel walls (tolerance 1°), e.g. only cylindrical tubes.
- Do not use the clot detection function when pipetting from 100 ml Tecan troughs.

Carry over

Definition

Carry over is the term for a possible residue of sample liquid that remains inside and/or outside of a tip after rinsing at the end of a pipetting cycle. Such a residue is carried over to the next cycle. Where no carry over is admissible, disposable tips (DiTis) with filter must be used.

Carry over depends on several parameters, as e.g.

- type of liquid,
- tip material,
- tip geometry,
- adhesion, etc.

In addition, the aspirate and dispense methods used (i.e. the liquid handling parameters programmed in the Application Software) influence carry over.

Carry Over Measurements

For any application where carry over might lead to erroneous or unacceptable results, the actual carry over properties must be measured, using reference samples (positive and negative). The measurements must be conducted with test conditions identical to those of the application.

Optimization of Liquid Handling Parameters

The liquid handling parameters of applications whose results are sensitive to carry over must be optimized in that sense by a person having the liquid handling knowledge and having successfully attended the corresponding training proposed by Tecan.

Use of Disposable Tips

Disposable tips with filter must be used where no carry over is tolerable.

It is essential that the instrument’s operating condition is adequately maintained (preventive maintenance and performance check at regular time intervals) to ensure the appropriate performance.

Disposable Tips

For disposable tips, all the rules listed in this section apply. The following list contains additional information to be taken into account:

- Disposable tips with or without filter are used when contamination and carry over must be prevented.
- Disposable tips must not be reused as this bears the risk of incorrect detection and influences the precision. Disposable tips are intended for one single transfer cycle i.e., one aspiration and one or more dispense steps.
- Always use a Trailing Airgap (TAG) when operating with 1000 µl disposable tips. In this case a conditioning volume in multi pipetting mode is not necessary.
- Liquids with high vapor pressure require increased sample trailing air gaps. Sometimes, prewetting and decreased temperatures have to be taken into consideration.

ATTENTION

Problems in the process due to inapt disposable tips.

In case the Freedom EVO is equipped with the DiTi option, full system functionality can only be guaranteed when Tecan disposable tips are used.

Wash

- The wash volume for one wash step should amount to at least 7 ml.
- The wash volume must be checked for each application within the scope of the validation.
  Refer to cross references above.

6.4.2.3 Liquid Handling With Te-Fill Option

When the instrument is equipped with a Te-Fill option, pay attention to the following:

The inside shape of the 3/2-way valve does not provide for free flow-through, i.e. residues may remain in corners of the valve.

ATTENTION

Contamination of the 3/2-way valve.

Make sure not to aspirate sample, or other liquid that may contaminate the valve, into the 3/2-way valve.

6.4.2.4 Liquid Handling With MCA96 / MCA384

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Information on DiTi use	See section 6.4.2.2 “Liquid Handling With LiHa”, 2 6-28
Process validation	See section 6.4.1 “Process Validation”, 2 6-25

Wash

- The wash efficiency for the MCA96 / MCA384 tips must be checked for each application within the scope of the validation.
  Refer to cross reference above.

Disposable Tips

For disposable tips, the information in the section for LiHa liquid handling applies also to the MCA96 / MCA384.
Refer to cross reference above.

The following list contains additional information for the MCA96:

- Liquid drops may stick to the DiTis due to electrostatic charge of the tips.
  - The pipetting volume can possibly be increased to reduce the absolute influence on the pipetting results.
  - The DiTis can be treated with an ionizer that neutralizes the electrostatic charge.
  - Disposable tips must not be reused as this increases the electrostatic charge.

Additional information concerning the MCA384:

WARNING

Unsatisfactory pipetting results, if the MCA384 DiTis have not the same temperature as the instrument / pipetting head.

- Acclimate the MCA384 DiTis for at least 48 hours

Fixed Tip Block (MCA96)

If you use fixed tip blocks in small volume ranges, pay attention to the following:

- If deionized water is used as wash liquid, volumes of water smaller than 30 µl (standard fixed tip block) or 20 µl (high precision fixed tip block) cannot be pipetted reliably without taking precautions.
  - To achieve good pipetting results it may be necessary to prime the fixed tip block. Priming means moistening the surfaces of the tips with wash liquid.
  - Wash liquid containing 20% ethanol has provided good results at volumes of down to 5 µl. It can be assumed that wash liquids containing detergents or other surface tension reducing agents provide similar results.
- For good results at volumes below 5 µl a conditioning procedure for dry fixed tip blocks with 1-Propanol 99% for 30 minutes, followed by wash steps with wash liquid, is recommended.
- The effects of the wash liquid on the pipetting results must be checked for each application within the scope of the validation.
  Refer to cross reference above.

Fixed Tip Adapter (MCA384)

If you use the fixed tip adapter in small volume ranges, pay attention to the following:

Prime Fixed Tip Adapter

  - To achieve good pipetting results it may be necessary to prime the fixed tip adapter. Priming means moistening the surfaces of the tips with wash liquid.
  - Wash liquid containing 5% ethanol has provided good results at the following volumes:

Adapter 15 µl:	1 µl
Adapter 125 µl:	3 µl

  It can be assumed that wash liquids containing detergents or other surface tension reducing agents provide similar results.

- The effects of the wash liquid on the pipetting results must be checked for each application within the scope of the validation.
  Refer to cross reference above.

Fixed Tip Adapter / MCA384 Wash Station

WARNING

Damage to the wash station channels and tips if the wash height is not taught appropriately. When using fixed tip adapters in conjunction with the MCA384 wash station, the teaching of the wash height should be conducted with care. The “Adapter 96 Fixed 125 µl MCA384” has a tip length of 44 mm. The other fixed tip adapters have a tip length of 28 mm and therefore cannot enter the channels of the wash station as deeply as the longer tips.

6.4.2.5 Working With Beads

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Inner diameter of tip	See section 3.5.3 “Multichannel Arm (MCA96)”, 2 3-56

ATTENTION

Tips blocked by beads
When working with beads the pipetting tips can be clogged by beads if their diameter is inappropriate.

- Make sure that the beads cannot clog the tips. For the inner diameter of the corresponding tip refer to the cross references above.

6.4.2.6 Access to Reagent Troughs

Note: *Not all tips are long enough the reach the bottom of the 250 ml reagent trough.*

- *The high precision fixed tip block and the 50 µl DiTis are not apt for accessing reagent troughs larger than 125 ml, because the tips do not reach to the trough bottom.*

6.4.3 Use of Barcodes and Positive Identification

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Alignment of barcode labels	See section 3.5.9 "Positive Identification (PosID)", 2 3-78

Barcodes for PosID

To ensure reliable barcode reading with the PosID, pay attention to the following:

- The horizontal and vertical positions of barcode labels on all containers must be aligned precisely.
  Refer to cross references above.
- The barcodes must fulfill the following quality requirements:
  - Grade A, according to standards ANSI/DIN EN.
  - The barcode labels used must not be yellowed, stained, creased, wet, damaged or peel away at the edges.
  - Assuring the good quality of barcodes by a process is recommended.
- The carrier ID must correspond to the sample tube size used.
- Only the barcode types actually present on the worktable must be activated.
- Recommendation: Use checksum-protected barcodes only (code 128 uses a checksum by definition).
- The checksum function must be active. For barcodes without checksum, at least the number of characters must be defined.

ATTENTION

Erroneous identification of containers.

- Never use interleaved 2 of 5 barcodes without the definition of the number of characters.
- Using and activating **Start** and **Stop** characters is recommended.

6.4.4 Use of Containers Without Barcode Identification

ATTENTION

Risk of mixing up troughs without barcode identification.

- If troughs cannot be labelled with barcodes that can be read by the PosID, Tecan recommends you to implement human controlled intervention (i.e. color coding, etc.)

ATTENTION

Risk of mixing up containers during loading.

If you load containers without barcode identification, e.g. in a carrier that does not allow the containers to be identified by the PosID, pay attention to the following:

- Use only a single carrier of that kind to minimize the risk of mixing up containers.

6.4.5 Defining Scripts and Processes

Note: *This section gives instructions on good usage, safe worktable layout and correct use of the instrument.*

Please pay attention to the following general items when defining scripts and processes:

- Make sure that the log file function is always switched on. This facilitates troubleshooting and tracking of process steps.
- If a user management function is available in the application software, keep this function switched on. This prevents unauthorized or untrained operators from interfering with the application.
- Make sure that all coordinates (X, Y, Z) of the used carriers/racks/containers have been calibrated carefully. Well calibrated carriers/racks/containers help avoiding collisions and malfunction.

Regarding specific system modules, take the following essential considerations into account when defining scripts and processes.

6.4.5.1 Safe Worktable Layout

For a safe worktable layout, pay attention to the following instructions:

Reagent Troughs / Wash Station

Be aware of the fact that splashes from the wash station may get into reagent troughs that are placed near the wash station. In critical cases do not place the reagents troughs next to the wash station.

DiTi Waste and Wash Station Unit

The same applies to the DiTi waste and wash station unit. Avoid placing critical reagents in the troughs next to the wash station.

Considerations With Regard to Positive Identification

Container barcodes cannot be read in the two rightmost grid positions due to limited movement space.

If operating with the PosID, do not place carriers with containers to be identified in the two rightmost grid positions.

6.4.5.2 LiHa Arm

High-Density Applications

Vibrations, caused by the movement of other arms, e.g. a 2nd LiHa, may result in positioning difficulties in high density applications.

If you encounter such difficulties, please contact your local service organization.

In such applications, where the mechanical precision is very critical, speed and acceleration of the arm movements may be adapted accordingly.

Limitations for Magnetic Racks

Because the tip presence detection uses a magnetic switch inside the tip adapter the following limitations apply when using magnetic racks:

- The Te-MagS option must not be placed on the adjacent grid position on the left of the grid position accessed by LH channels.

6.4.5.3 Air LiHa Arm

When the instrument is equipped with an Air LiHa, pay attention to the following:

Requirements for Air LiHa

Since the dimensions of the Air LiHa tip adapter differ from the dimensions of the standard tip adapter (refer to section 3.5.2 "Air Displacement Pipetting Arm (Air LiHa)", 2 3-48) there are the following implications:

Z-Offset

The Z-offset (not range) of the Air LiHa is smaller by seven steps (0.7 mm).

Height of Labware

The maximum permissible height of system labware placed on the adjacent grid position on the left of the accessed grid position is 3 mm less than for a standard liquid handling arm.

This is the case when pipetting is done at a minimum Z-height.

6.4.5.4 MultiSense Option

When the instrument is equipped with the MultiSense option, pay attention to the following:

Requirements for MultiSense Option

The dimensions of the MultiSense tip adapter differ from the dimensions of the standard tip adapter.

This implies that

- The Z-offset (not range) is smaller by 7 steps (0.7 mm)
- The maximum permissible height of labware on the left is 3 mm smaller.

For details see section 3.5.1.5 "MultiSense Option", 2 3-44.

6.4.5.5 Multichannel Arm (MCA96 / MCA384)

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Prime fixed tip block / fixed tip adapter	See section 6.4.2.4 “Liquid Handling With MCA96 / MCA384”, 2 6-34
Tip length/clearance MCA96	See section 3.5.3 “Multichannel Arm (MCA96)”, 2 3-56
Tip length/clearance MCA384	See section 3.5.4 “Multichannel Arm (MCA384)”, 2 3-65

Operation with Fixed Tip Block / Fixed Tip Adapter

When working with a fixed tip block / fixed tip adapter, pay attention to the following:

- Wash the tips before starting a procedure as means of priming and cleaning the system.
  Priming the fixed tip block / fixed tip adapter can also improve the pipetting results. Refer to cross references above.
- Routine pipetting with steel tips requires washing between each pipetting step to ensure that the tips are clean; i.e. that carry over from liquid to liquid is minimized.
- If using the MCA96 wash system, the wash level sensor simulation plug must not be used during routine operation, since this disables the system to detect errors of the wash system, e.g. a lack of wash liquid in the wash block.

Worktable Layout

When defining the worktable layout for a specific process, pay attention to the following:

- The multichannel head footprint is larger than an ANSI/SLAS microplate.
- Depending on the tip length and on the height of the adjacent racks and carriers an aspirate, dispense or mix command can result in a collision of the head with the adjacent object.
  For the corresponding tip lengths and the clearance between the tips and the worktable refer to cross references above.

6.4.5.6 Pick and Place Arm

Positions of Tubes

If your instrument is equipped with a PnP arm, pay attention to the following:

- When you define processes with the application software, you should check whether tubes transported with the PnP arm always arrive at the expected destination. A tube might be placed in a wrong tube rack position if (e.g. due to a collision with another object) it is not held correctly between the grippers of the PnP.
- It is recommended that you always use the PosID functions to verify the correct position of a transported tube.
- Create a worktable layout that minimizes the risk of collision and contamination, e.g. avoid movements of tubes over critical sections, such as sample sections, etc.
- Do not exceed the recommended fill levels for cavities.

6.4.5.7 Robotic Manipulator Arm

If your instrument is equipped with a RoMa arm, pay attention to the following:

- Create a worktable layout that minimizes the risk of collision and contamination, e.g. avoid movements of microplates over critical sections, such as sample sections, etc.
- Do not exceed the recommended fill levels for cavities.

6.4.6 Maintenance

Make sure that your instrument and devices are in a faultless state. Regular maintenance guarantees the high accuracy and precision you require and at the same time minimizes downtime of instrument and devices. For detailed descriptions of the maintenance tasks, refer to 7 “Preventive Maintenance and Repairs”, 2 7-1 in this Operating Manual.

7 Preventive Maintenance and Repairs

Purpose of This Chapter

This chapter gives instructions on all maintenance work to be performed in order to keep the Freedom EVO in good working condition.

In addition to this, adjustment and repair jobs the operator can carry out by himself/herself are explained.

Principle

Only operate the Freedom EVO when it is in good working condition. Strictly observe the maintenance instructions as set out in this manual. To achieve specified performance and reliability of the instrument, regularly carry out the maintenance and cleaning tasks.

In case of any problems and for inquiries contact the local service organization.

Additional Documents

In the **Freedom EVO Daily/Weekly Maintenance Checklist**, the maintenance work that has been carried out can be recorded to be kept in the **Freedom EVO Maintenance and Service Logbook**.

7.1 Tools and Consumables

7.1.1 Cleaning Agents

WARNING

Working with cleaning agents may be hazardous.

- Always observe the safety measures given by the manufacturer.

WARNING

Fire hazard.

- Do not use flammable liquids without supervision by the operator.
- Take measures to prevent electrostatic discharge.

ATTENTION

Strong detergents can dissolve carrier and worktable surface coatings.

- For cleaning the instrument, use alcohol or water as cleaning agents.

Commercially Available Cleaning Agents

Tab. 7-1 Commercially available cleaning agents

Agent	Description	Manufacturer	Part No.
Contrad 70[a]	Surface active cleaning agent	Decon Labs Inc., USA www.deconlabs.com	Please contact the manufacturer
Contrad 90[a] Contrad 2000[a]	Surface active cleaning agent	Decon Laboratories Limited, UK www.decon.co.uk	Please contact the manufacturer
Decon 90[a]	Surface active cleaning agent	Decon Laboratories Limited, UK www.decon.co.uk	Please contact the manufacturer
Bacillol Plus	Alcoholic, disinfection agent, free of formaldehyde, for surface cleaning	Bode Chemie, Hamburg www.bode-chemie.de	Please contact the manufacturer
DNAzap	Cleaning agent for surfaces contaminated with nucleic acids	Ambion www.ambion.com	Please contact the manufacturer
SporGon	Disinfectant	Decon Laboratories www.deconlabs.com	Please contact the manufacturer
Liqui-Nox	Weak detergent	Alconox www.alconox.com	Please contact the manufacturer

a) These are identical products; are hereafter called Decon / Contrad

Cleaning Agents Specifications

Tab. 7-2 Cleaning agents specifications

Agent	Specification
Water	Distilled or deionized water
Alcohol	70% ethanol or 100% isopropanol (2-Propanol)
Decon / Contrad	Liquid concentrate, for dilution with water (normally 2%, 5% in case of severe contamination)
Weak detergent	e.g., Liqui-Nox
Disinfectant	e.g., Bacillol plus, SporGon
Surface disinfectant	All disinfectants except: Lysetol FF, SporGon
Base	e.g., 0.025–0.25 mol/l NaOH
Bleach	0.5% to 3% sodium hypochlorite

Instrument Parts and Cleaning Agents

Tab. 7-3 Cleaning agents application

Instrument part	Cleaning agent
Liquid system, including waste system	Water, alcohol, weak detergent, base Suitable for flushing are: Bleach, Decon / Contrad, Terralin protect
DiTi waste slide	Water, alcohol, weak detergent, disinfectant, base, bleach
Worktable	Water, alcohol, weak detergent, disinfectant, base, bleach
Housing	Water, alcohol, surface disinfectant
Metal parts	Water, alcohol, disinfectant
Carriers	Water, alcohol, weak detergent, disinfectant **Use**: Decon / Contrad for surface cleaning only **Do not use**: Decon / Contrad, Bleach, SporGon as cleaning bath for carriers (damage to aluminum)
Racks	Water, alcohol, weak detergent, disinfectant
Gripper	Water, alcohol, weak detergent, disinfectant
Tips	Water, alcohol, weak detergent, disinfectant, base
DiTi Adapter (MCA384)	Alcohol
Fixed Tip Adapter (MCA384)	Alcohol
Safety panels	Water, alcohol, disinfectant, suitable for acrylic glass
Disposable tip cones	Alcohol
DiTi cones MultiSense	Alcohol. Dry thoroughly after cleaning
DiTi kit MultiSense	Alcohol. Dry thoroughly after cleaning

Tab. 7-3 Cleaning agents application (cont.)

Instrument part	Cleaning agent
PosID scanner head laser beam output window	Alcohol
Arm guide, arm guide roller of arms	Do not use any agent
Z-rod	Do not use any agent
Te-PS sensor plate	Alcohol
Te-Link	Water, alcohol, disinfectant
Centrifuge rotor and hangers	Alcohol. Dry thoroughly after cleaning.

Refer to section 3.7.2 “Resistance of Special Materials”, 2 3-86.

***Note:** After use of weak detergents, base or bleach, thoroughly clean with water and wipe dry to totally remove the cleaning agent and obtain normal operating conditions.*

Cleaning

Cleaning Tissue

Use a lint-free tissue together with the appropriate cleaning agent.

7.1.2 Lubricants

Instrument Parts and Lubricants

Tab. 7-4 Lubricants

Instrument part	Lubricants
Centrifuge hangers	Hettich grease no. 4051

Refer to section **3.7.2 “Resistance of Special Materials”, 2 3-86**.

7.1.3 For MultiSense Option Maintenance

Tools for MultiSense Tip Adapter

The following tools must be available for maintenance on the MultiSense tip adapter:
Refer to section 11.4 “Tools, Gauges”, 2 11-2.

Tab. 7-5 Tools for MultiSense tip adapter

Tool	Application
DiTi cone wrench	Tightening the DiTi cone
X-Ring mounting tool	Mounting the X-Ring (sealing)
Tube adjusting tool	Adjustment of the tube (protruding the DiTi cone by 2 mm)
Tube cutter	Cutting the tube in a right angle

7.1.4 For Air LiHa Maintenance

Material Needed for Maintenance

To perform the maintenance on the Air LiHa, the following tools and consumables must be available:

- Special tools and consumables
  - Inline Filter kit Air LiHa (incl. filter removal tool)
  - DiTi cone wrench
  - Air LiHa tip adapter adjustment gauge (optional)

7.1.5 For MCA96 Maintenance

Material Needed for Maintenance

To perform the maintenance on the Multichannel Arm MCA96, the following tools and consumables must be available:

- Special tools and devices
  - Absorption reader, e.g. Tecan Sunrise
  - Reference block
  - Fixed tip maintenance tool (in case of clogged tips)
- Agents
  - Color solution

7.1.6 For MCA384 Maintenance

Material Needed for Maintenance

To perform the maintenance on the Multichannel Arm MCA384, the following tools and consumables must be available:

- Special tools and devices
  - Absorption reader, e.g. Tecan Infinite
  - MCA384 Reference pins
- Agents
  - Color solution

7.1.7 For MCA384 Gripper Maintenance

Material Needed for Maintenance

To perform the maintenance on the MCA384 Gripper, the following tool must be available:

– Reference plate RoMa-3 (for plate move test)

7.2 Maintenance Schedule

Note: *To ensure a good working condition of the instrument a half-yearly or yearly (depending on configuration) maintenance carried out by a Tecan authorized field service engineer (FSE) is recommended.*

Maintenance Record

Note: *In order to be able to track all maintenance performed on the Freedom EVO over the whole lifetime, the periodic maintenance must be recorded as follows:*

- *Fill in the necessary data in the form "Freedom EVO Daily/Weekly Maintenance Checklist".*
- *File the form in the "Freedom EVO Maintenance and Service Logbook".*

Maintenance Tables

The maintenance tables are divided according to the frequency the corresponding maintenance task must be periodically performed. For example, there are tables for:

- Daily maintenance
- Weekly maintenance
- Half-yearly maintenance

Example and Explanations

Example for a maintenance table, followed by explanations:

Tab. 7-6 *Example (e.g. daily maintenance)*

Instrument/Component	Maintenance Task	Reference
Part A	Clean thoroughly	Water with weak detergent
Part B	Check adjustment of component C	Refer to section X.X.X, 🗎 Y-Z

- Instrument/Component
  - Specifies the instrument or one of its individual components on which a maintenance task must be performed.
- Maintenance Task
  - States briefly what maintenance must be performed on the instrument/ component mentioned before.
- Reference
  - Gives additional information, e.g. on means, tools, etc. that are necessary to perform the maintenance task mentioned before.
  - Contains references to the sections in this manual or to other documents where the corresponding instructions can be found.

General Guideline

Note: *The daily and weekly maintenance schedule described here is a general guideline. The schedule and the cleaning agents may have to be adapted to your special laboratory conditions and depending on your application.*

7.2.1 Maintenance: Immediate Maintenance

If the instrument is leaking, switch it off immediately and eliminate the source of leakage. Refer also to section7.3.1.1 "Checking for Leaks", 2 7-19.

7.2.2 Maintenance Table: Daily Maintenance

At Beginning of Day

Tab. 7-7 Daily maintenance in chronological order

Instrument/ Component	Maintenance Task	Reference
Liquid system	Check for leakage	See section 7.3.1.1 “Checking for Leaks”, 2 7-19
	Check the tubing connections and tighten, if necessary	See figure in 7.3.1 “Liquid System”, 2 7-19
Diluters and Syringes	Check syringes and plunger lock screws and tighten, if necessary	See section 7.6.4 “Diluter”, 2 7-100
Tips	Clean	See section 7.3.3 “Fixed Tips of LiHa”, 2 7-23
	Check for damage	See section 7.3.3 “Fixed Tips of LiHa”, 2 7-23
DiTi cones (LiHa)	Clean	See section 7.3.5.1 “Disposable Tip Cone (DiTi cone) LiHa”, 2 7-33
	Check for deposits	Visually
	Tighten	See section 7.3.5.1 “Disposable Tip Cone (DiTi cone) LiHa”, 2 7-33
	Adjustment check	See section 7.3.16 “Te-PS Carrier”, 2 7-57
LiHa with MultiSense option	Clean and inspect DiTi cones	See section 7.3.18.1 “DiTi Cone, MultiSense Tip Adapter”, 2 7-62
	Check pipetting tube for cleanliness and correct tube end	See section 7.3.18.1 “DiTi Cone, MultiSense Tip Adapter”, 2 7-62
Air displacement pipetting arm (Air LiHa)	Clean and inspect DiTi cones	See section 7.3.5.2 “Disposable Tip Cone (DiTi cone) Air LiHa”, 2 7-36
System liquid container	Make sure that it is full	-
Waste container	Make sure that it is empty	-
Plate Washer	Flush with distilled or deionized water	Refer to Washer Manual
Liquid system	Flush	See section 7.3.1.2 “Flushing the Liquid System”, 2 7-20
	Check for air bubbles	See section 7.3.1.2 “Flushing the Liquid System”, 2 7-20

Tab. 7-7 Daily maintenance in chronological order (cont.)

Instrument/ Component	Maintenance Task	Reference
MCA96 fixed tip block	Check the coating of the tips	See section 7.3.18.4 “Checking the Coating of the Tips (MCA96)”, 2 7-67
	Check the tip cone seals	See section 7.3.18.5 “Checking the Tip Cone Seals (MCA96 Head)”, 2 7-67
MCA384 head	Check the gaskets	See section 7.3.18.6 “Checking the Gaskets (MCA384 Head)”, 2 7-69
MCA96 / MCA384 wash system	Before the first run: Prime the wash block	See section 7.3.18.3 “Exchange Steel Needle (MCA96)”, 2 7-65
RoMa	Visually check grippers for deformities and damage	Call Tecan customer service if they are not in order
PnP	Visually check grippers for deformities and damage	Call Tecan customer service if they are not in order

During Day

Tab. 7-8 Daily maintenance during the day

Instrument/ Component	Maintenance Task	Reference
Liquid system	Flush prior to each application run	See section 7.3.1.2 “Flushing the Liquid System”, 2 7-20
DiTi waste bag	Check and change when it is full	See section 7.3.6 “DiTi Waste Bag”, 2 7-41
DiTi waste and wash station unit	Clean DiTi waste slide	See section 7.3.8.1 “Cleaning the DiTi Waste Slide”, 2 7-46
Nested DiTi waste Option	Clean Nested DiTi waste slide if necessary	See section 7.3.9 “Waste Option for Nested DiTi”, 2 7-50

At End of Day

Tab. 7-9 Daily maintenance at end of day in chronological order

Instrument/ Component	Maintenance Task	Reference
Tips	Clean inside and outside	See section 7.3.3 “Fixed Tips of LiHa”, 2 7-23
	Clean standard tips	Caustic soda solution (1% NaOH)
	Check all tubing, tubing connections, syringes and DiTis for leakages	See section 7.3.1.1 “Checking for Leaks”, 2 7-19

Tab. 7-9 Daily maintenance at end of day in chronological order (cont.)

Instrument/ Component	Maintenance Task	Reference
LiHa with MultiSense option	Clean and inspect DiTi cones	See section 7.3.18.1 “DiTi Cone, MultiSense Tip Adapter”, 2 7-62
	Check pipetting tube for cleanliness and correct tube end	See section 7.3.18.1 “DiTi Cone, MultiSense Tip Adapter”, 2 7-62
Air displacement pipetting arm (Air LiHa)	Clean and inspect DiTi cones	See section 7.3.5.2 “Disposable Tip Cone (DiTi cone) Air LiHa”, 2 7-36
Carriers and racks	Clean using a detergent or antiseptic solution	See section 7.3.16 “Te-PS Carrier”, 2 7-57
Worktable	Clean	See section 7.3.10 “Worktable”, 2 7-51
Safety panel	Clean	See section 7.3.11 “Safety Panels”, 2 7-51
Wash station	Clean using a detergent or antiseptic solution	See section 7.3.7 “Wash Station”, 2 7-43
DiTi waste bag	Change	See section 7.3.6 “DiTi Waste Bag”, 2 7-41
DiTi waste and wash station unit	Clean	See section 7.3.8.2 “Cleaning the Complete DiTi Waste and Wash Station Unit”, 2 7-48
Nested DiTi waste Option	Clean Nested DiTi waste slide	See section 7.3.9 “Waste Option for Nested DiTi”, 2 7-50
Lower DiTi eject option	Clean rocker	See section 7.3.13 “Lower DiTi Eject Option”, 2 7-53
System liquid container	Rinse with water and fill up	
Waste container	Clean using a detergent or antiseptic solution	See section 7.3.12 “Liquid Containers”, 2 7-52
Waste tubing	Clean using a detergent or antiseptic solution	
MCA96	Park, clean and cover the fixed tip block Check, if the parked fixed tip block is covered	See section 7.3.18.7 “Parking, Cleaning and Covering the Fixed Tip Block (MCA96)”, 2 7-70

Tab. 7-9 *Daily maintenance at end of day in chronological order (cont.)*

Instrument/ Component	**Maintenance Task**	**Reference**
MCA384	Clean the fixed tip adapter	See section 7.3.18.8 “Parking and Cleaning the Fixed Tip Adapter (MCA384)”, 2 7-71
	Before shutting down: Clean and wash the fixed tip block or fixed tip adapter	See section 7.3.18.10 “Washing the Fixed Tip Block (MCA96) or Fixed Tip Adapter (MCA384)”, 2 7-73
	Before shutting down: Wash and empty the wash block	See section 7.3.18.9 “Washing and Emptying the Wash Block”, 2 7-72
RoMa standard, RoMa long, PnP arm, MCA96 gripper, MCA384 Gripper	Clean gripper fingers using alcohol or acetone	–
Plate washer	Leave filled with deionized water overnight	–
Liquid system	Check for leakages after every 8 hours of operation	See section 7.3.1.1 “Checking for Leaks”, 2 7-19
	If liquids other than water are used as system liquid, flush with deionized water	See section 7.3.1.2 “Flushing the Liquid System”, 2 7-20

7.2.3 Maintenance Table: Weekly Maintenance

Weekly Maintenance

Tab. 7-10 *Weekly maintenance*

Instrument/Component	**Maintenance Task**	**Reference**
Liquid system	Clean	See section 7.3.1.3 “Cleaning the Liquid System”, 2 7-21
System liquid container	Empty and clean	See section 7.3.12 “Liquid Containers”, 2 7-52
Waste container	Empty and clean	See section 7.3.12 “Liquid Containers”, 2 7-52
LICOS tubes	Clean	
Liquid handling arm, Robotic manipulator arm, Pick and place arm, Multichannel arm	Clean front arm guide	See section 7.3.21 “Arm Guide”, 2 7-79

Tab. 7-10 Weekly maintenance

Instrument/Component	Maintenance Task	Reference
Air displacement pipetting arm (Air LiHa)	Perform the following tests: • Inline Filter Test • Self diagnositc test (leakage test)	The tests are performed by means of Freedom EVOware. Refer to the “Freedom EVOware Software Manual”.
MCA96 pipetting head/ DiTis	Perform leakage test with DiTis	See section 7.4.2.2 “Leakage Tests with DiTis or Fixed Tips”, 2 7-83
MCA96 pipetting head / fixed tip block	Perform leakage test with fixed tip block	See section7.4.2.2 “Leakage Tests with DiTis or Fixed Tips”, 2 7-83
MCA96 / MCA384 wash system	Empty and clean the wash liquid containers	See section 7.3.18.12 “Emptying and Cleaning the Wash Liquid Containers”, 2 7-74
	Check the filter of the wash system	See section 7.3.18.11 “Checking the Filter of the Wash System”, 2 7-74
	Check the carrier positions (MCA96)	See section 7.3.18.14 “Checking the Carrier Positions (Offsets)”, 2 7-75
MCA384 pipetting head / DiTis	Perform leakage test with DiTis	See section 7.4.2.2 “Leakage Tests with DiTis or Fixed Tips”, 2 7-83
MCA384 pipetting head / fixed tip adapter	Perform leakage test with fixed tip adapter	See section7.4.2.2 “Leakage Tests with DiTis or Fixed Tips”, 2 7-83
MCA384 pipetting head	Check if the pipetting head is fastened properly.	If the head is loose call the local Tecan service organization
MCA384 adapters	Clean	Check for any dirt in the channels and thoroughly remove it. Degrease the MCA384 adapters with isopropanol and carefully blow/dry with compressed air.
PosID	Clean laser output window and “No Tube” sensor	See section 7.3.19 “Positive Identification (PosID)”, 2 7-76
	Clean PosID working area of the worktable (abrasion)	Lint-free cloth and alcohol

Tab. 7-10 *Weekly maintenance*

Instrument/Component	**Maintenance Task**	**Reference**
Microplate Washer	Flush all channels with distilled or deionized water	See washer manual
	if necessary, clean washer head with an ultra sonic bath	See washer manual
Centrifuge	Clean rotor and hangers with alcohol	See section 7.3.20 “Centrifuge”, 2 7-78
	Lubricate hangers with Hettich 4051	See section 7.3.20 “Centrifuge”, 2 7-78

Note: *The weekly maintenance should be performed on the last working day of each week.*

7.2.4 Maintenance Table: Fortnightly Maintenance

Every Two Weeks

Tab. 7-11 *Fortnightly maintenance*

Instrument/Component	**Maintenance Task**	**Reference**
MCA96	Run a performance qualification test, e.g. a “Color Precision Test”	See section 7.4.2.1 “Color Precision Test”, 2 7-81 Also refer to the “Freedom EVOware Software Manual”
MCA384	Run a performance qualification test, e.g. a “Color Precision Test”	See section 7.4.2.1 “Color Precision Test”, 2 7-81 Also refer to the “Freedom EVOware Software Manual”
MCA96 with DiTis	Perform “Get and Drop Tip Block Functional Test” with DiTis	Refer to the “Instrument Software Manual”
MCA96 with fixed tip block	Perform “Get and Drop Tip Block Functional Test” with fixed tip block	Refer to the “Instrument Software Manual”

7.2.5 Maintenance Table: Half-Yearly Maintenance

Every Six Months

Tab. 7-12 Half-yearly maintenance

Instrument/Component	Maintenance Task	Reference
MCA96 wash system	Replace the filter of the wash system	See section 7.6.3.2 “Replacing the Wash System Filter”, 2 7-95
	Check tubing of the wash system	See section 7.3.18.13 “Checking the Tubing of the Wash System”, 2 7-74
MCA384 wash system	Replace the filter of the wash system	See section 7.6.3.2 “Replacing the Wash System Filter”, 2 7-95
	Check tubing of the wash system	See section 7.3.18.13 “Checking the Tubing of the Wash System”, 2 7-74
MultiSense / pipetting tubing	Cut low volume tubing to remove tubing section worn out by x-ring	Call Tecan customer support to perform the task.
MultiSense / tip adapter	Replace DiTi Kit MultiSense	See section 7.6.2.1 “DiTi Kit MultiSense”, 2 7-87

7.2.6 Maintenance Table: Yearly Maintenance

Every twelve Months

Tab. 7-13 Yearly maintenance

Instrument/Component	Maintenance Task	Reference
LiHa and/or MCA	Liquid handling performance verification testing with QC Kit (optional)	See section 7.4.1 “Liquid Handling Performance Verification Testing”, 2 7-80
Air displacement pipetting arm (Air LiHa)	Perform liquid handling performance verification test (gravimetric test)	See section 7.4.1 “Liquid Handling Performance Verification Testing”, 2 7-80
Complete Freedom EVO	Clean system	Call Tecan customer support to perform the task.
Frontal arm guide	Clean	Call Tecan customer support to perform the task.
Worktable	Visually inspect worktable grids for wear and replace if necessary.	Call Tecan customer support to perform the task.

Tab. 7-13 Yearly maintenance

Instrument/Component	Maintenance Task	Reference
LiHa	Visually inspect moving parts, especially Y-belt and lower DiTi eject option, for wear and replace faulty parts. Check parts for abrasion; wipe wear debris off, if necessary.	Call Tecan customer support to perform the task.
LiHa; support tubing	Check condition of mesh (must not be broken). Check if support tubing ends lock firmly in their seats. Replace defective support tubing.	Call Tecan customer support to perform the task.
DiTi cone and tubing extension	Replace	Call Tecan customer support to perform the task.
Air LiHa; DiTi cone tip adapter	Replace option DiTi cone Air LiHa	Refer to the “Freedom EVO Operating Manual”
MCA96 / MCA384	Visually inspect moving parts, especially Y-belt, for wear and replace faulty parts. Check parts for abrasion; wipe wear debris off, if necessary.	Call Tecan customer support to perform the task.
MCA384	Clean and grease s-motor spindle	Call Tecan customer support to perform the task.
MCA384; p-drive	Check the toothed belt of the p-drive.	Call Tecan customer support to perform the task.
MCA96; p-drive	Check the toothed belt of the p-drive.	Call Tecan customer support to perform the task.
MCA96 / MCA384; wash system	Replace the external tubing.	Call Tecan customer support to perform the task.
	Remove the wash unit and check for internal corrosion and leakage.	Call Tecan customer support to perform the task.
MCA96; gripper	Clean and lubricate gripper spindle	Call Tecan customer support to perform the task.
CGM (MCA384 Gripper)	Visually inspect moving parts, especially Y-belt, for wear and replace faulty parts. Check parts for abrasion; wipe wear debris off, if necessary. Clean Z-spindle and guide shafts.	Call Tecan customer support to perform the task.
RoMa	Visually inspect moving parts, especially Y-belt, for wear and replace faulty parts. Check parts for abrasion; wipe wear debris off, if necessary.	Call Tecan customer support to perform the task.

Tab. 7-13 *Yearly maintenance*

Instrument/Component	Maintenance Task	Reference
RoMa; Z-rod	Clean	Call Tecan customer support to perform the task.
PnP	Visually inspect moving parts, especially Y and Z-belts, for wear and replace faulty parts. Check parts for abrasion; wipe wear debris off, if necessary.	Call Tecan customer support to perform the task.
Liquid system, diluters	Replace syringe	Call Tecan customer support to perform the task.
Liquid system, diluters	Replace 3-way valve	Call Tecan customer support to perform the task.
LiHa	Replace fixed tips	Refer to the “Freedom EVO Operating Manual”
MultiSense option	Replace tip adapter	Call Tecan customer support to perform the task.
Liquid system	Replace aspirating tubing	Call Tecan customer support to perform the task.
Liquid system	Replace interconnecting tubing	Call Tecan customer support to perform the task.
Liquid system	Replace pipetting tubing	Call Tecan customer support to perform the task.
Liquid system	Check and replace waste tubing, if necessary.	Call Tecan customer support to perform the task.
Te-Fill option	Replace complete tubing	Call Tecan customer support to perform the task.
LiHa/Air LiHa; Z-rod	Clean and apply very thin layer of grease	Call Tecan customer support to perform the task.
X-rail	Clean and apply thin layer of grease	Call Tecan customer support to perform the task.
Loading Interface	Check correct function • LED-Test • Sensor Test	Call Tecan customer support to perform the task.
MCA96; pipetting head	Replace the tip cone seals	Call Tecan customer support to perform the task.
	Lubricate the plungers and spindles	Call Tecan customer support to perform the task.
MCA384; pipetting head	Check the gaskets and blunt tubes and replace if necessary	Refer to the “Freedom EVO Operating Manual”
MCA96 / MCA384; wash system	Remove the wash unit and replace internal tubing.	Call Tecan customer support to perform the task.

Tab. 7-13 *Yearly maintenance*

Instrument/Component	Maintenance Task	Reference
Centrifuge	Perform the imbalance test	Call Tecan customer support to perform the task.
Centrifuge	Carry out the speed calibration	Call Tecan customer support to perform the task.
Centrifuge	Carry out the temperature calibration	Call Tecan customer support to perform the task.
Complete Freedom EVO	Perform tests according to form “Preventive Maintenance”	Call Tecan customer support to perform the task.

Note: *Depending on your system configuration there are other parts not described in this chapter, which have to be exchanged during regular service maintenance procedures. Please contact your local service organization, for further information on maintenance tasks and schedule of your system.*

7.2.7 Maintenance Table: Two-Yearly Maintenance

Every Two Years

Tab. 7-14 *Two-yearly maintenance*

Instrument/Component	Maintenance Task	Reference
Air LiHa tip adapter	Replace tip adapter Air LiHa.	Call Tecan customer support to perform the task.
Air LiHa Cylinder Assembly	Replace Cylinder Assembly	Call Tecan customer support to perform the task.
Liquid LiHa	Replace tip adapter on Li-LiHa used with disposable tips	Call Tecan customer support to perform the task.
LiHa / liquid detection	Replace ILID cables	Call Tecan customer support to perform the task.
MultiSense option	Replace pressure sensor cables	Call Tecan customer support to perform the task.

7.2.8 Maintenance Table: Three-Yearly Maintenance

Every Three Years

Tab. 7-15 *Three-yearly maintenance*

Instrument/Component	Maintenance Task	Reference
EVO front safety panel	Replace the gas spring; front safety panel closed and adjustable on EVO 200 must have 75N gas spring, all other front safety panels have 50N gas spring	Call Tecan customer support to perform the task.
MCA96 / pipetting head	Replace the pipetting head	Call Tecan customer support to perform the task.
Te-Fill option	Replace bidirectional pump	Call Tecan customer support to perform the task.
Centrifuge Rotanta; Rubber-metal bearings	Check for cracks; replace, if necessary	Call Tecan customer support to perform the task.

7.2.9 Maintenance Table: Special Intervals depending on Plunger Movements

1 Mio. Plunger Movements

Tab. 7-16 *1 mio. plunger movement maintenance*

Instrument/Component	Maintenance Task	Reference
MCA384 / pipetting head	Replace the pipetting head	Call Tecan customer support to perform the task.

7.3 Maintenance Tasks

WARNING

Automatically moving parts.
Injuries (crushing, piercing) possible if the safety panels are not in place.

- Always switch off the instrument for maintenance tasks or to clean the instrument surfaces, e.g. worktable, instrument panels etc.
- Never clean the instrument while it is switched on.

7.3.1 Liquid System

7.3.1.1 Checking for Leaks

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Chemical resistance of the tubing material	See section 3.4.3 “System Liquid Requirements”, 2 3-31
Flushing the liquid system	See section 7.3.1.2 “Flushing the Liquid System”, 2 7-20
Lock nut tightening	See section 7.3.3 “Fixed Tips of LiHa”, 2 7-23
DiTi cone tightening	See section 7.3.5 “Disposable Tip (DiTi) of LiHa / Air LiHa”, 2 7-32
Syringe and plunger lock screw tightening	See section 7.3.2 “Syringe”, 2 7-22

The liquid system is leaking

- if liquid droplets are hanging on the fixed tips or DiTi cones before the instrument is switched on or when it is in stand-by mode.
- if the syringes are leaking, e.g. liquid accumulates around the diluters before the instrument is switched on or when it is in stand-by mode.
- if there are drops on the worktable.

Leakages in the liquid system can also be caused by an empty liquid system or by aggressive liquids. When using aggressive liquids, take into account the chemical resistance of the tubing material.
Refer to cross references above.

Instructions

If the system is leaky, do the following:

1. Make sure that the system liquid container is full.
2. Tighten the lock nut and the DiTi cones.
   Refer to cross references above.
3. Tighten syringe and plunger lock screw.
   Refer to cross references above.
4. Flush the liquid system until all air is removed.
   Refer to cross references above.
5. Observe the tips or DiTi cones for 1 minute.
   If no droplets are formed, the liquid system is tight.
6. If the system is still leaky, remove the top cover of the instrument by loosening the two outer screws.
7. Tighten the tubing connections (A) according to the figure:

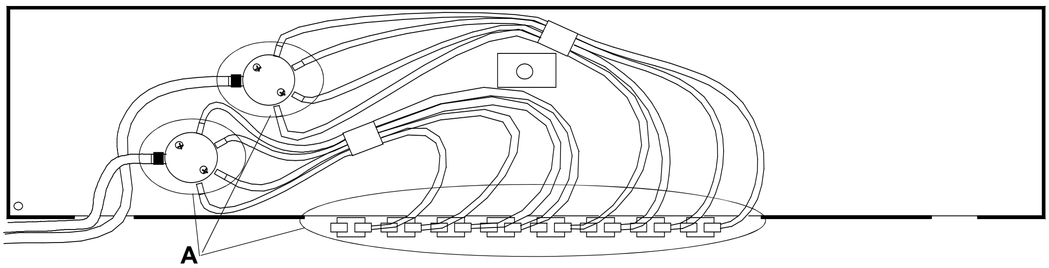


Fig. 7-1 *Tubing connections (top view of instrument)*

8. Flush the liquid system.
   Refer to cross references above.
9. Observe the tips or DiTi cones for 1 minute.
   If no droplets are formed, the liquid system is tight.
10. If the system is still leaky, call your local Tecan service organization.

ATTENTION

A leaking liquid system causes pipetting inaccuracy and cross-contamination.

- Never operate the Freedom EVO if the liquid system is leaking.

7.3.1.2 Flushing the Liquid System

When to Flush

If the liquid system has been stationary overnight, outgassing results in air bubbles present in the liquid system. Even during a run air bubbles may remain in the liquid system. Therefore, flushing the liquid system is recommended before each application run, with the following volumes:

- During start-up or after more than 2 hours in standby mode
  – 50 ml using the FWO/SPO/MPO
  – 5 ml using the diluter
- Before starting a new application run
  – 20 ml using the FWO/SPO/MPO
  – 2 ml using the diluter

Flush Procedure

To flush the liquid system:

1. Make sure that the system liquid container is full.
2. Switch on the instrument and start the application software.
3. Flush the liquid system with the following settings:
   – Volume: As recommended above
   – Speed: 495 µl/sec.
   – Use FaWa (FWO/SPO/MPO) if available
4. Click **Execute**.

   The liquid system is flushed.
5. During flushing, carefully observe the tubing. If necessary, gently move the tubing to make sure all air bubbles are removed.
6. If there are still air bubbles in the tubing, repeat steps 3 - 5.

ATTENTION

Air bubbles in the liquid system cause pipetting inaccuracy.

- Never operate the Freedom EVO with air bubbles in the liquid system.

7.3.1.3 Cleaning the Liquid System

Cleaning the Liquid System

To prevent growth of micro-organisms in the liquid system, we recommend cleaning the liquid system once a week. Depending on your application you can fill the system with one of the following agents (water is used as system liquid):

- Mild detergent
- Weak acid and base in sequence
- Disinfectant

Note: *If a system liquid other than de-ionized water is used, clarify the suitability of the cleaning agents with the manufacturer.*

To fill the liquid system and allow the agent to react, proceed as follows:

1. Place the tubing in a bottle with the cleaning agent and flush the liquid system twice.
   Refer to cross references above.
2. Allow the cleaning agent to react for at least 10 minutes.
3. Place the tubing in a bottle with distilled or de-ionized water and flush the liquid system twice.
   Refer to cross references above.
4. Flush the liquid system eight times with system liquid.
   Refer to cross references above.

7.3.2 Syringe

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Replace syringe	See section 7.6.4.1 “Replacing the Syringe”, 2 7-100
Replace syringe cap	See section 7.6.4.2 “Replacing the Syringe Cap”, 2 7-101

By the continuous up and down movements of the syringes during operation, the syringe and plunger lock screws might get loose if these elements were not tightened properly. This may result in leakage of the liquid system.

To avoid this problem, proceed as follows:

Tightening Syringe and Plunger Lock Screws

1 Manually tighten the plunger lock screw and the syringe screw before switching the Freedom EVO on.

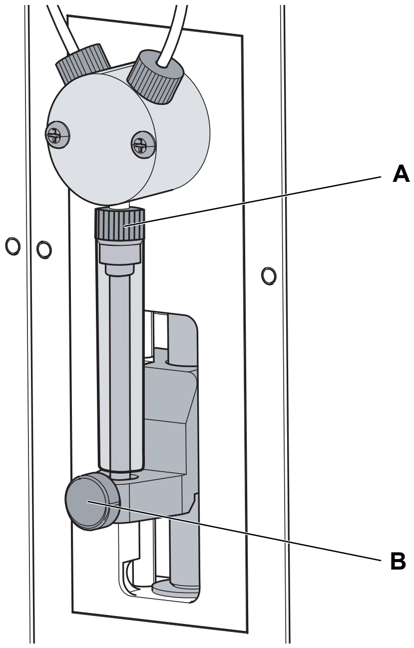


Fig. 7-2 Syringe and valve

A	*Syringe screw*	***B***	*Plunger lock screw*

2 If leakages still occur, replace the syringe or the syringe cap. Refer to cross references above.

7.3.3 Fixed Tips of LiHa

ATTENTION

Electrostatic discharge can damage the liquid detector.

- Discharge yourself electrically through contact with an earthed object before touching the tips.

WARNING

Pipetting tubing and tips can be contaminated.

- Decontaminate the instrument and assure appropriate safety measures.

WARNING

Pipetting tips can cause injuries.

- Avoid contact with the pipetting tips and contact with aerosols when accessing the worktable, by wearing adequate protective clothing.

Cleaning the Fixed Tips

Before switching on the instrument, use a lint free tissue soaked in ethanol (70%) or isopropanol to clean the fixed tips. Make sure not to damage the tip coating.

Checking Fixed Tips for Damage

Visually inspect the tip coating before switching on the instrument. Use a mirror for proper inspection of the tip outlet. Make sure that the tips are not bent. If the tip coating is damaged or the tip is bent, the tip must be replaced (refer to cross references above).

ATTENTION

Bent tips or damaged tip coating cause pipetting inaccuracy and liquid detection errors.

- Never work with damaged or bent tips.

Replacing Fixed Tips

This section covers the principle for exchange procedures for all types of fixed tips, i.e. adjustable and non-adjustable tips.

ATTENTION

Handle tips with extreme care at all times.

- Do not use bent tips or tips with damaged coating. Replace them.
- If a tip is to be reinstalled, do not remove the lock nut from the tip.
- Always hold the tip at its upper end, avoiding contact with the coated surface whenever possible.

Preparation

1 Switch the instrument off.
2 Open the front safety panel.
3 Manually move all Z-rods up to their topmost position.
4 Move all Z-rods together towards the front of the instrument.
5 Spread the Z-rods all the way.

Removal

1 If an adjustable tip is installed on the system, loosen the four tip adjustment screws.

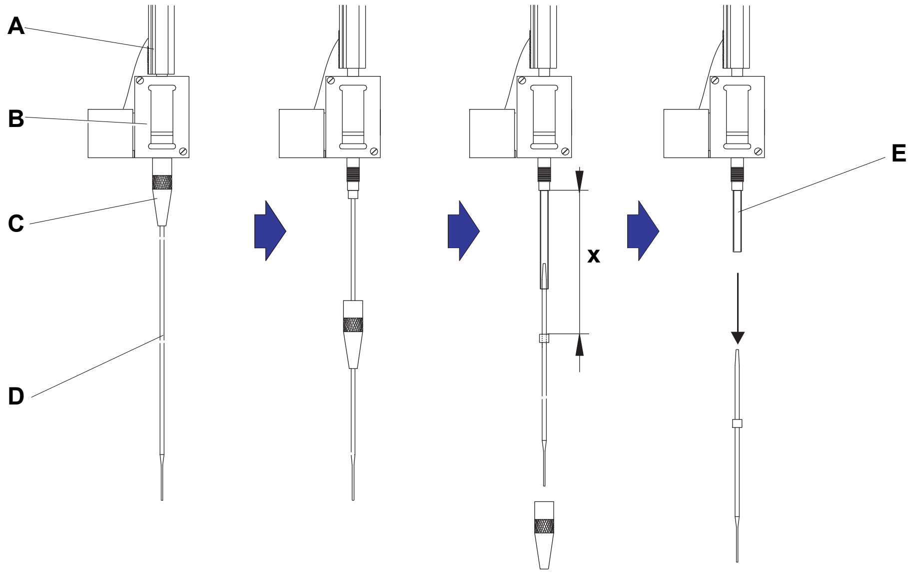


Fig. 7-3 *Standard tip removal*

A	*Z-rod*	***D***	*Tip*
B	*Tip adapter*	***E***	*Pipetting tubing*
C	*Lock nut*		

2 Unscrew lock nut, holding the tip immediately below the lock nut with the other hand.
3 Remove the lock nut by moving it along the tip axis, avoiding contact between the lock nut and the tip coating.
4 If the tip is adjustable, turn the lock nut upside down above a clean surface to remove the O-ring and the washer (FEP). Make sure that both the O-ring and the washer are no longer inside the lock nut.
5 If this channel is equipped with the low volume option, unscrew the flange on top of the solenoid valve, to free the tubing running through the Z-rod.
6 Pull pipetting tubing some distance (x) out of the tip adapter by pulling on the tip.
Hold the tip at its upper end when pulling.
7 Pull the tip off the tubing, withholding the tubing with the other hand.
Use a dry piece of emery cloth for an improved grip on the tubing only.

Installation

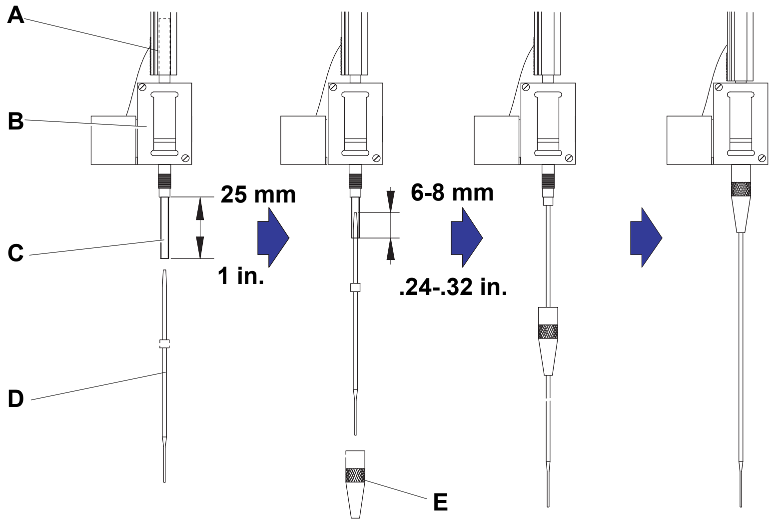


Fig. 7-4 *Standard tip installation*

A	*Z-rod*	***D***	*Tip*
B	*Tip adapter*	***E***	*Lock nut*
C	*Pipetting tubing*		

1 Carefully pull the pipetting tubing approx. 25 mm (1 in.) out of the tip adapter.
If a tip has been installed before, cut off approx. 5 mm (0.2 in.) of the tubing, using a sharp knife to obtain a proper, straight cut.

ATTENTION

Emery cloth on tips must not be used, as it would abrade the delicate tip coating. Use a dry piece of emery cloth for an improved grip on tubing only.
Wet sandpaper could leave tiny particles and thus clog inside tubing and tips.

2 Wrap the tubing near its end with a small piece of emery cloth, to have a better grip of the tubing.
3 Seize the tubing end wrapped in emery cloth.
4 In case of Te-PS tips, use the Te-PS tubing widener to widen the tubing end by pushing the Te-PS tubing widener up to the hilt into the tubing while turning the tool.

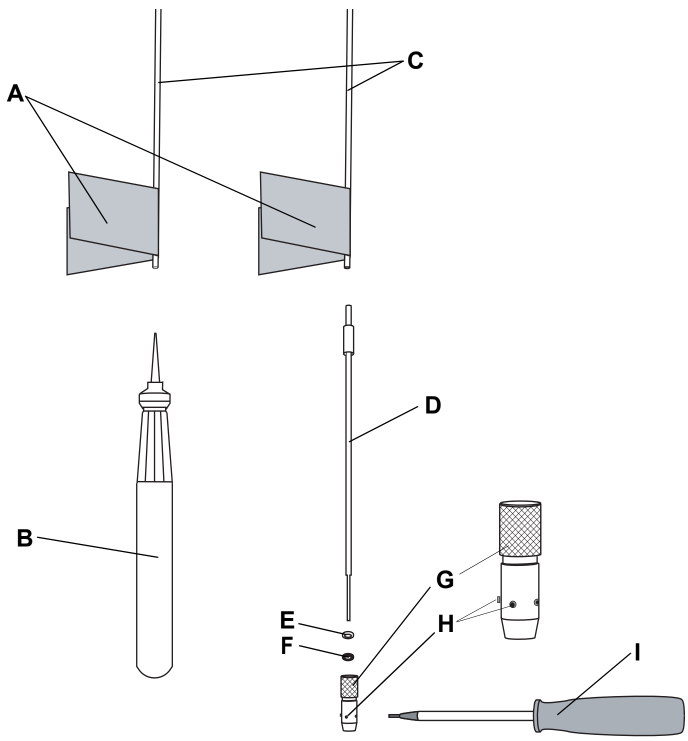


Fig. 7-5 *Te-PS tip installation*

A	*Emery cloth*	***F***	*O-ring, black*
B	*Te-PS tubing widener*	***G***	*Adjustable lock nut*
C	*Tubing*	***H***	*Tip adjustment screw*
D	*Te-PS tip*	***I***	*Allen key for tip adjustment screws*
E	*Washer, white (FEP)*		

5 In case of Te-PS tips, pull the Te-PS tubing widener out of the tubing end.
6 In case of Te-PS tips, while the tubing is still wide, push the Te-PS tip into the tubing end by approx. 4 mm (0.16 in.).

Or For all other fixed tips, push the blank, conical end of the tip by 6 to 8 mm (0.24 to 0.32 in.) into the tubing end.

7 In case of adjustable tips (including Te-PS tips), loosen the four tip adjustment screws sufficiently to obtain enough room for inserting the washer (FEP) and the O-ring. Make sure that there are no washers or O-rings in the lock nut.

ATTENTION

Damage to the tubing or the seals if the tip adjustment screws are not turned back.
Make sure to loosen the tip adjustment screws before sliding the lock nut onto the tip.

8 For adjustable tips, slide on the tip:
- First the white washer (FEP)
- Then the black O-ring, which will sit on the lock nut inner bottom

9 Slide the lock nut on the tip and - in case of adjustable tips - over the washer and the O-ring, avoiding contact with the delicate end of the tip and its coating.

10 Shift the tip and the tubing into the tip adapter.

11 Screw the lock nut on the tip adapter and tighten it. In case of adjustable tips, tighten the lock nut in such a way that its 4 tip adjustment screws are at a 45° angle to the worktable's X/Y coordinate system.

12 In case of adjustable tips, slightly pretighten the four tip adjustment screws.

13 Clean the tip, using isopropanol and a lint-free tissue.

14 In case of adjustable tips, perform the adjustment procedure provided in the Instrument Software to complete the tip installation.

Performance Test

To ensure operating readiness, perform the following performance tests before resuming normal operation:

- Gravimetric or equivalent pipetting performance test to make sure that the precision and accuracy specifications are met.

7.3.4 Te-PS Tips

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Replacing Te-PS tips	See section 7.3.3 “Fixed Tips of LiHa”, 2 7-23

WARNING

Pipetting tips can cause injuries.

- Avoid contact with the pipetting tips and contact with aerosols when accessing the worktable, by wearing adequate protective clothing.

ATTENTION

Te-PS tips are highly sensitive.
The slightest damage resulting from mechanical stress or the use of any incompatible liquids will destroy the Te-PS tip beyond repair.
Observe these instructions at all times to avoid damage:

- Handle tips with extreme care at all times.
- Te-PS tips with a cracked tip must be replaced.
- Do not use saturated solutions, or liquids with undissolved particles.
- Allow only short exposure of the Te-PS tips to strong acids or bases, rinse them thoroughly immediately afterwards, e.g. with water.

Te-PS Tip Maintenance

Instrument Preparation

1. Switch the instrument off.
2. Open the front safety panel.

Cleaning the Te-PS Tips

ATTENTION

Any deposits of pipetted media or a contaminant in the system liquid can influence dispensing and in the worst case can result in clogging of the Te-PS tip.

- Clean the Te-PS tip at the end of each pipetting routine or at least daily.
- Clean the Te-PS tips before storing.
- Use only clean system liquid.

To clean the Te-PS tips:

1 Remove the Te-PS tips.

2 With a single-serving syringe, flush the tips with an appropriate solvent.

Isopropanol for example is suitable in most cases. A second procedure with a weak acid (citric acid) is recommended. Do not use strong detergents, acids and bases.

3 If necessary, flush the system with the tips removed.

4 Reinstall and adjust the tips.

Inspection

1 Visually check the Te-PS tips.

2 If a Te-PS tip is found cracked, it must be replaced.
Refer to cross references above.

3 If a Te-PS tip is found clogged, free it by performing the complete unclogging procedure (refer to "Te-PS Tip Unclogging", 2 7-32).

4 If a Te-PS tip is found wet and/or dirty, clean it (refer to "Cleaning the Te-PS Tips", 2 7-29).

5 When all Te-PS tips are found clean and in proper working condition, continue with the application preparation.

ATTENTION

Bent tips or damaged tip coating cause pipetting inaccuracy and liquid detection errors.

- Never work with damaged or bent tips.

Checking the Te-PS Tip Alignment

WARNING

Contamination risk. The Te-PS tips**,** Te-PS sensor plate and Te-PS carrier can be contaminated by leakage of hazardous liquid.

- Make sure to clean the Te-PS sensor plate before calibration.
- Decontaminate the Te-PS sensor plate after calibration.
- Periodically clean and disinfect the Te-PS sensor plate after use.

ATTENTION

Temperature differences of > 5 °C result in precision decrease critical for 1536 microplates.

- Make sure that the Te-PS tip calibration, Te-PS tip alignment check and instrument use are always carried out under similar climatic conditions (temperature ±5 °C).
- If the variation in ambient temperature exceeds 5 °C during instrument use, recalibration of tips is necessary, to maintain instrument precision.
- If the variation in ambient temperature exceeds 5 °C, regularly check the Te-PS tip alignment by means of the Te-PS sensor plate. To this end, consider positioning the sensor plate permanently on the Te-PS carrier on the worktable, and to run precision checks before each run.

ATTENTION

Performance can be reduced due to bent tips, and the software pauses and displays an error message. The pipetting tips might touch the inner side of the vessel.

- Visually inspect the tips for damage. If necessary, replace the tips.

To check the Te-PS tip alignment:

ATTENTION

Wet and/or dirty tips can cause diffusion of the laser light in the Te-PS sensor plate.

- Visually inspect the tips. If necessary, clean them or proceed according to the procedure in section "Te-PS Tip Adjustment".

1 Start up the Instrument Software, to start the Te-PS tip adjustment procedure. Follow the instructions given in the software.
Refer to the "Instrument Software Manual".

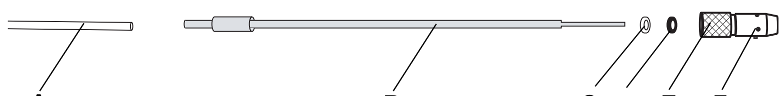


Fig. 7-6 *Te-PS tips, overview*

A	*Tube*	***D***	*O-ring (elastomer, black)*
B	*Te-PS tip*	***E***	*Adjustable Te-PS lock nut*
C	*Washer, white (FEP)*	***F***	*Adjustment screw on Te-PS lock nut*

Te-PS Tip Adjustment

ATTENTION

Wet and/or dirty tips can cause diffusion of the laser light in the Te-PS sensor plate.

- Visually inspect the tips. If necessary, clean them or proceed according to the following procedure.

How to Proceed if There Is Liquid in the Tips

Due to the fact that the tips are moved quickly in Z-direction during procedures accessing the Te-PS sensor plate, droplets can be forced out of the tips if they are filled with liquid. Such droplets lead to wrong measurements of the Te-PS sensor plate.

Preparation in instrument software (Setup & Service):

1 Choose **System Devices\LiHa**. In case of several LiHas, select the arm (C5 or C7).

2 On the dilutor page, enter the position of the wash station, select its type, and move to it (move to button).

3 On the dilutor page, tips can be flushed. Please ensure that the tips are clean afterwards.

4 Choose **Instrument\Command Tool**. Activate tab for **Single Commands**. Enter the Command **CxPVL0,0,0,0,0,0,0,0**, where x = 5 or 7, to switch all eight valves on the dilutors to output.

5 Enter **CxPPA3000,3000,3000,3000,3000,3000,3000,3000** to aspirate air into the tips.

   This procedure fills the tips with air to ensure that no liquid disturbs the measurements on the Te-PS sensor plate.

6 To ease the cleaning of the tips with isopropanol (and tissue, e.g. Kimwipe), the tips can be lifted and their spacing increased on the **Move LiHa** page.

To adjust the Te-PS tips:

1 Start up the Instrument Software, to complete the Te-PS tip installation with the Te-PS tip adjustment procedure. Follow the instructions given in the software.
   Refer to the “Instrument Software Manual”.

Te-PS Tip Unclogging

To unclog a Te-PS tip:

1 Remove the tip from the instrument.
2 With a single-serving syringe, flush the tip, to remove clogs.
3 Reinstall the tip to the instrument.
4 Start up the Instrument Software, to continue the Te-PS tip installation with the Te-PS tip adjustment procedure. Follow the instructions given in the software.
   Refer to the “Instrument Software Manual”.

7.3.5 Disposable Tip (DiTi) of LiHa / Air LiHa

ATTENTION

Possible contamination of samples, or leaking of DiTis.
Prior to loading disposable tip trays into the rack and onto the worktable, make sure that the DiTis are faultless and clean:

- Ensure that only regular and straight Tecan disposable tips are being used.
- Inspect the DiTi box for traces of microbial contamination.

WARNING

Pipetting tips can cause injuries.

- Avoid contact with the pipetting tips and contact with aerosols when accessing the worktable, by wearing adequate protective clothing.

WARNING

Possible contamination. Tips can be contaminated.

- Assure appropriate safety measures (e.g. wear rubber gloves).
- Dispose of used DiTis properly and safely according to your local regulations.

7.3.5.1 Disposable Tip Cone (DiTi cone) LiHa

WARNING

Possible contamination.
The space between the disposable tip cones and the tubing extension can become moistened with sample liquid and thus create a contamination risk.

- Decontaminate the entire equipment thoroughly before maintenance work.
- Decontaminate also the space between disposable tip cones and the tubing extension before manipulating the DiTi pickup mechanism.

ATTENTION

Possible malfunction due to deposits in or on the disposable tip cone.
If the DiTi cones get moistened with sample liquid containing certain substances, a hard coating can build up.

- Eventually the DiTis do not fit any more and pick-up problems or leakages are the result.
- Deposits can clog the tubing extension after a period of time.
- Replace DiTi cones that cannot be cleaned with the means mentioned below.

Cleaning and Inspection

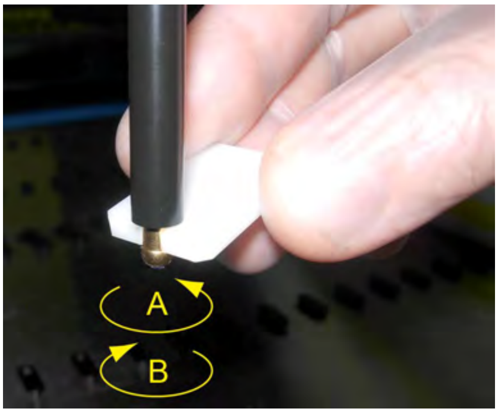
Perform the following maintenance on the DiTi cone:

1 Clean the DiTi cones with a lint-free tissue and isopropanol.

2 Visually check the disposable tip cones and the protruding tip during maintenance. Make sure that the tubing extensions are clean and free of deposits.

3 If deposits are visible, remove DiTi cone and
   – disassemble and thoroughly clean the DiTi adapter.
   – replace critical components every 6 months.

4 Check if the DiTi cones are not loose. If necessary, use the cone wrench to tighten the DiTi cones.



A *Tighten (counterclockwise)*
B *Loosen (clockwise)*

Fig. 7-7 *Cone wrench*

Replacing DiTi Adapter

This section describes the replacement of the DiTi adapters.

Preparation

To prepare for replacement, proceed as follows:

1. Switch the instrument off.
2. Open the front safety panel.
3. Manually move all Z-rods up to their topmost position.
4. Move all Z-rods together towards the front of the instrument.
5. Spread the Z-rods all the way.

Removal

To remove the DiTi adapter, proceed as follows:

1. Hold the tip ejector tube while unscrewing the DiTi cone, using the supplied cone wrench (see Fig. 7-7, 2 7-33).
2. Remove the tip ejector tube.
3. Unscrew the adapter cylinder.
4. Pull the tubing extension and the pipetting tubing approx. 25 mm (1 in.) out of the tip adapter.
5. Separate the tubing extension from the pipetting tubing.
6. Remove the tubing extension together with the adapter cylinder.

Installation

To install the DiTi pickup mechanism, proceed as follows:

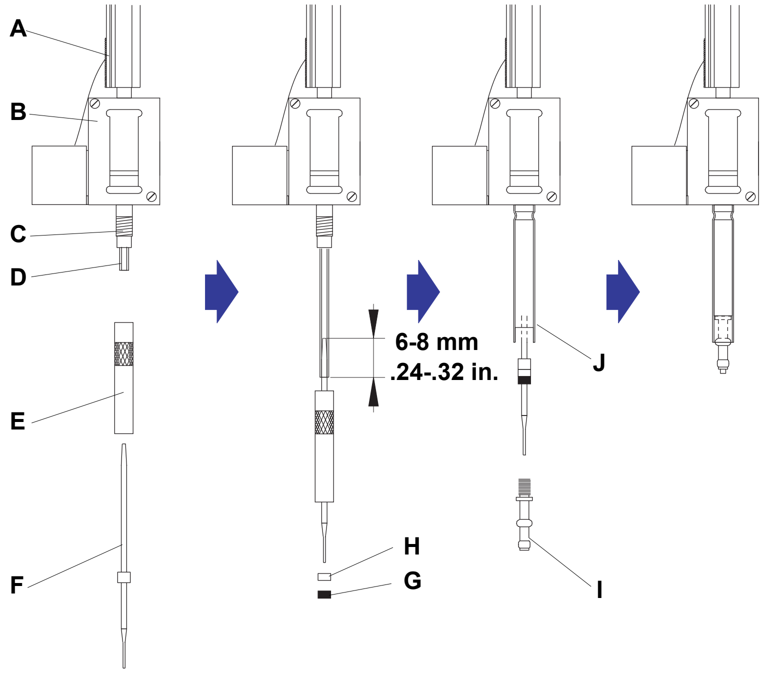


Fig. 7-8 DiTi pick up mechanism installation

A	*Z-rod*	*F*	*Tubing extension*
B	*Tip adapter*	*G*	*O-ring*
C	*Thread*	*H*	*Separator ring (white)*
D	*Pipetting tubing*	*I*	*DiTi cone*
E	*Adapter cylinder*	*J*	*Tip ejector tube (outer rim pointing upwards)*

1. Carefully pull the pipetting tubing approx. 25 mm (1 in.) out of the tip adapter.
2. Put the adapter cylinder on the tubing extension (knurled part pointing upwards).
3. Seize the two parts and push the conical (blank) part of the tubing extension 6 to 8 mm (0.24 to 0.32 in.) into the tubing.
4. Screw the adapter cylinder onto the tip adapter and tighten slightly.
5. Slide the separator ring and then the O-ring onto the lower part of the tubing extension.
6. Shift the tubing into the adapter cylinder.
7. Slide the tip ejector tube (outer rim pointing upwards) on the adapter cylinder, hold it with one hand and screw the DiTi cone into the adapter cylinder.
8. Tighten the DiTi cone carefully, using the supplied cone wrench.

7.3.5.2 Disposable Tip Cone (DiTi cone) Air LiHa

References

List of cross references to information provided in other sections:

Subject	Reference
Air LiHa DiTi cone removal	See section "Preparation", 2 7-37
Replace inline filter	See section 7.3.5.3 "Air LiHa Inline Filter", 2 7-40
Release Z-brake	See section 8.2.4 "Releasing the Z-brake of the Air LiHa", 2 8-13

ATTENTION

Possible malfunction.

- If the disposable tip cones get moistened with sample liquid containing certain substances, a hard coating can build up. This may render the DiTi cone incompatible with the disposable tips, resulting in pick-up problems.
- Deposits can clog the tip cone after a period of time.

ATTENTION

Initialization error possible, if the Z-rod is blocked in the uppermost Z-position.

- Do not (manually) move the Air LiHa's Z-rods to the uppermost Z-position.
- If an initialization error occurs, release the Z-brake and manually move the Z-rods down by approx. 2.5 cm (1 in.).
  Refer to cross references above.

Cleaning and Inspection

Perform the following maintenance on the Air LiHa DiTi cone:

1. Clean the DiTi cones with a lint-free tissue and isopropanol.
2. Visually check the disposable tip cones during maintenance. Make sure that the tip cones are clean and free of deposits.
3. If deposits are visible:
   – Remove the Air LiHa DiTi cone.
   Refer to cross references above.
   – Clean the parts thoroughly.
   – Replace the inline filter.
   Refer to cross references above.

Test and Settings

4. To ensure operating readiness, perform one of the following tests:
   – Filter Test
   Refer to the Instrument Software Manual
   or
   – Inline filter test command
   Refer to the EVOware Software Manual

   For manuals see 1.1 "Reference Documents", 2 1-2

Preparation

To prepare for replacement, proceed as follows:

1. Switch the instrument off.
2. Open the front safety panel.
3. Release the Z-brake (refer to cross references above) and manually move all Z-rods in middle Z-position for easy access to the tip adapters (just below the DiTi eject rocker).
4. Move all Z-rods together towards the front of the instrument.
5. Spread the Z-rods and fix the Air LiHa tip adapters in position by inserting the adjustment gauge for the tip adapters as shown in Fig. 7-9, 2 7-37 (insertion sequence as in Fig. 7-12, 2 7-39)

   For best access to the tip adapters the adjustment gauge should be inserted so that every other slot fixes a tip adapter with an empty slot in-between. With this method only four tip adapters can be fixed in position at the same time. I.e. insert the gauge according to the tip adapter you want to work on.

ATTENTION

Make sure that you do not cut any of the cables when inserting the adjustment gauge on the tip adapters.

Fig. 7-9 *Insertion of adjustment gauge for Air LiHa tip adapters*

A	*Adjustment gauge for tip adapters*	***C***	*Empty slots*
B	*Tip adapter engaged*		

Removal

To remove the Air LiHa DiTi cone, proceed as follows:

1 Make sure the adjustment gauge is inserted to fix the tip adapter in position (see Fig. 7-9, 2 7-37).

Fig. 7-10 DiTi cone wrench

2 Hold the tip ejector tube and tip adapter while unscrewing the DiTi cone, using the supplied DiTi cone wrench (step (1) and (2) in Fig. 7-11, 2 7-38).

3 If the inline Filter in the DiTi cone is wetted or defective, parts of the tip adapter might be contaminated. In this case follow steps 4 to 7.

4 Remove the tip ejector tube (step (3) in Fig. 7-11, 2 7-38).

5 Unscrew and remove the adapter cylinder and the air tube (step (4) in Fig. 7-11, 2 7-38).

6 Clean the adapter cylinder and the air tube thoroughly with isopropanol.

If necessary use a lint-free tissue. Wipe dry after cleaning.

7 Replace the inline filter in the Air LiHa DiTi cone.
Refer to cross references above.

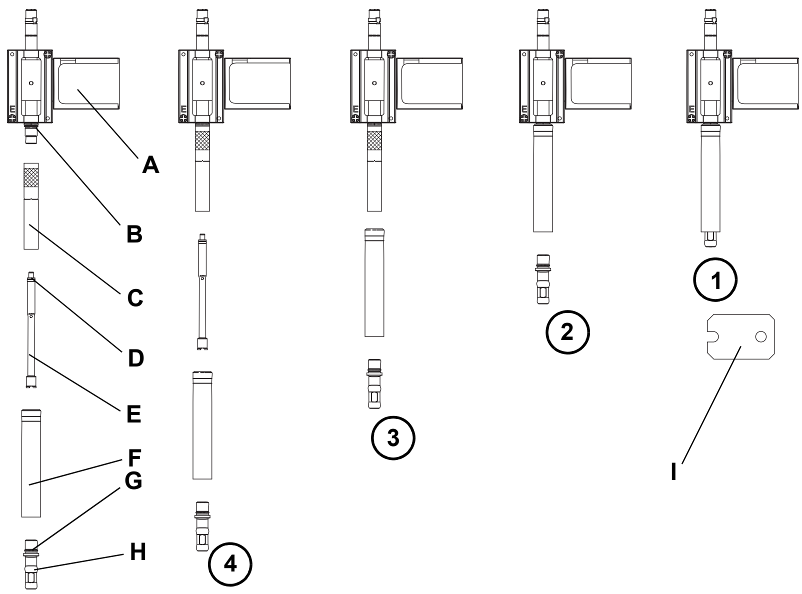


Fig. 7-11 Air LiHa DiTi pick up mechanism removal/installation

A	*Air LiHa DiTi adapter*	*F*	*Tip ejector tube (outer rim pointing upwards)*
B	*O-ring seal*	*G*	*O-ring seal*
C	*Adapter cylinder*	*H*	*Air LiHa DiTi cone*
D	*Seals (X-ring [black], sep. ring [white])*	*I*	*DiTi cone wrench*
E	*Air tube*		

Installation

To install the Air LiHa DiTi pickup mechanism, proceed as follows:

1. Install the DiTi cone and the DiTi pick up mechanism in reverse order as described for removal.
   - Tighten the adapter cylinder finger tight.
   - Tighten the DiTi cone carefully, using the supplied cone wrench (see Fig. 7-10, 2 7-38).
2. Remove the adjustment gauge which fixed the tip adapters in position.

ATTENTION

Air LiHa tip adapters may crash if not aligned correctly.

- Make sure that the Air LiHa tip adapters are aligned correctly.
  It must be possible to insert the adjustment gauge onto the Air LiHa tip adapters as shown in Fig. 7-12, 2 7-39.

If the air LiHa tip adapters are not aligned correctly call your local Tecan support organization.

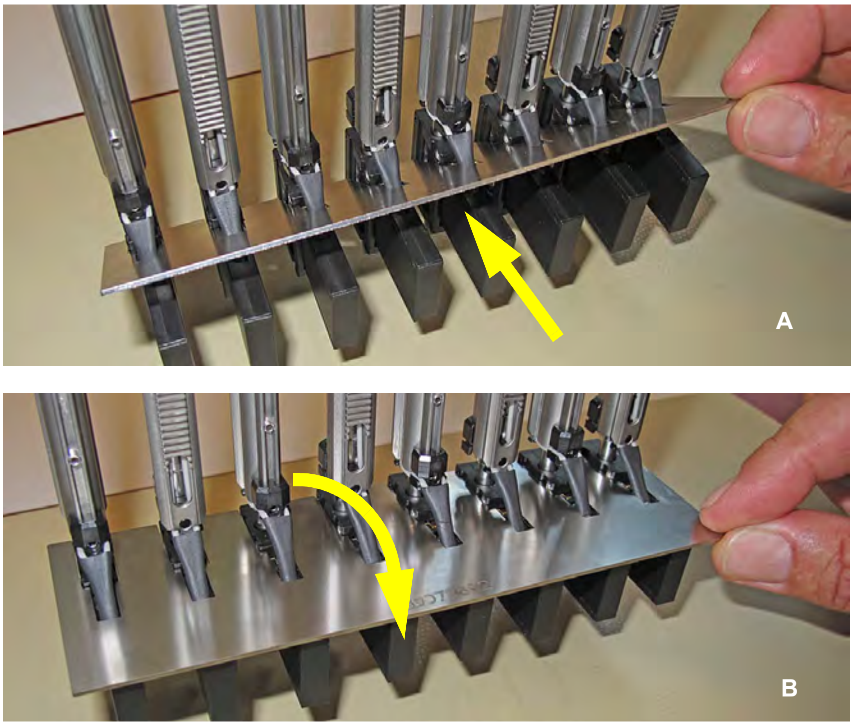


Fig. 7-12 Adjustment gauge for Air LiHa tip adapters

A *Insert the gauge diagonally down engaging the tip adapters*

B *Swing the gauge into horizontal position*

7.3.5.3 Air LiHa Inline Filter

Note: *Irrespective of the regular maintenance schedule, the filter needs replacement when it got moistened as a result of an erroneous aspiration (too much liquid aspirated).*

WARNING

DiTi cone can be contaminated.

- Decontaminate the DiTi cone and assure appropriate safety measures.

WARNING

The filter removal tool can cause injuries.

- Avoid piercing your finger or hand.
- Wear protective rubber gloves during filter removal.

To replace the inline filter in the DiTi cone of the Air LiHa, proceed as follows:

1 Remove the inline filter from the DiTi cone as shown in the figure below:

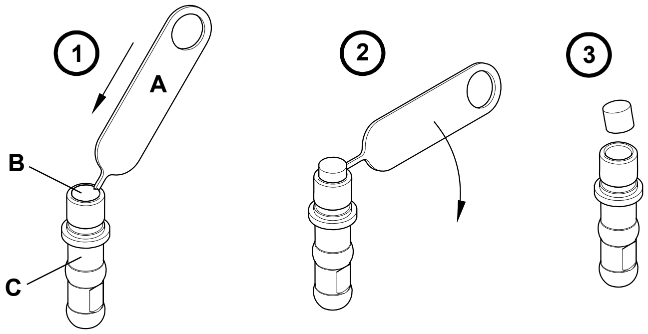


Fig. 7-13 *Filter removal tool*

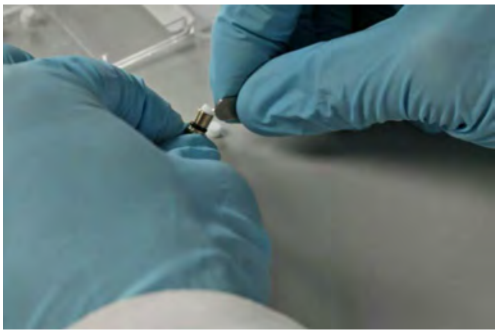


Fig. 7-14 *Inline filter removal*

– Carefully pierce the old filter sideways, using the filter removal tool (A).
– Swivel the tool downwards to pry out the filter.
– Remove the filter from the DiTi cone.

2 Clean the DiTi cone with alcohol and allow to dry.
Make sure that the DiTi cone is dry before inserting the inline filter.

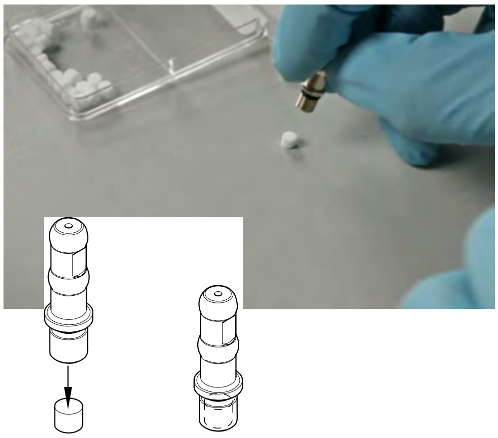


Fig. 7-15 *Inline filter installation*

3 Place the new inline filter on a clean and even surface.

4 Move the DiTi cone downwards onto the filter.

Press the filter into the DiTi cone in such a way that it does not stick out from the DiTi cone any more.

Test and Settings

5 To ensure operating readiness, perform one of the following tests:

– Filter Test
Refer to the Instrument Software Manual
or

– Inline filter test command
Refer to the EVOware Software Manual

For manuals see 1.1 "Reference Documents", 2 1-2

7.3.6 DiTi Waste Bag

WARNING

Potentially infectious
Instrument parts and solid waste may be contaminated with potentially infectious materials.

- Follow basic biohazard precautions
- Wear appropriate personal protective equipment, such as gloves, lab coats and protective eye wear

WARNING

Risk of fire or explosion.
If inflammable reagents were used in the process, remains of these substances on the waste DiTis may accumulate and form combustible vapors.

- If inflammable reagents are in use change the DiTi waste bag frequently.
- Perform a risk assessment to define further measures.

The filling height of the DiTi waste bag must be checked regularly. Make sure that there is no DiTi jam within the DiTi waste slide and change the DiTi waste bag at least once at the end of the day.

Removal

Follow the procedure below to change the DiTi waste bag:

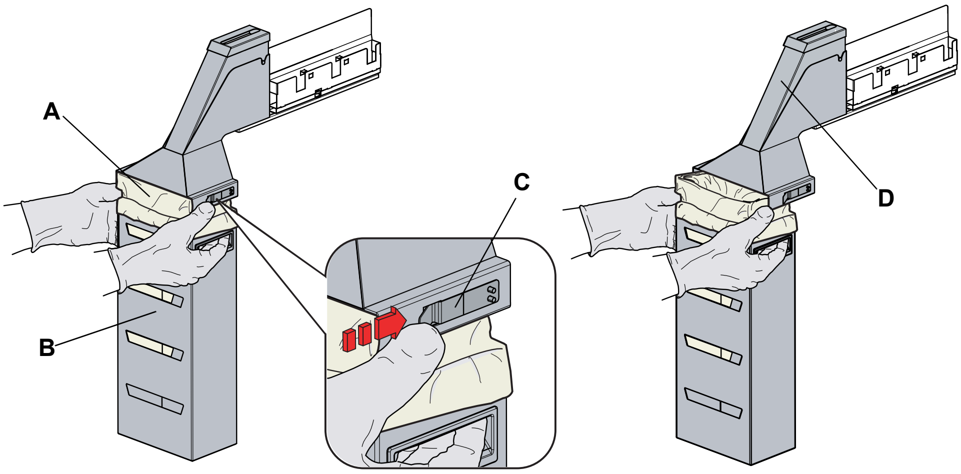


Fig. 7-16 *Changing the DiTi waste bag*

A	*DiTi waste bag*	***C***	*Fastener*
B	*Bag housing*	***D***	*DiTi waste slide*

1 Lift the fastener to remove the bag housing.

Note: *Be sure to dispose of waste according to your laboratory guidelines.*

2 Remove the DiTi waste bag and dispose of it appropriately.

Installation

3 Install a new DiTi waste bag into the empty bag housing.

Note: *The waste bag must be suitable for disposable tips and, in case you are operating with biohazardous material suitable for those material as well, it must e.g. have an adequate thickness and be labeled with a corresponding biohazard label.*

Waste Bag Specification

Typical dimensions for the waste bag (W x L): 300 mm x 600 mm
Thickness: 0.05 mm
Material: polypropylene, polyethylene or co-polymer (autoclavable)
Imprint: Biohazard

Note: *The waste bags used must meet your local safety guidelines.*

7.3.7 Wash Station

***Note:** Always make sure that the wash station is installed in the correct grid position when it has been removed. If the grid position has changed, verify the corresponding definitions in the application software.*

7.3.7.1 Cleaning the (Standard) Wash Station

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Clean worktable	See section 7.3.10 “Worktable”, 2 7-51

The wash station can come in contact with reagents and samples. If a spillage occurred, the wash station needs to be removed from the worktable for cleaning.

Clean the wash station as follows:

1 Wipe the surface of the wash station with a suitable cleaning agent (e.g. water, alcohol, disinfectant) to remove any spilled reagent.

***Note:** Do not use bleach to clean the wash station and do not clean it in a laboratory washing machine.*

2 If necessary, rinse the wash station and clean it additionally with water or alcohol.

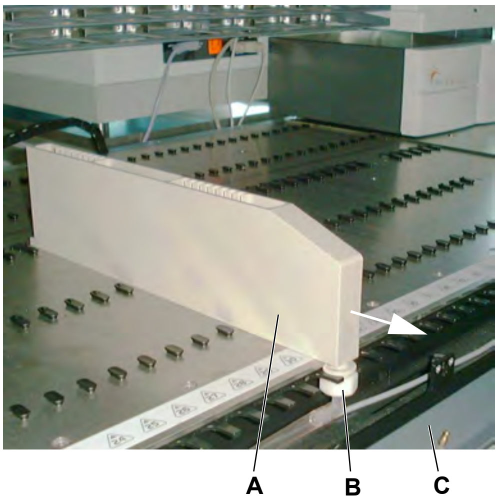


Fig. 7-17 *Wash station*

If necessary, remove the wash station from the worktable.

1 Open the front access panel (C).

2 Loosen the nut (B).

3 Pull the wash station (A) to the front (see arrow).

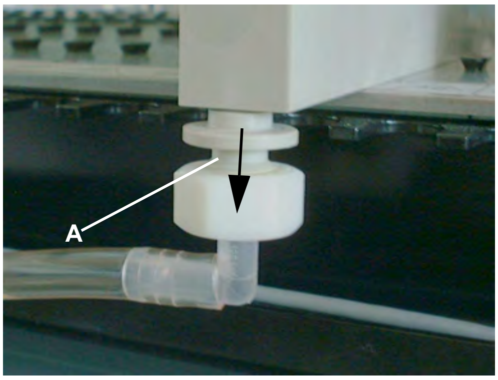


Fig. 7-18 Waste tubing connector

4 Pull the waste tubing connector (A) out of the wash station (see arrow).

5 Remove the wash station from the worktable.

6 Clean the wash station as described above.

7 Clean the worktable.
Refer to cross references above.

8 Reinstall the wash station on the worktable.

Make sure that the wash station is pushed all the way back to the stop during installation.

7.3.7.2 Cleaning the Low Volume Wash Station

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Clean wash station	See section 7.3.7.1 “Cleaning the (Standard) Wash Station”, 2 7-43

Clean the low volume wash station as described for the standard wash station. Refer to cross references above.

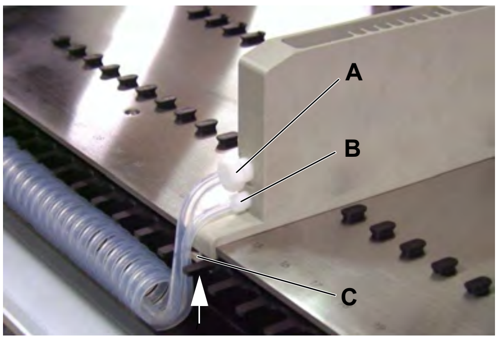


Fig. 7-19 Tubing connectors

If necessary, remove the wash station from the worktable.

1 Loosen the fitting (A) of the waste tubing.

2 Loosen the fitting (B) of the fill tubing.

3 Loosen the fixing screw (see arrow) of the clamp plate (C).

4 Remove the wash station from the worktable.

5 Reinstall the wash station on the worktable.

Make sure that the wash station is pushed all the way back to the stop during installation.

Do not overtighten the fittings.

7.3.7.3 Cleaning the Wash Station of the DiTi Waste and Wash Station Unit

The wash station may be contaminated with residues from reagents and samples, which must be removed.

To remove and clean the wash station, proceed as follows:

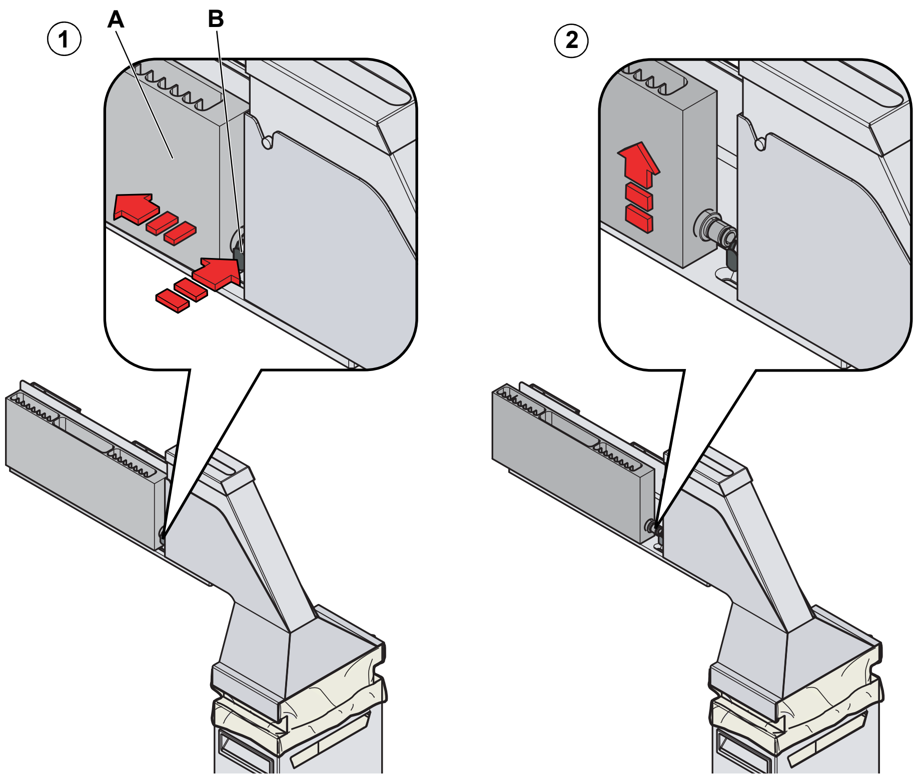


Fig. 7-20 Removing the wash station from the worktable

Removal

1 Unplug the wash station (A) from the DiTi waste and wash station unit by pushing the button (B) of the quick release fastener and sliding the wash station backwards.

2 Remove the wash station from the DiTi waste and wash station unit.

Cleaning

3 Wipe the surface of the wash station with a suitable cleaning agent (e.g. water, alcohol, disinfectant) to remove any spilled reagent.

***Note:** Do not use bleach to clean the wash station and do not clean it in a laboratory washing machine.*

4 If necessary, rinse the wash station and clean it additionally with water or alcohol.

Installation

5 Return the wash station to the Freedom EVO worktable by pushing the button of the quick release fastener again and sliding the wash station to its original positioning until it engages at the fastener.

7.3.8 DiTi Waste and Wash Station Unit

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Clean wash station	See section 7.3.7.3 “Cleaning the Wash Station of the DiTi Waste and Wash Station Unit”, 2 7-45

WARNING

Potentially infectious
Instrument parts may be contaminated with potentially infectious materials.

- Follow basic biohazard precautions
- Wear appropriate personal protective equipment, such as gloves, lab coats and protective eye wear

To clean the wash station of the DiTi waste and wash station unit, refer to cross references above.

7.3.8.1 Cleaning the DiTi Waste Slide

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Suitable agents	See section 7.1 “Tools and Consumables”, 2 7-1

The discarded DiTis contain residues of sample and reagents, which contaminate the DiTi waste slide.

Note: *Heavy contamination of the slide might cause the DiTis to get stuck in the DiTi waste slide.*

Quick Cleaning

To clean the DiTi waste slide, proceed as follows:

1 Open the front safety panel.

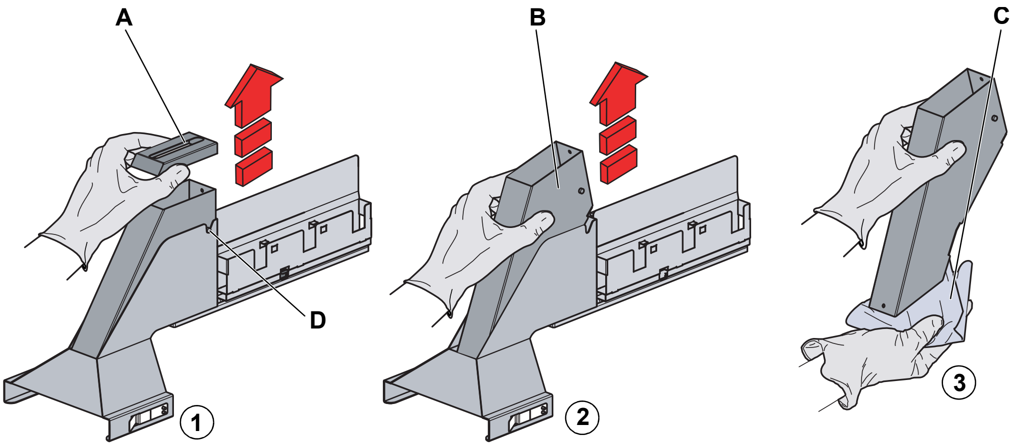


Fig. 7-21 *Removing DiTi waste slide inset*

2 Remove the cover (A) from the DiTi waste slide.

3 Remove the DiTi waste slide inset (B) from its holder.

Hold a tissue (C) under the DiTi waste slide inset when carrying it away to prevent contaminated substances and DiTis from dropping to the floor.

Fig. 7-22 *DiTi waste slide*

4 Spray some disinfectant on the inner surface of the DiTi waste slide as shown in the figure.

Suitable agents:
See cross references above.

5 Check if there are residues of contamination on the inner surface of the DiTi waste slide.

If yes, schedule a thorough cleaning of the parts as described below.

6 Reinstall the DiTi waste slide inset.

Make sure that the positioning pin of the DiTi waste slide is properly positioned in the slot (D, Fig. 7-21 , 2 7-47).

7 Reinstall the cover.

Thorough Cleaning

To thoroughly clean the DiTi waste slide, perform the following procedure:

1 Remove the cover from the DiTi waste slide as described above.
2 Remove the DiTi waste slide inset from its holder as described above.
3 Put the DiTi waste slide inset and the cover into a basin filled with cleaning agent and allow to soak for 30 minutes to 4 hours (depending on agent).
4 Allow the parts to dry.
5 Reinstall the DiTi waste slide inset as described above.
6 Reinstall the cover as described above.

7.3.8.2 Cleaning the Complete DiTi Waste and Wash Station Unit

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Remove wash station	See section 7.3.7.3 “Cleaning the Wash Station of the DiTi Waste and Wash Station Unit”, 2 7-45
Remove DiTi waste bag	See section 7.3.6 “DiTi Waste Bag”, 2 7-41
Remove DiTi waste slide inset	See section 7.3.8.1 “Cleaning the DiTi Waste Slide”, 2 7-46
Clean wash station	See section 7.3.7.3 “Cleaning the Wash Station of the DiTi Waste and Wash Station Unit”, 2 7-45
Clean worktable	See section 7.3.10 “Worktable”, 2 7-51

The DiTi waste and wash station unit may be contaminated with residues from reagents and samples, which must be removed.

Apart from the normal position (work position) the DiTi waste and wash station unit can take the following positions:
- If pulled to the mechanical stop: The front access panel can be opened, but the unit cannot be removed.
- If pulled to the middle position: The unit can be removed, but the front access panel cannot be opened.

To remove and clean the DiTi waste and wash station unit, proceed as follows:

Removal

1 Remove the wash station.
Refer to cross references above.

2 Remove the DiTi waste bag housing.
Refer to cross references above.

3 Remove the DiTi waste slide inset.
Refer to cross references above.

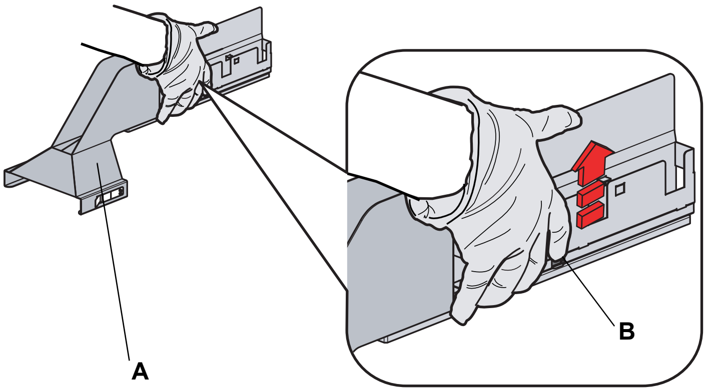


Fig. 7-23 Removing the DiTi waste and wash station unit from the worktable

4 Pull and hold the quick release lever (B).

5 Pull the DiTi waste and wash station unit (A) towards yourself.

6 Open the front access panel to be able to release the waste tubing.

7 Remove the waste tubing.

8 Close the front access panel.

9 Shift the unit back to the middle position and remove (lift) it.

Cleaning

Note: *To clean the unit, it is not necessary to disconnect the waste tubing.*

10 Wipe the surface of the DiTi waste and wash station unit with a suitable cleaning agent (e.g. water, alcohol, disinfectant) to remove any spilled reagent.

Note: *You can now clean the wash station and the worktable.*
Refer to cross references above.

Installation

11 Reapply the waste tubing under the front access panel and close the panel.

12 Reinstall the DiTi waste and wash station unit on the worktable by pushing the button of the quick release fastener again and sliding the option to its original position until it engages on the positioning pins of the worktable.

7.3.9 Waste Option for Nested DiTi

WARNING

Potentially infectious
Instrument parts may be contaminated with potentially infectious materials.

- Follow basic biohazard precautions
- Wear appropriate personal protective equipment, such as gloves, lab coats and protective eye wear

7.3.9.1 Cleaning the Nested DiTi Waste Slide

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Suitable agents	See section 7.1 "Tools and Consumables", 2 7-1

The discarded DiTis contain residues of sample and reagents, which contaminate the DiTi waste slide.

Note: *Heavy contamination of the slide might cause the DiTis to get stuck in the DiTi waste slide.*

Quick Cleaning

To clean the DiTi waste slide, proceed as follows:

1 Open the front safety panel.

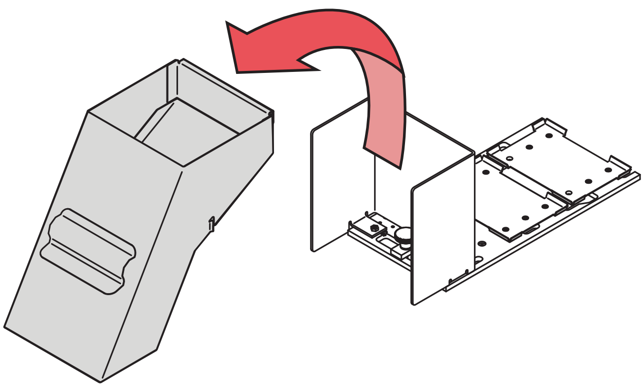


Fig. 7-24 *Removing Nested DiTi waste slide*

2 Lift the Nested DiTi waste slide up and remove the slide from its holder (see arrow).

Hold a tissue under the Nested DiTi waste slide when carrying it away to prevent contaminated substances and DiTis from dropping to the floor.

3 Spray some disinfectant on the inner surface of the Nested DiTi waste slide.

   Suitable agents:
   See cross references above.

4 Check if there are residues of contamination on the inner surface of the Nested DiTi waste slide.

   If yes, schedule a thorough cleaning of the parts as described below.

5 Reinstall the Nested DiTi waste slide.

6 Close the front safety panel.

Thorough Cleaning

To thoroughly clean the Nested DiTi waste slide, perform the following procedure:

1 Remove the Nested DiTi waste slide as described above.

2 Put the Nested DiTi waste slide into a basin filled with cleaning agent and allow to soak for 30 minutes to 4 hours (depending on agent).

3 Allow the Nested DiTi waste slide to dry.

4 Reinstall the Nested DiTi waste slide as described above.

7.3.10 Worktable

WARNING

Possible worktable damage

- Only clean the worktable with small amounts of cleaning agent, e.g. with a damped cloth.
- Do not spill cleaning agent on the worktable.

Cleaning the Worktable

Perform the following procedure to clean the pipetting instrument’s worktable:

1 Remove all racks and carriers from the worktable.

2 Wipe the surface of the worktable with a suitable cleaning agent (e.g. alcohol, disinfectant) to remove any spilled reagent.

3 If necessary, additionally clean with water.

7.3.11 Safety Panels

Cleaning the Safety Panels

Perform the following procedure to clean the safety panels.

- Wipe the inner and outer surface of the safety panels with a suitable cleaning agent, e.g. water, alcohol or disinfectant, to remove any spilled reagent or sample.
- If necessary, additionally clean the surface with water or alcohol.

7.3.12 Liquid Containers

System Liquid Container

To prevent deposition of crystals and growth of micro-organisms in liquid containers, clean all liquid containers at least once a week. Make sure to allow solvents (e.g. ethanol) to evaporate before filling reagents into the containers again.

Waste Container

Clean the waste container at least once a day.

WARNING

Contamination through waste liquid, if the containers and/or the LICOS tubes are installed wrongly.

- Make sure not to mix up the system liquid container and the waste container.
- Make sure not to mix up the two LICOS tubes.

Reconnect the tubing as according to the following figures:

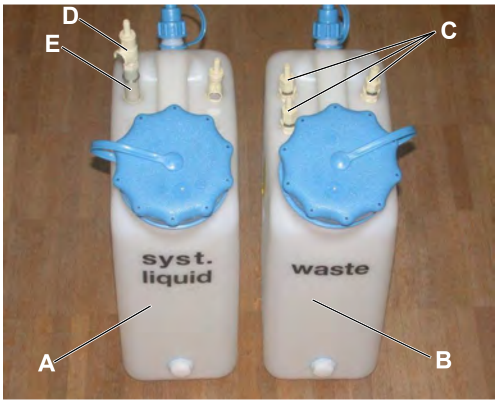


Fig. 7-25 *Liquid containers (10 l)*

The figure shows the standard liquid containers with a capacity of 10 l (without LICOS option).

A	*System liquid container*
B	*Waste container*
C	*Liquid coupling for waste liquid*
D	*Liquid coupling for system liquid*
E	*Aspiration tube*

Fig. 7-26 *Liquid containers (30 l)*

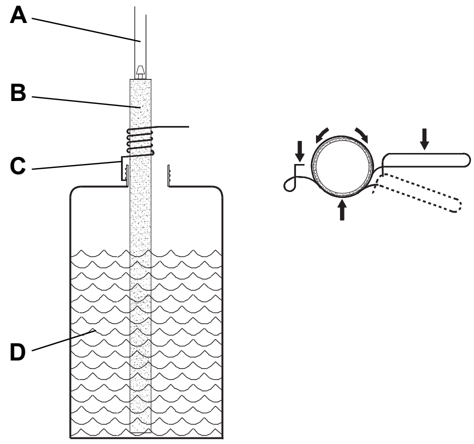
The figure shows the standard liquid containers with a capacity of 30 l (without LICOS option).

A	*System liquid container*
B	*Waste container*
C	*Liquid coupling for waste liquid*
D	*Liquid coupling for system liquid*
E	*Aspiration tube*

Note: *If you don't use the standard liquid containers, make sure that the tubing to the waste container is fastened is such a way that it cannot disconnect inadvertently from the waste container.*

SPO/MPO Option

If your instrument is equipped with the SPO/MPO option and LICOS, pay attention to the following:



Fasten the LICOS tube with the tube clamp as shown in the figure.

Make sure that the end of the LICOS tube is close to the container bottom.

To move the tube clamp on the LICOS tube, press the clamp open (see arrows).

A *Tubing to sensor*
B *LICOS tube*
C *Tube clamp*
D *Liquid container*

Fig. 7-27 *LICOS tube clamp*

7.3.13 Lower DiTi Eject Option

Cleaning the Rocker

Perform the following procedure to clean the rocker of the lower DiTi eject option:

1 Wipe the surface of the rocker (A) with a suitable cleaning agent (e.g. alcohol, disinfectant).

2 If necessary, additionally clean with water.

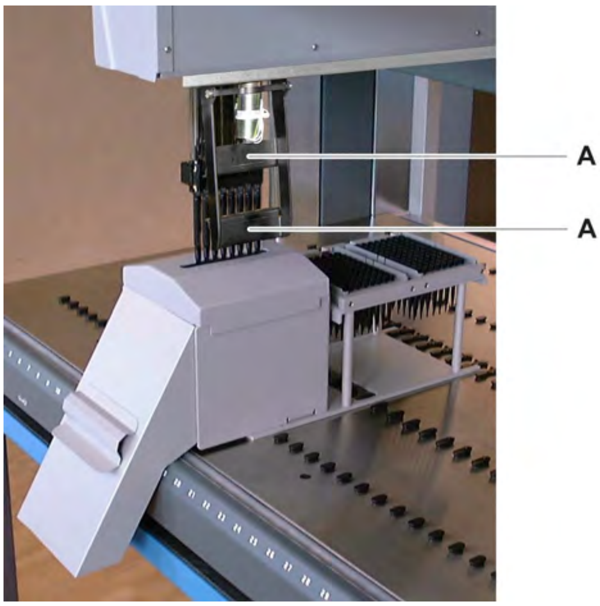


Fig. 7-28 *Lower DiTi eject option*

7.3.14 Te-PS Sensor Plate

WARNING

Laser light (CLASS 1 LASER PRODUCT).

- Caution – Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

WARNING

The Te- PS Sensor Plate utilizes a Class IIIB laser diode. The laser light is not visible for the human eye.

- Avoid the laser beam hitting an eye of the laboratory staff, even through reflective surfaces such as mirrors, etc.
- To prevent direct exposure to laser beam, do not try to open the enclosure.
- Refer service to qualified personnel only.

ATTENTION

Possible malfunction, failure recognizing the Te-PS sensor plate.

- Do not unplug the Te-PS sensor plate while the instrument is running.
- Do not connect the Te-PS sensor plate to the instrument while the instrument is running.

Two-LiHa Instrument

Note: *If there are two LiHas on the instrument, keep in mind that each LiHa needs its own Te-PS sensor plate.*

Removal

Removing the Te-PS Sensor Plate

To remove the Te-PS sensor plate from the Te-PS carrier, proceed as follows:

1. Press down the microplate locking device on the Te-PS carrier.
2. Manually remove the Te-PS sensor plate from the carrier.
3. If you intend to unplug the sensor plate from the instrument:
   – Switch the instrument off.
   – Open the left access door.
   – To unlock the connector, press the latch towards the connector. Then unplug the sensor plate from the instrument.

Te-PS Sensor Plate Maintenance

Cleaning the Te-PS Sensor Plate

To clean the Te-PS sensor plate, proceed as follows:

1. Switch the instrument off and open the front safety panel.
2. Remove the Te-PS sensor plate from the Te-PS carrier.
3. Clean the Te-PS sensor plate with soft cloth and alcohol or weak detergent. Make sure to clean the laser emitting diodes and the receivers on the opposite side.

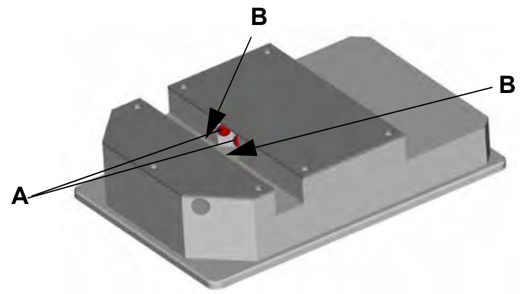


Fig. 7-29 Te-PS sensor plate

A	*Laser emitting diode*	*B*	*Receiver*

Installation

Installing the Te-PS Sensor Plate

To install the Te-PS sensor plate on the Te-PS carrier, proceed as follows:

1. Press down the microplate locking device on the Te-PS carrier.
2. Place the Te-PS sensor plate between the positioning pins on the Te-PS carrier.
3. Release the microplate locking device. The Te-PS sensor plate is pushed into its correct position.

4 If the sensor plate is not connected to the instrument:
- – Switch the instrument off.
- – Open the left access door.
- – Connect the sensor plate cable to the RJ45 socket on the Optibo DCU.

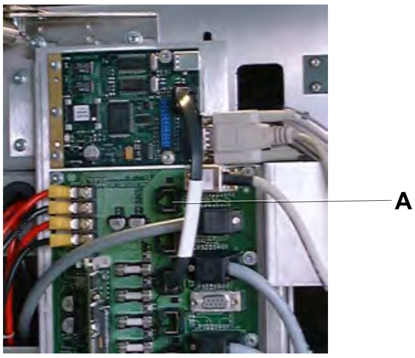


Fig. 7-30 Electronics behind the left access door

A RJ45 socket

5 Close the left access door.

6 Switch the instrument on.

7.3.15 Carriers and Racks

WARNING

Potentially infectious
Instrument parts may be contaminated with potentially infectious materials.
- Follow basic biohazard precautions
- Wear appropriate personal protective equipment, such as gloves, lab coats and protective eye wear

Cleaning Carriers and Racks

Racks and carriers can come in contact with reagents and samples, which must be removed.

Perform the following procedure to clean the carriers and racks.

1 Remove all carriers and racks from the Freedom EVO worktable.

The wash station can be cleaned on the worktable.

2 Before cleaning, remove the barcode labels from the carriers, if possible.

3 Wipe the surface of the racks, carriers and the gripper with a suitable cleaning agent (e.g. water, alcohol, disinfectant) to remove any spilled reagent.

If you have not removed the labels on the carriers and racks, make sure not to damage them with the cleaning agent.

Note: *Do not use bleach to clean the carriers and racks and do not clean them in a laboratory washing machine.*

4 If necessary, rinse the carriers and racks and clean them additionally with water or alcohol.

5 Replace the barcode labels and make sure to put them back to their original position.

6 Return the carriers and racks to the Freedom EVO worktable.

Note: *If barcode labels are damaged or contaminated, replace them immediately.*

7.3.16 Te-PS Carrier

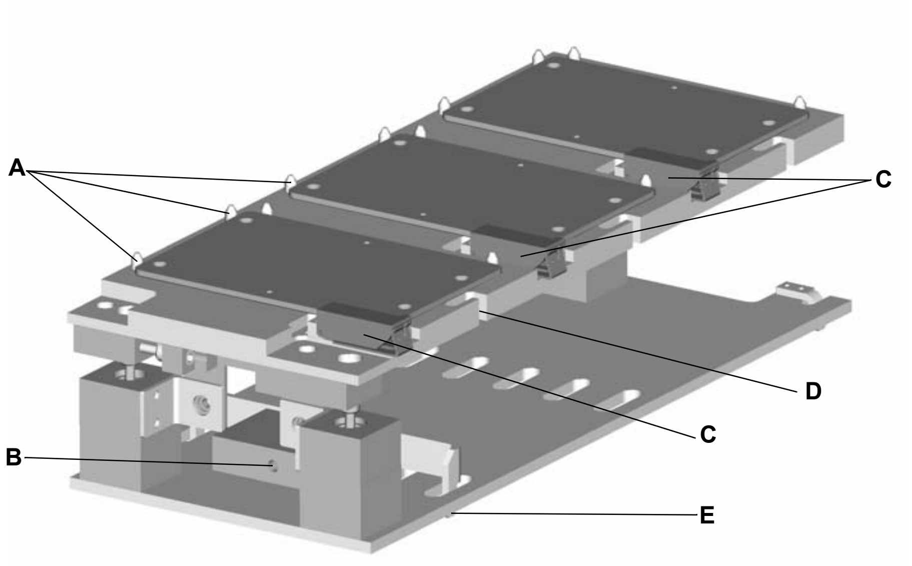


Fig. 7-31 *Te-PS carrier*

A	*Te-PS plate positioning pins*
B	*Te-PS carrier fixation screw*
C	*Microplate locking device*
D	*Cut-out for the Te-PS sensor plate cables*
E	*Te-PS carrier fixation pin*

Te-PS Carrier Maintenance

Instrument Preparation

1 Switch the instrument off and open the front safety panel.
2 Remove the Te-PS sensor plate from the Te-PS carrier.

Cleaning the Te-PS Carrier

Clean the Te-PS carrier with soft cloth and alcohol or weak detergent.

Inspection

Visually inspect the Te-PS carrier for damage and contamination with system or sample liquid.

Te-PS Carrier Installation

Installing the Te-PS Carrier

To install the Te-PS carrier on the worktable, proceed as follows:

1 In the grid positions, where the Te-PS carrier needs to be installed, remove two positioning pins and one stop pin from the worktable.

   If the Te-PS carrier has been installed in the correct position before, this step is not necessary.

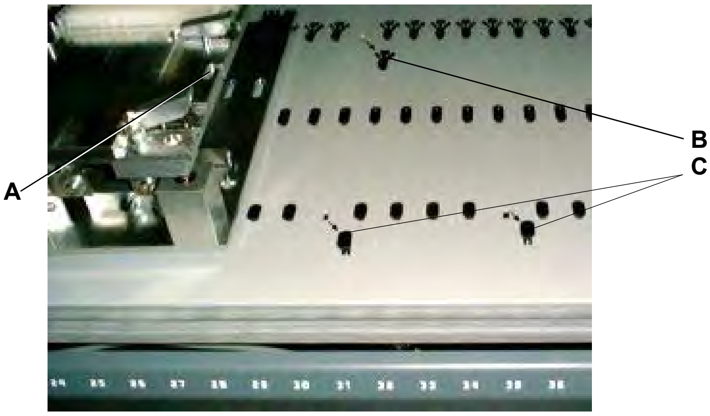


Fig. 7-32 *Te-PS carrier installation*

A	*Cutout for the Te-PS sensor plate cable*	***B***	*Stop pin*
		C	*Positioning pin*

2 Put the Te-PS carrier on the worktable, with the cutouts for the Te-PS sensor plate cables towards the right-hand side.
3 Insert the positioning pin on the bottom of the Te-PS carrier into the hole at the instrument rear (where the stop pin was removed in step 1).
4 Move the remaining two positioning pins on the bottom of the Te-PS carrier with their holder in such a way as to fit in the two front holes (where the positioning pins were removed in step 1).

5 Fit the two positioning pins on the bottom of the Te-PS carrier into the two positioning holes.
6 Tighten the fixation screw in the center of the Te-PS carrier front to lock the Te-PS carrier in its position on the worktable.
7 For the subsequent adjustment of the Te-PS carrier, start up the Setup & Service Software and follow the instructions given.
Refer to the Instrument Software Manual.

Te-PS carrier Adjustment

Several Carriers

Each Te-PS carrier is adjustable in X-, Y- and Z- direction. If more than one Te-PS carrier is used, they are all adjusted to the same Z dimension, i.e. in the software there is only one carrier definition.

Two-LiHa Instrument

Note: *If there are two LiHas on the instrument, keep in mind that an individual Te-PS carrier can only be assigned to one specific LiHa. Access from the other LiHa does not provide the desired accuracy.*

Adjusting the Carrier

To adjust thee Te-PS carrier, proceed as follows:

1 Make sure the carrier is placed in the required position on the worktable.
2 Make sure to have the Te-PS sensor plate ready to be mounted to the Te-PS carrier. The position where the Te-PS sensor plate must be mounted on the carrier will be indicated by the Setup & Service Software.
Refer to the Instrument Software Manual.
3 Start up the Setup & Service Software to continue the Te-PS carrier adjustment procedure. Follow the instructions given.
Refer to the Instrument Software Manual.

Te-PS carrier Adjustment Check

Two-LiHa Instrument

Note: *If there are two LiHas on the instrument, keep in mind that an individual Te-PS carrier can only be assigned to one specific LiHa. Access from the other LiHa does not provide the desired accuracy.*

Checking Adjustment

To check the adjustment of the Te-PS carrier, proceed as follows:

1 Make sure the carrier is placed in the required position on the worktable.
2 Make sure to have the Te-PS sensor plate ready to be mounted to the Te-PS carrier. The Setup & Service Software or the application software will indicate the position where the Te-PS sensor plate must be mounted onto the Te-PS carrier.
Refer to the Instrument Software Manual.
3 Start up the Setup & Service Software, to continue the Te-PS carrier adjustment check. Follow the instructions given in the software.
Refer to the Instrument Software Manual or your Application Software Manual.

Removal

Removing the Te-PS Carrier

Note: *Be aware that removing the carrier requires performing a carrier alignment in the course of the carrier reinstallation.*

To remove the Te-PS carrier from the worktable, proceed as follows:

1. Note the current position of the installed Te-PS carrier (put it in the same position when subsequently reinstalling the carrier).
2. Loosen the fixation screw.
3. Remove the carrier from the worktable.

7.3.17 Te-Link

Te-Link Daily Maintenance

Instrument Preparation

1. Switch off the instrument and open the front safety panel.

Removal

1. Take note of the Te-Link's installed position as it is, to know how to reposition it after cleaning.
2. Lift the Te-Link off the worktable, for cleaning or decontamination.
   The Te-Link is not fastened to the worktable.

Cleaning the Te-Link

Clean the Te-Link with a soft cloth moistened with ethanol or isopropanol.

Installation

To install the Te-Link on the worktable:

1 Fit the adapter plate end of the Te-Link between the guide pins or stop pins as required.

The adapter plate remains fixed to the Te-Link bottom.

2 Fit the two pads on the Te-Link's other end in between the worktable guide pins.

The pads remain fixed to the Te-Link bottom.

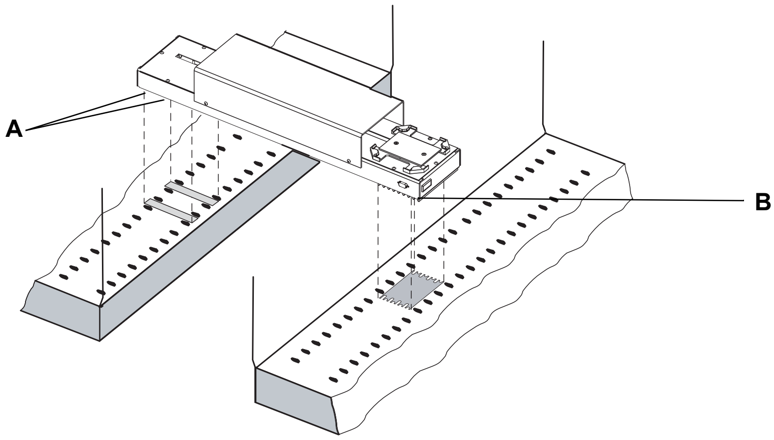


Fig. 7-33 *Te-Link positioning on worktable*

A	*Pads underneath Te-Link*	***B***	*Adapter plate underneath Te-Link, home position*

7.3.18 MultiSense Option

7.3.18.1 DiTi Cone, MultiSense Tip Adapter

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Decontaminate	See section 7.5 “Decontamination”, 2 7-85
Disassemble and install the DiTi kit MultiSense	See section 7.6.2.1 “DiTi Kit MultiSense”, 2 7-87
Adjust the tubing end	see section 7.6.2.2 “Cutting/Adjusting the Tube End”, 2 7-90

WARNING

Possible contamination.

The DiTi kit MultiSense may have been in contact with sample liquid thus creating a contamination risk.

- Decontaminate the entire equipment thoroughly before performing maintenance work.
- Disassemble and decontaminate the complete DiTi kit MultiSense and the tubing inside before maintenance work.
  Refer to cross references above.

ATTENTION

Possible malfunction.
Disposable tip cones that have been sprayed with sample liquid, e.g. with serum, may be covered with a coat of dry sample preventing proper pick-up and ejection of the DiTis.

- Always make sure that the DiTi cone remains clean and dry.

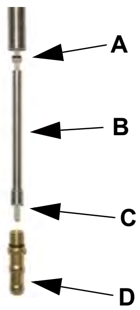


Fig. 7-34 *Clean*

It is essential that the following parts are kept clean and dry:

A *X-ring*
B *Needle tube*
C *Pipetting tubing*
D *Tip cone*

ATTENTION

Malfunction of the pressure sensor.

Debris on the tubing or X-ring will compromise the sealing. When cleaning, adjusting the tube end or replacing the DiTi kit MultiSense, pay attention to the following:

- Use only powder free gloves.
- When removing parts, place them on a dry and clean surface.

ATTENTION

Malfunction of the pressure sensor.

If the space between the pipetting tubing and the inside walls of the DiTi cone becomes wet, the pressure sensing function will be impaired. This can happen if the DiTi cone was immersed by mistake in the sample or if pipetting has been performed with the pipetting tubing pushed into the cone after a crash.

This malfunction will result in **Sensor Out Of Range** errors and, if using the PMP function, **Aspiration Errors** (clogged pressure channels).

- The inside of the DiTi cone must remain dry. During regular maintenance cleaning of the DiTi cones, do not soak them completely (i.e. do not dip them into a trough with alcohol).
- Make sure not to push the tubing back into the tip adapter. It must protrude as shown in Fig. 7-35 “Pipetting tubing MultiSense”, 2 7-64.

In case of malfunction due to circumstances mentioned above, the DiTi cone and needle tube needs to be removed and cleaned as follows.

1 Disassemble the DiTi kit MultiSense.
Refer to cross references above.

2 Place the parts on a clean and dry surface.

3 Soak the DiTi cone and the needle tube in isopropanol.

4 Allow the DiTi cone and the needle tube to dry overnight or dry the inside of the parts with an air blower.

5 Reassemble the DiTi kit MultiSense.
Refer to cross references above.

Note: *If the PMP leakage test fails, it may indicate that dried sample residues remain on the inner walls of the DiTi cone or the needle tube. Try to clean these parts in an ultrasonic bath or order replacement parts.*

Cleaning and Inspecting

Cleaning the DiTi Cones

1 Clean the DiTi cones with a lint-free tissue moistened with alcohol (e.g. isopropanol).

Inspecting the DiTi Cones

2 If deposits are visible disassemble and thoroughly clean the MultiSense tip adapter.
Refer to cross references above.

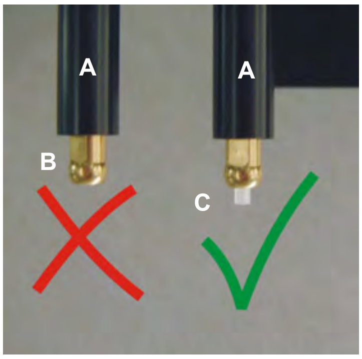


Fig. 7-35 *Pipetting tubing MultiSense*

3 Check if the pipetting tubing protrudes by 2 mm as shown in the figure.

If the pipetting tubing does not protrude accordingly, adjust it. Refer to cross references above.

A	*DiTi ejector*
B	*Tubing pushed-in (bad)*
C	*Tubing protrudes (OK)*

7.3.18.2 Priming the Wash Block

Purpose

Priming means filling the wash block slowly to avoid spilling over.

Required Material

Wash liquid as required by the application.

1 Open a script with a worktable that contains a wash system.

2 Check if the wash block is placed on the defined carrier position and if its tubing (wash and waste) is connected properly (use “container 1 wash liquid”).

3 Prime the wash block:

– Click the corresponding command button in the application software, Refer to the “Freedom EVOware Software Manual”.

Or Start the “Setup & Service” software.

– In the “Wash Tool” page, select “Prime Wash Block”. Refer to the “Instrument Software Manual”.

7.3.18.3 Exchange Steel Needle (MCA96)

Exchange steel needles

In case that a steel needle needs to be exchanged the operator can open the lid and exchange the steel needle.

1 Place fixed tip block on device (A).

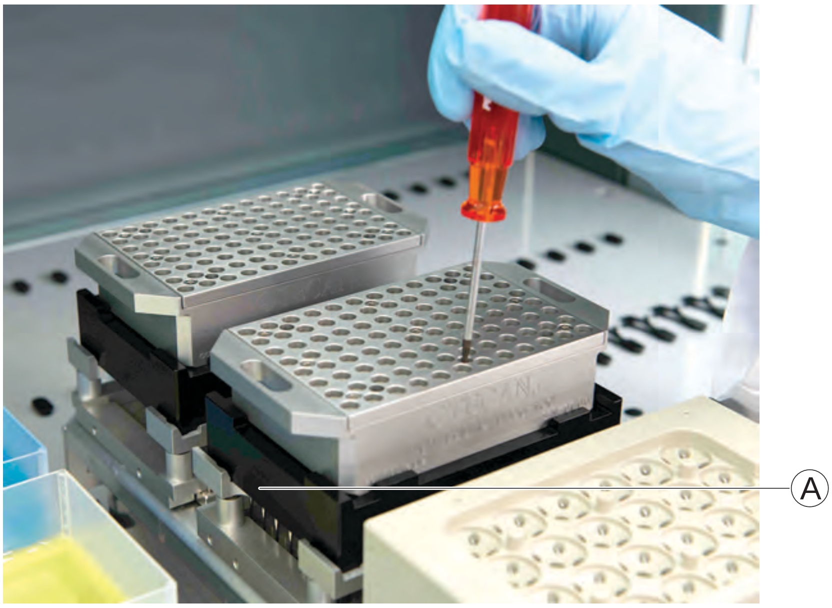


Fig. 7-36 Place Fixed Tip Block

2 Release screws (B).

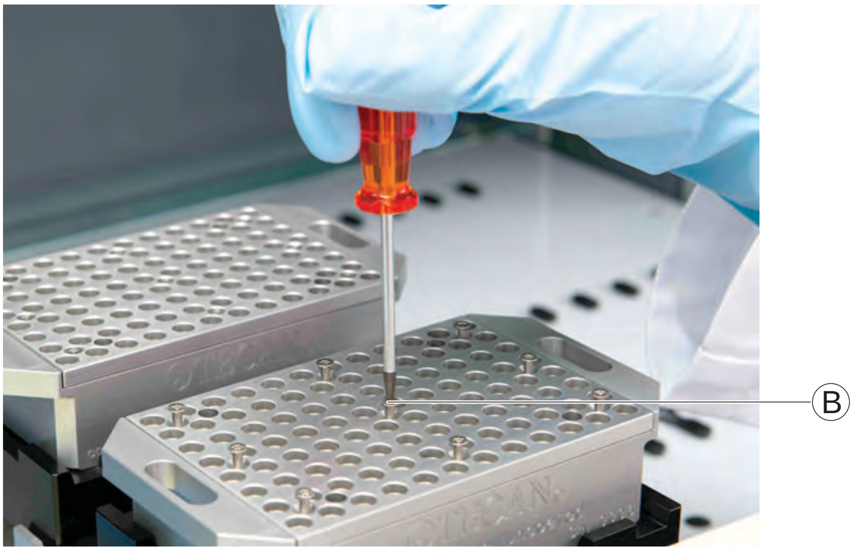


Fig. 7-37 Release screws

3 Remove lid (C) from container (D).

4 Store lid and screws in a clean and dry place.

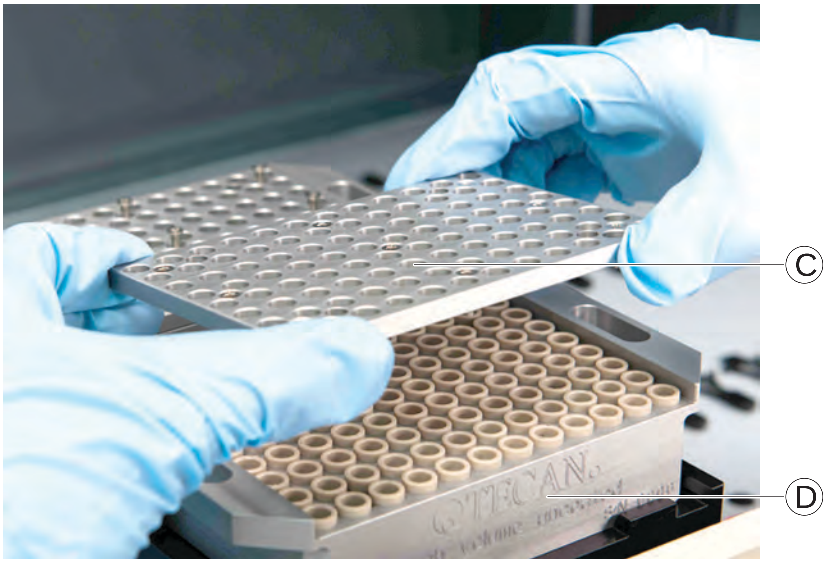


Fig. 7-38 *Remove lid*

5 Remove steel needles (E) from container.

6 Store steel needles in a clean and dry place.

Fig. 7-39 *Remove steel needle*

7 Clean and insert all removed steel needles.

8 Check, if all steel needles are clean and have been inserted.

9 Fit the lid onto the container.

10 Fasten all screws.

Standard fixed tip adapter can be used.

7.3.18.4 Checking the Coating of the Tips (MCA96)

Conditions

Tip block parked.

Checking the Tips

To check the tips for damaged coating, proceed as follows:

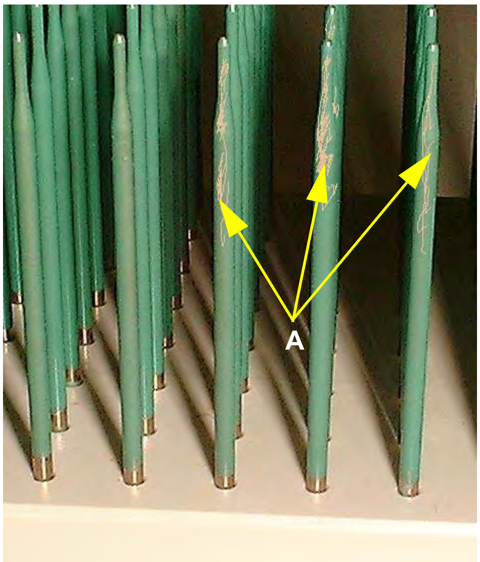


Fig. 7-40 *Tip block with damaged coating*

1. Visually check the coating of the tips for scratches or other damages on the surface.
2. Also check the points of the tips.
3. Clean the tips carefully with 70% ethanol cleaning agent.
4. In case of damaged tips, replace the tip block.

ATTENTION

The tip block cannot be repaired by the operator. A damaged tip block must be replaced completely, or a Tecan FSE must be called to repair it.
Do not attempt to repair the tip block by yourself.

7.3.18.5 Checking the Tip Cone Seals (MCA96 Head)

Cross References

List of cross references to information provided in other sections:

Subject	**Reference**
Replace tip cone seal	See section 7.6.3.4 “Replacing the Tip Cone Seals (MCA96)”, 2 7-95
Perform leakage test	See section 7.4.2.2 “Leakage Tests with DiTis or Fixed Tips”, 2 7-83
Check carrier positions (offsets)	See section 7.3.18.14 “Checking the Carrier Positions (Offsets)”, 2 7-75
Teach carrier positions	Refer to the “Freedom EVOware Software Manual”

Conditions

Instrument switched off.

Checking Seals

To check the seals for damage, proceed as follows:

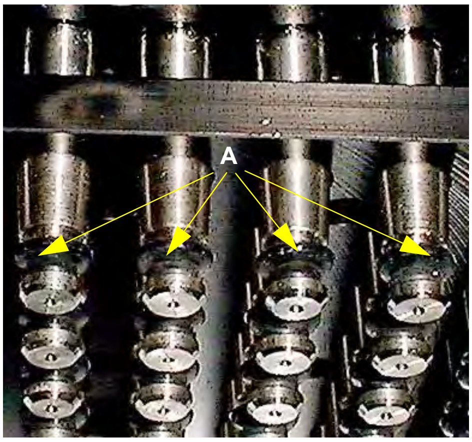


Fig. 7-41 Tip cone seals

1. Check the tip cone seals (A) for damage.
2. Replace the tip cone seals, if necessary.
   Refer to cross references above.
3. Perform the leakage test.
   Refer to cross references above.

Note: *If the pipetting head leaks after the tip cone seals have been replaced, proceed as follows:*

1. Check if the tips are properly mounted
2. If the tips are OK, check the carrier/rack offset.
   Refer to cross references above.
3. Teach the offset, if necessary.
   Refer to cross references above.

If the error cannot be eliminated, call the Tecan FSE.

7.3.18.6 Checking the Gaskets (MCA384 Head)

Cross References

List of cross references to information provided in other sections:

Action	Reference
Replace gasket	See section 7.6.3.5, 2 7-96
Perform leakage test	See section 7.4.2.2, 2 7-83
Check carrier positions (parallelism)	See section 7.3.18.14, 2 7-75
Teach carrier positions	Refer to the “Freedom EVOware Software Manual”

Conditions

Instrument switched off.

Checking Gaskets

To check the gaskets on the MCA384 head for damage, proceed as follows:

1. Check the gaskets (A) for damage.
2. Replace the gaskets, if necessary.
   Refer to cross references above.
3. Perform the leakage test.
   Refer to cross references above.

A *Gasket*
B *Blunt tube*

Fig. 7-42 *Gaskets*

Note: *If the pipetting head leaks after the gaskets have been replaced, proceed as follows:*

1. Check if the tips and the adapter are properly mounted.
2. If the tips are OK, check the carrier/rack offset.
   Refer to cross references above.
3. Teach the offset, if necessary.
   Refer to cross references above.

If the error cannot be eliminated, call the Tecan FSE.

7.3.18.7 Parking, Cleaning and Covering the Fixed Tip Block (MCA96)

How to Keep the Tip Block After Use

Note: *Tecan recommends you to park the tip block and remove it from the instrument after every work shift. Always clean and properly store the tip block.*

WARNING

The pointed tips of the tip block might cause injuries when you handle the tip block carelessly.

- Always be aware of the mechanical hazards.
- Wear laboratory apparel, rubber gloves, safety goggles, etc. as appropriate.

ATTENTION

Always handle the tip block in such a way that it will not be contaminated:

- It is important to store the tip block in a dust-free place.
- Never touch the tips with your fingers. When handling the tip block, always hold it by the PEEK block.
- Never put down the tip block with its tips resting on the table.

1. Park the tip block on the transfer rack.
2. Clean the tip block with 70% isopropanol or ethanol cleaning agent.
3. Wipe the tip block dry with a lint-free tissue.

   Or Blow the tip block dry by means of oil-free compressed air.
4. Store the tip block in the tip block box.

7.3.18.8 Parking and Cleaning the Fixed Tip Adapter (MCA384)

How to Keep the Fixed Tip Adapter After Use

Note: *Tecan recommends you to mount the* Adapter QC MCA384 *on the head after work shifts. Always clean the fixed tip adapter and store it safely.*

WARNING

The pointed tips of the fixed tip adapter might cause injuries when you handle the fixed tip adapter carelessly.

- Always be aware of the mechanical hazards.
- Wear laboratory apparel, rubber gloves, safety goggles, etc. as appropriate.

ATTENTION

Always handle the fixed tip adapter in such a way that it will not be contaminated:

- Never touch the tips with your fingers. When handling the fixed tip adapter, always hold it by the adapter itself.
- Never put down the fixed tip block with its tips resting on the table.

1. Drop the fixed tip adapter on an empty adapter rack on the System Carrier.
2. Mount the Adapter QC MCA384.
3. Clean the fixed tip adapter with 70% isopropanol or ethanol cleaning agent.
4. Wipe the fixed tip adapter dry with a lint-free tissue.
   Or Blow the fixed tip adapter dry by means of oil-free compressed air.
5. Leave the fixed tip adapter on the adapter rack on the System Carrier or store it in the acrylic glass adapter storage box.

7.3.18.9 Washing and Emptying the Wash Block

How to Keep the Wash Block After Use

Note: *Tecan recommends you to wash and empty the wash block after every work shift.*

- *You can make use of specific wash liquids for washing, if necessary.*

Washing the Wash Block

Required Material: Wash liquid.

Fig. 7-43 *Wash unit*

1 Check if the wash block is primed.
2 On the front side of the wash unit, connect the container with the 70% ethanol wash liquid to the tube fitting “wash liquid container 1” (A).
3 Start the “Setup & Service” software.
4 Select the “Wash Tool” page.
5 Wash and empty the wash block.
Refer to the “Instrument Software Manual” for information on how to do it.
Wash liquid container 1 is used.
6 Depending on the application, repeat step 5 until desired cleanliness of the wash block is achieved.

Emptying the Wash Block

To empty the wash block and the tubing system, proceed as follows:

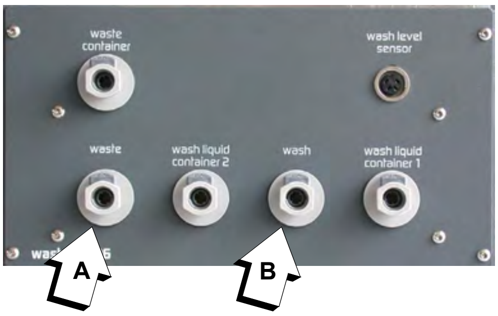


Fig. 7-44 *Wash unit: waste and wash fittings*

1 On the front side of the wash unit, uncouple the waste tubing from the fitting “waste” (A).
– The waste tubing is automatically secured against leakage by a check valve.
2 Uncouple the wash tubing from the fitting “wash” (B) and connect it to fitting “waste” (A).

3 Start the “Setup & Service” software.
4 In the “Contents” page, select “Waste Pump”.
5 Run the waste pump.
Refer to the “Instrument Software Manual” for information on how to do it.
6 Repeat step 5 until the wash system is empty.
7 On the front side of the wash unit, uncouple the wash tubing from the fitting “waste” (A) and put it back into the position “wash” (B).
8 Connect the waste tubing to fitting “waste” (A).

7.3.18.10 Washing the Fixed Tip Block (MCA96) or Fixed Tip Adapter (MCA384)

How to Wash the Fixed Tip Block / Fixed Tip Adapter

To wash the fixed tip block or fixed tip adapter, proceed as follows:

ATTENTION

Make sure that no precipitates can be produced during the wash procedure. Depending on your application you need to use different wash liquids.

***Note:** Tecan recommends you to define a script in the application software for the following procedure:*

1 Place a reagent trough with deionized water and a reagent trough with 70% ethanol on a (service) carrier.
2 Aspirate twice deionized water and dispense it into the wash block.
3 Aspirate twice 70% ethanol and dispense it into the wash block.
4 Once aspirate and dispense air.
5 Store the dry fixed tip block / fixed tip adapter in the fixed tip block box / fixed tip adapter box.
6 Prime the wash block.

7.3.18.11 Checking the Filter of the Wash System

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Replace filter	See section 7.6.3.2 “Replacing the Wash System Filter”, 2 7-95

Conditions

Instrument switched off.

Checking the Wash System

To check the wash system filter for contamination, proceed as follows:

1. Visually check if the filter is affected by algae (greenish/brownish color) or other contamination.
2. Replace the filter, if necessary.
   Refer to cross references above.

7.3.18.12 Emptying and Cleaning the Wash Liquid Containers

How to Empty and Clean the Containers

To empty and clean the wash liquid containers, proceed as follows:

1. Empty the wash liquid containers manually or by using the waste pump.
   Refer to the “Instrument Software Manual” for information on how to use the waste pump.
2. Clean the container in a sink basin and rinse them with 70% ethanol.

7.3.18.13 Checking the Tubing of the Wash System

How to Check the Tubing

Check the tubing as follows:

1. Visually check tubing for contamination with algae (greenish/brownish color) as well as for lime or other precipitates.
   It is essential that the tubing is clean.

ATTENTION

If the tubes are heavily contaminated the entire wash system must be checked. Call the Tecan FSE.

Note: *Algae in the tubing system can cause the tips to be clogged.*

7.3.18.14 Checking the Carrier Positions (Offsets)

Cross References

Setup Positions

WARNING

Moving parts.
Injuries possible if instrument starts unexpectedly.

- Do not reach into the area of the moving parts while checking the positions.

ATTENTION

Possible damage to the fixed tip block.

- Do not use the fixed tip block, but the special teach block and the reference plate/reference block for teaching the positions.
- Make sure that the Setup & Service software is adjusted to the correct teach pin length (430 or 670).

Checking Setup Positions

To check the site positions on the service carrier, proceed as follows:

1. Place the reference block onto the corresponding site of the service carrier.
2. Switch the instrument on.
3. Pick up the teach block.
4. Start the Setup & Service software.
5. Use the move tool (**System Devices**>**MCA96**>**Move Tool**) to move the pipetting head to the corresponding position.
   Refer to the “Instrument Software Manual”.
6. Check rotational and horizontal adjustment.
7. In case of deviations proceed as follows:
   – If the tips do not move to the correct position, the position of the corresponding carrier must be re-adjusted and taught-in newly.
   Call your field service engineer.
8. Drop the teach block.

Microplates, Wash Blocks and Reagent Troughs

Checking Labware Positions

To check the positions (offsets) of the microplates, wash blocks and reagent troughs relative to the tips, proceed as follows:

Parallelism

Note: *In case the pipetting head is not parallel to the microplates, wash blocks and reagent troughs, the horizontal alignment of the head needs to be readjusted. Call the Tecan FSE.*

1. Make sure that the setup positions are correct.
   See “Setup Positions” earlier in this section.
2. Check the positions with the microplates, etc. that are in use with your process.
3. In case of deviations adjust the offsets in your application software.
   Refer to the “Freedom EVOware Software Manual”.

7.3.19 Positive Identification (PosID)

WARNING

Fire hazard, if heated parts are cleaned with flammable agents.

- Allow the PosID to cool down before cleaning.

ATTENTION
The laser output window of the PosID barcode scanner must be perfectly clean at all times. Even slight soiling may cause errors.

- For cleaning, avoid abrasive substances.
- Do not scour the surface. Use a soft, clean tissue.

Barcode Scanner

To clean the laser output window of the barcode scanner, proceed as follows:

WARNING

Laser light (CLASS 2 LASER PRODUCT).

- Do not stare into beam nor into its reflections on the worktable.
- Caution – Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.
- Ensure appropriate FDA regulatory actions have been taken for any Class II laser products.

1. Check if the barcode scanner (A) is in vertical position and if the laser output window is accessible as shown in the figure below.
   If this is not the case, initialize the PosID.

ATTENTION

Damage to the barcode scanner drive if the position of the barcode scanner is forced manually.

- Do not attempt to rotate the barcode scanner manually.
- Use the initialization routine to run the barcode scanner into maintenance position.

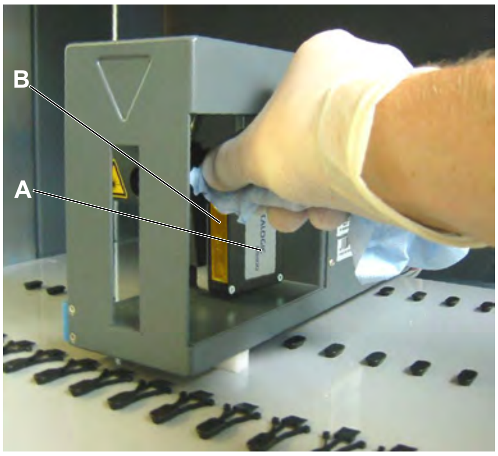


Fig. 7-45 PosID barcode scanner

2 Switch the instrument off.

3 Remove the carriers in front of the PosID to gain access to the PosID.

4 Visually check the laser output window (B) for cleanliness.

5 Moisten a lint-free tissue with alcohol and clean the output window, if necessary.

"No Tube" Sensor

To clean the "No Tube" sensor, proceed as follows:

1 Switch the instrument off.

2 Remove the carriers in front of the PosID to gain access to the PosID.

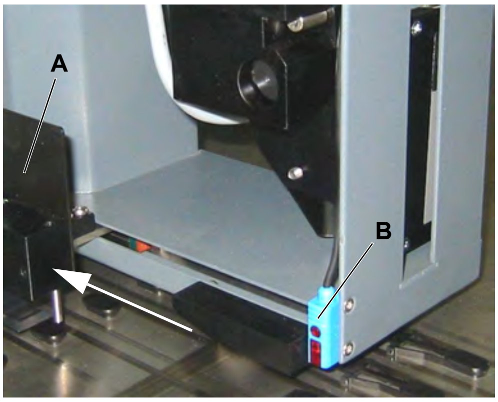


Fig. 7-46 PosID "No Tube" sensor

3 Slide the PosID gripper (A) back to gain access to the "No Tube" sensor (B).

4 Moisten a lint-free tissue with alcohol and clean the front surface of the "No Tube" sensor.

7.3.20 Centrifuge

To lubricate the centrifuge hangers:

1 Switch on the instrument.
2 Remove the lock pin and pull out the centrifuge.

Fig. 7-47 *Lock pin*

3 Unlock and open the lid.
4 Remove buckets (FE500) or microplates (Freedom EVO) and hangers.
5 Clean and disinfect hangers.
6 Clean the inside of the centrifuge.
7 Grease the bearings surface (e.g. with Tecan Grease or Hettich 4051).

Note: *The figure shows a hanger for FE500 tube buckets. The hanger bearings surface of a microplate hanger is similar.*

Fig. 7-48 *Greasing the bearings surface*

8 Insert the hangers.
If the hangers are numbered, match numbers of hangers and rotor.
9 Place buckets or microplates in the hangers.
10 Close and lock the lid.
11 Push the centrifuge into position and secure it with the lock pin.

7.3.21 Arm Guide

The following description is applicable to:

- Liquid handling arm (LiHa)
- Multichannel arm (MCA96)
- Multichannel arm (MCA384)
- Robotic manipulator arm (RoMa standard and long)
- Pick and place arm (PnP)

Cleaning the Arm Guide

In order to avoid uneven movements of the arm, use a cotton tab or a lint-free tissue on a screwdriver to clean the arm guide roller and a lint-free tissue to thoroughly clean the arm guide rails.

Note: *Do not use alcohol or solvents to clean the arm guide. Do not use grease on the arm rails.*

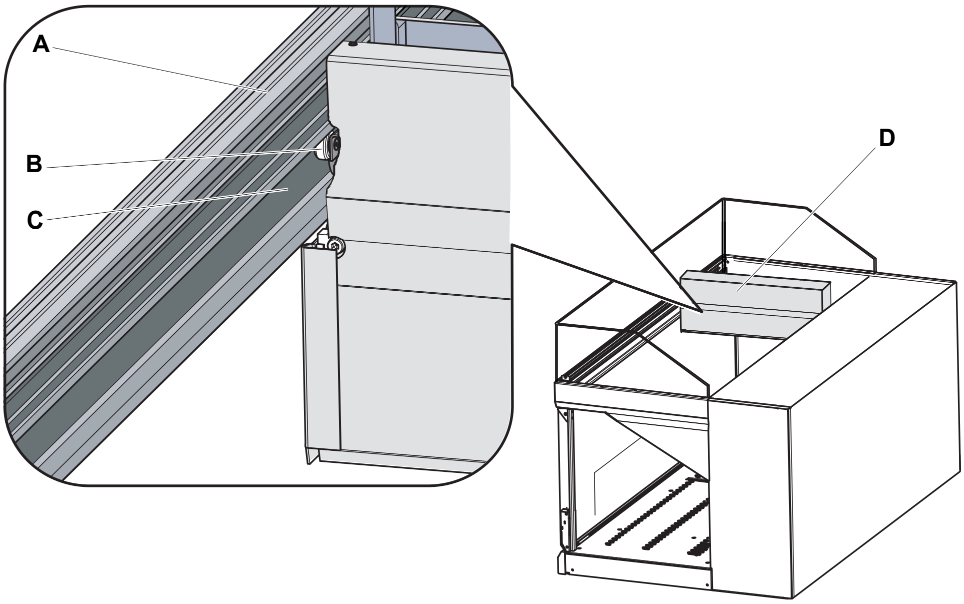


Fig. 7-49 *Arm guide and roller*

A	*Arm guide*	***C***	*Arm rail*
B	*Arm guide roller*	***D***	*Arm*

Note: *If a multichannel arm is installed make sure not only to clean the lower face of the guide rail but also the upper face, since the MCA96 and MCA384 are equipped with rollers that run on both sides of the guide rail.*

7.4 Precision and Function Tests

7.4.1 Liquid Handling Performance Verification Testing

QC Kit

Tecan recommends the use of the QC Kit for liquid handling performance verification testing at least once per year; a higher test frequency may apply, based on the Quality & Regulatory requirements of the laboratory using the Freedom EVO platform.

The new QC Kit is based on Artel's patented Ratiometric™ Photometric technology, now being made available for Tecan's customers.

Customer benefits include:

- Traceability of test results to the international standards
- Robustness of the method in a daily lab environment
- Ease-of-use

The QC Kit covers LiHa and MCA.

For details about the QC Kit refer to the QC Kit manuals (see 1.1 “Reference Documents”, 2 1-2) and the website **www.tecan.com/qckit**.

Alternative Methods

Alternative methods are:

- Gravimetric test (LiHa / Air LiHa); description in the Instrument Software Manual
- Color Precision test (MCA); description in section 7.4.2.1, 2 7-81

Software Used for various Tests

Note: *The “Setup & Service” and the application software offer a variety of tests to check individual functions of the modules.*

- *Refer to the “Instrument Software Manual”.*
- *Refer to the “Freedom EVOware Software Manual”.*

7.4.2 MCA-Specific Tests

7.4.2.1 Color Precision Test

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Perform leakage test	See section 7.4.2.2 “Leakage Tests with DiTis or Fixed Tips”, 2 7-83

Purpose

The color precision test is used to determine how precise the pipetting head dispenses liquid (using DiTis or a fixed tip block).

It is necessary to calibrate your colored solution to determine accuracy, e.g. with an accurate manual pipette.

Note: *Precision and accuracy depend on the specific liquid and the DiTis or the fixed tip block which are used. Tecan recommends you to check precision and accuracy with the specific liquid and pipetting device (DiTi or fixed tip block) used in your application, to verify the corresponding calibration factors and to adjust them, if necessary.*

Required Material

Color solution, e.g., Orange-G
A microplate reader for 384-well microplates

Script

This test is carried out in the application software. There are predefined maintenance scripts available in the application software. These can be adapted to the user’s needs, if necessary.
For further information refer to the “Freedom EVOware Software Manual”.

Running the Test

To run the color precision test, run the maintenance script and pay attention to the following:

- Tecan recommends you
  – to use different tip devices to pipette diluent and color solution, e.g., diluent with fixed tips, color solution with DiTis.

Calibration Factors

- Mind that calibration factors may need to be adapted.
  – In the application software, default calibration factors are defined for contact dispense with DMSO and water.
  – Tecan recommends you to verify the calibration factors and the accuracy with the specific liquids used in each application.

Procedure with MCA96

1. Aspirate 100 µl diluent and dispense it by contact dispense into a 96-well microplate.
2. Aspirate x µl color solution and dispense it by contact dispense into the prefilled 96-well microplate.
3. Aspirate (100 - x) µl diluent and dispense it by contact dispense into a 96-well microplate.
4. Mix by five aspirating and dispensing cycles of 80 µl.
5. Measure the colorimetric values of the pipetted solutions in the microplates.

   Shake the microplate before measurement with high intensity for 30 seconds.

Procedure with MCA384

1. Aspirate 25 µl diluent and dispense it by contact dispense into a 384-well microplate.
2. Aspirate x µl color solution and dispense it by contact dispense into the prefilled 384-well microplate.
3. Aspirate (75 - 25 - x) µl diluent and dispense it by free dispense into a 384-well microplate.
4. Measure the colorimetric values of the pipetted solutions in the microplates.

   Centrifuge the microplate before measuring in a reader.

Note: *Tecan recommends you to use*

- *an appropriate Tecan reader for 96- or 384-well microplates.*
- *0.1 mol disodium hydrogen phosphate dihydrate (Sigma O3756) as diluent and to dissolve orange G (Sigma 71643).*
- *Greiner flat bottom 96-well microplates 7.6555101 or 384-well microplates 781101.*

5. If the measured CVs and Accuracies are within tolerance, the test has been passed.

If the test results are out of tolerance, make sure that

- solutions are not contaminated.
- the microplates are not damaged.
- the reader is in a good condition (calibrated).
- the pipetting head is not leaking.
  Refer to cross references above.

Note: *If the desired precision cannot be achieved, call the Tecan FSE.*

7.4.2.2 Leakage Tests with DiTis or Fixed Tips

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Replace tip cone seals (MCA96)	See section 7.6.3.4 “Replacing the Tip Cone Seals (MCA96)”, 2 7-95
Replace gaskets (MCA384)	See section 7.6.3.5 “Replacing the Gaskets (MCA384)”, 2 7-96

Purpose

To check if one or several of the 96 channels of the pipetting head are leaking.

Script

This test is carried out in the application software. There are predefined maintenance scripts available in the application software. These can be adapted to the user’s needs, if necessary.
For further information refer to the “Freedom EVOware Software Manual”.

Running the Test with DiTis (MCA96)

To run the leakage test with DiTis, run the corresponding maintenance script. The script suggests the following procedure:

1. Pick up largest on site available MCA 96 DiTis.
2. Condition the tips with a wash or a mix cycle.
3. Without trailing air gap aspirate the maximum applicable volume (depending on DiTi size, e.g. 190µl for a 200µl DiTi).
4. Move the pipetting head so that it is placed above a dry microplate (dispense 0µl).
5. Wait for five minutes.
   - During this time, check if there are any DiTis that are loosing liquid.
   - There may be small drops forming at the ends of the DiTis, but the microplate must remain dry.
6. Dispense 100 µl and drop the DiTis.

If there are DiTis loosing liquid:

- Replace the corresponding tip cone seals.
  Refer to cross references above.
- Repeat the test.

Note: *If the pipetting head still leaks after the tip cone seals have been replaced, it must be sent to Tecan for repair.*

Running the Test with Fixed Tip Block (MCA96)

To run the leakage test with the fixed tip block, run the corresponding maintenance script. The script suggests the following procedure:

1 Pick up the fixed tip block.
2 Condition the fixed tip block with a wash or a mix cycle.
3 Without trailing air gap, aspirate 100 µl water.
4 Move the pipetting head so that it is placed above a dry microplate (dispense 0 µl).
5 Wait for one minute.
   – During this time, check if there are any tips that are loosing liquid.
   – There may be small drops forming at the ends of the tips, but the microplate must remain dry.
6 Dispense 100 µl and park the fixed tip block.

If there are tips loosing liquid:
- Replace the corresponding tip cone seals.
  Refer to cross references above.
- Repeat the test.

Note: *If the pipetting head still leaks after the tip cone seals have been replaced, it must be sent to Tecan for repair.*

Running the Test with DiTis or Fixed Tips (MCA384)

To run the leakage test with DiTis or fixed tips, run the corresponding maintenance script. The script suggests the following procedure:

1 Pick up an Adapter DiTi MCA384 or an Adapter Fixed Tip 125 µl MCA384.
2 Pick up largest on site available MCA 384 DiTi if using the Adapter DiTi MCA384.
3 Condition the tips with a wash or a mix cycle.
4 Without trailing air gap aspirate the maximum applicable volume (depending on DiTi size, eg. 125µl for a 125µl DiTi).
5 Move the pipetting head so that it is placed above a dry microplate (dispense 0 µl).
6 Wait for five minutes.
   – During this time, check if there are any DiTis or fixed tips that are loosing liquid.
   – There may be small drops forming at the ends of the DiTis or fixed tips, but the microplate must remain dry.
7 Move the pipetting head so that it is placed above a second dry microplate.
8 Dispense 15 - 20 µl.
   – Check if all 384 wells are filled with this small amount of liquid.
9 Dispense the rest (85 - 80 µl).
10 Drop the DiTis and the Adapter DiTi MCA384 or the Adapter Fixed 125 µl MCA384.

If there are DiTis or fixed tips loosing liquid:

- Replace the corresponding gaskets.
  Refer to cross references above.
- Repeat the test.

If there are single wells not filled with water after dispensing 15 - 20 µl:

- Replace the corresponding gasket and/or replace the corresponding fixed tip. (channel is not tight or clogged).
- Repeat the test.

Note: *If the pipetting head still leaks after the gaskets have been replaced, it must be sent to Tecan for repair.*

7.5 Decontamination

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Safety information on decontamination	See section 2.8 "Decontamination Declaration", 2 2-19
Commercially available agents	See section 7.1 "Tools and Consumables", 2 7-1

Agents

Note: *The selection of the appropriate decontamination agent depends on the contamination degree and the kind of contaminant.*

Decontamination can be performed with the following agents:

- Bleach 0.5% to 3%
- 70% ethanol + 30% H_2O

Commercially Available Agents

For commercially available agents that can be used for decontamination or disinfection, refer to cross references above.

Hints Concerning Decontamination

In order to remove protein residues in the tubing and tips, flush the liquid system periodically with weak acid, followed by base. Alternatively, use the above mentioned commercially available agents.
Certain agents can be used as system liquid additives. Most of the immunological assays will not be affected by them.

Elimination of Nucleic Acid Residues

Nucleic acid residues in standard tips and pipetting tubing can usually be eliminated by means of wash or decontamination cycles with a 3% bleach solution.
Appropriate commercially available agents (e.g. DNAzap) are used to keep the pipetting area (worktable, carriers etc.) free of interfering nucleic acids.

7.6 Adjustments and Replacements

7.6.1 Positioning Pins

Replacing Positioning Pins

To replace a positioning pin on the worktable, proceed as follows:

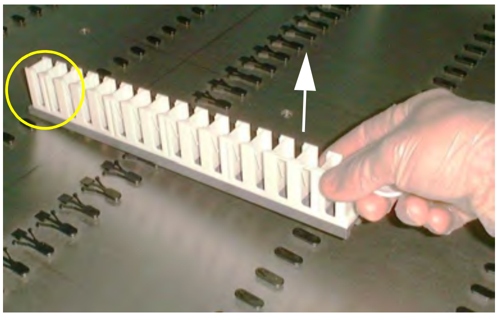


Fig. 7-50 *Extracting a positioning pin*

1 Slide the frontmost part of a carrier onto the positioning pin to be replaced.

2 Carefully lift the carrier (see arrow) to pull out the positioning pin.

Do not use force to extract the pin. If it doesn't come loose, retry with the carrier in a slightly changed position.

Fig. 7-51 *Inserting a positioning pin*

3 Carefully press the new pin into the hole on the worktable.

You can use a small rubber mallet if the pin cannot be inserted manually.

Note: *When replacing positioning pins, take note to the following:*

- *Make sure to only replace a pin by one of exactly the same type and pay attention to the orientation.*
- *Do not leave uncovered grid holes on the worktable as liquids might flow into the area below the worktable.*

ATTENTION

Loose positioning pins can result in bad positioning of carriers and labware.

- It is recommended that you replace removed positioning pins with new ones

7.6.2 MultiSense Option

7.6.2.1 DiTi Kit MultiSense

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Cut and adjust the tube end	See section 7.6.2.2 “Cutting/Adjusting the Tube End”, 2 7-90

DiTi Kit MultiSense Parts

The DiTi kit MultiSense (available as spare part) includes the following parts:

Fig. 7-52 DiTi kit MultiSense

A	*Distance tube (with groove)*	***E***	*DiTi ejector*
B	*X-ring*	***F***	*O-ring*
C	*Separator ring*	***G***	*DiTi cone MultiSense (gold-plated)*
D	*Needle tube*		

Note: *Unlike the distance tube of the standard tip adapter, the distance tube (A) of the MultiSense option is marked with a groove. This groove has no technical function, it’s only there for identification purposes.*

Disassembling

To remove the DiTi kit MultiSense, proceed as follows:

1. Switch the instrument off and open the front safety panel.
2. Manually move all Z-rods completely up.
3. Move all Z-rods together towards the front of the instrument.
4. Spread the Z-rods as wide as possible.
5. Hold the MultiSense tip adapter (L) while unscrewing and removing the DiTi cone (G), using the cone wrench (H).
6. Remove the DiTi ejector (E).
7. Remove the needle tube (D).
8. Unscrew and remove the distance tube (A).
9. Remove if necessary:
   - X-ring (B)
   - white separator ring (C)
   - O-ring (F)

Installing

The DiTi kit MultiSense is installed in the following sequence:

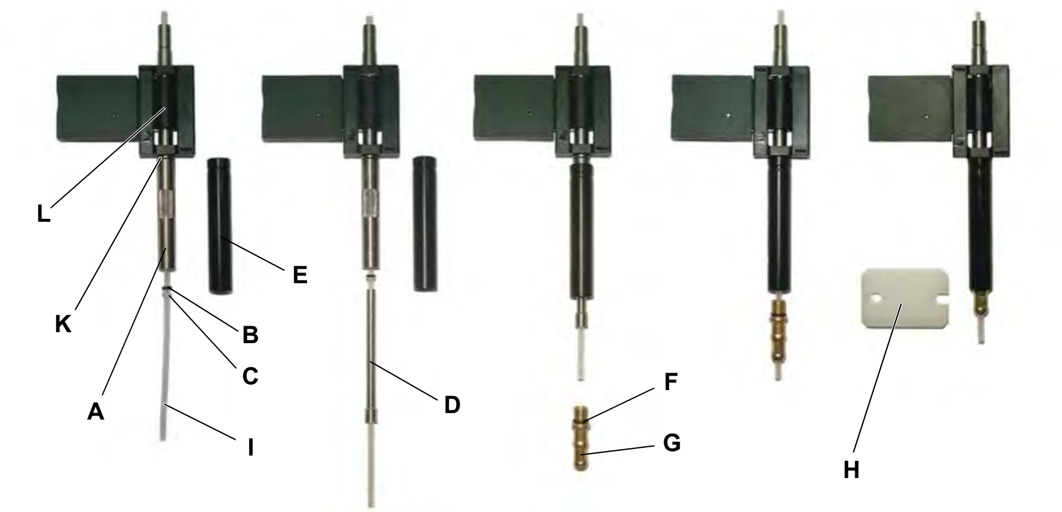


Fig. 7-53 *DiTi kit MultiSense installation*

A	*Distance tube*	***G***	*DiTi cone MultiSense*
B	*X-ring*	***H***	*Cone wrench*
C	*Separator ring*	***I***	*Pipetting tube*
D	*Needle tube*	***K***	*O-ring*
E	*DiTi ejector*	***L***	*MultiSense tip adapter*
F	*O-ring*		

1. Switch the instrument off and open the front safety panel.
2. Manually move all Z-rods completely up.
3. Move all Z-rods together towards the front of the instrument.
4. Spread the Z-rods as wide as possible.

5 Pull the pipetting tube (I) approx. 6 cm out of the MultiSense tip adapter (L).

6 Make sure the O-ring (K) is placed correctly behind the thread of the MultiSense tip adapter (L).

7 Screw the distance tube (A, knurled part up) onto the tip adapter.

8 Attach the X-ring (B) onto the X-ring mounting tool (M) and slide it onto the pipetting tube (I).

B	*X-ring*
I	*Pipetting tube*
M	*X-ring mounting tool*

Fig. 7-54 *Mounting the X-ring*

9 Slide the white separator ring (C) behind the X-ring (B) onto the pipetting tube (I).

10 Slide the needle tube (D) over the pipetting tube.

11 Make sure the sealing (F, O-ring) on the DiTi cone is placed correctly behind the thread.

12 Glide the DiTi ejector (E), outer rim pointing upwards, over the distance tube (A) and fasten the DiTi kit MultiSense with the DiTi cone (hand tight).

13 Tighten carefully, using the supplied cone wrench (H); approx. ¼ turn.

14 Cut and adjust the tube end.
Refer to cross references above.

7.6.2.2 Cutting/Adjusting the Tube End

ATTENTION

Possible malfunction of the MultiSense option if the pipetting tubing is

- wet, dusty or contaminated.
- not cut in a right angle (see section "Cutting the Tube End", 2 7-90).
- not protruding out of the DiTi cone by 2 mm (see section "Adjusting the Tube End", 2 7-91).

Cutting the Tube End

The end of the pipetting tube, sticking out from the DiTi cone, must be clean and cut in a right angle to ensure that the MultiSense option works correctly.

WARNING

Sharp edged blade on tube cutter can cause injuries on hand or fingers.

- Keep hand and fingers out of the area between cutting blade and cutter body.

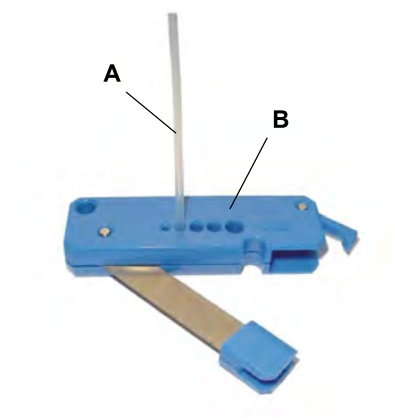


Fig. 7-55 Tube cutter

1. Pull the pipetting tube (A) out of the DiTi cone, as far as necessary.
   Refer to cross references above.
2. Cut the pipetting tube in a right angle with the tube cutter (B).

Adjusting the Tube End

After disassembling and installing the DiTi kit MultiSense the protruding pipetting tube needs to be adjusted to 2 mm.

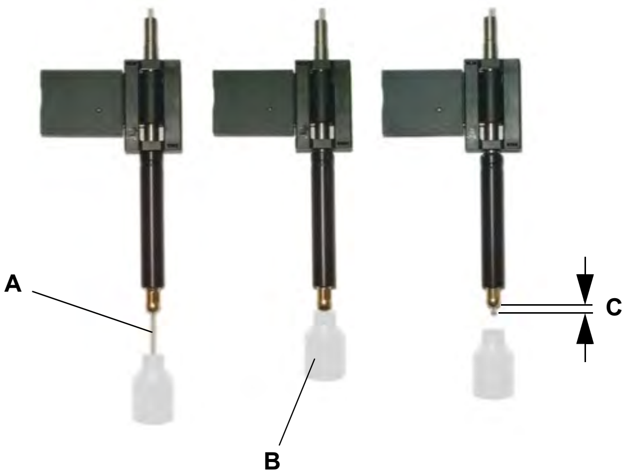


Fig. 7-56 Adjusting the tube end

1. Pull the pipetting tube (A) by approx. 1 cm (0.5 in) out of the DiTi cone. Refer to cross references above.
2. Shift the tube back with the tube adjusting tool (B) until the tool is touching the DiTi cone.

   The tube is now sticking out of the DiTi cone by 2 mm (C).

Note: *Make sure that the pipetting tube is not kinked during this procedure.*

Tests and Settings

To ensure operating readiness, perform the following tests:
Refer to the “Instrument Software Manual”.

- PMP Tests

7.6.2.3 Retrieving the Pipetting Tube

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Remove / Install the DiTi kit MultiSense	See section 7.6.2.1 “DiTi Kit MultiSense”, 2 7-87
Cut and adjust the tube end	See section 7.6.2.2 “Cutting/Adjusting the Tube End”, 2 7-90

To ensure the proper function of the MultiSense option the pipetting tube must be properly installed, i.e. it must protrude from the tip adapter by 2 mm.

Cause

After a crash (e.g. incorrect DiTi pick-up) the tube may be pushed into the tip cone. This often leads to a malfunction of the MultiSense option.

In this case retrieve the pipetting tube and readjust it as follows:

1. Remove the DiTi kit MultiSense.
   Refer to cross references above.

   Do not remove:

   – the separator ring (A)
   – the X-ring (B)

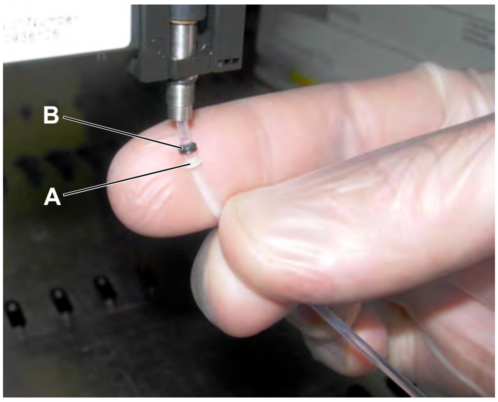


Fig. 7-57 *Separator ring and X-ring*

2. Pull the tube out by approx. 2 cm (1 in).

   With the DiTi cone installed the tube should protrude about 1 cm (0.5 in.)

Note: *Be careful not to loose the separator ring and the X-ring.*

3. Reinstall the DiTi kit MultiSense.
   Refer to cross references above.
4. Cut and adjust the tube end.
   Refer to cross references above.

7.6.3 Multichannel Arm (MCA96 / MCA384)

7.6.3.1 Adjusting the Service Carrier (MCA96)

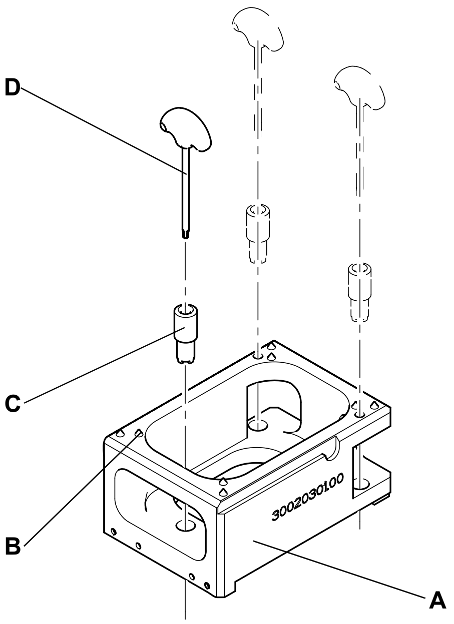
Cross References

List of cross references to information provided in other sections:

Subject	Reference
Check carrier positions	See section 7.3.18.14 “Checking the Carrier Positions (Offsets)”, 2 7-75

Note: *The service carrier is adjusted at the manufacturer's with regard to the height and the position of the three sites on the carrier. Therefore, this factory setting does not usually need to be changed.*

In some cases, the user may wish to adjust the site plates on the service carrier for special applications.
The figure shows the reference block and the tools that are provided.



A	*Reference block*
B	*Cone point*
C	*Height adjustment tool*
D	*Torx key*

Fig. 7-58 *Reference block and tools*

Note: *If you adjust the service carrier, pay attention to the following:*

- *The elements that enable adjustment are secured by lacquer.*
- *If the lacquer is broken, it is assumed that the service carrier is out of adjustment.*
- *Therefore, it must not be used for teaching positions or make other adjustments, such as adjustments to the pipetting head.*

Do not change the adjustment of the service carrier unless absolutely necessary.
Check/teach the carrier positions by means of the corresponding software.
Refer to cross references above.

To adjust the site plates of the service carrier, proceed as follows:

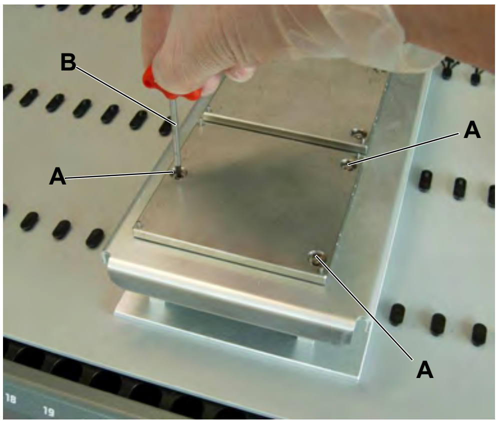


Fig. 7-59 Site on service carrier

1 Loosen the screws (A) by means of the Torx key (B).

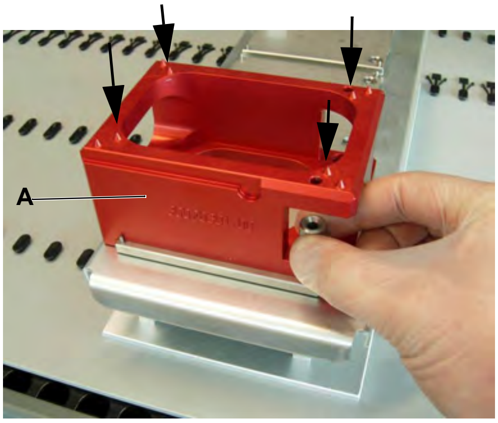


Fig. 7-60 Reference pins/cone points

2 Put the reference block (A) onto the corresponding site.

3 Mount the teach block with the corresponding teach pins to the MCA96 pipetting head.

4 Use the move tool to run the head near the service carrier. Refer to the "Instrument Software Manual".

5 Match the position of the teach pins with the cone points (see arrows) of the reference tool.

6 Visually judge the height.

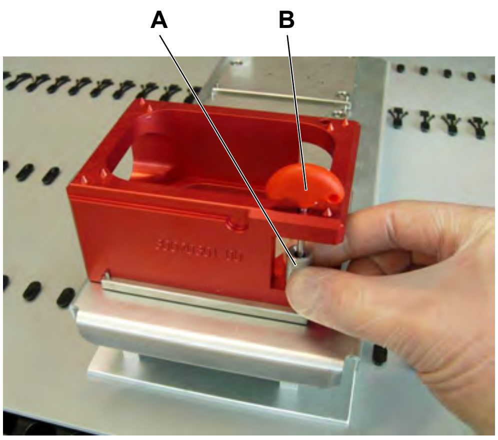


Fig. 7-61 Height adjustment tool

7 To adjust the height, turn the adjustment rings in the site plates by means of the height adjustment tool (A).

   – Turning clockwise lifts the site.

   – Turning counter-clockwise lowers the site.

   There are three adjustment rings to change the height of the site.

8 When the height is correct, adjust the rotational position of the site (shift it into position).

9 Tighten the screws with the Torx key (B).

7.6.3.2 Replacing the Wash System Filter

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Wash/empty wash block	See section 7.3.18.9 “Washing and Emptying the Wash Block”, 2 7-72
Prime wash block	See section 7.3.18.3 “Exchange Steel Needle (MCA96)”, 2 7-65

Conditions

Instrument switched off.

Replacing Filter

To replace the filters, proceed as follows:

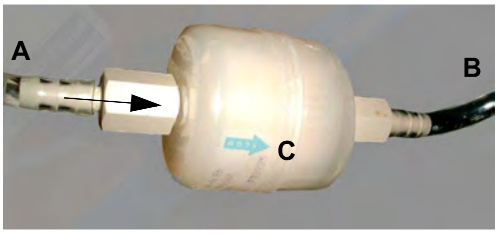


Fig. 7-62 *Wash system filter*

1 Empty the wash block.
Refer to cross references above.
2 Disconnect the tube (A) coming from the wash unit.
3 Disconnect the tube (B) leading to the wash block and remove the old filter.
4 Connect the tubes to the new filter.
Make sure that the arrow (C) on the filter points towards the wash block.
5 If the Freedom EVO is used for routine operation after replacement of the filter, prime the wash block.
Refer to cross references above.

7.6.3.3 Removing / Installing the Pipetting Head

MCA96 and MCA384

The pipetting head must only be removed for maintenance and repair done by a Tecan FSE. For a description of this procedure refer to the Freedom EVO Service Manual.

7.6.3.4 Replacing the Tip Cone Seals (MCA96)

The tip cone seals of the 96 channel head must only be replaced, if necessary, by a Tecan FSE. For a description of this procedure refer to the Freedom EVO Service Manual.

7.6.3.5 Replacing the Gaskets (MCA384)

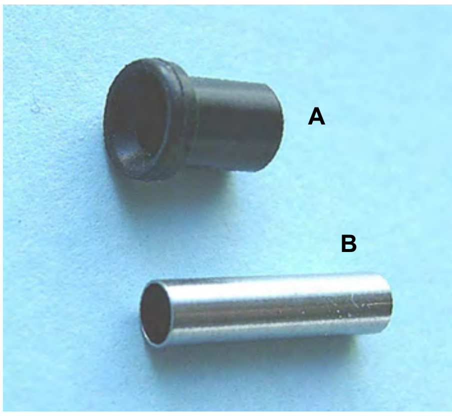
Cross References

List of cross references to information provided in other sections:

Action	Reference
Perform leakage test	See section 7.4.2.2 “Leakage Tests with DiTis or Fixed Tips”, 2 7-83
Perform color precision test	See section 7.4.2.1 “Color Precision Test”, 2 7-81

Parts

The following parts are used to seal the pipetting head against a mounted adapter:

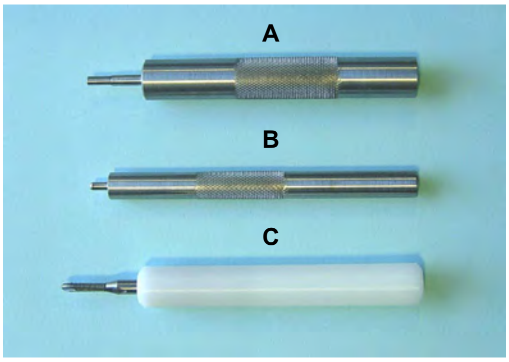


A *Gasket*
B *Blunt tube*

Fig. 7-63 *Gasket and Blunt tube*

Tools

Use the following tools for replacing the gaskets on the MCA384 head:



A *Blunt tube insertion tool*
B *Gasket insertion tool*
C *Blunt tube removal tool*

Fig. 7-64 *Gasket tools*

Replacing

To replace gaskets between the 384 channel head and the tip adapter, proceed as follows:

WARNING

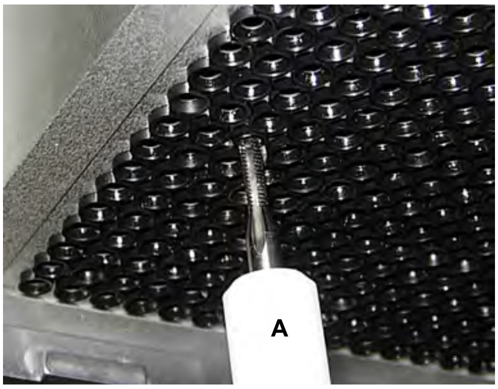
Moving parts of the pipetting head.
Injury of fingers possible if instrument starts unexpectedly.

- Do not reach into the moving area of the pipetting head when the instrument is in an undefined state.

ATTENTION

Always wear rubber gloves to avoid contamination of yourself and/or the tip cones.

1 Drop the MCA384 adapter.
2 Move the pipetting head to the front and up as high as possible.
3 Push the Blunt Tube Removal Tool (A) for approx. 2 mm into the channel/ Blunt tube by turning the tool clockwise.



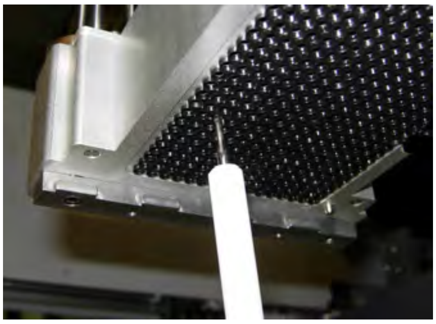


Fig. 7-65 *Insert Blunt Tube Removal Tool*

4 Pull the Blunt tube (B) out from the channel.

Fig. 7-66 *Remove Blunt tube*

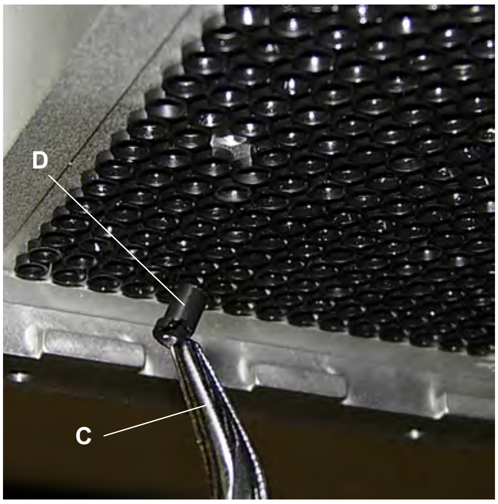


Fig. 7-67 *Remove Gasket*

5 Use a long nose pliers (C) to remove the Gasket (D) from the channel.

Be careful not to damage the other gaskets.

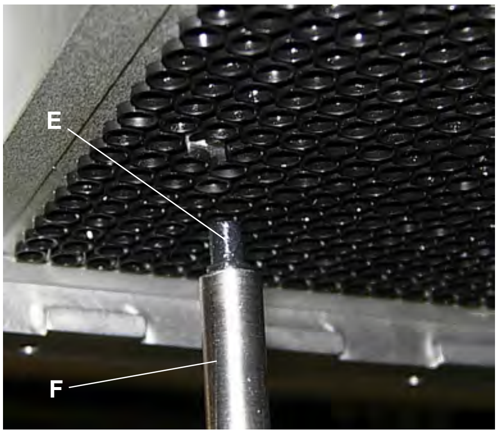


Fig. 7-68 *Insert Gasket*

6 Lubricate a new Gasket (E) with a thin film of mineral oil.

7 Insert the lubricated Gasket into the channel by using the Gasket Insertion Tool (F).

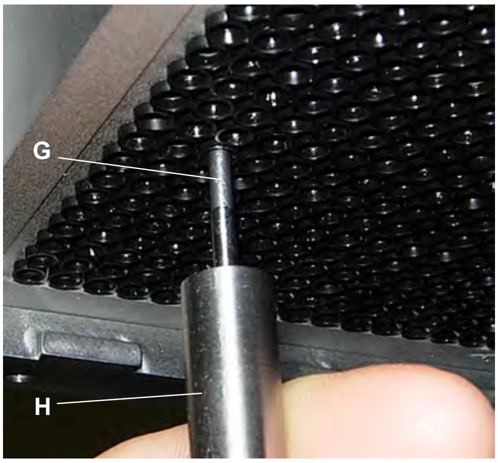


Fig. 7-69 *Insert Blunt tube*

8 Lubricate the outside surface of a new Blunt tube (G) with mineral oil.

9 Insert the lubricated Blunt tube gently into the channel by using the Blunt Tube Insertion Tool (H), until it goes all the way inside the channel.

10 Inspect the newly replaced Gasket for evenness within the other Gaskets.

ATTENTION

If the wrong gaskets have been used, or if they have been damaged during installation, the pipetting head may leak.

- Only use original gaskets and Blunt tubes provided by Tecan.
- Use only the special Gasket tools for removal and mounting the gaskets.

Requested Tests

To ensure operating readiness, perform the following tests:

- “Leakage” test
  Refer to cross references above.
- “Color Precision” test
  Refer to cross references above.

7.6.4 Diluter

7.6.4.1 Replacing the Syringe

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Fill Liquid System	Refer to the Instrument Software Manual

Syringes and Special Tips

Note: *250 µl syringes are recommended for use with Te-PS tips.*

ATTENTION

Erroneous pipetting results.
Use only 250 µl or 500 µl syringes with the low volume option.

- With larger syringes, precision and accuracy will not be within specifications.
- With smaller syringes, liquid spotting (free dispense) for volumes above the solenoid valve tubing volume (3 µl) is not possible.

Removing

To remove the syringe, proceed as follows:

1. Empty the liquid system:
   – Pull the system liquid tube out of system liquid container.
   – Run **Fill Liquid System**.
   Refer to cross references above.
2. Switch the instrument off.

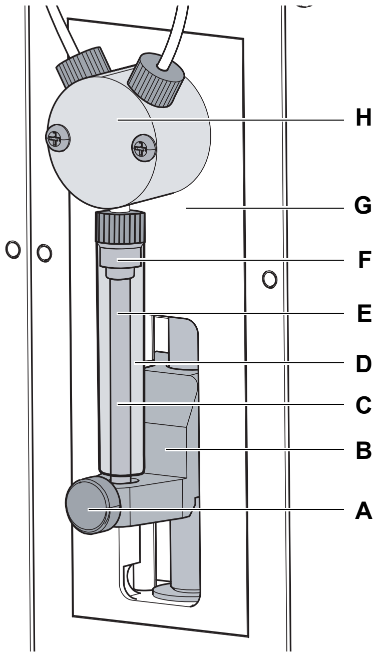


__Fig. 7-70__ Syringe

3. Loosen the plunger lock screw.
4. Manually move the plunger drive down.
5. Unscrew the syringe from the 3-way valve.

A	*Plunger lock screw*
B	*Plunger drive*
C	*Syringe (Plunger, Seal, Syringe barrel)*
D	*Syringe barrel (glass)*
E	*Plunger*
F	*Syringe cap (plunger to barrel seal)*
G	*Diluter front plate*
H	*3-way valve*

Installing

To install the syringe, proceed as follows:

1 Manually move the plunger drive down.
2 Screw the syringe into the 3-way valve.
3 Pull the plunger down into the plunger drive.
4 Check alignment of syringe barrel and plunger:
Syringe and plunger have to be aligned axially and must be in a straight line.
5 If necessary, adjust the syringe and plunger carefully.
6 Tighten the plunger lock screw firmly.
7 Tighten the syringe in the 3-way valve.

Performance Test

To ensure operating readiness, perform the following performance tests before resuming normal operation:

- Gravimetric or equivalent pipetting performance test to make sure that the precision and accuracy specifications are met.

7.6.4.2 Replacing the Syringe Cap

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Remove syringe	See section 7.6.4.1 “Replacing the Syringe”, 2 7-100

Replacing the Syringe Cap

To replace the syringe cap, proceed as follows:

1 Remove the syringe.
Refer to cross references above.
2 Pull the plunger out of the syringe barrel.

ATTENTION

Damage to O-ring. A damaged O-ring will lead to malfunction and erroneous pipetting volumes.

- Use caution when cutting the syringe cap for removal.

3 Carefully cut a slit into the neck of the syringe cap (A).
4 Remove the syringe cap (A) from the plunger (C).
Should the syringe cap not be able to be removed, cut another slit into the syringe cap neck.

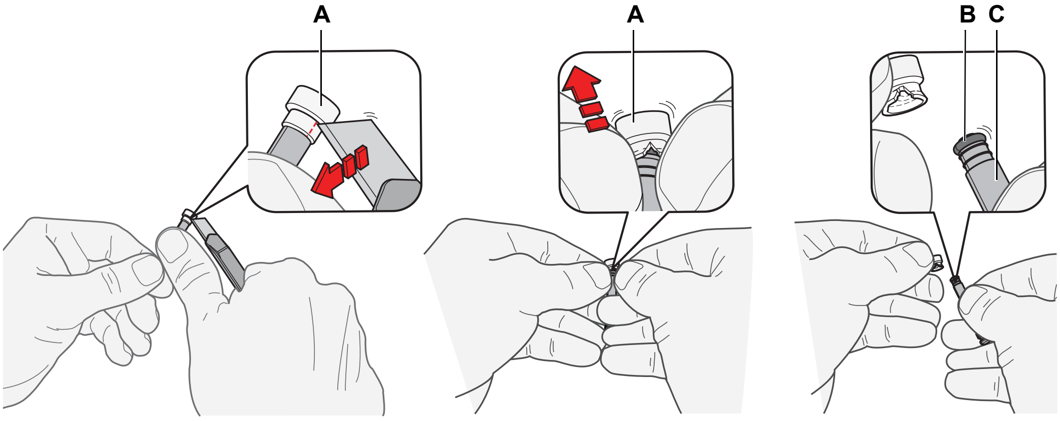


Fig. 7-71 Syringe seal

A	*Syringe cap*	**C**	*Plunger*
B	*O-ring*		

5 Moisten the o-ring with distilled or de-ionized water.
Place the new syringe cap on a table and press the plunger as straight as possible into the cap opening.

6 Press the syringe cap (A) wall onto the sharp edges (D) of the plunger (C) for anchoring.

7 Moisten the syringe cap (A) and push the plunger (C) into the syringe barrel.

8 Reinstall the syringe.

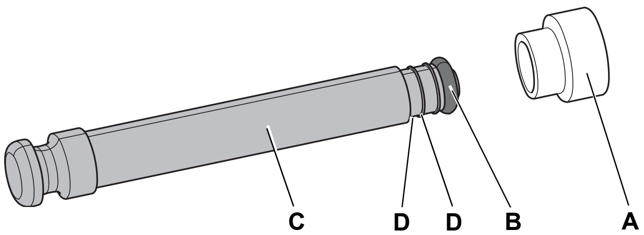


Fig. 7-72 Syringe plunger and seal

A	*Syringe cap*	**C**	*Plunger*
B	*O-ring*	**D**	*Sharp edges*

Performance Test

To ensure operating readiness, perform the following performance tests before resuming normal operation:

- Gravimetric or equivalent pipetting performance test to make sure that the precision and accuracy specifications are met.

8 Troubleshooting

Purpose of This Chapter

This chapter helps to resume operation after a minor problem has occurred with the Freedom EVO. It lists possible occurrences, their probable cause and suggests how to remedy the problem.

Which Errors can the Operator Correct?

The troubleshooting table below lists possible malfunctions and errors of the Freedom EVO. The operator is enabled to correct some of those problems or errors by him/herself. For this, appropriate corrective measures are listed in the column “Corrective measures”.

The elimination of more complicated malfunctions or errors is usually performed by the Tecan FSE according to separate instructions. In this case, reference to the FSE is made.

8.1 Troubleshooting Table

Trouble-shooting by the Operator

The following table lists problems and errors and gives instructions on how to eliminate them:

Tab. 8-1 Troubleshooting table

Problem, error	Possible cause	Corrective measures
Problem, error on instrument level		
System liquid leakage	Tubing and/or tubing connections not tight Syringe is leaking	Switch off instrument immediately Perform decontamination and/or maintenance Replace syringe or syringe cap. See 7.6.4 “Diluter”, 2 7-100
Communication error	Power not ON Power/communication interrupted No communication	Switch on instrument Check cable and plug Switch off instrument and PC, wait until the status lamp is dark, switch on instrument and PC
	X, Y or Z-drive or PosID scanner head blocked	Check for obstacles
Initialization error	Arms can not initialize	Make sure that the arms can move freely, i.e. that their movement range is not obstructed by other objects.
	Hardware defective	Contact your local service organization
Front safety panel does not unlock properly	Mechanical failure of the door locks	Contact your local service organization

Tab. 8-1 Troubleshooting table (cont.)

Problem, error	Possible cause	Corrective measures
Front safety panel does not lock properly	Mechanical failure of the door locks	Switch off the instrument. Contact your local service organization
Problem, error on liquid handling arm (LiHa) and tips		
Positioning error	X, Y or Z-drive blocked Crash Hardware defective	Check for obstacles Check container, rack and carrier positions Contact your local service organization See "Carrier Positioning", 2 6-14
No Tip available	Disposable tip tray empty Wrong disposable tip tray elected	Place disposable tip tray on specified position Use worktable editor to assign disposable tip tray See 6.3.4, 2 6-11 See Application Software Manual
Tip not picked up	Wrong tip position coordinates	Define tip position See Application software manual
Tip not removed	Wet or unclean cone DiTi adapter mounted incorrectly	Clean DiTi cone Check correct installation of DiTi adapter See 7.3.5.1 "Disposable Tip Cone (DiTi cone) LiHa", 2 7-33 MultiSense option: Clean DiTi cone MultiSense See 7.3.18.1 "DiTi Cone, Multi-Sense Tip Adapter", 2 7-62
No liquid detected	Not enough liquid Bad ground connection of carrier Wrong detection parameters Dirty tips Dirty DiTi cone MultiSense option: Pressure measurement bad	Check/add liquid Place rack correctly on carrier Clean carrier, to ensure good connection Assure container-rack-carrier-worktable contact Check parameter in the application software Clean tips See 7.3.3 "Fixed Tips of LiHa", 2 7-23 Clean DiTi cone See "Instrument Parts and Cleaning Agents", 2 7-3 MultiSense option: Clean DiTi cone MultiSense See 7.3.18.1 "DiTi Cone, Multi-Sense Tip Adapter", 2 7-62 Check pressure sensor function See "PMP option panel" in the "Instrument Software Manual"

Tab. 8-1 Troubleshooting table (cont.)

Problem, error	Possible cause	Corrective measures
Not enough liquid detected	Not enough liquid Incorrect container/rack definition	Check/add liquid Check container, rack definition See Application Software Manual
Clot detected	Clot aspirated (cLLD) Wrong container diameter	Clean fixed tip and retry Replace DiTi and retry Check container data See “Application Software Manual” See “PMP option panel” in the “Instrument Software Manual”
Te-PS pipetting tips clogged	Contaminant in system liquid, e.g. algae, plastic particles Aspiration of large particles	Check system liquid container Clean tip See 7.3.4 “Te-PS Tips”, 2 7-28
Level sense failure	Use of mobile phone or high level of static electricity in the area	Do not use mobile phones, not even in standby-mode closer than 2 m to the instrument.
	Low humidity in the room	Increase ambient humidity (humidifier)
	Incorrect sample positioning Bent tips Use of incorrect carrier Incorrect LiHa, X-, Y- and Z-setup Incorrect tip configuration	Rectify sample positioning Replace bent tips Use/configure the correct carrier. Rectify LiHa setup Rectify tip configuration
	Wrong settings for liquid conductivity Wrong liquid class settings Foam or bubbles in the liquid containers	Rectify the settings for liquid conductivity Rectify the settings for liquid classes or remove foam/bubbles
	Loose or leaking connections causing drops at tips to appear Insufficient system liquid	Perform daily maintenance Perform daily maintenance
	Electrostatic charged clothing or furniture	Discharge electrically through contact with an earthed object
	Highly conductive system liquid	Use system liquid with a conductivity below 500 µS/cm
MultiSense option: pLLD level detection malfunction	Previously used DiTis	Use new DiTis only. Perform daily maintenance
MultiSense option: PMP errors	Various	Refer to the “PMP Option Application Manual” and PMP option tests in “Instrument Software Manual”

Tab. 8-1 Troubleshooting table (cont.)

Problem, error	Possible cause	Corrective measures
MultiSense option: “sensor out of range” error	Pressure channel not dry Tube end pushed into tip adapter (e.g. after crash, incorrect DiTi pick-up position)	Clean DiTi cone MultiSense Perform daily maintenance Retrieve the pipetting tube and adjust the tube end see 7.6.2 “MultiSense Option”, 2 7-87
Precision (Gravimetric) Test failed	Air bubbles in liquid system Dirty tips Noticeable significant temperature change in the room Dirty DiTi cone	Flush liquid system and check for leakages Clean tips Ensure constant temperature in room Clean DiTi cones MultiSense option: Clean DiTi cone MultiSense See 7.3.18.1 “DiTi Cone, MultiSense Tip Adapter”, 2 7-62
Problem, error on air displacement pipetting arm (Air LiHa) and tips		
Precision (Gravimetric) Test failed	Wrong liquid class used Dirty DiTi cone Plunger seal defective	Check / correct the liquid classes Clean DiTi cones See 7.3.5.2, 2 7-36 Contact the Tecan FSE
Pipetting channel does not meet specified performance	Inline filter moistened (too much liquid aspirated)	Replace inline filter See 7.3.5.3 “Air LiHa Inline Filter”, 2 7-40
Initialization error in Z-axis	Z-rods are blocked in the uppermost Z-position	Manually reposition the Z-rods by releasing the Z-brake and moving the Z-rod down by approx. 2.5 cm (1 in.) See 8.2.4 “Releasing the Z-brake of the Air LiHa”, 2 8-13
Air LiHa tip adapter crash	Tip adapters not aligned correctly	Contact the Tecan FSE for re-aligning the tip adapters
Problem, error on multichannel arm, MCA96 / MCA384		
Tips/DiTis are not aligned properly to the carriers	The carrier offsets are not taught correctly The carriers are not adjusted correctly The mechanics are defective	Teach the carrier positions Check the current script Adjust the carriers Contact the Tecan FSE

Tab. 8-1 Troubleshooting table (cont.)

Problem, error	Possible cause	Corrective measures
During the pipetting process the pipetting head stops and generates an error	Aspirate / dispense acceleration and or deceleration is too fast compared to speed or MCA96: plunger plate is blocked	acceleration / deceleration must be in a reasonable relation to speed for Aspirate / Dispense If the problem cannot be solved, contact the Tecan FSE MCA96: Maximum speed is 600 µl/s Tecan recommends you to work with a speed of 400 µl/s or less for all volumes Adjust speeds and perform a “Random Move Test for Plunger” (200 cycles) If the problem cannot be solved, contact the Tecan FSE
MCA96: The pipetting head does not initialize correctly (after a long break)	The plunger plate is blocked	Loosen the plunger plate manually (refer to 8.2.2 “Unblocking MCA96 Plungers”, 2 8-10) If the problem cannot be solved, contact the Tecan FSE
Several or all pipetting channels are leaking	Wrong DiTis, fixed tip block, fixed tip adapter, tip cone seals or gaskets used The DiTis are not picked up properly	Only use DiTis, fixed tip block, fixed tip adapter, tip cone seals or gaskets provided by Tecan Check the carrier positions (refer to 7.3.18.14 “Checking the Carrier Positions (Offsets)”, 2 7-75) MCA96: Perform the “Check Carrier/Racks Offsets” test and the “Get and Drop DiTi” test (refer to the “Instrument Software Manual”)
	Old, defective tip cone seals or gaskets	Perform leakage test (refer to 7.4.2.2 “Leakage Tests with DiTis or Fixed Tips”, 2 7-83 Replace defective tip cone seals or gaskets (refer to 7.6.3.4 “Replacing the Tip Cone Seals (MCA96)”, 2 7-95 or 7.6.3.5 “Replacing the Gaskets (MCA384)”, 2 7-96)
	Pipetting head defective	Contact the Tecan FSE
A single channel is leaking	The tip cone seal, gaskets or other seals in the pipetting head are defective	Replace the tip cone seal or gasket and perform the “Leakage Test” and the “Color Precision” test If the problem cannot be solved, contact the Tecan FSE

Tab. 8-1 Troubleshooting table (cont.)

Problem, error	Possible cause	Corrective measures
A single DiTi is not picked up correctly	The individual DiTi is defective MCA96: The tip cone seal on this DiTi position is defective	Replace the DiTis MCA96: Perform the “Get and Drop Tip Block Functional Test” with another set of DiTis Replace the defective tip cone seal If the problem cannot be solved, contact the Tecan FSE
A single DiTi is not dropped	The individual DiTi is defective The tip cone seal on this DiTi position is defective	Replace the DiTis MCA96: Perform the “Get and Drop Tip Block Functional Test” with another set of DiTis Replace the defective tip cone seal If the problem cannot be solved, contact the Tecan FSE
Several/all DiTis are not dropped	Wrong DiTis are used	Use DiTis provided by Tecan only If the problem cannot be solved, contact the Tecan FSE
MCA96: DiTis are not dropped properly (remain hanging from the DiTi cones)	Electrostatic charge of the DiTis due to inappropriate packaging/storage or inappropriate environmental conditions DiTis are not new, i.e. they are reused	Control the storage conditions (relative humidity greater than 35% and temperature at least 20°C) Treat DiTis with ionizer before use Do not reuse DiTis
The DiTi box is lifted up with the DiTis after picking up DiTis	The carrier is not adjusted correctly X and/or Y offsets are specified incorrectly MCA384: The DiTi Carrier is defective (malfunction of the DiTi box retainers) The DiTi Box does not meet the specifications	Exactly adjust all carriers (mechanical) Check carrier positions (X and Y-axis, refer to 7.3.18.14 “Checking the Carrier Positions (Offsets)”, 2 7-75) Replace the DiTi Carrier If the problem cannot be solved, contact the Tecan FSE Use only DiTi boxes that meet the standards of the Society of Biomolecular Screening If the problem cannot be solved, contact the Tecan FSE

Tab. 8-1 Troubleshooting table (cont.)

Problem, error	Possible cause	Corrective measures
Inaccurate pipetting results	The DiTis are not picked up properly	Check the carrier positions (refer to 7.3.18.14 “Checking the Carrier Positions (Offsets)”, 2 7-75) MCA96: Perform the “Get and Drop DiTi” tests (refer to the “Instrument Software Manual”) Perform the “Color Precision Test” with DiTis
	MCA96: The tip cone seals are defective	Replace the tip cone seals
	The coating of standard tips is damaged	Check the tip coating, replace fixed tip block, if necessary
	The liquid handling parameters are incorrect	Check the application script
	The carriers are not adjusted correctly	Adjust the carriers
	The pipetting head is defective	If the problem cannot be solved, contact the Tecan FSE
Carry over	Damaged tip coating	Replace the fixed tip block or fixed tip adapter if coating is damaged
	Inappropriate application script.	In the application script, adjust the wash or liquid handling settings, use different wash buffer
	Clogged wash channels	Clean wash block If the problem cannot be solved, contact the Tecan FSE
Wash system: Erroneous overflow and empty errors during the process run	Overflow sensor not clean	Dry the overflow sensor cavity
	The sensors are not connected or defective	Check if sensors are connected MCA96: Otherwise use the Freedom EVO wash level sensor simulation plug and contact the Tecan FSE.
Wash system: Regular overflow of the wash block	Kinked or clogged tubing	Check tubing, replace if necessary
	Waste pump defective	Check waste pump If waste pump is defective, call the Tecan FSE
Wash system: No wash liquid pumped through the wash block (wash system empty)	Kinked or clogged tubing	Check tubing, replace if necessary
	The wash block is not connected	Connect the wash block properly
	The wash container(s) are empty or missing	Refill / replace the wash container(s)
	The wash pump is defective	Check the wash pump If the wash pump is defective, contact the Tecan FSE
Problem, error on Positive Identification, PosID		

Tab. 8-1 *Troubleshooting table (cont.)*

Problem, error	Possible cause	Corrective measures
Positioning error	Hardware defect	Contact your local service organiza-tion
Barcode not read	Barcode label not facing barcode scanner	Check container position on carrier See 3.5.9, 2 3-78
	Bad barcode label quality	Check with new barcode label See 3.5.9, 2 3-78
	Barcode type not accord-ing to specifications	Check if barcode type is permissible See 3.5.9, 2 3-78
	Barcode label position not according to specifications	Check barcode label position on container See 3.5.9, 2 3-78
	Barcode type not specified in software	Check the settings in the application software
	Laser output window dirty	Clean output window See 7.3.19, 2 7-76
Alignment barcode on bar-code flag not read	PosID adjustment/setup not correct	Contact your local service organiza-tion
Carrier or tube presence not detected	“No Tube” sensor dirty	Clean “No Tube” sensor See 7.3.19, 2 7-76
Unusual noise during movement	Worn out or damaged parts	Contact your local service organiza-tion
Problem, error on MCA gripper / MCA384 Gripper		
Microplate not picked up	No microplate on carrier Cannot pick up microplate	Put microplate on carrier Set gripper position Clean gripper fingers Readjust gripper fingers
Unusual noise during arm / gripper movement	Worn or damaged parts	Contact your local service organiza-tion
Problem, error on robotic manipulator arm, RoMa Standard		
Microplate not picked up	No microplate on carrier Cannot pick up microplate	Put microplate on carrier Set gripper position Clean grippers
Unusual noise during arm movement	Worn or damaged parts	Contact your local service organiza-tion
Problem, error on robotic manipulator arm with long Z-Axis, RoMa long		
Microplate not picked up	No microplate on carrier Cannot pick up microplate	Put microplate on carrier Set gripper position
	Gripper fingers are slippery	Clean gripper
Unusual noise during arm movement	Worn or damaged parts	Contact your local service organiza-tion

Tab. 8-1 Troubleshooting table (cont.)

Problem, error	Possible cause	Corrective measures
Problem, error on Pick and Place arm, PnP		
Tube not picked up	No tube on carrier Wrong diameter of tube	Place tube on carrier Use tubes with 13 - 16 mm diameter See 3.5.8, 2 3-77
Unusual noise during arm movement	Worn or damaged parts	Contact your local service organization
Z-brake cannot be released automatically.	Z-axis was pushed up manually too high	See 8.2.3, 2 8-12
Problem, error on wash station		
Overflow of wash station	Waste tube is below liquid surface in the waste container	Use a wash container with fixed wash tubing inlet
	DiTis or algae block the wash station	Clean the wash station
	Waste tubing kinked	Check tubing for kinks

8.2 Troubleshooting Instructions

8.2.1 Unclogging MCA96 Tips

Note: *Clogged tips can be freed from residues using the special fixed tip maintenance tool.*

8.2.2 Unblocking MCA96 Plungers

Problem

If the pipetting head has not been used for some time it may generate an error (error No.26 “plunger blocked”) in case the plunger drive is unable to initialize.

Solution

Manually loosen the plunger plate.

8.2.2.1 Removing the MCA96 Pipetting Head Cover

Removing

To remove the pipetting head cover, proceed as follows:

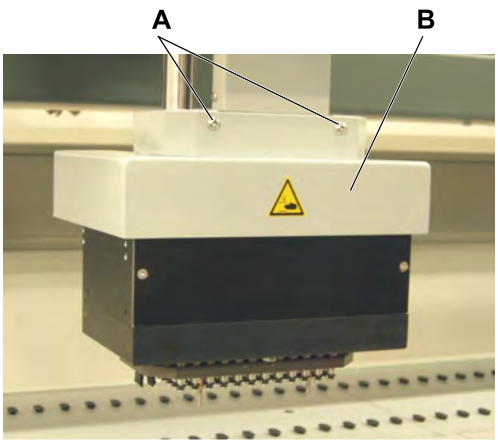


Fig. 8-1 *Pipetting head cover*

1 Remove the two screws (A).

2 Remove the pipetting head cover (B).

Installing

To install the pipetting head cover, proceed in reverse order as described for removal.

8.2.2.2 Manually Loosen Plunger Plate

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Remove pipetting head cover	See section 8.2.2.1 “Removing the MCA96 Pipetting Head Cover”, 2 8-10

Problem

The plungers of the pipetting head are blocked. During initialization an error message is displayed.

Possible Cause

The plungers may stick to the seals after long out-of-service periods.

1 Quit the application software and switch instrument off.

2 Switch instrument on, restart application software and initialize the Freedom EVO again.
Refer to the “Freedom EVOware Software Manual”.

If the error message is displayed again, continue with step 3.

WARNING

Moving parts of the pipetting head.
Injury of fingers possible if instrument is still on and starts unexpectedly.
Always switch the instrument off before removing the pipetting head cover.

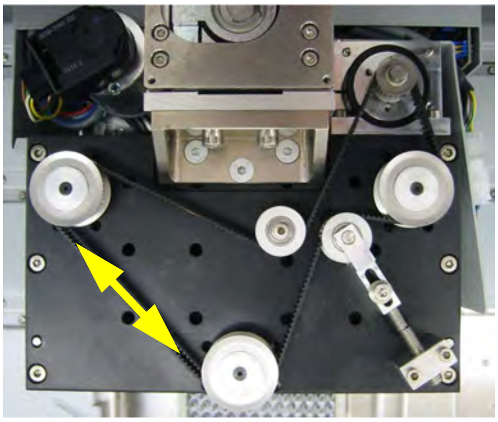


Fig. 8-2 *Belt of the plunger drive*

3 Quit the application software and switch instrument off.

4 Remove the pipetting head cover.
Refer to cross references above.

5 Manually move the plunger plate up and down ten times by pulling at the toothed belt in both directions (see arrow).

6 Remount pipetting head cover.

7 Switch the instrument on and start the setup and service software.

8 Perform the “Random Move Test for Plunger” with 200 cycles.
Refer to the “Instrument Software Manual”.

9 If the error message is displayed again, contact the Tecan FSE.

8.2.3 Releasing the Brake of the PnP

How to Release the Brake

In order to move the PnP gripper head up and down with the instrument power off, release the brake by depressing the lever through the slot on the right side of the PnP, using a screwdriver.

See arrow in the figure below:

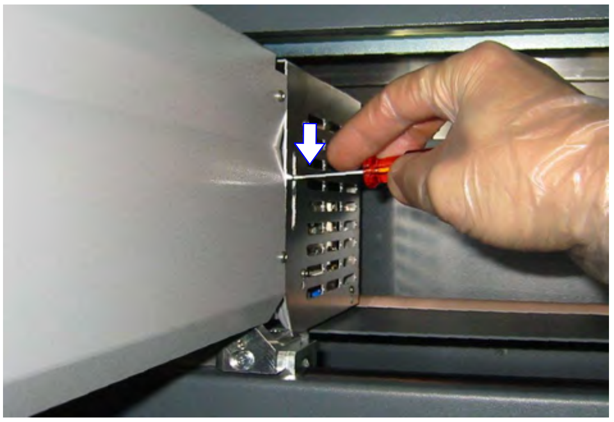


Fig. 8-3 *Slot for brake release access*

8.2.4 Releasing the Z-brake of the Air LiHa

The Air LiHa is equipped with a Z-brake (electrical actuation of release) to prevent the Z-rods from moving down by their weight when the power is off.

Manual Activation

The Z-brake of the Air LiHa can be released manually, when the instrument is switched off.

Note: *The Z-brake releases or brakes all Z-rods simultaneously.*

Note: *When the instrument is switched on the Z-brake is actuated electrically.*

To release the Z-brake of the Air LiHa manually, proceed as follows:

WARNING

Moving parts of the Air LiHa.
Injury of fingers possible when releasing the Z-brake manually or if instrument starts unexpectedly.

- Switch the instrument off before actuating the Z-brake manually.
- Do not reach into the moving area of the Air LiHa and the Z-rods when the instrument is in an undefined state.
- Stop all programs that may cause the Air LiHa to move.

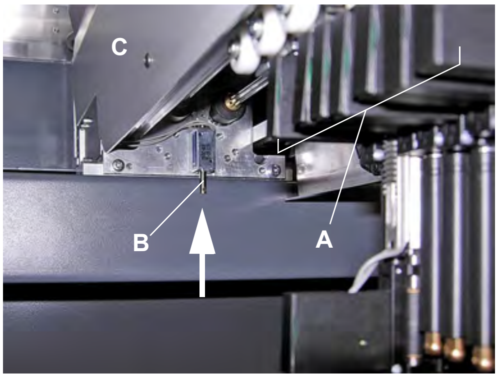


Fig. 8-4 *Air LiHa Z-brake release button*

1. Switch the instrument off.
2. Hold the Z-rods in position before actuating the brake release armature.
   Best is to hold a finger underneath all isolation blocks of the tip adapters (A).
3. Press the brake release armature (B) in the back of the Air LiHa (C) upwards (arrow) to release the Z-brake.
   The brake release armature is accessible with all covers mounted.
4. Move the Z-rods manually up or down.
   In principle the Z-rods tend to move downwards.
   Make sure that the tip adapters and tips do not collide with any objects below.
5. Release the armature when the tip adapters and tips are in the desired position.

8.2.5 Releasing the Brake of the MCA96 / MCA384

The MCA96 and the MCA384 are equipped with a Z-brake (electrical actuation of release) to prevent the pipetting head from moving down by its weight when the power is off.

Precondition

To release the brake, the instrument must be switched on.

Note: *The brake cannot be released when the instrument is switched off.*

To release the brake of the MCA96 or the MCA384, proceed as follows:

WARNING

Moving parts of the pipetting head.
Injury of fingers possible if instrument starts unexpectedly.
- Do not reach into the moving area of the pipetting head when the instrument is in an undefined state.
- Stop all programs that may cause the MCA96 or MCA384 to move.

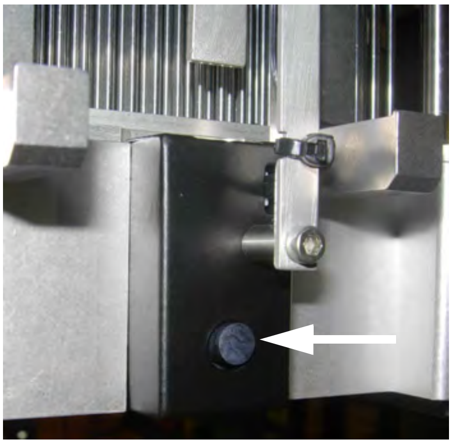
MCA96

Fig. 8-5 *Multichannel arm MCA96: View from below*

1. Press the brake release switch (see circle in figure), which is located on the Y-slide under the MCA96, to release the brake.
2. Move the pipetting head manually down.
   Make sure that the head does not collide with the objects below.
3. Release the switch when the pipetting head is in the desired position.

MCA384

vertical cable channel



rear side of pipetting head

Fig. 8-6 *Multichannel arm MCA384, brake release switches*

1 Press one of the brake release switches (see arrows in figure) to release the brake.

One switch is located on the left side of the vertical cable channel and the other one on the rear side of the 384 channel pipetting head.

2 Move the pipetting head manually down.

Make sure that the head does not collide with the objects below.

3 Release the switch when the pipetting head is in the desired position.

8.2.6 Releasing the Z-Brake of the MCA384 Gripper (CGM)

The CGM is equipped with a Z-brake (electrical actuation of release) to prevent the CGM rotator from moving down by its weight when the power is off.

Precondition

To release the Z-brake of the CGM, the instrument must be switched on.

Note: *The Z-brake cannot be released when the instrument is switched off.*

To release the Z-brake of the CGM, proceed as follows:

WARNING

Moving parts of the CGM.
Injury of fingers possible if instrument starts unexpectedly.

- Do not reach into the moving area of the CGM when the instrument is in an undefined state.
- Stop all programs that may cause the CGM to move.

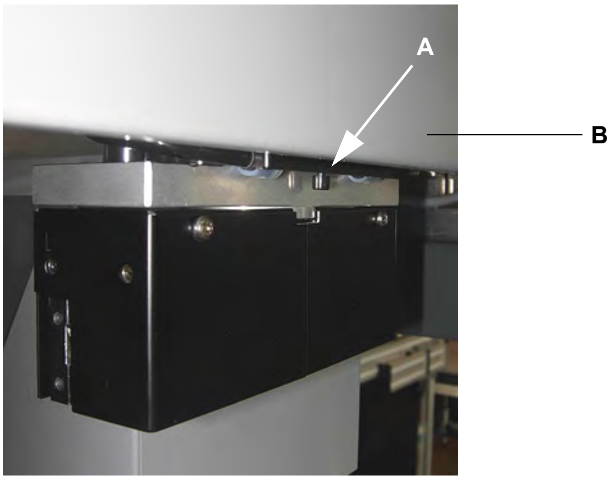


Fig. 8-7 *CGM Z-brake release button*

1. Press the brake release button (A) below the right side cover (B) of the MCA384 to release the Z-brake of the CGM.

   The brake release button is accessible with all covers mounted.
2. Move the CGM rotator manually up or down.

   In principle the CGM rotator tends to move downwards.
   Make sure that the CGM rotator with the gripper fingers does not collide with any objects below.
3. Release the button when the CGM rotator is in the desired Z-position.

8.2.7 RoMa / Gripper Alignment

Checking the Gripper Fingers

To check the adjustment of the gripper fingers, proceed as follows:

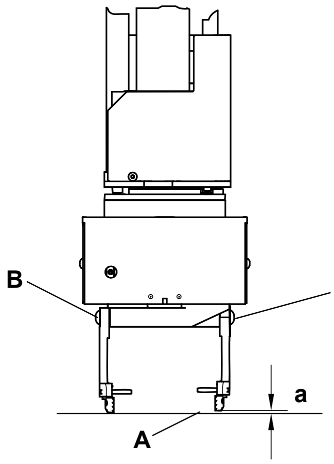


Fig. 8-8 Adjustment of gripper fingers

1. Switch the instrument off.
2. Move the RoMa down until the gripper fingers almost touch the worktable surface (A).
3. Check if the gripper fingers are at the same height and if they are parallel.
4. If necessary (difference in height, [a]), adjust the height of the gripper fingers by slackening the screws (B) and moving the gripper fingers in the correct position.
5. Make sure that the gripper fingers are parallel.
6. Tighten the screws.

Checking the RoMa Alignment

To check the alignment of the RoMa Z-axis, proceed as follows:

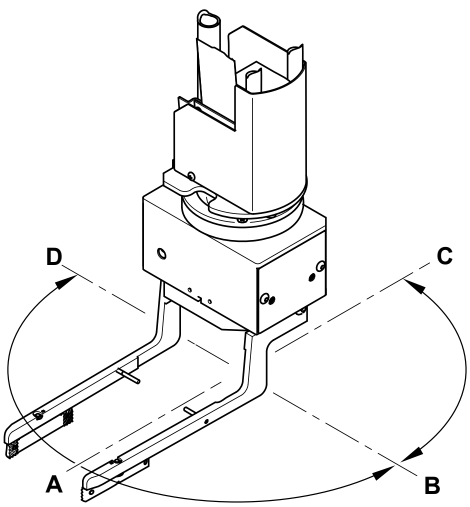


Fig. 8-9 Checking RoMa alignment

1. Switch the instrument off.
2. Move the RoMa down until the gripper fingers almost touch the top surface of the positioning pins.
3. Check the gap to the worktable surface (or to the positioning pins).
4. Swivel the gripper module head and compare the gap in all positions as indicated in the figure (A, B, C, D).
5. If the difference of the gap exceeds 0.5 mm (0.02 in.) the RoMa is misaligned.

   In this case contact your local service organization.

9 Shutdown, Transport and Storage

Purpose of This Chapter

This chapter instructs how to shut down the Freedom EVO, how to pack it for storage or transport, and specifies the storage and shipping conditions.

9.1 Shutdown

9.1.1 Instrument

Since the material processed by the Freedom EVO is not known to Tecan, detailed information on how to dispose of it cannot be given here.

WARNING

Chemical, biological and radioactive hazards can be associated with the waste material from the process run on the Freedom EVO.
Treat these substances and disposables, such as DiTis, wash liquid, etc. in accordance with good laboratory practice guidelines.

Inquire about appropriate collecting points and approved methods of disposal in your country, state or region.
When disposing of operating material of the Freedom EVO the relevant national and regional laws, directives and recommendations must be followed.

To shut down the instrument for a long period:

1. Empty the liquid system and thoroughly clean and decontaminate all liquid system components.
2. Save data and exit application software and instrument software.
3. Press the power **ON/OFF switch** for 2 seconds to switch the instrument off.

   The status lamp turns off.

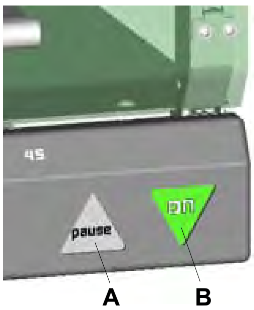


Fig. 9-1 *Power Switch*

A *Pause button* ***B*** *Power ON/OFF switch*

Note: *Wait until the status lamp is off before switching the instrument on again.*

Fig. 9-2 *Power cord/mains socket*

4 Unplug the power cord from the power supply at the rear of the instrument.

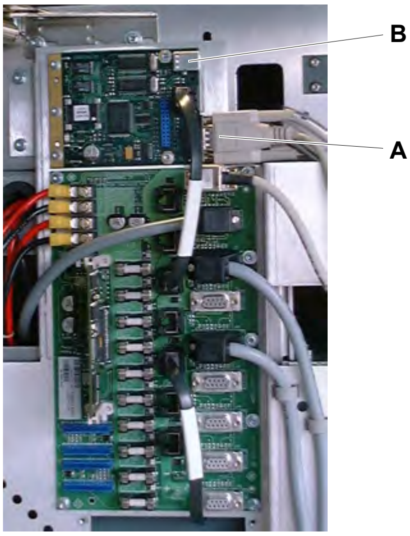


Fig. 9-3 *RS232 interface on Optibo PCB*

A	*RS232 interface connector*	***B***	*USB connector*

5 Disconnect the instrument from the PC.

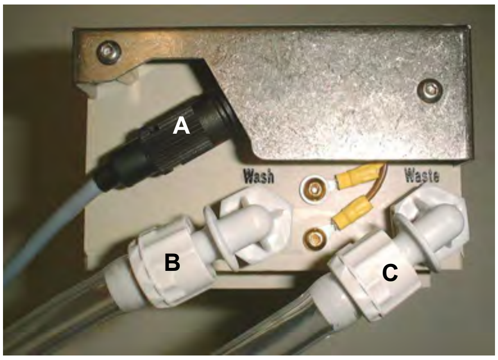
6 If desired, unplug the interface cable from the USB port on the Te-CU board behind the left access door.

Or Disconnect the RS-232 interface cable from the Te-CU board.

7 Clean and, if necessary, decontaminate the entire instrument.

9.1.2 Multichannel Arm (MCA96)

If the instrument is equipped with an MCA96 with wash system, perform the following tasks:



1 Disconnect the level sensor cable (A) from the wash block.

2 Disconnect the wash tube (B) from the wash block.

3 Disconnect the waste tube (C) from the wash block.

4 Remove the wash block.

Fig. 9-4 *Connections of the wash block*

5 Remove the fixed tip block, dry it and put it into the fixed tip block box.

ATTENTION

Damage to the tips, if the fixed tip block is stored wrongly.
Never put the fixed tip block down with its tips resting on the table.

6 Disconnect all tubes from the wash unit, wash liquid containers and waste container.

9.1.3 Multichannel Arm (MCA384)

9.1.3.1 MCA384 Pipetting Head

Mount an Adapter QC MCA384 onto the head to safeguard the gaskets and the area between the head and the adapter.

9.1.3.2 Wash System

If the instrument is equipped with an MCA384 with wash system, perform the following tasks:

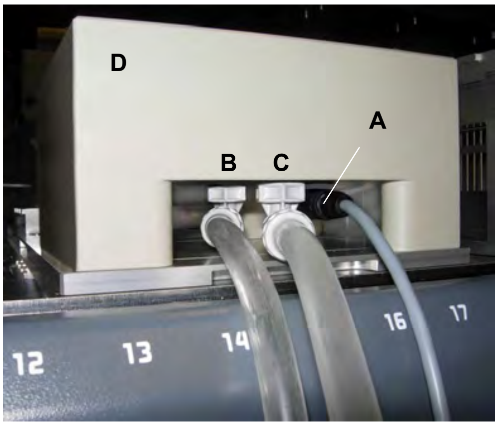


Fig. 9-5 Connections of the wash block

1 Empty and clean the wash block (see section 7.3.18.9 “Washing and Emptying the Wash Block”, 2 7-72).

1 Disconnect the level sensor cable (A) from the wash block.
2 Disconnect the wash tube from the wash block (B).
3 Disconnect the waste tube from the wash block (C).
4 Remove the wash block (D).

5 Store DiTi and fixed tip adapters in a safe place.

ATTENTION

Damage to the tips, if a fixed tip adapter is stored wrongly.
Never put a fixed tip adapter down with its tips resting on the table.

6 Disconnect all tubes from the wash unit, wash liquid container and waste container.

9.1.4 Reporting

1 Fill out a copy of the decontamination form and place it with the instrument.
2 Record the shut down in your “Maintenance and Service Logbook”.

9.2 Transport

WARNING

Lifting or moving the instrument can cause serious injuries

- Injuries to the back due to overload can occur
- Injuries can be caused due to a falling instrument
- Lifting or moving the instrument must be correctly prepared and may only occur under the direction of a qualified Tecan person

ATTENTION

Lifting or moving the instrument can cause damage due to unsecured parts

- Lifting or moving the instrument must be correctly prepared and may only occur under the direction of a qualified Tecan person only

Transport

The transport of the instrument may be done under direction of a qualified Tecan service person only. Due to the heavy weight, trained relocation staff is needed to lift the instrument.

9.2.1 Unpacking

The unpacking of the instrument may be done by a qualified Tecan service person only.

Packaging materials

The instrument packaging has been designed to prevent damage to instrument and parts during normal transport conditions.
Keep the packaging materials for future use.

ATTENTION

Do not remove the transport moorings before the instrument is in its final operating position.

9.2.2 Packaging

The packaging of the instrument may be done by a qualified Tecan service person only.

Packaging materials

Use original packing material that has been designed to prevent damage to instrument and parts under normal transport conditions.

Guarantee

All Tecan guarantees are void if the instrument is not correctly prepared by qualified Tecan service personnel for transport.

9.3 Storage

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Storage conditions	See section 3.2.8 “Environmental Conditions”, 2 3-13
Packaging	See section 9.2.2 “Packaging”, 2 9-5

Protect the instrument against dust and debris with a cover. For long term storage, pack the instrument in its original packing.
Store all manuals and the “Maintenance and Service Logbook” with the instrument.

10 Disposal

Purpose of This Chapter

This chapter includes regulatory information about recycling that needs to be followed.

NOTICE

Recycling in accordance with applicable legal regulations!
Observe the laws applicable in your country for recycling.

10.0.1 Local Requirements European Union

EC Directive WEEE

The European Commission has released the Directive on Waste Electrical and Electronic Equipment (WEEE; 2012/19/EU).

Since August 2005, producers have been responsible for taking back and recycling electrical and electronic equipment.

Tab. 10-1 *Electrical and electronical equipment waste logo*

Marking	Explanation
	Negative environmental impacts associated with the treatment of waste. • Do not treat electrical and electronic equipment as unsorted municipal waste. • Collect waste electrical and electronic equipment separately.

10.0.2 Local Requirements People’s Republic of China

Marking for the Restriction of the Use of Hazardous Substances in Electronic and Electrical Products

Required Product Information

The People’s Republic of China Electronic Industry Standard SJ/T11364-2014 “Marking for the Restriction of the Use of Hazardous Substances in Electronic and Electrical Products” requires the marking for the restriction of the use of hazardous substances in electronic and electrical products.

Product Marking

In accordance with the requirements specified in SJ/T11364-2014, all electronic and electrical Tecan products sold in the People’s Republic of China are labeled with a marking for the restriction of the use of hazardous substances.

Tab. 10-2 Marking for the restriction of the use of hazardous substances

Marking	Explanation
	This marking indicates that this electronic product contains certain hazardous substances and can be safely used during the environment-friendly use period, but it shall enter the recycling system after the environment-friendly use period.

11 Spare Parts and Accessories

Cross References

List of cross references to information provided in other sections:

Subject	Reference
Ordering address	See section 12 "Customer Support", 2 12-1

Purpose of This Chapter

This chapter lists disposables that are used in connection with the Freedom EVO, spare parts, accessories and options including their ordering information.

How to Find Spare Parts

Look up the ordering information in the tables.

How to Order Spare Parts

Order the parts from Tecan. Always state the designation and the part number when ordering spare parts.

Note: *This chapter only contains spare parts which can be replaced by the operator him/herself. To order spare parts other than listed here, please contact the Tecan Customer Support.*

Ordering Address

Order the parts from Tecan.
For addresses, refer to cross references above.

11.1 Software

Tab. 11-1 *Software*

No.	Plain Text Designation	p/n	Label Designation
1	EVOware Standard	10615150	SOFTWARE EVOWARE STANDARD
2	EVOware Plus	10615151	SOFTWARE EVOWARE PLUS

11.2 Documentation

Tab. 11-2 *Documentation*

No.	Plain Text Designation	p/n	Label Designation
1	Freedom EVO Operating Manual	-	Not for sale

11.3 Freedom EVO Basic Accessories Kit

Tab. 11-3 *Freedom EVO basic accessories kit*

No.	Plain Text Designation	p/n	Label Designation
1	Freedom EVO-2 basic accessories kit, including:	30013546	KIT ACCESSORY EVO2
2	• Set of Allen keys	-	Not for sale
3	• Screw driver #1.5	-	Not for sale
4	• Screw driver #2	-	Not for sale
5	• Key for Te-PS lock nuts	10643007	KEY TIP LOCK NUT TE-PS
6	• Freedom EVO Operating Manual	-	Not for sale
7	• Instrument Software CD	30027158	SOFTWARE INSTRUMENT V5.5 CD
8	• Maintenance and Service Logbook	10646000	MANUAL LOGBOOK FREEDOM EVO

11.4 Tools, Gauges

Tab. 11-4 *Tools, gauges*

No.	Plain Text Designation	p/n	Label Designation
1	Transport handles, 1 set	10612003	HANDLE TRANSPORT SET GENESIS
2	Cone wrench for DiTi option	10619517	WRENCH CONE DITI OPTION 5 PCE.
3	Te-PS tubing widener	10643003	WIDENER PIPETTING TUBING TE-PS
4	Key for Te-PS tip lock nuts	10643007	KEY TIP LOCK NUT TE-PS
5	Tool set PMP	30013579	SET TOOL PMP
6	Reference tip PMP[a)]	30013574	TIP REFERENCE PMP
7	X-ring mounting tool[a)]	30013576	TOOL MOUNTING X-RING 0.4/1.2
8	Tubing mounting tool[a)]	30013577	TOOL MOUNTING TUBING FEP
9	Leakage test block PMP[a)]	30013578	BLOCK TEST LEAKAGE PMP
10	Fixed tip maintenance tool (for MCA96)	10619168	TOOL MAINTENANCE FIXED TIP BLOCK TE-MO 9
11	Teach block, high precision and standard tips (for MCA96)	10619174	TEACHBLOCK 96 CHANNEL TE-MO
12	Adjustment gauge for Air LiHa tip adapters	30078450	TOOL ADJUST GAUGE AIRLIHA

Tab. 11-4 Tools, gauges (cont.)

No.	Plain Text Designation	p/n	Label Designation
12	Reference block (for MCA96)	30020087	BLOCK REFERENCE MCA
13	Tool set for gasket replacement (MCA384)	30020063	GASKET SERVICE TOOL SET MCA384
14	Reference pin (MCA384)	30020068	PIN REFERENCE MCA-384
15	Reference plate RoMa-3	30033849	PLATE REFERENCE ROMA-3 BCD EVOLYZER-2

a) Included in 30013579 "Tool set PMP"

11.5 Optional System Modules and Accessories

11.5.1 Air Displacement Pipetting Arm (Air LiHa)

Tab. 11-5 Air displacement pipetting arm (Air LiHa)

No.	Plain Text Designation	p/n	Label Designation
1	Air LiHa Tip adapter	30066882	DITI ADAPTER MULTISENSE AIR LIHA
2	Inline filter kit for Air LiHa DiTi cone, package of 30 pc. incl. filter removal tool	30066883	INLINE FILTER AIR LIHA

11.5.2 MultiSense Option (LiHa)

Tab. 11-6 MultiSense option: Tip adapter

No.	Plain Text Designation	p/n	Label Designation
1	MultiSense tip adapter	30013404	ADAPTER TIP REED CONT. WITH PMP SENSOR
2	DiTi kit MultiSense	30013403	KIT ASSEMBLY DITI PMP
3	Sealing set DiTi kit MultiSense	30013401	SET SEAL DITITKIT PMP
4	Sealing set insulation block MultiSense	30013402	SET SEAL INSULATIONBLOCK PMP

For DiTis refer to section 11.9.2.3 "Disposable Tips for PMP Function", 2 11-30.

11.5.3 Multichannel Arm (MCA96)

Tab. 11-7 *Multichannel arm (MCA96) pipetting head*

No.	Plain Text Designation	p/n	Label Designation
1	Tip cone seals (MCA96), 100 pieces	10619162	SEALING TIP CONE 100 PCE. HEAD 96 TE-MO

Tab. 11-8 *Multichannel arm (MCA96) fixed tip blocks*

No.	Plain Text Designation	p/n	Label Designation
1	Standard 96-channel fixed tip block	10619170	BLOCK 96 FIXED TIP STD.UNCOAT.1-200µL TE
2	Standard 96-channel fixed tip block, coated	10619171	BLOCK 96 FIXED TIP STD.COATED 1-200µL TE
3	High precision 96-channel fixed tip block uncoated tips, for water, 1-50 µl	10619172	BLOCK 96 FIXED TIP HP FOR WATER UNCOATED
4	High precision 96-channel fixed tip block, coated tips, for DMSO, 1-50 µl	10619173	BLOCK 96 FIXED TIP HP FOR DMSO COATED

Tab. 11-9 *Multichannel arm (MCA96) wash system/accessories*

No.	Plain Text Designation	p/n	Label Designation
1	96 channel wash system (PP) complete with wash block, tubing and fittings	10619180	WASHSTATION CPL.96PIP. HEAD TE-MO
2	96 channel wash block (PP), with fittings	10619182	BLOCK WASHSTATION 96 PIP.HEAD TE-MO
3	90° connector fittings for wash block, set of 6 pieces	10619593	JOINT SCREW WASH BLOCK TE-MO 6 PIECES
4	Tubing for 96 channel wash system, 15 m, Tygon	10619183	TUBING SET WASHSTATION TE-MO
5	Fitting set for 96 channel wash system	10619184	FITTING SET WRC 96 PIP.HEAD TE-MO
6	Filter for wash system	10619185	FILTER WASHSTATION TE-MO
7	Simulation plug level sensor	10619597	PLUG SIMULATION SENSOR WASH LEVEL TE-MO
8	System liquid container, capacity 30 l	10619674	BOTTLE SYSTEM LIQUID 30L
9	Waste container, capacity 30 l	10619675	CONTAINER WASTE 30L TE-MO
10	Waste container, capacity 10 l	10619676	CONTAINER WASTE 10L TE-MO
11	System liquid container, capacity 10 l	10619677	BOTTLE SYSTEM LIQUID 10LT

Tab. 11-10 Multichannel arm (MCA96) carriers and racks

No.	Plain Text Designation	p/n	Label Designation
1	Service carrier	30020006	CARRIER SERVICE MCA
2	Transfer rack (for fixed tip block and DiTis)	10619195	RACK TRANSFER FIX TIP TE-MO
3	Reagent trough (PP) complete, 300 ml	10619190	TROUGH REAGENT 300ML PP TE-MO
4	Reagent trough (PP) set (with blister and partition), 125 ml	10619198	TROUGH REAGENT 125ML COMPLETE TE-MO
5	Reagent trough (PP) set (with blister and partition), 250 ml	10619197	TROUGH REAGENT 250ML COMPLETE TE-MO
6	Nested DiTi flat carrier, 3 positions with ANSI/SLAS footprint, for cpl. stack of 8 DiTis with MCA96	30052707	CARRIER 3 POS. NESTED TIPS MCA96 AND 384
7	Nested DiTi flat carrier, 4 positions with ANSI/SLAS footprint, for cpl. stack of 8 DiTis with MCA96	30052708	CARRIER 4 POS. NESTED TIPS MCA96 AND 384
8	Waste option for Nested DiTi, for flat carriers 30052707 / 30052708, will occupy the front position of the carrier	30097479	OPTION WASTE FOR CARRIERS MCA 96 SILVER
9	Nested DiTi flat carrier, 2x4 positions with ANSI/SLAS footprint, for very tight space conditions	30054412	CARRIER 2X4-POS FOR MCA96 NESTED TIPS

Tab. 11-11 Multichannel arm (MCA96) consumables

No.	Plain Text Designation	p/n	Label Designation
1	Reagent trough blisters (PP), 250 ml, 50 pc.	10619191	BLISTER REAG.TROUGH 250ML GENMATE/TE-MO
2	Reagent trough blisters (PP), 125 ml, 50 pc.	10619196	BLISTER REAGENT TROUGH 125ML TE-MO
3	Plastic blister for transfer rack (drip tray)	10619200	BLISTER TIPRACK TE-MO

For DiTis refer to section 11.9.2.1 “Disposable Tips for MCA96”, 2 11-28.

11.5.4 Multichannel Arm (MCA384)

Tab. 11-12 *Multichannel arm (MCA384), pipetting head*

No.	Plain Text Designation	p/n	Label Designation
1	Set of gaskets and blunt tubes MCA384, 10 pieces	30020064	GASKET AND BLUNT TUBE SET MCA384

Tab. 11-13 *Multichannel Arm (MCA384), adapters*

No.	Plain Text Designation	p/n	Label Designation
1	Adapter DiTi Combo MCA384 • Can pick up 384 DiTis or one row of 24 DiTis or one or two columns of 16 or 32 DiTis. Compatible with MCA384 15 µl[a)], 50 µl and 125 µl disposable tips	30032060	ADAPTER COMBO 384 DITI MCA384
2	Adapter DiTi MCA384 • Can pick up 384 MCA384 DiTis. No row- or column-wise DiTi picking possible. 15 µl[a)], 50 µl and 125 µl	30032061	ADAPTER 384 DITI MCA384
3	Adapter 96 DiTi MCA384 • Can pick up 96 DiTis out of a box of 384 MCA384 DiTis (4 picks for all 384 DiTis) or one or two rows of 12 or 24 DiTis or one or two columns of 8 or 16 DiTis, 15 µl[a)], 50 µl and 125 µl	30032063	ADAPTER COMBO 96 DITI MCA384
4	Adapter 96 DiTi 1to1 MCA384 • Can pick up 96 MCA96 DiTis or one row of 12 DiTis or one column of 8 DiTis from a DiTi box in ANSI/SLAS format	30032048	ADAPTER 96 MCA96 DITI MCA384
5	Adapter 96 DiTi 4to1 MCA384 EVA (Extended Volume Adapter) • Can pick up 96 MCA96 DiTis or one row of 12 DiTis or one column of 8 DiTis from a DiTi box in ANSI/SLAS format	30032062	ADAPTER EXT VOL 96 MCA96 DITI MCA384
6	Adapter Set, Combo MCA384 and EVA • incl. the following two adapters: 30032060 and 30032062	30051709	SET ADAPTER COMBO 384 AND EVA
7	Adapter Fixed 125 µl MCA384 • Has 384 fixed tips of 28 mm length with a capacity of 125 µl / channel	30032064	ADAPTER+384 FIXED TIPS LC MCA384 UNCOATED

Tab. 11-13 *Multichannel Arm (MCA384), adapters*

No.	Plain Text Designation	p/n	Label Designation
8	Adapter Fixed 15 µl MCA384 • Has 384 fixed tips of 28 mm length with a capacity of 15 µl / channel	30032065	ADAPTER+384 FIXED TIPS SC MCA384
9	Adapter 96 Fixed 125 µl MCA384 • Has 96 fixed tips of 44 mm length with a capacity of 125 µl / channel	30032066	ADAPTER+96 FIXED TIPS LC MCA384 UNCOATED
10	Adapter 96 Fixed 15 µl MCA384 • Has 96 fixed tips of 28 mm length with a capacity of 15 µl / channel	30032067	ADAPTER+96 FIXED TIPS SC MCA384
11	Adapter QC MCA384 • Head adapter for QC ID 15 (four magnets)	30032055	ADAPTER QC FOR MCA384

a) *For availability see section 11.9.2.2 "Disposable Tips for MCA384", 2 11-29*

Tab. 11-14 *Multichannel Arm (MCA384), carriers and accessories*

No.	Plain Text Designation	p/n	Label Designation
1	System Carrier MCA384 (base)	30032024	CARRIER SYSTEM BASE FOR MCA384
2	Adapter rack for System Carrier MCA384	30032027	RACK ADAPTER MCA384
3	ANSI/SLAS nest for DiTi boxes and plates for System Carrier MCA384	30032026	NEST ANSI/SLAS FOR MCA384 SYSTEM CARRIER
4	MCA384 DiTi Carrier	30032023	CARRIER DITI FOR MCA384
5	MCA384 DiTi Carrier adapter for 15 µl DiTi boxes	30072320	ADAPTER CARRIER DITI MCA384 FOR 15µL TIP
6	Nested DiTi flat carrier, 3 positions with ANSI/SLAS footprint, for cpl. stack of 8 DiTis with MCA96	30052707	CARRIER 3 POS. NESTED TIPS MCA96 AND 384
7	Nested DiTi flat carrier, 4 positions with ANSI/SLAS footprint, for cpl. stack of 8 DiTis with MCA96	30052708	CARRIER 4 POS. NESTED TIPS MCA96 AND 384

Tab. 11-14 *Multichannel Arm (MCA384), carriers and accessories*

No.	Plain Text Designation	p/n	Label Designation
8	Waste option for Nested DiTi, for flat carriers 30052707 / 30052708 / 30053521, will occupy the front position of the carrier	30097479	OPTION WASTE FOR CARRIERS MCA 96 SILVER
9	Nested DiTi flat carrier, 3 positions with ANSI/SLAS footprint, for cpl. stack of 8 DiTis with MCA96, allows free access to each DiTi stack	30053521	CARRIER 3 POS INDIVDUAL ACCESS NEST DITI
10	Reagent trough (PP) w. window, set (with blister and partition), 200 ml	10612070	TROUGH REAGENT 200ML 384HEAD CPL.
11	Reagent trough blisters (PP), 200 ml, 50 pc.	10619686	BLISTER REAGENT TROUGH 200ML TE-MO 384

Tab. 11-15 *Multichannel Arm (MCA384), wash system*

No.	Plain Text Designation	p/n	Label Designation
1	Wash Control Unit MCA (requires washblock on System Carrier)	30032025	OPTION WASHSTATION COMPLETE FOR MCA384
2	Washblock MCA384 (for System Carrier)	30032028	WASHBLOCK MCA384
3	Filter	10619185	FILTER WASHSTATION TE-MO
4	Tubing for wash unit MCA	10619183	TUBING SET WASHSTATION TE-MO
5	Set of tube fittings (male, labeled) for connection to the wash unit MCA	10619184	FITTING SET WRC 96 PIP.HEAD TE-MO

11.5.5 Robotic Manipulator Arm (RoMa)

Tab. 11-16 *Robotic manipulator arm (RoMa)*

No.	Plain Text Designation	p/n	Label Designation
1	Eccentric RoMa fingers	30017037	GRIPPER ECCENTRIC ROMA-3
2	Eccentric RoMa gripper finger with rubber paddles	30065673	GRIPPER FINGER ECCENTRIC ROMA RUBBER PAD
3	Centric RoMa fingers	10614007	FINGER CENTRIC ROMA ARM

11.6 Optional Equipment and Modules

Tab. 11-17 *Optional equipment and modules*

No.	Plain Text Designation	p/n	Label Designation
1	External status lamp	10612823	LAMP SIGNAL RED/GREEN INSTRUMENT STATUS
2	External pause/resume button	10619848	BUTTON PAUSE/RESUME EXTERNAL
3	I/O option (4 input, 4 output, RS485 communication)	10643010	PCBA OPTION I/O EVO 4-IN/4-OUT/1 485
4	Disposable tip option, cone for 10 µl, 200 µl and 1000 µl tips	10612502	OPTION DITI CONE 10/200/1000µL
5	Adapter plate for balance	10619009	PLATE ADAPTER BALANCE
7	Variable worktable extension (for reader, etc.)	10612651	WORKTABLE EXTENSION VARIABLE L+R RWS
11	Adapter plate for Infinite 200 (use with extension 10612651)	30021794	PLATE ADAPTER 1 INFINITE RIGHT
12	Adapter plate for Infinite 200 at rear of worktable	30020478	PLATE ADAPTER 3 INFINITE WORKTABLE
13	Adapter plate for Infinite 200 injectors at rear of worktable	30020481	PLATE ADAPTER 3 INFINITE INJECTORS WORKT
	Adapter plate for Spark (use with extensions 10612651)	30100812	PLATE ADAPTER SPARK GREY

11.6.1 Sensor Plate

Tab. 11-18 *Sensor plate (reference tool) for Te-PS and 384-well microplates*

No.	Plain Text Designation	p/n	Label Designation
1	Sensor plate for Te-PS option and 384 option	10642025	PLATE SENSOR TE-PS

Fig. 11-1 *Sensor plate for the Te-PS option and 384 option*

11.7 Carriers, Racks, Troughs

11.7.1 Carriers for Microplates

***Tab. 11-19** Carriers for microplates*

Plain Text Designation	p/n	Label Designation	Width[a)]	Reference
Carrier for microplates, RoMa, 3 pos., landscape orientation	10612604	CARRIER MP ROMA 3 POS. LANDSCAPE	6 150 mm (5.9 in.)	See Fig. 11-3 , 2 11-11
Carrier for microplates for RoMa, 2 microplates portrait	10612605	CARRIER MP ROMA 2 POS. PORTRAIT	6 150 mm (5.9 in.)	-
Carrier for microplates, flat, RoMa, 3 pos., landscape orientation	10612624	CARRIER MP FLAT ROMA 3 POS. LANDSCAPE	6 150 mm (5.9 in.)	-
Carrier for microplates, flat, 4 pos., landscape orientation, low profile	30013061	CARRIER MP 4 POS. FLAT	6 150 mm (5.9 in.)	-
Carrier for 3 microplates landscape, with centering springs	10613006	CARRIER 3 MP LANDSCAPE WIDTH 6 CAR.UNIT	6 150 mm (5.9 in.)	See Fig. 11-3 , 2 11-11
Carrier for 2 microplates portrait, with centering springs	10613007	CARRIER 2 MP PORTRAIT WIDTH 6 CAR.UNIT	6 150 mm (5.9 in.)	See Fig. 11-2 , 2 11-11
Carrier for 384-well microplates, RoMa, 3 pos., landscape orientation, not accessible for PosID; mandatory for use with 384-well tips	10613031	CARRIER 384WELL MP 3 POS.ACCESSIBLE ROMA	6 150 mm (5.9 in.)	See Fig. 11-4 , 2 11-11
Te-PS carrier for 1536-well microplates, RoMa, 3 pos., landscape orientation; not accessible for PosID; mandatory for use with Te-PS tips	10643025	CARRIER TE-PS 3 MICROPLATE LANDSCAPE	6 150 mm (5.9 in.)	See Fig. 11-5 , 2 11-11
Heated/cooled carrier for microplates, RoMa, 3 pos., landscape orientation	10290111	CARRIER COOLING/ HEATING 3 PLATES	6 150 mm (5.9 in.)	-

a) Number or grid positions the carrier occupies

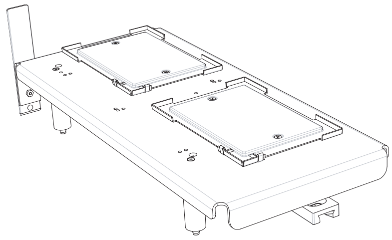


Fig. 11-2 *Carrier for 2 microplates portrait*

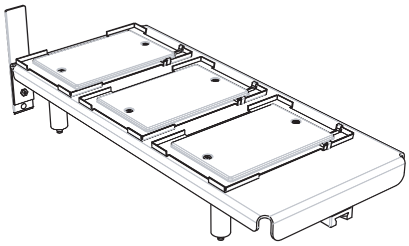


Fig. 11-3 *Carrier for 3 microplates landscape*

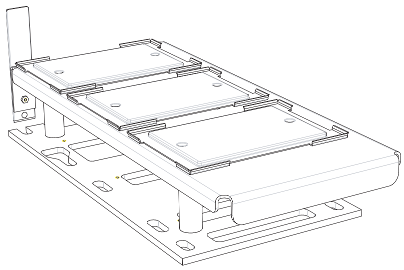


Fig. 11-4 *Carrier for 3 384-well microplates landscape*

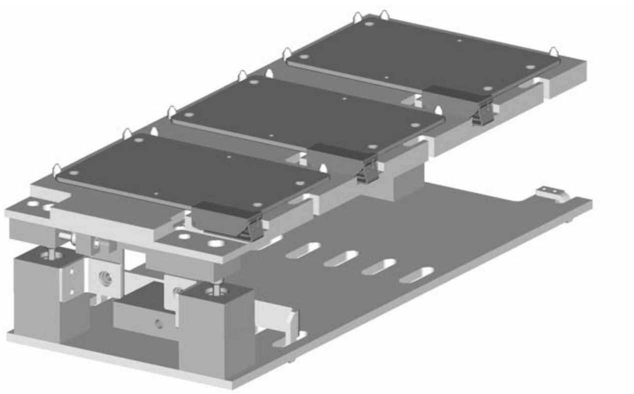


Fig. 11-5 *Te-PS carrier for 3 1536-well microplates landscape*

11.7.2 Carriers for Reagents and Troughs

Tab. 11-20 *Carriers for reagents and troughs*

Plain Text Designation	p/n	Label Designation	Width a)	Reference
Carrier for 3 reagent troughs In use with 100 ml (10613049) or 3 trough holders (10619626)	10613020	CARRIER ADDITIVE TROUGH 3 PCE. MAX.100ML	1 25 mm (0.98 in.)	See Fig. 11-6 , 2 11-13
Trough holder, aluminum for low volumes up to 25 ml In use with troughs 25 ml (30055743, 10520629); 1 pc.	10619626	HOLDER TROUGH ALU-MINIUM 25ML	1 25 mm (0.98 in.)	See Fig. 11-8 , 2 11-14
Reagent Troughs 25 ml, PP gray; 120 pc.; for maximum reagents recovery down to 500 µl Tecan Pure, certified free of human DNA, RNase, DNase and PCR inhibitors In use with trough holder (10619626)	30055743	TROUGH DISPOSABLE 25ML PP 120PCE.	1 25 mm (0.98 in.)	See Fig. 11-7 , 2 11-13
Reagent troughs 25 ml COA, PS with cover, PE; 100 pc., for low volumes up to 25 ml In use with trough holder (10619626)	10520629	TRAY TROUGH 100 PCE.	1 25 mm (0.98 in.)	See Fig. 11-8 , 2 11-14
Reagent carrier, cooled, cooling block for tubes	10613016	CARRIER REAGENT COOLED	6 150 mm (5.91 in.)	-
Cold pack set, 4 pc. In use with reagent carrier, cooled (10613016)	10613017	COLDPACK SET 4 PCE.	-	-
Temperature controlled reagent carrier for 2 x 0.8 l beakers	10290066	ARRIER COOLING/ HEATING 2 GLASS 800 ML	7 175 mm (6.89 in.)	-
Reagent troughs 100 ml, 108 pc., with liquid level indication markings 10 to 100 ml, gray For use with carrier for 3 reagent troughs (10613020)	10613049	TROUGH DISPOSABLE 100ML PP GRAY 108 PCE.	-	See Fig. 11-7 , 2 11-13

Tab. 11-20 Carriers for reagents and troughs (cont.)

Plain Text Designation	p/n	Label Designation	Width a)	Reference
Like reagent troughs (10613049), but natural, Tecan sterile, cleanliness certified	10613048	TROUGH DISPOSABLE 100ML PP TRA. 108 PCE.	-	See Fig. 11-7 , 2 11-13
Carrier for 16 Eppendorf tubes, PosID compatible	10613035	CARRIER 16*1.5ML TUBE POSID COMP.SPE/MBS	1 25 mm (0.98 in.)	-
Temperature controlled carrier for 32 Eppendorf tubes	10613053	RACK TEMP.CTLD.32 TUBE EPPENDORF GENESIS	3 75 mm (2.95 in.)	-
Temperature controlled carrier, 4 x 400 ml trough	10613052	RACK TEMP.CTLD.TROUGH 4*400ML GENESIS	7 175 mm (6.89 in.)	-

a) *Number or grid positions the carrier occupies*

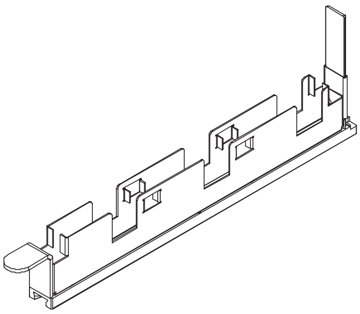
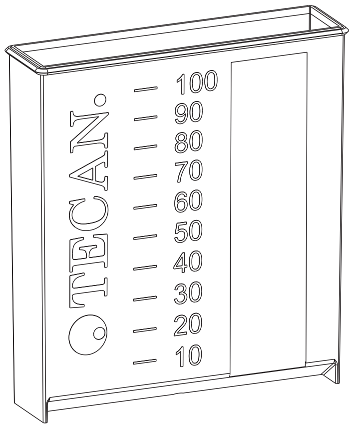
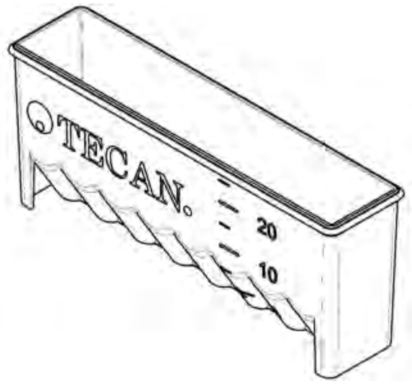


Fig. 11-6 *Carrier for 3 reagent troughs 100 ml*



100 ml



25 ml

Fig. 11-7 *Trough 100 ml and 25 ml*

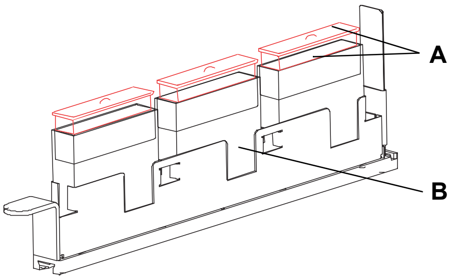


Fig. 11-8 *Trough holder and troughs*

A *Troughs COA for low volume containers up to 25 ml and covers*

B *Trough holder for low volumes up to 25 ml*

11.7.3 Carrier for Disposable Tips

Tab. 11-21 *Carrier for disposable tips*

Plain Text Designation	p/n	Label Designation	Width[a)]	Reference
DiTi Carrier for 2 trays of 96 disposable tips 10 µl, 200 µl or 1000 µl, with 2 pick-up and 1 waste position (without waste slide and cover)	10613012	CARRIER RACK 2 DITI+1 WASTE POS.6 CAR.U.	6 150 (5.91 in.)	See Fig. 11-9 , 2 11-16
DiTi waste slide and bag holder In use with DiTi Carrier (10613012)	30097476	SLIDE WASTE+BAG HOLDER DITI RACK SILVER	6 150 (5.91 in.)	See Fig. 11-9 , 2 11-16
Waste chute for plates In use with DiTi Carrier (10613012)	10290193	WASTE CHUTE MP		
DiTi waste slide cover, only for lower DiTi eject	10613030	COVER SLIDE DITI WASTE	6 150 (5.91 in.)	See Fig. 11-9 , 2 11-16
DiTi Carrier for 3 trays of 96 disposables tips	10613022	CARRIER RACK 3 DITI WIDTH 6 CARRIER UNIT	6 150 (5.91 in.)	-
DiTi waste and wash station unit with 3 trough container positions	30097477	DITI WASTE + WASHSTATION SILVER	2 50 mm (1.97 in.)	See Fig. 11-10 , 2 11-16 and section 11.7.6, 2 11-21
Waste slide for the nested tip carriers, compatible with all LiHa and MCA96 DiTis, as well as the nested MCA96 DiTi inserts and nested LiHa DiTi layers, with out carrier ground plate	30089580	OPTION WASTE FOR NESTED DiTi	6 150 mm (5.91 in.)	
DiTi waste chute and trough carrier, for 100 ml troughs, 6 positions	30097478	DITI WASTE STATION AIR LIHA SILVER	2 50 mm (1.97 in.)	-
DiTi Carrier Variant 1				

Tab. 11-21 Carrier for disposable tips (cont.)

Plain Text Designation	p/n	Label Designation	Width a)	Reference
Carrier for disposable tips, 3 DiTi racks with 96 tips	10650036	CARRIER DITI 3 POS.RELOADABLE	6 150 (5.91 in.)	–
Rack for DiTi box 200 µl	10650030	RACK DITI ROBOTIC 200µL	–b)	–
Rack for DiTi box 1000 µl	10650031	RACK DITI ROBOTIC 1000µL	–b)	–
DiTi Carrier Variant 2				
Carrier for 3 DiTi racks (200 µl DiTis)	30030578	CARRIER 3 RACK DITI 200	6 150 (5.91 in.)	See Fig. 11-11, 2 11-17
Carrier for 3 DiTi racks (2 x 200 µl DiTis) (1 x 1000 µl DiTis)	30030579	CARRIER 2 RACK DITI 200 1 RACK DITI 1000	6 150 (5.91 in.)	See Fig. 11-12, 2 11-17
Carrier for 3 DiTi racks (1 x 200 µl DiTis) (1 x 350 µl DiTis) (2 x 1000 µl DiTis)	30030580	CARRIER 1 RACK DITI 200 2 RACK DITI 1000 350 2 RACK DITI 50	6 150 150 (5.91 in.)	See Fig. 11-13, 2 11-17
Carrier for 3 DiTi racks (1000 µl DiTis)	30030581	CARRIER 3 RACK DITI 1000	6 150 (5.91 in.)	See Fig. 11-14, 2 11-18
Rack for DiTi box (96 disposable tips, 200 µl)	30030576	RACK DITI 200 EVO-LYZER-2	–b)	See Fig. 11-15, 2 11-18
Rack for DiTi box (96 disposable tips, 1000 µl)	30030575	RACK DITI 1000 EVO-LYZER-2	–b)	See Fig. 11-16, 2 11-18
DiTi waste and wash station unit with 3 trough container positions	See Fig. 11-20, 2 11-21 and section 11.7.6, 2 11-21			

a) *Number or grid positions the carrier occupies*
b) *See carrier*

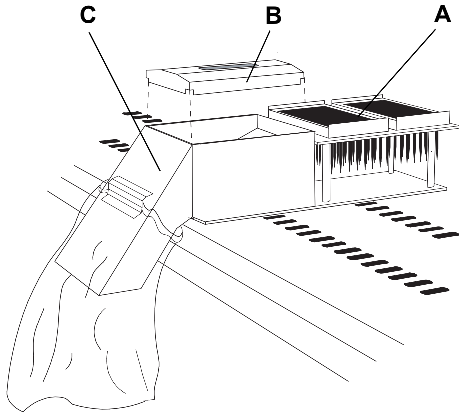


Fig. 11-9 *Carrier for disposable tips*

A *Carrier for disposable tips: Holds 2 frames with 96 DiTis each*

B *DiTi waste slide cover: Protective cover to minimize splashing*

C *DiTi waste slide and bag holder: Collects used tips in waste bag*

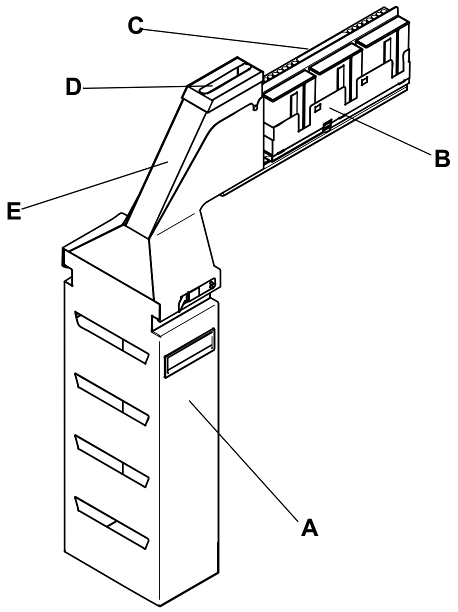


Fig. 11-10 *DiTi waste and wash station unit*

A *Container for DiTi waste bag*

B *Trough holder*

C *Wash station*

D *Slot of lower DiTi waste*

E *DiTi waste slide*

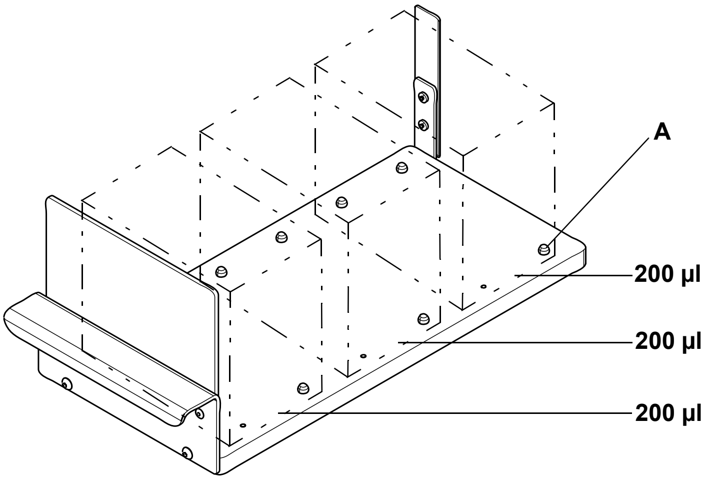


Fig. 11-11 *Carrier for DiTi racks (3 DiTi racks 200 µl)*

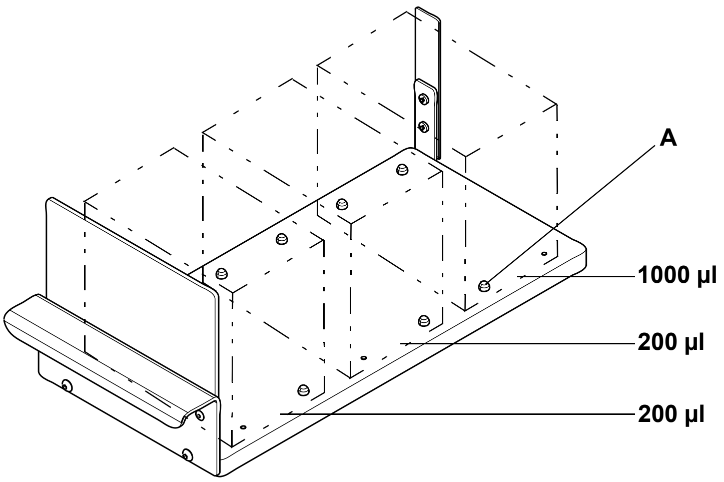


Fig. 11-12 *Carrier for DiTi racks (2 DiTi racks 200 µl, 1 DiTi rack 1000 µl)*

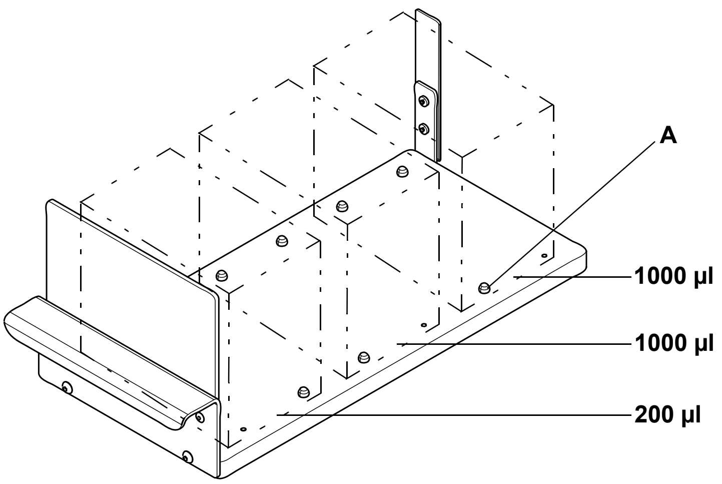


Fig. 11-13 *Carrier for DiTi racks (1 DiTi rack 200 µl, 2 DiTi racks 1000 µl)*

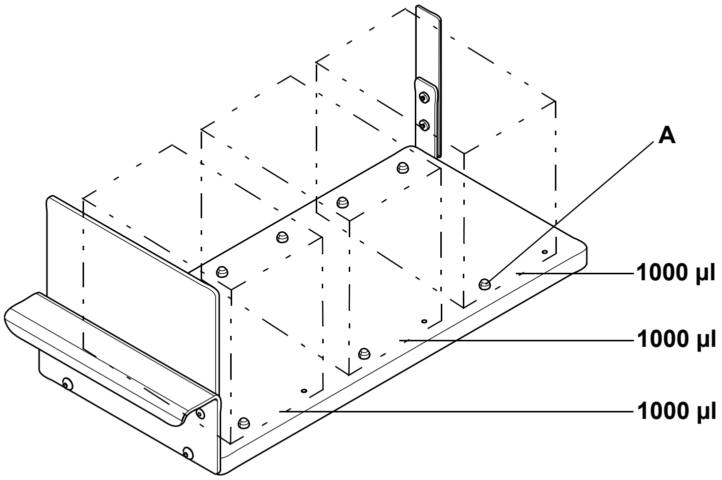


Fig. 11-14 *Carrier for DiTi racks (3 DiTi racks 1000 µl)*

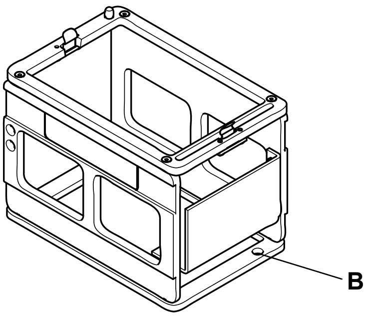


Fig. 11-15 *DiTi rack for 200 µl DiTis*

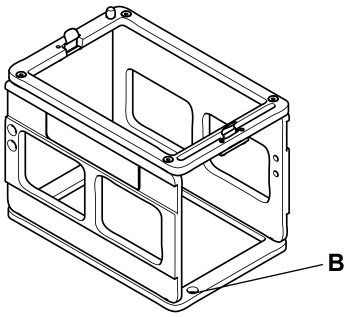


Fig. 11-16 *DiTi rack for 1000 µl DiTis*

11.7.4 Customized Carriers

Tab. 11-22 *Carriers, customized*

Plain Text Designation	p/n	Label Designation	Width[a)]	Reference
Carrier for reagents, solid block ready to be drilled	10613010	CARRIER+PLASTIC BLOCK UNDRILLED 75MM	3 75 mm (2.95 in.)	See Fig. 11-17 , 2 11-19
Custom carrier kit: 1 positioning rail, 1 glider and 8 screws	10613011	CARRIER CUSTOM KIT RAIL/GLIDER/SCREWS	3 75 mm (2.95 in.)	See Fig. 11-18 , 2 11-19
Reagent block, undrilled plastic block, microplate format, transportable with robotic manipulator arm	10613019	RACK REAGENT TRANSPORT-ABLE+ROMA RMP	-	-

a) *Number or grid positions the carrier occupies*

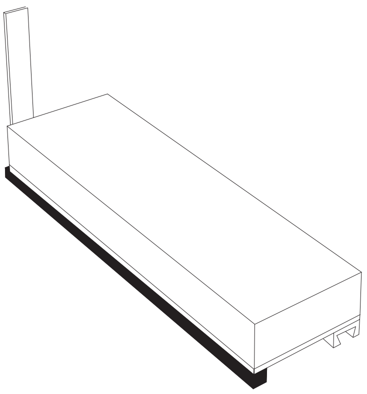


Fig. 11-17 *Carrier for reagents, solid block*

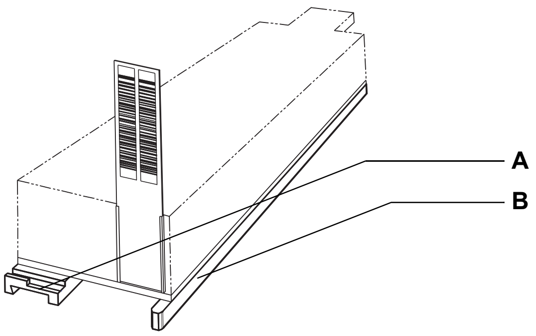


Fig. 11-18 *Custom carrier kit*

A Positioning rail ***B*** Glider

11.7.5 Carriers for Tubes

Tab. 11-23 *Tube carriers*

Plain Text Designation	p/n	Label Designation	Width[a)]	Reference
Carrier for tubes 10 mm 6 x 16 pos.	30019985	RACK STRIP 16 POS. TUBE 10MM 1 PCE.	1 25 mm (0.98 in.)	See Fig. 11-19 , 2 11-20
Carrier for tubes 10 mm 6 x 16 pos. Set of 6 carriers	10613014	RACK STRIP 16 POS. TUBE 10MM 6 PCE.	1 25 mm (0.98 in.)	See Fig. 11-19 , 2 11-20
Carrier for tubes 13 mm 6 x 16 pos.	30019986	RACK STRIP 16 POS. TUBE 13MM 1 PCE.	1 25 mm (0.98 in.)	See Fig. 11-19 , 2 11-20
Carrier for tubes, 13 mm, 6 x 16 pos. Set of 6 carriers	10613002	RACK STRIP 16 POS. TUBE 13MM 6 PCE.	1 25 mm (0.98 in.)	See Fig. 11-19 , 2 11-20
Carrier for tubes, 16 mm, 6 x 16 pos.	30019987	RACK STRIP 16 POS. TUBE 16MM 1 PCE.	1 25 mm (0.98 in.)	See Fig. 11-19 , 2 11-20
Carrier for tubes, 16 mm, 6 x 16 pos. Set of 6 carriers	10613003	RACK STRIP 16 POS. TUBE 16MM 6 PCE.	1 25 mm (0.98 in.)	See Fig. 11-19 , 2 11-20
Carrier for tubes, 10 mm, 6 x 16 pos.	10613015	CARRIER 6*16 POS. TUBE 10MM	6 150 (5.91 in.)	-
Carrier for tubes, 13 mm, 6 x 16 pos.	10613004	CARRIER 6*16 POS. TUBE 13MM	6 150 (5.91 in.)	-
Carrier for tubes, 16 mm, 6 x 16 pos.	10613005	CARRIER 6*16 POS. TUBE 16MM	6 150 (5.91 in.)	-

a) Number or grid positions the carrier occupies

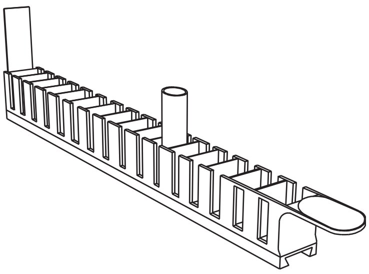


Fig. 11-19 *Carrier for tubes (example for 16 tubes)*

11.7.6 Wash Stations

Tab. 11-24 *Wash/waste stations*

Plain Text Designation	p/n	Label Designation	Width a)	Reference
Wash/waste station standard, PP 8 wash positions shallow at rear 1 waste position at center 8 wash positions deep at front	10613001	WASHSTATION GENESIS 8+8POS.WIDTH 1 CAR.	1 25 mm (0.98 in.)	See Fig. 11-20 , 2 11-21
Wash station low volume, PP 8 wash positions shallow at rear 1 waste position at center 8 wash/clean positions deep at front In use with the low volume option	10613033	WASHSTATION COMPLETE LOWVOLUME GENESIS	1 25 mm (0.98 in.)	See Fig. 11-21 , 2 11-21
DiTi waste and wash station unit with 3 trough container positions	30097477	DITI WASTE + WASHSTATION SILVER	2 50 mm (1.97 in.)	See section 11.7.3, 2 11-14

a) *Number or grid positions the carrier occupies*

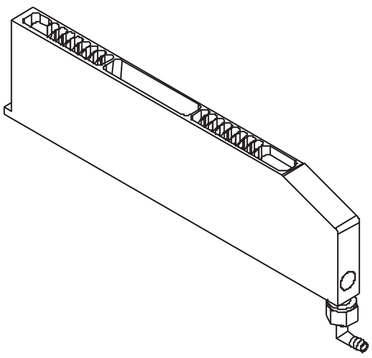


Fig. 11-20 *Wash/waste station, standard*

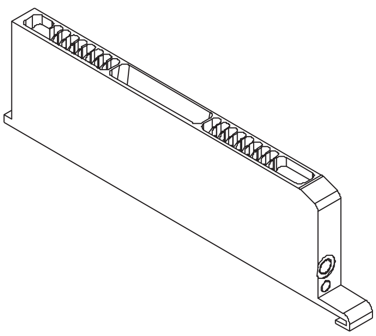


Fig. 11-21 *Wash Station low volume*

11.8 Syringes and Accessories

Tab. 11-25 *Syringes and accessories*

Plain Text Designation	p/n	Label Designation	Cap form
Syringe 0.025 ml for diluter type XP SMART	30025512	SYRINGE 25µL NANO-PIP.DIL.XP3000 PLUS V2	flat
Syringe 0.05 ml for diluter type XP SMART	30025511	SYRINGE 50µL NANO-PIP.DIL.XP3000 PLUS V2	flat
Syringe 0.25 ml for diluter type XP SMART	10619530[a)]	SYRINGE 250µL NEW	conical
Syringe 0.50 ml for diluter type XP SMART	10619531	SYRINGE 500µL CONICAL CAPS	conical
Syringe 1.00 ml for diluter type XP SMART	10619532	SYRINGE 1.0ML NEW	conical
Syringe 2.50 ml for diluter type XP SMART	10619426	SYRINGE 2.5ML	flat
Syringe 5.00 ml for diluter type XP SMART	10619427	SYRINGE 5.0ML	flat
Syringe cap for syringe 0.25 ml, PTFE, 8 pc.	10619428	CAP SYRINGE 250µL SET 8 PCE.	–
Syringe cap for syringe 0.50 ml, PTFE, 8 pc.	10619429	CAP SYRINGE 500µL SET 8 PCS.	–
Syringe cap for syringe 1.00 ml, PTFE, 8 pc.	10619430	CAP SYRINGE 1.0ML SET 8 PCS.	–
Syringe cap for syringe 2.50 ml, PTFE, 8 pc.	10619431	CAP SYRINGE 2.5ML SET 8 PCS.	–
Syringe cap for syringe 5.00 ml, PTFE, 8 pc.	10619432	CAP SYRINGE 5.0ML SET 8 PCS.	–
Syringe cap for syringe 0.05 ml, PTFE, 8 pc.	10619473	CAP XP SYRINGE 50µL SET 8 PCE.	–

a) 0.25 ml syringes are recommended for Te-PS tips.

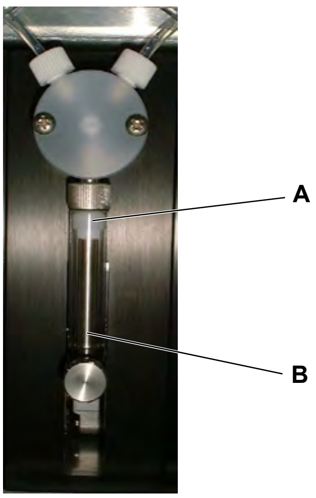


Fig. 11-22 *Syringe*

A *Syringe cap* ***B*** *Syringe*

11.9 Tips and Accessories

11.9.1 Fixed Tips and Accessories

Tab. 11-26 *Fixed tips and accessories*

No.	Plain Text Designation	p/n	Label Designation
1	Standard tip, stainless steel tip with soft PTFE outside coating, without lock nut - color light green, not adjustable	10612501	TIP STD. STA.STEEL PTFE COATED EVO SP
2	Ceramic tip, stainless steel tip, hard ceramic coating inside and outside, without lock nut - color black, not adjustable	10612504	TIP STEEL CERAMIC-COATED TRA. SP
3	Lock nut for standard and ceramic tip	10619515	NUT LOCK TIP STANDARD+CERAMIC
4	Lock nut for 96-well tips	10619548	NUT LOCK GOLD PLATED TIP STD.+CERAMIC
5	Lock nut for Te-PS tips	10643006	NUT LOCK TIP TE-PS
6	Lock nut for 384-well microplate tips, set of 8 pc.	10643521	NUT LOCK EVO 384 ADJUST WITH 4 SCREWS
7	Standard tip, stainless steel tip with hard PTFE inner coating for 384-well pipetting - color dark green	10612530	TIP STD. 384WELL PTFE HARD COAT.INSIDE
8	384-well Standard tip, stainless steel tip with hard PTFE outside coating, DMSO resistant, excluding lock nut (619518), adjustable with 613032 - color gray	10612532	TIP 384WELL STA. PTFE DMSO-RES. SP
9	384-well low volume tip, stainless steel tip with hard PTFE outside coating, DMSO resistant, excluding lock nut (619518), adjustable with 613032 - color gray	10612533	TIP LV384WELL STA. PTFE DMSO-RES. SP
10	Low Volume tip, stainless steel tip with soft PTFE outside coating color light green	10612804	TIP LOWVOLUME PTFE COATED SP
11	Low Volume tip standard, non-adjustable, short, hard PTFE coating, DMSO resistant stainless steel, without lock nut.	10612534	TIP LV STD. SHORT STA. PTFE DMSO-RES.
12	Low Volume tip 384-well, short, hard PTFE coating, DMSO resistant stainless steel, without lock nut	10612535	TIP LV 384W SHORT STA.PTFE HARD DMSO-RES.
13	Te-PS tip, 1536-well, short, hard PTFE coating, DMSO resistant stainless steel (excluding lock-nut).	10643004	TIP PIPETTING TE-PS

11.9.2 Disposable Tips and Accessories

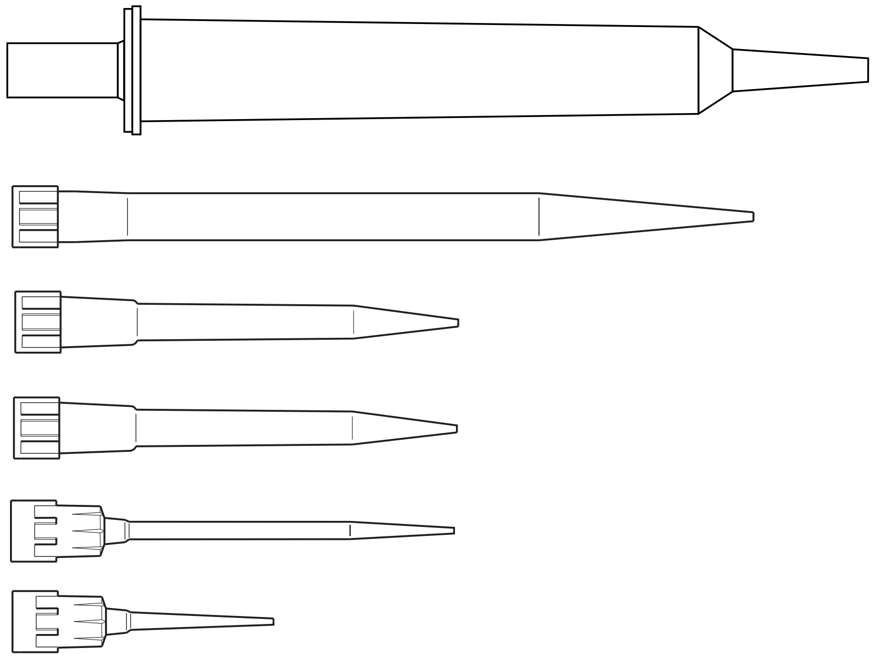


Fig. 11-23 *Disposable tips for Air LiHa and Liquid LiHa expect for* 5000 µl (for Liquid LiHa only)

Tab. 11-27 *Disposable tips*

No.	Plain Text Designation	p/n	Label Designation
1	LiHa, hanging tip format, standard purity, non-filtered, conductive, 200 µl	10612552	DITI LIHA 200µL CONDU.17280 PCE.
2	LiHa, hanging tip format, standard purity, filtered, conductive, 200 µl	10612553	DITI LIHA 200µL CONDU.FIL.17280 PCE.
3	LiHa, hanging tip format, standard purity, non-filtered, conductive, 1000 µl	10612554	DITI LIHA 1000µL CONDU.9600 PCE.
4	LiHa, hanging tip format, standard purity, filtered, conductive, 1000 µl	10612555	DITI LIHA 1000µL CONDU.FL.9600 PCE.
5	LiHa, hanging tip format, pure, filtered, conductive, 50 µl	30032114	DITI LIHA 50µL CONDU.FIL. 2304 PCE.
6	LiHa, hanging tip format, pure, non-filtered, conductive, 50 µl	30032115	DITI LIHA 50µL CONDU.2304 PCE.
7	LiHa, hanging tip format, pure, non-filtered, conductive, 200 µl	30000627	DITI LIHA 200µL CONDU.2304 PCE.
8	LiHa, hanging tip format, pure, filtered, conductive, 200 µl	30000629	DITI LIHA 200µL CONDU.FIL. 2304 PCE.

Tab. 11-27 *Disposable tips (cont.)*

No.	Plain Text Designation	p/n	Label Designation
9	LiHa, hanging tip format, pure, non-filtered, conductive, 1000 µl	30000630	DITI LIHA 1000µL CONDU.2304 PCE.
10	LiHa, hanging tip format, pure, filtered, conductive, 1000 µl	30000631	DITI LIHA 1000µL CONDU.FIL.2304 PCE.
11	LiHa, ANSI, pure, non-filtered, conductive, 50 µl, refill insert	30057811	DITI LIHA 50µL CONDU. 2304 PCE. SBS
12	LiHa, ANSI, pure, filtered, conductive, 50 µl, refill insert	30057813	DITI LIHA 50µL CONDU.FIL. 2304 PCE. SBS
13	LiHa, ANSI, sterile, non-filtered, conductive, 50 µl	30057818	DITI LIHA 50µL CONDU. STE. 3840 PCE.
14	LiHa, ANSI, sterile, filtered, conductive, 50 µl	30057819	DITI LIHA 50µL CONDU.FIL.STE. 3840 PCE.
15	LiHa, ANSI, pure, non-filtered, conductive, 200 µl, refill insert	30057814	DITI LIHA 200µL CONDU. 2304 PCE. SBS
16	LiHa, ANSI, pure, filtered, conductive, 200 µl, refill insert	30057815	DITI LIHA 200µL CONDU.FIL. 2304 PCE. SBS
17	LiHa, ANSI, pure, non-filtered, conductive, 1000 µl, refill insert	30057816	DITI LIHA 1000µL CONDU. 2304 PCE. SBS
18	LiHa, ANSI, pure, filtered, conductive, 1000 µl, refill insert	30057817	DITI LIHA 1000µL CONDU.FIL. 2304PCE. SBS
19	LiHa, ANSI, sterile, non-filtered, conductive, 200 µl	30057820	DITI LIHA 200µL CONDU.STE. 3840 PCE.
20	LiHa, ANSI, sterile, filtered, conductive, 200 µl	30057821	DITI LIHA 200µL CONDU.FIL.STE. 3840 PCE.
21	LiHa, ANSI, sterile, non-filtered, conductive, 1000 µl	30057822	DITI LIHA 1000µL CONDU.STE. 3840 PCE.
22	LiHa, ANSI, sterile, filtered, conductive, 1000 µl	30057823	DITI LIHA 1000µL CONDU.FIL.STE. 3840 PCE
23	LiHa, ANSI, pure, non-filtered, conductive, 5000 µl	30059897	DITI LIHA 5000µL CONDU. 240 PCE.
24	LiHa, ANSI, sterile, filtered, conductive, 5000 µl	30059898	DITI LIHA 5000µL CONDU.FIL.STE. 240 PCE.
25	LiHa, ANSI, pure, filtered, conductive, 5000 µl	30065423	DITI LIHA 5000µL CONDU.FIL. 240 PCE.
26	LiHa, ANSI, nested 5 stack, pure, non-filtered, conductive, 350 µl	30083400	DITI LIHA 350µL COND.NESTED 7680 PCE
27	LiHa, ANSI, nested 5 stack, sterile, non-filtered, conductive, 350 µl	30083401	DITI LIHA 350µL COND.STE.NESTED 7680 PCE
28	Tool, Nested LiHa DiTi Transfer	30083403	TOOL DISP.TRANS.NESTED LIHA 112 PCE
29	New! LiHa, hanging tip format, pure, non-filtered, conductive, 10 µl, 3.6mm longer	30104803	DITI LIHA 10µL CONDU. 2304 PCE.
30	New! LiHa, hanging tip format, pure, filtered, conductive, 10 µl, 3.6mm longer	30104804	DITI LIHA 10µL CONDU.FIL. 2304 PCE.

Tab. 11-27 *Disposable tips (cont.)*

No.	Plain Text Designation	p/n	Label Designation
31	LiHa, ANSI, pure, non-filtered, conductive, 10 µl, refill insert	30104973	DITI LIHA 10µL COND. 2304 PCE. SBS
32	LiHa, ANSI, pure, filtered, conductive, 10 µl, refill insert	30104974	DITI LIHA 10µL COND.FIL. 2304 PCE. SBS
33	LiHa, ANSI, pure, non-filtered, conductive, 10 µl, refill insert	30104975	DITI LIHA 10µL COND. STE. 3840 PCE.
34	LiHa, ANSI, sterile, filtered, conductive, 10 µl	30104976	DITI LIHA 10µL COND.FIL.STE. 3840 PCE.
35	LiHa, ANSI, nested 5 stack, pure, non-filtered, conductive, 10 µl	30104977	DITI LIHA 10µL COND.NESTED 7680 PCE
36	LiHa, ANSI, nested 5 stack, pure, filtered, conductive, 10 µl	30104978	DITI LIHA 10µL COND.NESTED FIL.7680 PCE
37	LiHa, ANSI, nested 5 stack, sterile, filtered, conductive, 10 µl	30104979	DITI LIHA 10µL COND.NESTED.FIL.STE.7680
38	LiHa, hanging tip format, pure, filtered, conductive, wide-bore 1000 µl	30115239	DITI LIHA 1000UL COND.FIL. 960 PCE WIDE
39	LiHa, hanging tip format, standard purity, non-filtered, clear, 200 µl	30126017	DITI LIHA 200UL CLEAR 17280 PCE.
40	LiHa, hanging tip format, standard purity, filtered, clear, 200 µl	30126018	DITI LIHA 200UL CLEAR FIL.17280 PCE.
41	LiHa, hanging tip format, standard purity, non-filtered, clear, 1000 µl	30126019	DITI LIHA 1000UL CLEAR 9600 PCE.
42	LiHa, hanging tip format, standard purity, filtered, clear, 1000 µl	30126020	DITI LIHA 1000UL CLEAR FIL.9600 PCE.
43	LiHa, hanging tip format, pure, non-filtered, clear, 50 µl	30126096	DITI LIHA 50UL CLEAR 2304 PCE. PURE
44	LiHa, hanging tip format, pure, filtered, clear, 50 µl	30126097	DITI LIHA 50UL CLEAR FIL.2304 PCE. PURE

Note: *The standard DiTi cone is used for all disposable tip sizes. For free dispense pipetting of low volumes (i.e. 1 - 3 µl) with 10 µl tips, the low volume option must be used.*

Note: *Clear LiHa DiTis are only for use on Air FCA and not with conductive liquid level detection. Not for instrument qualification.*

Accessories

Tab. 11-28 DiTi option accessories

No.	Plain Text Designation	p/n	Label Designation
1	Disposable Transfer Tool for nested LiHa DiTi product, usable with a Liquid or Air LiHa. Includes 112 pieces in one sales unit, packaged in a bag and with outer cardboard packaging. The disposable Transfer Tool has to be filled in by hand into the Transfer Tool Holder.	30083403	TOOL DISP.TRANS.NESTED LIHA 112 PCE
2	Holder for disposable Transfer Tool to be placed into a 3 position trough carrier (Mat.Nr. 10613020). Holder can contain up to 16 Transfer Tools, which need to be filled in by hand.	30092506	HOLDER DISPOSABLE TRANSFER TOOL ASSY
3	3 position through carrier for the Holder for disposable Transfer Tool. Can contain up to three Holders (see table 11-22)	10613020	CARRIER ADDITIVE TROUGH 3 PCE. MAX.100ML
4	Nested LiHa DiTi Waste for non-nested and nested LiHa. MCA96 disposable tips and layers, insets. Can be mounted on MCA nested, SBS DiTi Carrier.	30089580	OPTION WASTE FOR NESTED LIHA DITI
5	10 pc., ANSI/SLAS Box, small, refill, usable for LiHa DiTi 50 µl and 200 µl	30058506	LIHA DiTi SBS BOX REFILL SMALL 10PCE.
6	10 pc., ANSI/SLAS Box, large, refill, usable for LiHa DiTi 1000 µl	30058507	LIHA DITI SBS BOX REFILL LARGE 10PCE.

Accessories

Tab. 11-29 DiTi option accessories

No.	Plain Text Designation	p/n	Label Designation
1	Disposable tip preventive maintenance set for 8 channels consisting of 8 tubing extensions, 8 cones	10619460	MAINTENANCE PREVENTIVE SET 8 DITI
2	Set of sealing rings for option, 8 washers and 8 O-rings	10619508	RING SEAL SET 8P.+O-RING 8P.DITI OPTION

11.9.2.1 Disposable Tips for MCA96

Tab. 11-30 *Disposable tips for MCA96*

No.	Plain Text Designation	p/n	Label Designation
1	MCA 96, single stack, pure, non-filtered, 50 µl	30038606	DITI 50µL 3840 PCE. MCA96 SBS
2	MCA 96, single stack, sterile, non-filtered, 50 µl	30038607	DITI 50µL STE. 3840 PCE. MCA96 SBS
3	MCA 96, single stack, sterile, filtered, 50 µl	30038608	DITI 50µL STE.FIL. 3840 PCE. MCA96 SBS
4	MCA 96, ANSI, nested 8 stack, pure, non-filtered, 50 µl	30038609	DITI 50µL 3840 PCE. MCA96 NESTED
5	MCA 96, Te-stack (10 stack), pure, non-filtered, 50 µl	30038610	DITI 50µL 7680 PCE. MCA96 TE-STACK SBS
6	MCA 96, single stack, pure, non-filtered, 100 µl	30038611	DITI 100µL 3840 PCE. MCA96 SBS
7	MCA 96, single stack, sterile, non-filtered, 100 µl	30038612	DITI 100µL STE. 3840 PCE. MCA96 SBS
8	MCA 96, single stack, sterile, filtered, 100 µl	30038613	DITI 100µL STE.FIL. 3840 PCE. MCA96 SBS
9	MCA 96, ANSI, nested 8 stack, pure, non-filtered, 100 µl	30038614	DITI 100µL 3840 PCE. MCA96 NESTED
10	MCA 96, single stack, pure, non-filtered, 200 µl	30038616	DITI 200µL 3840 PCE. MCA96 SBS
11	MCA 96, single stack, sterile, non-filtered, 200 µl	30038617	DITI 200µL STE. 3840 PCE. MCA96 SBS
12	MCA 96, single stack, sterile, filtered, 200 µl	30038618	DITI 150µL STE.FIL. 3840 PCE. MCA96 SBS
13	MCA 96, ANSI, nested 8 stack, pure, non-filtered, 200 µl	30038619	DITI 200µL 3840 PCE.MCA96 NESTED
14	MCA 96, Te-stack (10 stack), pure, non-filtered, 200 µl	30038620	DITI 200µL 7680 PCE. MCA96 TE-STACK SBS
15	MCA 96, single stack, pure, non-filtered, 500 µl[a)]	30046341	DITI 500µL 4800 PCE. MCA96 SBS
16	MCA 96, single stack, sterile, filtered, 500 µl[a)]	30046342	DITI 500µL STE.FIL. 4800 PCE. MCA96 SBS
17	MCA 96, nested 8 stack, sterile, non-filtered, 50 µl	30048822	DITI 50µL STE. 3840 PCE. MCA96 NESTED
18	MCA 96, nested 8 stack, sterile, non-filtered, 100 µl	30048823	DITI 100µL STE. 3840 PCE. MCA96 NESTED
19	MCA 96, nested 8 stack, sterile, non-filtered, 200 µl	30048824	DITI 200µL STE. 3840 PCE. MCA96 NESTED
20	MCA 96, wide-bore, single stack, pure, non-filtered, 200 µl	30050348	DITI 200µL 3840 PCE. MCA96 WIDE BORE SBS
21	MCA 96, wide-bore, single stack, sterile, filtered, 200 µl	30050349	DITI 150µL 3840 PCE.FIL. MCA96 WIDE BORE

a) *The 500 µl tips are longer than the 200 µl, 100 µl and 50 µl tips and therefore might collide with high DiTi carriers. Maximum volume of 500 µl (400 µl filtered) are only possible on the MCA384 with the Extended Volume Adapter (EVA)*

11.9.2.2 Disposable Tips for MCA384

TECAN STERILE purity level: sterile, tested and certified to be free from human DNA, DNase, RNase, pyrogens and endotoxins

TECAN PURE purity level: tested and certified to be free of human DNA, RNase, DNase and PCR inhibitors

Tab. 11-31 *Multichannel Arm (MCA384), DiTis*

No.	Plain Text Designation	p/n	Label Designation
1	MCA 384, single stack, pure, non-filtered, 15 µl	30051802	DITI 15µL 40*384P MCA384
2	MCA 384, single stack, sterile, non-filtered, 15 µl	30051803	DITI 15µL STE. 40*384P MCA384
3	MCA 384, single stack, sterile, filtered, 15 µl	30051804	DITI 15µL STE. FIL. 40*384P MCA384
4	MCA 384, single stack, pure, non-filtered, 50 µl	30051805	DITI 50µL 40*384P MCA384
5	MCA 384, single stack, sterile, non-filtered, 50 µl	30051806	DITI 50µL STE. 40*384P MCA384
6	MCA 384, single stack, sterile, filtered, 50 µl	30051807	DITI 50µL STE. FIL. 40*384P MCA384
7	MCA 384, single stack, pure, non-filtered, 125 µl	30051808	DITI 125µL 40*384P MCA384
8	MCA 384, single stack, sterile, non-filtered, 125 µl	30051809	DITI 125µL STE. 40*384P MCA384
9	MCA 384, single stack, sterile, filtered, 125 µl	30051810	DITI 125µL STE. FIL. 40*384P MCA384

TECAN STERILE purity level: sterile, tested and certified to be free from human DNA, DNase, RNase, pyrogens and endotoxins

TECAN PURE purity level: tested and certified to be free of human DNA, RNase, DNase and PCR inhibitors

11.9.2.3 Disposable Tips for PMP Function

Tab. 11-32 *Disposable tips for PMP function*

No.	Plain Text Designation	p/n	Label Designation	Volume
1	Disposable tips, conductive, boxes of 17280 pc.	10612552	DITI 200µL CONDUCTIVE 17280 TIP STD.CONE	200 µl
2	Disposable tips, conductive with filter; boxes of 17280 pc.	10612553	DITI 200µL CONDUCT.FI.17280 TIP STD.CONE	200 µl
3	Disposable tips, conductive with filter; boxes of 9600 pc.	10612555	DITI 1.0ML CONDUCT.FI.9600 TIP STD.CONE	1000 µl

11.9.2.4 Disposable Tips for cLLD and pLLD Function

All Tecan branded 200 µl and 1000 µl tips are compatible with pLLD and cLLD.

11.10 Containers

Tab. 11-33 *Containers*

No.	Plain Text Designation	p/n	Label Designation
1	System liquid container, 10 liter	30022095	CONTAINER SYSTEMLIQUID 10L SPO
2	Waste liquid container, 10 liter	30022097	CONTAINER WASTE 10L SPO

12 Customer Support

Purpose of This Chapter

This chapter informs you how to contact us in case help is needed. It lists addresses and telephone numbers of the manufacturer's representatives.

How to get Help

Tecan and its representatives maintain a fully trained staff of technical specialists around the world. For any technical question, contact the nearest Tecan representative.

Feedback on This Manual

If you have any comments on this Operating Manual or suggestions for improvement, please send them by e-mail to **docfeedback@tecan.com**.
In your e-mail, please specify the manual name, the document ID and the manual version. This information is shown at the bottom of each printed page and on the first page of the help file (context-sensitive help of software products).

12.1 Contacts

Addresses

Contact your local distributor or one of the addresses below.
Also see our homepage on the web: **www.tecan.com**

Country/Region	Address	Telephone/Telefax/E-mail	
Asia	Tecan Asia Pte Ltd. 18 Boon Lay Way, #10-106 TradeHub 21 Singapore 609966 Singapore	Phone Fax E-mail	+65 6444 1886 +65 6444 1836 tecan@tecan.com.sg
Australia New Zealand Pacific Islands	Tecan Australia Pty Ltd. Unit 2, 475 Blackburn Road Mount Waverley VIC 3149 Australia	Phone Phone Fax E-mail	Toll Free: 1300 808 403 +61 3 9647 4100 +61 3 9647 4199 helpdesk-aus@tecan.com
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13 Glossary

Purpose of This Chapter

This chapter contains a glossary to explain terms and expressions used in this Operating Manual.

Accuracy

The degree of conformity of a measure to a standard or true value (difference between expected value and actual value, divided by the expected value multiplied by 100%).

Adapter rack

Adapter rack for System Carrier (MCA384). Various versions to hold *tip adapters*, *DiTi boxes* or *microplates*.

Adapter DiTi

Adapter for the MCA384 pipetting head for mounting DiTis.

Adapter Fixed

Adapter for the MCA384 pipetting head with 384 or 96 fixed tips.

Adapter QC

Adapter for setups and tests with the MCA384.

Additive

A liquid (e.g. reagent, diluent) taken from a *container* on the work table and added to several or all *Samples/Standards/Controls/Blanks* in order to cause or influence a reaction.

Additive distribution

A *distribution* which adds an *additive* to *destination* containers which have already received liquid during a previous *distribution* or are going to receive liquid in a *follow-up distribution*.

Air displacement pipetting arm (Air LiHa)

Robotic arm with multiple tips for general pipetting tasks. The Air LiHa picks up disposable tips to aspirate / dispense liquids. Its working principle is based on air displacement technology (variation of an air chamber); a **Plunger Drive**, directly mounted on top of each Z-rod (pipetting channel), varies the air chamber for aspiration and dispensing (compare: Liquid handling arm).

Air LiHa MultiSense

Air LiHa MultiSense is a hardware module available per default on the Air LiHa.

It requires an Air LiHa MultiSense tip adapter comprising a pressure sensor. Either four or eight tip positions can be fitted with Air LiHa MultiSense tip adapters.

The Air LiHa MultiSense hardware allows Pressure Monitored Pipetting (PMP) and liquid level detection (pLLD). In contrast to the capacitive liquid level detection (cLLD), pLLD is also suitable for detecting non-conductive liquids. The PMP and LLD settings can be configured individually for each liquid class (liquid type). The liquid class can be configured to use cLLD, pLLD or both systems in parallel.

Application

Generally refers to a software package with a specific purpose, for example RIA, EIA, etc.

Blank

A position in a d*estination rack* which does not receive *sample* but only the *additive(s)*. It is used to determine the background signal in the detection or measurement system (e.g. a photometer).

Carousel

A microplate stack hotel (with stacks that are arranged in a circle), i.e. a device for microplate storage, which offers random access to the plates.

Carrier

A carrier is a mount for *microplates* or other *racks*. It is positioned on the worktable or on devices like the *Te-Link*.

Carry over

Residue of any liquid that remains in a tip after rinsing at the end of a pipetting cycle. Such residue is "carried over" to the next cycle. Where no carry over is admissible, *disposable tips (DiTis)* must be used.

CGM

see "MCA384 Gripper (CGM)"

Cleaner

The well in which a tip is positioned in order to wash both its interior and exterior surfaces, by dispensing *system liquid* through the tip.

cLLD, Capacitive Liquid Level Detection

An Electronic device (ILID, Integrated Liquid Detector) mounted on the arm monitors the capacitance between the pipetting tip and the electrical ground (worktable). It generates a signal when there is a sudden change in capacitance, caused by the pipetting tip coming in and out of contact with an ionic solution. This signal is used for liquid and clot detection.

Clot detector

A program function issuing a message if the difference between the liquid levels measured before and after sample aspiration and dispense does not correspond to the calculated difference of level, indicating clots attached to the tip.

Coefficient of variation (CV%)

A statistical representation of the precision of a test.
The function: standard deviation / mean expressed in percent.

Conditioning volume

The volume of excess liquid which is aspirated together with the liquid to be distributed and immediately discarded (usually in the source container) before the dispense process starts. It serves to create a controlled state of the system.

Container

Any vessel placed on or under the worktable and containing a liquid or other chemical, e.g. one well in a microplate, a sample tube or a system liquid bottle.

Control

A liquid containing a known concentration of the substance which is to be tested. Used to determine (high/low/cutoff) limits and/or as reference for quality control. The properties of the control are well known and stable.

Blister (inset)

Multichannel arm: Disposable inset for the reagent trough with 96 inlets to reduce death volume.

Destination
The *rack* holding the *container(s)* into which liquid is dispensed.

Device
An addressable component of the Freedom EVO or additional option which can communicate with the *Te-CU*, e.g. arm, diluter, *PosID*, etc.

Diluter
Precision pump used for aspirating and dispensing exactly defined volumes of liquid by means of a motor driven syringe.

Disposable tip
Tip used for one single aspiration/dispensation cycle and discarded afterwards. Used when it is absolutely necessary that no residues from one sample are carried over to the next. See also "Carry over".

Distribution
One or a sequence of *pipetting cycles* defined together with the appropriate liquid handling parameters.

DiTi
See "Disposable tip"

DiTi transfer rack
Multichannel arm: The DiTi transfer rack is used to pick up or park the disposable tips.

Excess volume
The volume of excess liquid which is aspirated together (not separated by an air gap) with the liquid to be distributed. It is not dispensed anywhere, but discarded to waste (or a special position) after use, and serves to minimize dilution of the reagents by the system liquid.

Fixed tip
General term for a tip that can be fastened to a pipetting device (e.g. LiHa). Unlike a *disposable tip* it is rinsed after each pipetting cycle and can be reused.

Fixed tip block
Multichannel arm: Standard 96 multichannel fixed tip block; with long needles, uncoated/coated, for microplates and deep well plates in the 96-well format.

Flush
The procedure which rinses the complete *liquid system* with the purpose of removing air pockets or exchanging the *system liquid*. It is executed only at the beginning or the end of a *distribution*.

Follow-up distribution
A *distribution* which uses as source a position filled in a previous distribution.

Free dispense
Dispensing without the tip touching the liquid.

GenePaint
Automated solution for in situ hybridization (ISH), fluorescence in situ hybridization (FISH) and immunohistochemistry (IHC), based on the Te-Flow modules and a Tecan pipetting instrument. The GenePaint system consists of Te-Flow chamber racks equipped with up to 192 flow-through chambers, which enable the temperature controlled microscopy slides processing. The system can be integrated within a Tecan pipetting instrument.

Global liquid
A liquid used for several tests. It is in a defined position on the worktable.

HP fixed tip block

Multichannel arm: High precision 96 multichannel fixed tip block; with short needles, uncoated/coated, for microplates in the 96, 384, 1536-well format.

Incubation Device

Subsystem, consisting of a heating block and a control circuit, that is used for heating up samples and keeping them at a defined temperature.

Instrument Software

Software package that includes the setup & service software, the complete worktable editor and other software modules for special purposes.

Laser scanner

Scanner (e.g. LS Series Laser Scanner) used to scan substrates in standard glass arrays, membrane arrays, gel on glass, etc. for sample imaging. Sample images are then processed further, e.g. for quantification or spot finding.

LiHa

See "Liquid handling arm (LiHa)".

Liquid class

A set of properties defining a theoretical model of one type of liquid. Identified by a generic name (e.g. 'Serum', 'Buffer', 'Ethanol', etc.), it includes all default *liquid handling parameters* required to process liquids of this type.

Liquid handling arm (LiHa)

Robotic arm with multiple tips for general pipetting tasks. The LiHa can be equipped with fixed tips or disposable tips. It is connected to a liquid system, which features pipetting, dilution and tip wash functions [compare: Air displacement pipetting arm].

Liquid level detection (LLD)

Two different liquid level detection technologies are available for the Freedom EVO pipetting instrument series: capacitive and pressure-based. The capacitive method is always available and the pressure-based method is optional.

Capacitive liquid level detection (**cLLD**) detects the liquid surface through a change of the electrical capacitance of the pipetting tip when the tip enters or exits the liquid.

Pressure-based liquid level detection (**pLLD**) detects the liquid surface through a change of pressure in the airgap between the sample and the system liquid of a LiHa or in the air chamber of an Air LiHa pipetting channel when the pipetting tip enters or exits the liquid. pLLD is supported by the Air LiHa and by the MultiSense option for liquid LiHa. pLLD requires the use of disposable tips. In contrast to cLLD, pLLD is also suitable for detecting non-conductive liquids.

The LLD settings can be configured individually for each liquid class (liquid type). The liquid class can be configured to use cLLD, pLLD or both systems in parallel.

Liquid system

All instrument modules and parts which contain or directly influence liquid (tubing, diluters, valves, tips, etc.).

Local liquid

A liquid used for one test only, and which is placed into a test-specific (transportable) reagent rack.

MCA

See "Multichannel arm".

MCA384 Gripper (CGM)

Optional gripper mounted on the right side of the Multichannel arm 384. The gripper can move independently in Y- and Z-axis and its rotator with the gripper fingers can turn 360 deg. The gripper can pick up and move microplates and DiTi boxes within the working area of the instrument.

Microplate

A plate of standardized size, comprising 96, 384 or 1536 containers (wells).

Multichannel arm

Robotic arm with a multichannel pipetting head fixed to it. All channels of the pipetting head can aspirate/dispense liquid simultaneously.

Multichannel pipetting head

Pipetting head with 96 or 384 channels through which liquid can be aspirated/dispensed simultaneously.

Multi pipetting

The pipetting mode where one aspiration is performed for aliquoting into several destination positions.

MultiSense

MultiSense is a hardware module available as an option on the liquid LiHa.

It requires a MultiSense tip adapter comprising a pressure sensor. Either four or eight tip positions can be fitted with the MultiSense option.

The MultiSense hardware allows Pressure Monitored Pipetting (PMP) and liquid level detection (pLLD). In contrast to the capacitive liquid level detection (cLLD), pLLD is also suitable for detecting non-conductive liquids. The PMP and LLD settings can be configured individually for each liquid class (liquid type). The liquid class can be configured to use cLLD, pLLD or both systems in parallel.

Nested DiTi

Nested DiTi allows to have on the same rack position up to eight special inserts with DiTis stacked (8 X 96 DiTis). It can only be used with the *MCA96*.

Pick and place arm (PnP)

Robotic arm equipped with special grippers that can pick up, transport and place tubes within the working area of the instrument.

Piercing

The pipetting tip's penetrating or perforating the sealing membrane on a *microplate* or other container.

Pipetting cycle

A sequence of *Steps* which is repeated in identical or closely similar manner.

Pipetting mode

Describes the main method by which a liquid can be distributed: either by *single pipetting* or *multi pipetting*.

pLLD, Pressure based Liquid Level Detection

Function of the MultiSense option. To detect the liquid surface the pLLD function measures the pressure changes in the tip as the tip moves down. As soon as the tip touches the liquid surface the pressure change triggers a detection signal. The function works with conductive and non-conductive liquids and DiTis.

Plunger

The piston in a **Syringe** or in a pipetting channel of a **Multichannel pipetting head (MCA)** or an **Air LiHa**. It aspirates liquid by moving upwards and dispenses it when moving downwards.

Plunger Drive

Drive module which moves a **Plunger** upwards and downwards within an air chamber located just above the tip in order to aspirate and dispense.

PMP, Pressure Monitored Pipetting

Function of the MultiSense option and the Air LiHa MultiSense functions. PMP is a sophisticated process control feature which provides real-time quality control and allows detection of common sources of pipetting issues, such as clots or aspiration of air. It works with disposable tips only.

PnP

See “Pick and place arm (PnP)”.

PosID

See “Positive Identification (PosID)”.

Position

The physical coordinates of the pipetting tip at a given location on the worktable. It is expressed as X, Y and Z mm from the initialization position.

Positive Identification (PosID)

Moveable barcode scanner on the instrument’s worktable, used to read the barcode labels on containers and carriers.

Precision

See “Coefficient of variation (CV%)”.

Predilution

A technique in which a liquid (e.g. sample or control) is first diluted with *additive* or *system liquid*. Some of the resulting mixture is processed further in a *follow-up distribution*. The remainder of the mixture is usually discarded.

Rack, Rectangular Rack

A physical arrangement of *containers* whose dimensions are uniform, e.g. a microplate. Each row and column has the same number of containers and the distances between rows or columns are uniform.

Reader

Microplate reader, such as Sunrise absorbance reader, Infinite 200 and Spark reader.

Reagent trough

A reagent trough is a container from which reagents can be aspirated to be used in the process.

Reagent trough inset

Refer to “Blister (inset)”.

Reference tip

Special tool that can be fixed to a pipetting device (e.g. LiHa). Used to exactly adjust the device in the various axes. Reference tips can not be used for pipetting.

Retract

The process of pulling a tip back up after aspiration or dispensing.

Robotic manipulator arm (RoMa)

Component which picks up and moves objects within the working area of the instrument.

RoMa

See “Robotic manipulator arm (RoMa)”.

Run

A sequence of processes on the instrument started by the user.

Sample

Specimen of the substance (e.g. blood, serum, urine, etc.) to be analyzed by means of a *Test*.

Service carrier

Carrier used for the multichannel arm. The adjustable sites on the carrier can be rotated and adjusted horizontally to align wash block, troughs, etc. to the tips.

Setup

The implementation of the hardware on an instrument (e.g. tip type, size of installed syringes on a diluter, etc.) and the assignment of basic settings (e.g. permissible X-range of a specific instrument). This is usually done during the installation of a new instrument or option.

Setup & service software

Part of the instrument software. The setup & service software is used to perform setups and tests on the product.

Shaker

See "Te-Shake".

Standard tip

A Tecan standard tip is a special type of fixed tip that has predefined characteristics. There are various models of standard tips (with/without coating, various volumes).

Step

A sub-procedure or an element of a *distribution*.

Single pipetting

The *pipetting mode* in which an individual aspiration is performed for every destination position. See also "Multi pipetting".

Standard

A liquid containing a defined concentration of the substance to be tested. Used to create a standard curve by which concentration of the analyte in the *Samples* can be determined. The properties of the standard are well known and stable.

Submerge

The distance the tip will travel downward after liquid is detected. This parameter is programmed by the operator to avoid aspirating bubbles or debris at the liquid surface.

Syringe

Part of the *diluter*. A glass cylinder with a motor-driven *plunger* that aspirates/ dispenses the required quantity of liquid.

System Carrier

Multichannel arm MCA384: A carrier for mounting a *washblock* and *adapter racks* to hold *tip adapters*, *DiTi boxes* or *microplates*.

System liquid

A liquid which fills the *liquid system* and is used as wash fluid and /or can be added to several or all *samples* analogously to the *additive*.

Te-CU

Control unit, central electronics board with the Freedom EVO main microprocessor and EPROM. Is the control center for the instrument and all of its optional devices.

Te-Fill option

An extension to the liquid system with an additional pump to handle larger liquid volumes.

Te-Flow

See “GenePaint”.

Te-Link

The Te-Link is a device transporting microplates from one instrument to another, or across the worktable of one system, either along the instrument’s X-axis or Y-axis.

Racks to be moved to a neighboring instrument are placed on the carrier of the Te-Link and then moved to the neighboring system for further processing.

Te-MagS

The Te-MagS (Tecan Magnetic Separation Module) is a module that uses commercially available magnetic beads to isolate biomolecules (e.g. DNA, RNA, proteins, etc.) or whole cells from various crude mixtures by means of magnetic forces.

Te-PS

Positioning system, consisting of a special adjustable carrier, a sensor plate and adjustable tips. It is used to process high-density racks, such as 1536-well microplates.

Te-Shake

Orbital shaker for microplates that is used for mixing functions.

Te-Sonic

Module used to verify whether tubes actually contain samples. The Te-Sonic can be equipped with up to four ultrasonic transducers (USTs) that move over one or more rows of tubes to check the presence or absence of samples in them.

Te-Stack

Device for loading and unloading of standard microplates or DiTis. Used to automate the storage, retrieval and delivery of microplates and disposable tips (DiTi's)

Te-VacS

Solid phase extraction vacuum system used for vacuum separation of biological molecules and chemical compounds.

Teach block

Multichannel arm: The teach block is a special tool, which can be installed instead of the fixed tip block. It is used to check and teach the carrier positions.

Test

A sequence of actions that is performed automatically and gives a result that is automatically measured.

Tip

A needle-like device that can be mounted to a pipetting device for aspirating/dispensing liquid. The following tip types are used with Tecan instruments:

– Standard tip

– Disposable tip

– Fixed tip

– Te-PS tip

– Fixed tip block (multichannel pipetting heads)

Tip adapter

Multichannel arm (MCA96): The tip adapter is used to hold and center the DiTis or the fixed tip block with the tips.
Multichannel arm (MCA384): see "Adapter DiTi" and "Adapter Fixed".

Tip cone seal

Multichannel arm: L-ring seal between tip adapter and tip block or DiTis.

Transfer rack

Multichannel arm: The transfer rack is used to pick up or park the tip block or DiTis.

Trough

Refer to "Reagent trough".

Tube

Small round *container* which holds the substance to be analyzed. Tubes are often marked with a barcode label so that they can be identified with a barcode scanner.

Vacuum Separation

See "Te-VacS".

Wash

Aspirating system liquid from the system liquid container and dispensing it through the system into the wash position, to clean the inside and the outside of the pipetting tip.

Wash block

Multichannel arm: Block with 96 or 384 cavities to wash the tips.

Washer

Microplate strip washer, like e.g. HydroFlex or HydroSpeed.

Wash station

Generally referred to as the physical combination of a *cleaner* position and a *waste* position.

Wash system

Multichannel arm: The wash system is used to wash DiTis or fixed tips. It consists of control unit, wash unit, wash block, tubing, wash liquid container and waste container.

Wash unit

Multichannel arm: The wash unit is part of the wash system. It contains pumps and valves to connect the wash block with the wash liquid and waste containers.

Wash control unit

Multichannel arm: The wash control unit is part of the wash system. It is connected to the CAN bus electronics and controls the pumps, valves and the wash block of the wash system.

Waste

The position in the wash station into which a tip is placed for washing its interior. The system liquid is dispensed through the tip and then into the outer cavity of the wash /waste carrier. From there, waste liquid flows off through the waste tubing to the waste container.

Well

One of the containers in a *microplate*.

Worktable

Part of the instrument where the carriers are placed for access by the robotic arm(s).

X/Y/Z-movement

The left-right (X), front-back (Y), and up-down (Z) motions of the robotic arms.

Z-dispense

The height of the point of the tip at which liquid is dispensed.

Z-bottom

The lowest possible position the tip is allowed to reach. During a “search liquid command” the instrument will search for liquid from Z-start down to Z-bottom. If the tip reaches Z-bottom without finding liquid, the instrument reacts according to the liquid detection error mode selected.

Z-start

The height of the tip at which the *ILID* is switched on during a “search liquid command”. It is usually slightly above the rim of the liquid *container*.

Z-travel

The height at which the tip moves from one X/Y-position to another. Moves which cross different racks always use the highest Z-travel defined.

14 Index

Purpose of This Chapter

This chapter contains an alphabetical index which offers you help in finding information more quickly.

TECAN.