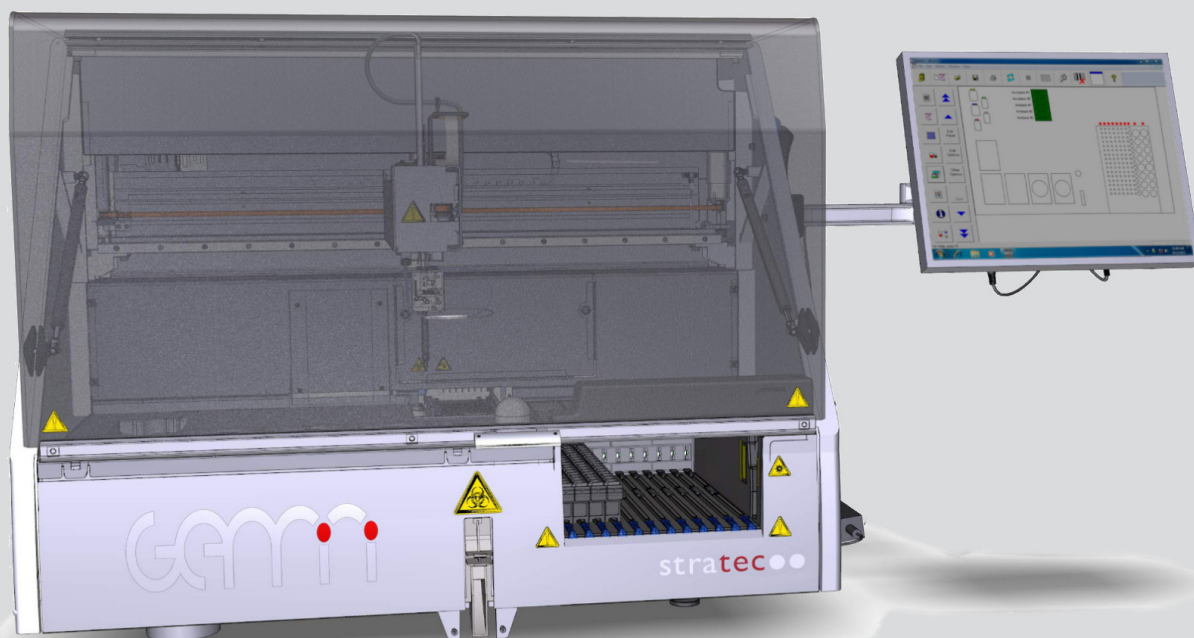


GEMINI

GEMINI COMBO

Service Manual



EDITION:

Date: April 2022
Document No.: 1000028971_B
Rev. 8

UDI-DI/BASIC UDI:

GEMINI Compact Microplate Analyzer

- UDI-DI: 4260678680010
- Basic-UDI: 42606786862804M

GEMINI Combo Microplate- and Immunofluorescence Slide Processor

- UDI-DI: 4260678680027
- Basic-UDI: 42606786862254D

SOFTWARE:

Service Software:

- GEMINI/GEMINI COMBO: Version 2.10

UniloadX:

- GEMINI/GEMINI COMBO: Version 7.0.0.8

Instrument Setup:

- GEMINI/GEMINI COMBO: Version 03.01.00.05

Teacher Software:

- GEMINI: Version 4.43.0
- GEMINI COMBO: Version 4.49.0

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1 INTRODUCTION

INFO

According to EU IVD regulation 2017/746, the **GEMINI** instrument is classified as class A.

The purpose of this document is to guide trained field service engineers on installation, adjustment, maintenance service and troubleshooting of the **GEMINI**, a fully automated microplate based ELISA analyzer.

It has to be pointed out that the service procedures on the **GEMINI** are designed to be handled in a module exchange fashion in the field. Only limited adjustments and repairs of modules will be performed in the field. Faulty modules are repaired by the manufacturer or national repair centers. Therefore the scope of this document does not reach into every detail of the modules.

In addition certain functionality of the software used by service engineers are implemented by and for development engineers to perform their tasks of concurrent engineering or for manufacturing tests. Although available to field service engineers these functionality need and should not be used in field service and are therefore only described in limited detail in this document.

INFO

This document is intended for field service engineers for training and performing field service.

1.1 MESSAGES, NOTES AND SYMBOLS

The warnings, notes and symbols described hereafter are used in the current manual, on the instrument and on its packaging.

1.1.1 DISPLAY OF WARNINGS AND NOTES



DANGER

Danger indicates a hazardous situation that, if not avoided will result in death or serious injury.



WARNING

Warning indicates a hazardous situation that, if not avoided, could result in death or serious injury.



CAUTION

Caution indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.



NOTICE

Notice indicates information considered important, but not hazard-related (e.g. messages related to property damage). The non-observance of a safety instruction can result in damage of the instrument or an adverse effect on the instrument function.



INFO

The non-observance of information can result in an adverse effect on the instrument function (result deterioration).

1.1.2 USED WARNING SYMBOLS



Biohazard!



Caution, hot surface!



Caution, risk of danger to person or damage to equipment! Consult instructions for use!



Cut injury hazard!



Electrical hazard!



Disconnect mains power connector before servicing



Laser hazard and laser information label

Do not stare into the beam!



1.1.3 OTHER SYMBOLS



CE mark



Certification mark of the Nemko North America, Inc.



Consult instructions for use!



Date of production



Fuse



Catalogue number



In Vitro Diagnostic



Information about the required access rights for GEMINI instrument software functions.



Manufacturer



Serial number



Disposal of electrical and electronic equipment

In the European Union, electrical and electronic equipment shall not be disposed with other household-type waste. It shall be collected separately. Please observe the relevant legal regulations effective in your country.



Temperature limitations

1.1.4 SPECIAL TYPES

LEDS AND SIGNAL LAMPS	LEDs (light emitting diode) and signal lamps are printed in special type. Example: Power LED
FIELDS	Fields are printed in bold type. Example: ID field
MENU ITEMS AND BUTTONS	Menu items and buttons are printed in spaced type. Example: Open button.
KEYS	Keys are printed in slanted type. Example: Press <i>Enter</i>
FILE EXAMPLES	File examples are printed in typewriter font. Example: DRIVER=C : \SERVICE\DRIVERS

1.2 SAFETY INSTRUCTIONS

The following safety instructions shall be observed at all times, both before and during operation and during maintenance.

⚠ WARNING



Handling of the service manual

The service manual is provided for your safety and gives important instructions for the handling of the instrument described.

- Read all instructions!
-

The **GEMINI** is designed and manufactured in accordance with the safety requirements for electronic and medical instruments. If the law lays down regulations on the installation and/or operation of the instrument, then it is the operator's responsibility to adhere to them.

The manufacturer has done everything possible to guarantee that the equipment functions safely, both electrically and mechanically. The instruments are tested by the manufacturer and supplied in a condition that allows safe and reliable operation.

1.2.1 GENERAL SAFETY

WARNING



Non-observance of safety instructions

The non-observance of safety instructions may result in serious personal injury and material damage.

- Follow all safety instructions included in this manual.
- Follow all warnings marked on the instrument.

WARNING



Improper use of the instrument

Improper use of the instrument can cause personal injury, produce erroneous results and produce damage to the instrument.

- The handling and maintenance of the instrument shall be performed only by trained and authorized personnel.
- Before operating the instrument, the instruction for use manual shall be completely read and understood.
- Only use the instrument in accordance with the intended use as described in this manual.
- Use only the approved consumables and accessories described herein (e. g. disposable tips, microplates etc.).
- The manufacturer assumes no liability for any damage, including those to third parties, caused by improper use or handling of the instrument.

WARNING



Liquid in instrument

Liquid which gets into the instrument can cause illnesses with deadly consequences in case of contact. The instrument can be damaged by liquids.

- Switch off the instrument.
- Separate the instrument from the mains supply.
- Wear suitable protective clothing.
- Clean, disinfect or decontaminate and dry the instrument according to the applicable local and national provisions, legislation and laboratory procedures.

⚠ WARNING



Missing, improperly opened, damaged or opened protective covers

To avoid serious injuries with deadly consequences due to electric shock or injuries by the instrument (e.g. contusion, cuts etc.), protective covers may only be opened or removed for certain maintenance procedures and with the highest level of caution.

- Only perform maintenance procedures described in this manual.
 - Make sure that nobody is working on the instrument and that all covers are attached and closed before reconnecting the instrument to the mains supply.
 - Make sure that all covers are attached and intact before switching on the instrument.
 - Switch off the instrument, separate it from the mains supply and protect the instrument against restarting, if protective covers/gears are missing or damaged.
 - Make sure that the motion of the pipettor, the plate transport has stopped before opening covers and/or accessing the working area of the instrument.
 - Avoid touching the pipettor, the plate transport and other moving parts while the instrument is in operation.
 - Perform all maintenance procedures with the highest level of caution.
-

⚠ WARNING



Unapproved or improper maintenance work

Unapproved or improper carried out maintenance work will result in serious personal injury and material damage.

- Take off watches and jewelry before performing any maintenance works.
 - Only perform maintenance procedures described in this manual.
 - Closely follow the steps contained in the individual instructions.
 - For maintenance, only use the parts mentioned in this instruction.
 - Tests and maintenance specified by the manufacturer shall be performed to ensure the safe operation of the instrument and the proper functioning of the instrument.
 - All service and maintenance which are not described in this instruction shall be performed by qualified and authorized field service engineers.
 - Any changes made to the instrument that are not authorized by the manufacturer will void the manufacturer's warranty.
-

⚠ WARNING



Sharp edges

Sheet metal parts and circuit boards located behind protective covers might have sharp edges. Contact might lead to injuries.

- Wear cut resistant gloves!
 - Use caution at corners and edges!
-

⚠ WARNING



Risk of injury by moving pipettor

The pipettor could cause injury during movement.

- Never put your head, hand or arm into the opened instrument.
- Never put your hand into the loading bay.
- Respect alarm sound before X-/Y-movement.

⚠ CAUTION



Moving barcode scanner

The movement of the moveable barcode scanner can trap you or knock over objects put down on the loading bay.

- Never enter the loading bay when the instrument is switched on and you have not received an approval by the instrument!
- Never enter the loading bay before the moveable barcode scanner has come to a standstill!
- Never use the loading bay as storage space!

NOTICE

Interference by mobile phones

Mobile phones can affect the correct function of the instrument.

- Do not use mobile phones next to a running instrument.

NOTICE

Damage of touch screen while operating

Improper use could damage the touch screen surface. Extreme force will damage the PET/FILM and cause the failure of the touch screen.

- Operate with a stylus (tip radius 0.8 mm or bigger), or with your finger without applying excessive pressure.
- Never use sharp edged or hard articles.
- Never draw lines along the edge of the touch screen housing.
- Keep the surface clean .

INFO

Laboratory equipment

The instrument has been designed and developed as laboratory equipment in accordance to the requirements of Regulation (EU) 2017/746 of the European Parliament and of the Council of 5 April 2017 on in vitro diagnostic medical devices and repealing Directive 98/79/EC and Commission Decision 2010/227/EU. This regulation is also known as EU Regulation 2017/746, abbreviated "EU IVD Regulation" (EU IVDR). In order to assure compliance, applicable standards recorded in the list of standards harmonized for the EU IVD Regulation, as well as additional relevant standards in their state of the art version were observed. The application of this product for in vitro diagnostics purposes requires a separate conformity assessment according to EU IVDR for the complete system into which it will be incorporated and/or has to be used in combination with (e.g. reagent).

⚠ WARNING



Unauthorized changes to the instrument

Any changes to the instrument that are not authorized by the manufacturer will lead to the loss of the validity of the conformity to the applicable regulations the manufacturer has declared. In this case, the customer is responsible for the fulfillment of the applicable regulations.

- Do not perform unauthorized changes.
-

1.2.2 ELECTRICAL SAFETY

⚠ DANGER



Non-observance of rules and regulations

Non-observance of rules and regulations will cause serious personal injury with deadly consequences and material damage.

- National rules and legal regulations for the safe electrical operation of the instrument shall be observed.
-

⚠ DANGER



Improper connection of mains supply

Improper connection of the instrument and the peripheral devices to the mains supply can cause serious personal injury with potentially deadly consequences and material damage (e.g. fire).

- Only use grounded connection and extension cables with sufficient capacity (voltage and current) to connect the instrument and any peripheral devices to the mains power supply.
 - Never remove ground connections.
 - Grounding of the instrument and its peripheral devices to the same protective earth potential shall be ensured.
 - The use of a multi-outlet power strip is not allowed!
 - Only use power cables that fulfill the minimum requirements for this instrument.
-

⚠ DANGER



Damaged power cables

Damaged power cables will cause serious personal injury with potentially deadly consequences and material damage (e.g. fire).

- Damaged power cables shall be replaced immediately!
 - No objects may be placed on the power cables.
 - Power cables shall be laid so that they cannot be squeezed or damaged.
 - Power cables shall be laid so that they do not lay in accessible or drivable areas.
-

⚠ DANGER



Defective instrument

Any defective instrument will result in serious injuries with deadly consequences and material damage (e.g. fire).

- Immediately disconnect the defective instrument from the mains supply, if a safe usage is no longer possible.
 - Secure the defective instrument against reconnection.
 - Label the defective instrument clearly as being defective.
-

⚠ DANGER



Electric shock by electrical devices on wet surfaces or due to spilled liquid

Working with electrical devices on wet surfaces (floors, work table) or due to spilled liquid will cause serious injuries with deadly consequences and material damage due to electric shock.

- Only work on dry surfaces (floors, work table).
 - Never use the mains supply near liquids and in rooms with high humid.
 - Protect the power supply against spilled liquid.
-

⚠ DANGER



Electric shock by improper replacement of fuses

Improper replacement of fuses will cause serious injuries with deadly consequences and material damage (e.g. fire).

- Separate the instrument from the mains supply and secure it against restarting before you replace fuses.
 - Check fuses if they match the values (nominal voltage, nominal current, and type) specified by the manufacturer.
 - Never repair or bridge blown fuses.
 - Never short-circuit the fuse holder.
-

⚠ DANGER



Electric shock or mechanical injury by mains supply

If the instrument is not separated from the mains supply before performing maintenance, this will cause serious injuries with deadly consequences due to electric shock. Additionally, there is the danger that the instrument could start and cause injury (e.g. contusion, cuts etc.) to the person working with the instrument.

- Switch off the instrument, separate it from the mains supply and protect it against restarting.
 - Make sure that nobody is working on the instrument and that all covers are attached and closed before reconnecting the instrument to the mains supply.
 - Only start cleaning, disinfection, decontamination, maintenance or repair work when instrument is secured.
-

⚠ DANGER



Emergency shutdown in case of functional disorder

Functional disorder of the instrument will cause electrical shock, burns, cuts or bruises.

- Pull out the mains plug to separate the instrument from the mains supply!
-

⚠ DANGER



Replacement of power supply

The power supply contains no serviceable parts! Repairs will cause accidents with serious injuries with deadly consequences, fire or serious instrument damage.

- Replace the whole power supply when it is faulty!
-

⚠ WARNING



Voltage-carrying system

If the instrument cannot be separated from the mains supply during required maintenance, additional precautions shall be taken to avoid serious injuries with deadly consequences or injuries by the instrument (e.g. contusion, cuts etc.) due to electric shock.

- Only switch on the instrument if this is explicitly required.
 - Only open explicitly described protective covers.
 - Perform the maintenance with highest caution.
 - Never touch electrical connecting contacts.
 - Please note that mechanical components (e.g. pipettor) can move unexpectedly.
-

⚠ CAUTION



Electrostatic discharge

Electronic components can be damaged or destroyed by electrostatic discharge.

- Use protective measures against electrostatic discharge.
-

1.2.3 LASER SAFETY

⚠ WARNING



Eye injuries due to laser radiation

Laser radiation cause eye injuries when you look into the laser beam.

- Never look directly into the laser beam!
 - Do not use optical devices (e.g. mirror).
 - Take off watches and mirroring jewelry before operating the laser.
 - Be careful during operation and testing the laser of the barcode scanner. A class 2 laser is used.
 - Note that the wrong usage of operating elements or of adjustments or the non-observance of processes can cause a dangerous emission of laser radiation.
-

1.2.4 BIOLOGICAL SAFETY



Risk of infection!

The instrument shall be treated as potentially infectious. Improper handling of infectious parts will cause skin irritations, illnesses and possible death.

- Strictly follow the local and national provisions, legislation and laboratory regulations.
- Use appropriate gloves!
- Use an appropriate lab coat!
- Use an appropriate eye protection (e.g. protective glasses)!
- Avoid contact between skin/mucous membrane and samples/test reagents or parts of the instrument.
- Clean, disinfect and decontaminate the instrument immediately if potentially infectious material has been spilled.
- Do not use broken or chipped tubes or bottles.
- Observe the instructions in the package inserts for correct use of reagents.
- Observe the legal regulations for the handling of infectious material.
- Never use bio-hazardous liquids for testing the instrument!
- The instrument shall be cleaned, disinfected and decontaminated before servicing!

NOTICE

Organic solvents

Reagent containers and tubes for system liquid and waste can be seriously damaged by organic solvents and become unusable.

- Never use organic solvents.

1.2.5 DISPOSAL AND DECONTAMINATION



Infectious waste

Potential infectious material and all parts that may come in contact with potential infectious material will cause severe environmental contamination.

- Strictly follow the local and national provisions, legislation and laboratory regulations.

⚠ WARNING



Misuse of battery

The product contains an internal lithium manganese dioxide, vanadium pentoxide, or alkaline battery or rechargeable battery. There is risk of fire and explosions which can lead to burns if the battery pack is not handled properly.

- Do not attempt to recharge the battery.
 - Do not expose to temperatures higher than 60°C (140°F).
 - Do not disassemble, crush, puncture, short external contacts, or dispose of in fire or water.
 - Spare batteries shall match the values (nominal voltage, nominal current, and type) specified by the manufacturer.
 - Dispose used batteries according to the local and national provisions or legislation.
-

NOTICE

Disposal of non-contaminated parts

Material out of use shall be disposed properly.

- Strictly follow the local and national provisions, legislation and laboratory regulations.
 - Keep the packaging to allow for safe transportation in case the instrument shall be shipped at some future date.
-

NOTICE

Cleaning, disinfection or decontamination

Observe the following aspects during cleaning, disinfection or decontamination because otherwise breakdowns or damage can be the result.

- Disinfect or decontaminate components with a suitable disinfection or decontamination method.
 - Only use liquid cleaning, disinfection or decontamination solutions with a moistened cleaning tissue.
 - Use only approved cleaning, disinfection or decontamination solutions and methods.
 - Avoid cleaning, disinfection or decontamination solutions to come into contact with bearings and guides, as otherwise the greasy film may dissolve!
 - Do not use cleaning, disinfection or decontamination solutions in the proximity of circuit boards, light barriers and acrylic glass surfaces!
 - Do not pour or spray liquid cleaning, disinfection or decontamination solutions into the instrument.
 - Do not autoclave containers and components for liquids or waste.
-

NOTICE

Handling of decontamination products

Pay attention to managing the decontamination products, because they are harmful as indicated on the bottle.

- Strictly follow the local and national provisions, legislation and laboratory regulations.
 - Only use decontamination liquid in accordance with the instructions for use!
-

NOTICE

Disposal of pneumatic gas springs

In the European Union, pneumatic gas springs shall not be disposed with other household-type waste. It shall be collected separately. Please observe the relevant legal regulations effective in your country.

- Strictly follow the local and national provisions, legislation and laboratory regulations.
 - Waste disposal only by raw materials traders or special refuse sites.
 - Pneumatic gas springs are under pressure and contain oil.
-

1.3 POSITIONS OF SAFETY LABELS AND TYPE LABEL

⚠ WARNING**Missing warnings**

Missing or unreadable warning labels or type labels will result in non-identified dangers. This could result in serious personal injury and material damage.

- Check the instrument for missing or unreadable warning labels and type labels.
- Missing or unreadable warning labels or type labels shall be replaced.




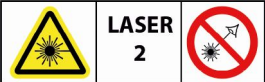



1.		<p>General warning label:</p> <ul style="list-style-type: none"> • On the pipettor arm • On both sides of the loading bay • On both edges of the cover • Next to the diluter pump • On the pumps module cover
2.		<p>Biological hazard label:</p> <ul style="list-style-type: none"> • On the washer service cover • On the disposable tip ramp • On the washer needles • On the pumps module cover • On the waste liquid container • On both washer aspiration bottles
3.		<p>Disconnect mains power connector before servicing label:</p> <ul style="list-style-type: none"> • Above the power switch
4.	 	<p>Laser hazard label:</p> <ul style="list-style-type: none"> • Next to the barcode scanner of the loading bay
5.		<p>Hot surface label:</p> <ul style="list-style-type: none"> • On the three pipettor motors.
6.		<p>Cut injury label:</p> <ul style="list-style-type: none"> • On the washer service cover • On the washer needles
7.	-	<p>Type label:</p> <ul style="list-style-type: none"> • On the right side of the instrument (near by the mains switch)

Table 1-1: Labels

INTRODUCTION

POSITIONS OF SAFETY LABELS AND TYPE LABEL

Intentionally left blank.

2 INSTRUMENT OVERVIEW

The purpose of this section is to provide a summary of the instrument components.

INFO

Generations of the instrument

Note the chapter Differences between the generations of the instrument (see chapter 2.1.1 on page 2-1) about the different types of the instrument.

2.1 INSTRUMENT OVERVIEW

2.1.1 DIFFERENCES BETWEEN THE GENERATIONS OF THE INSTRUMENT

Due to new developments or necessary changes there are differences in the modules of the instruments. This chapter gives a short summary about the greatest differences.

2.1.1.1 PIPETTOR TYPES

Pipettor version 1/2	<p>The system liquid tubing is guided on the top of the pipettor arm. The Z-motor is mounted on the pipettor arm and moves the toothed rack/disposable tip adapter via a Z-drive shaft. There are models with old and new energy chain guidance.</p> <p>=> Pipettor Module (see chapter 12 on page 12-1)</p>
Pipettor version 3	<p>The system liquid tubing is guided on the right side of the pipettor arm. The Z-motor is mounted on the Y-sledge and moves directly the toothed rack/disposable tip adapter.</p> <p>=> Pipettor Module (Version 3) (see chapter 13 on page 13-1)</p>

IFA-Pipettor (GEMINI COMBO only)	<p>The system liquid tubing is guided through a Y-sledge energy chain on the top of the pipettor arm.</p> <p>The Z-motor is mounted on the Y-sledge and moves directly the toothed rack/disposable tip adapter.</p> <p>The IFA-Pipettor does not support the APM function.</p> <p>The metal pick up of the disposable tip adapter has two tips.</p> <p>=> IFA Pipettor Module (optional) (see chapter 14 on page 14-1)</p> <p>Note: IFA Pipettor with Y-sledge cover must be upgraded to the advanced needle design without Y-sledge cover (see separate upgrade kit).</p> <p>Note: Only usable from software version 2.0.7 or higher.</p>
--	---

2.1.1.2 TOUCH SCREEN AND PC TYPES

Touch screen on the cover	<p>The touch screen is mounted on the cover.</p> <p>Touch screen and PC are separated from each other. The PC-board the hard drive are mounted on the rear panel of the instrument.</p> <p>In this manual we call this combination Internal-PC.</p>
Touch screen with PC on the right side	<p>The touch screen is mounted on an arm on the right side.</p> <p>The touch screen contains a complete PC.</p> <p>In this manual we call this combination All-In-One-PC.</p>

2.1.2 INSTRUMENT

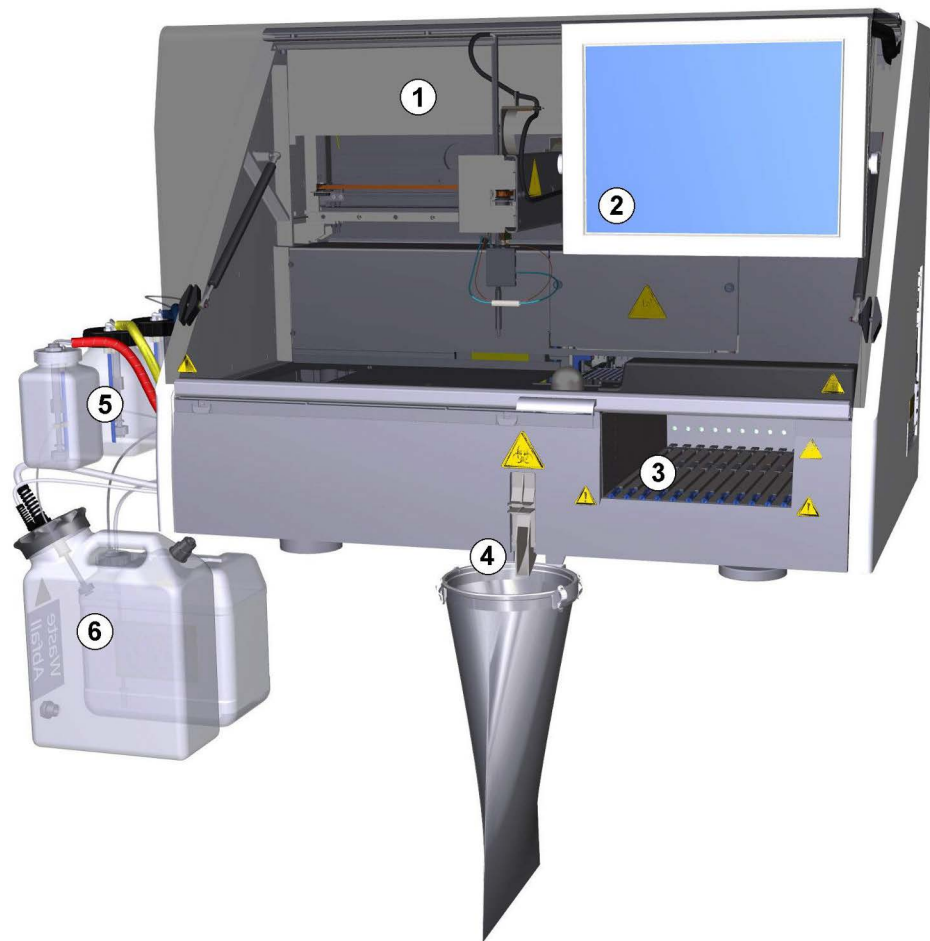


Figure 2-1: **GEMINI** instrument with Internal-PC

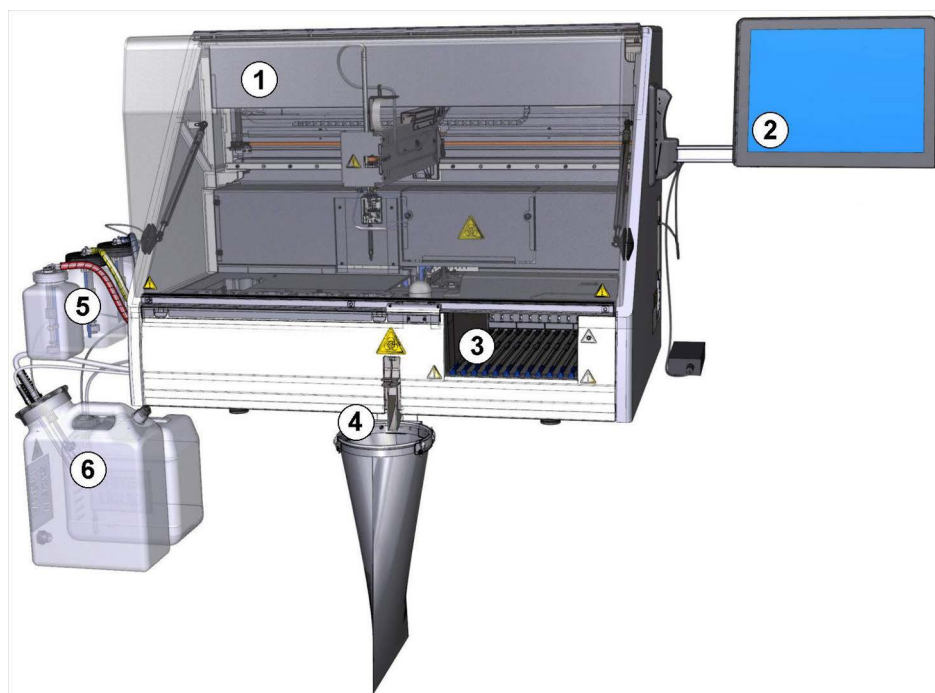


Figure 2-2: **GEMINI** instrument with All-In-One-PC

- | | |
|---|---|
| 1 | Cover |
| 2 | Touch screen or All-In-One-PC |
| 3 | Loading bay with barcode scanner for samples and reagents |
| 4 | Tip ejection station and waste bag for disposable tips |
| 5 | Wash buffer bottles and waste bottles for the washer |
| 6 | System liquid container and waste liquid container |

NOTICE

Use Handle!

Only open and close the cover with the handle!

2.1.3 INSTRUMENT MODULES



Figure 2-3: **GEMINI** instrument modules with Internal-PC

- | | |
|---|--|
| 1 | Pipettor |
| 2 | Service cover of washer |
| 3 | Plate transport |
| 4 | 3 - 4 positions for disposable tip racks |
| 5 | 1 - 2 positions for dilution or archive plates |
| 6 | Pipettor wash station, tip eject station and cover locking mechanism |
| 7 | Loading bay barcode scanner and shield for protection between pipettor and loading bay |

2.1.3.1 IFA BAY (OPTIONAL)

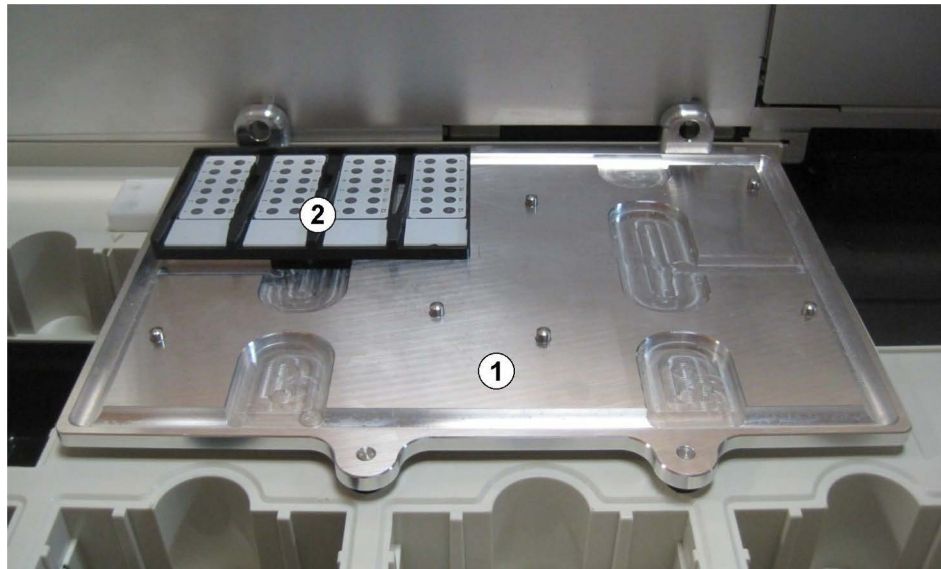


Figure 2-4: IFA bay with tray and slides

- | | |
|---|----------------------|
| 1 | IFA bay |
| 2 | IFA tray with slides |

2.1.4 LIQUID CONNECTIONS



Figure 2-5: Left side - liquid connections

- | | |
|----|---|
| 12 | Diluter pump |
| 13 | Liquid connections (for details see below) |
| 14 | 2 washer aspiration bottles (vacuum extraction) <ul style="list-style-type: none">• Washer aspiration bottle 1: 3 connectors• Washer aspiration bottle 2: 2 connectors |
| 15 | 3 wash buffer bottles |
| 16 | System liquid container |
| 17 | Waste liquid container |

 **DANGER**



Risk of infection!
The installation of washer liquid waste bottle and washer foam bottle must be lined up, that they cannot accidentally fall over during operation!

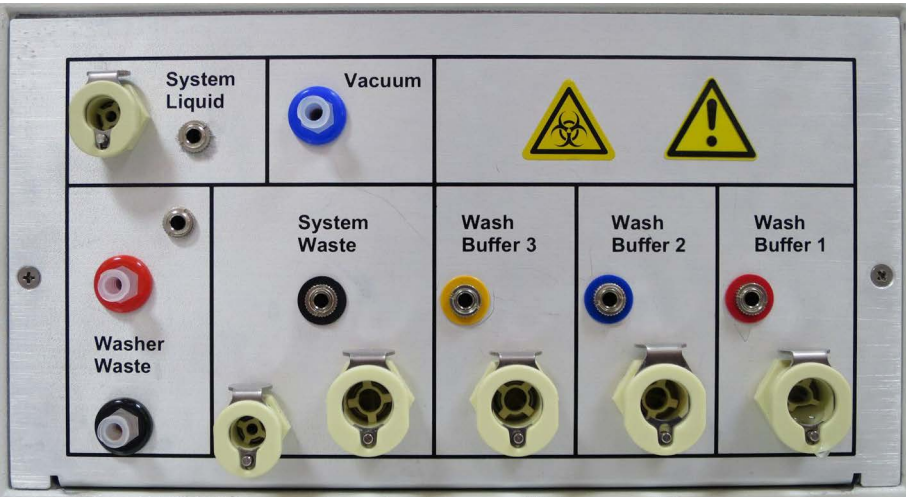


Figure 2-6: Liquid connections

System Liquid	System liquid container
Vacuum	Washer liquid waste bottle (trap bottle)
Washer Waste	Washer foam bottle (vacuum bottle)
System Waste	Waste liquid container
Wash buffer 3	Wash buffer bottle - yellow channel
Wash buffer 2	Wash buffer bottle - blue channel
Wash buffer 1	Wash buffer bottle - red channel

2.1.4.1 LIQUID CONNECTION WITH IFA BAY (OPTIONAL)



Figure 2-7: IFA liquid connections

System Liquid	System liquid container
System Waste	Waste liquid container
Vacuum	Washer liquid waste bottle (trap bottle)
Wash buffer 1	Wash buffer bottle - red channel
Wash buffer 2	Wash buffer bottle - blue channel
Wash buffer 3	Wash buffer bottle - yellow channel
Wash buffer 4	Wash buffer bottle - green channel (for IFA)
Wash buffer 5	Wash buffer bottle - white channel (for IFA)
Washer Waste	Washer foam bottle (vacuum bottle)

2.1.5 ELECTRICAL CONNECTIONS

INTERNAL-PC



Figure 2-8: Right side - electrical connections (Internal-PC)

USB	3 USB ports
VGA	External monitor connector
PS2	External mouse/keyboard connector
RS232	Serial interface connector (RS 232)
LAN	Network connector (LAN)
18	Main power connector with power switch and main fuses

ALL-IN-ONE-PC



Figure 2-9: Right side - electrical connections (All-In-One-PC)

- | | |
|---|--|
| 1 | Main power connector with power switch and main fuses |
| 2 | Connectors of the touch screen with PC (All-in-one-PC) |

PC connectors:

DC-IN	Power connector from the external power supply
LAN	Local Area Network connector (LAN)
USB	<p>USB ports</p> <p>Depending on the instrument generation, one of the following USB ports is used for the instrument:</p> <ul style="list-style-type: none"> • USB 3.0 port (blue), newest instrument generation • USB port with the label "Instrument (GEMINI)" next to the USB port • USB port 1 <p>All other USB connectors are free.</p>

VGA	External monitor connector
-----	----------------------------

2.1.5.1 EXTERNAL KEYBOARD AND MOUSE (OPTIONAL)

CONNECTION

1. Shut down the computer and switch off the instrument.
2. Connect the keyboard and/or the mouse to the instrument.
Several connection options are available:
 - Only USB: Connect the keyboard into an USB port and the mouse to an other USB port.
 - USB and PS2: Connect the keyboard into an USB port or into the PS2 port. Connect the mouse into the other port.
 - Only PS2: Use an optional PS2-Y-cable to connect keyboard and mouse to the PS2 port.
3. Switch on the instrument.

DISCONNECTION

INFO

It is not necessary to use an external keyboard or mouse for the **GEMINI** user software. Disconnect the keyboard/mouse after the service.

1. Shut down the computer and switch off the instrument.
2. Disconnect the keyboard and/or the mouse to the instrument.

2.1.5.2 EXTERNAL MONITOR (OPTIONAL)

CONNECTION

1. Shut down the computer and switch off the instrument.
2. Connect the monitor into the VGA port.
3. Switch on the instrument.
4. If necessary customize the Windows display settings (dependent on the used monitor).

DISCONNECTION

INFO

It is not necessary to use an external monitor for the **GEMINI** user software. Disconnect the monitor after the service.

1. Shut down the computer and switch off the instrument.
2. Disconnect the monitor.
3. Switch on the instrument.
4. If necessary check/customize the Windows display settings.

2.2 LIQUID PLAN

INFO

For detailed liquid plan see chapter 17.2.3 on page 17-5.

INFO

For detailed IFA liquid plan see chapter 18.2.2 on page 18-4.

2.3 ELECTRIC CONNECTIONS

INFO

For detailed electric connections plan see chapter 19 on page 19-1.

3

INSTALLATION OF THE INSTRUMENT

As the **GEMINI** instrument is a complex instrument and contains delicate electrical and mechanical components it must be unpacked and installed by a qualified service engineer.

3.1 SAFETY

DANGER



Improper connection of mains supply

Improper connection of the instrument and the peripheral devices to the mains supply can cause serious personal injury with potentially deadly consequences and material damage (e.g. fire).

- Only use grounded connection and extension cables with sufficient capacity (voltage and current) to connect the instrument and any peripheral devices to the mains power supply.
- Never remove ground connections.
- Grounding of the instrument and its peripheral devices to the same protective earth potential shall be ensured.
- The use of a multi-outlet power strip is not allowed!
- Only use power cables that fulfill the minimum requirements for this instrument.

DANGER



Wrong operation voltage

The wrong operation voltage will cause serious personal injury with deadly consequences and material damage (e.g. fire).

- Before connecting the instrument to the mains supply, check that the operating voltage is set correctly on all instrument components.
- This product shall be operated from the type of power source indicated on the type label. If you are not sure of the type of power available, consult the local electric power company.
- Connect the instrument only to an electricity supply system with protective earth.

DANGER



Damaged power cables

Damaged power cables will cause serious personal injury with potentially deadly consequences and material damage (e.g. fire).

- Damaged power cables shall be replaced immediately!
- No objects may be placed on the power cables.
- Power cables shall be laid so that they cannot be squeezed or damaged.
- Power cables shall be laid so that they do not lay in accessible or drivable areas.

WARNING



Poor performance and false result

Because of vibration due to wrong installation sites the instrument can show wrong results.

- Observe the technical specifications of the instrument (see chapter 22 on page 22-1) to avoid misjudgments.
- Position the instrument on a stable floor with an adequate load-bearing capacity.
- Check the load-bearing capacity and the building vibration of the floor where the instrument shall be placed to avoid false results of the instrument.

CAUTION



Non-observance of technical data

The non-observance of the technical data can cause injuries or can result in damage of the instrument or an adverse effect on the instrument function.

- Always pay attention to chapter "Technical data" (see chapter 22 on page 22-1) for power requirements, computer and connections, installation dimensions, weight, and environmental conditions.

3.2 ENVIRONMENT

See chapter 22.4 on page 22-4 for the required space of the entire **GEMINI** instrument. The ventilation slits on the rear panel of the instrument must not be covered. A clearance of at least 20 cm to the wall must be maintained.

The room where the **GEMINI** is operating should be evenly heated (summer and winter), since most immuno assays are temperature sensitive. The operation temperature is between 15 °C and 30 °C (see chapter 22.5 on page 22-4). We recommend to set up the **GEMINI** in air-conditioned rooms.

3.3 CONTENTS OF THE INSTRUMENT

See separate packing list.

3.4 UNPACK THE INSTRUMENT

1. Open the cardboard box (1) and remove the wooden protection cover.
2. Remove the five protection brackets (2).

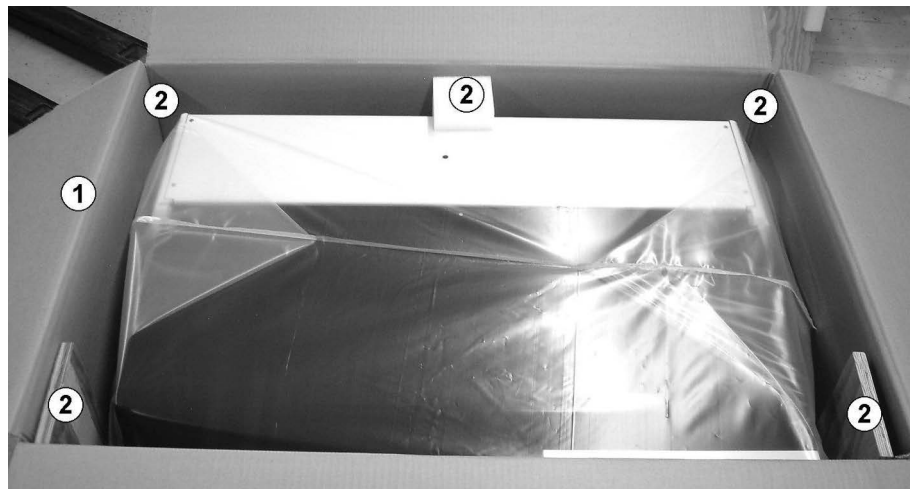


Figure 3-1: Protection brackets

3. Remove the cardboard box (1) and the plastic bag.
4. Check the Shockwatch on the backside of the instrument.
5. Remove the loading bay transportation lock (4).

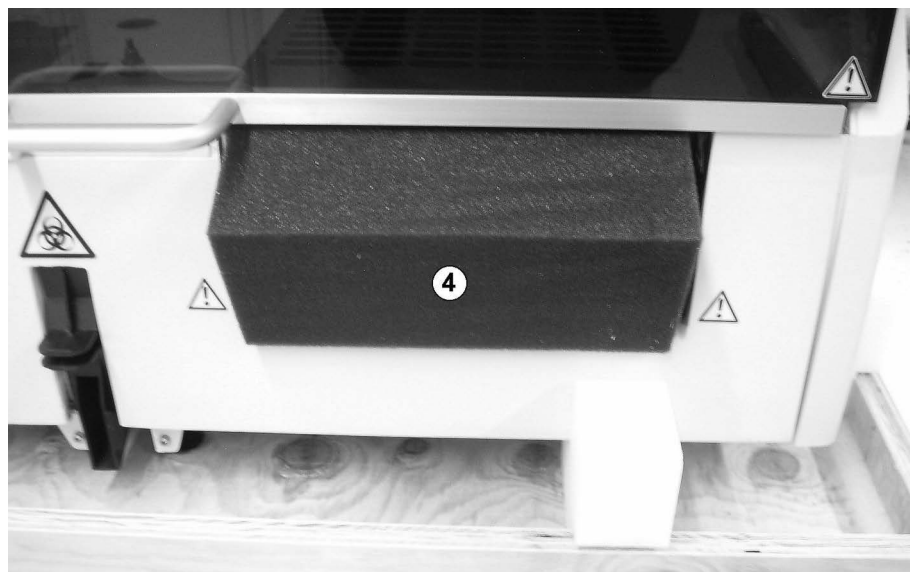


Figure 3-2: Loading bay transportation lock

3.5 SETUP OF THE INSTRUMENT

⚠ WARNING



Instability of instrument

Due to improper placing of the instrument, the instrument can tilt and fall down. The user can be heavily injured or the instrument can be seriously damaged.

- Position the instrument on a stable table, a floor cupboard or similar.
- Observe the technical specifications of the instrument (see chapter 22.4 on page 22-4).

⚠ WARNING



Blockade of access to mains supply

Improper placing of the instrument can cause accidents with serious injuries with deadly consequences, fire or serious instrument damage because the instrument cannot be separated from the mains supply.

- Make sure the mains plug is easily accessible.

⚠ WARNING



Overheating

Improper placing of the instrument may cause fire or serious instrument damage in case of overheating.

- Do not block or cover ventilation slots.
- The air shall be able to circulate.

1. Remove the packaging (see chapter 3.4 on page 3-4).

⚠ WARNING



Risk of injury due to high weight

Improper lifting/carrying of the instrument can cause serious injuries to the personnel and/or serious material damage.

- Use suitable transport aids (e.g. fork lift, crane, lift truck) for lifting/carrying the instrument.
- Observe the technical specifications of the instrument (see chapter 22.4 on page 22-4) to avoid misjudgments.
- Observe the valid work safety directives and use auxiliary means if necessary.

NOTICE

The used workbench must be levelled and flat!

2. Put the analyzer on a workbench.
3. Use a spirit level and the adjustable base to level the analyzer.

INFO

Generations of the instrument

Use the correct setup procedure for the touch screen.

**TOUCH SCREEN
ON THE COVER**

4. Remove the monitor transportation lock (5).

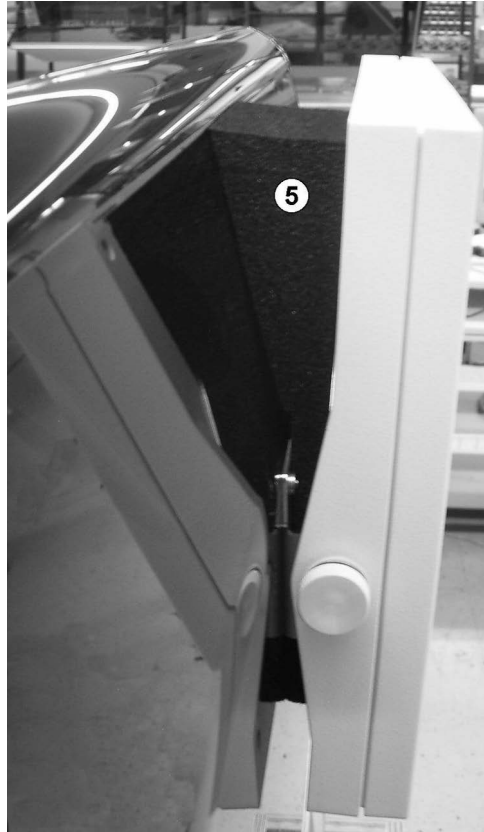


Figure 3-3: Monitor transportation lock

TOUCH SCREEN
WITH PC ON THE
RIGHT SIDE

5. Install the new All-In-One-PC (1) and tighten the four screws (2).

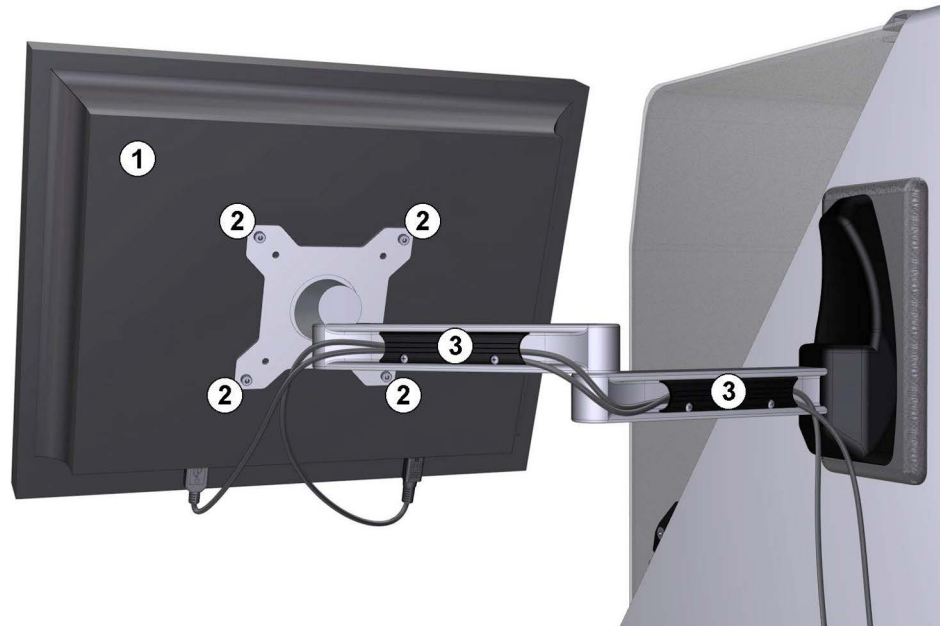


Figure 3-4: Rear side of an installed All-In-One-PC (PA-6322)

6. Install the new All-In-One-PC (1) and tighten the four screws (2).
7. Plug the cable of the new power supply into connector DC-IN of the All-In-One-PC (1).
8. Plug the USB cable into connector USB1 of the All-In-One-PC (1).
Note that some All-In-One-PCs have the label "Instrument (GEMINI)" next to the USB port. Please use this USB port.
9. Remove both cable supports (3).
10. Guide the USB and the power cables along the arm and install both cable supports (3).
11. Remove the touch screen protection.

TRANSPORTA-
TION LOCKS

12. Open the cover.
13. Remove both pipettor transportation locks (6).

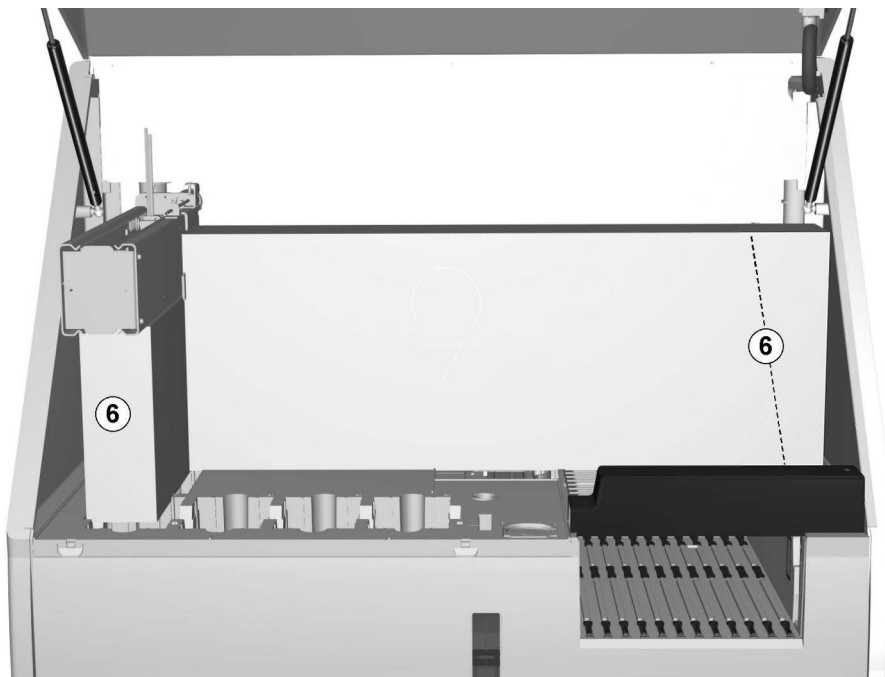


Figure 3-5: Pipettor transportation locks

14. Check the free movement of the Z-init pin (see chapter 12.4.3 on page 12-20).
15. Open the washer service cover (see chapter 8.3.2 on page 8-10).
16. Remove both washer transportation locks (7).

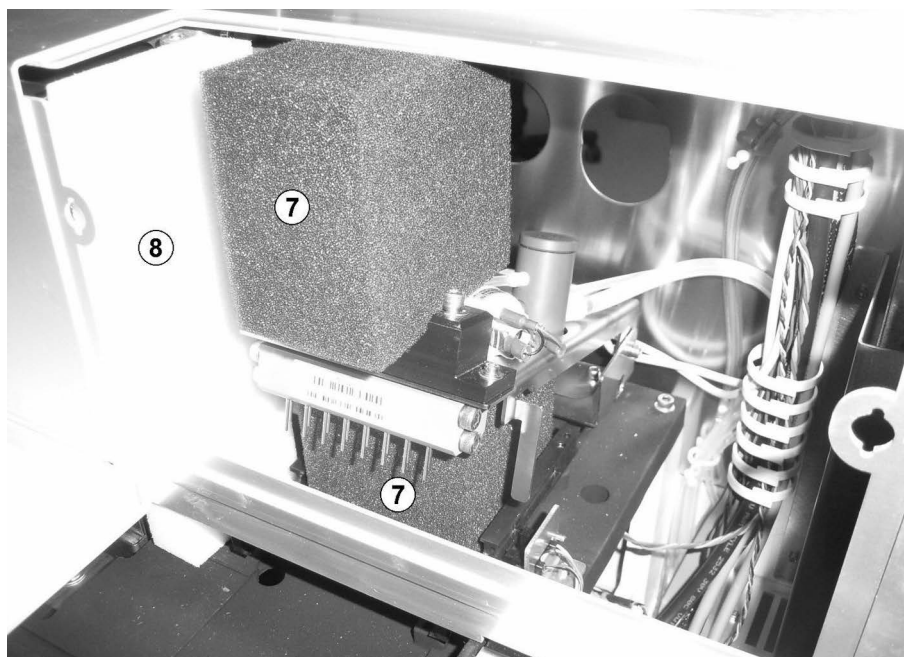


Figure 3-6: Incubator and washer transportation locks

17. Lift up the washer and remove the incubator transportation lock (8).

18. Note the USB flash drive with the all manuals and the used software on the backside of the washer service cover.
19. Close the washer service cover (see chapter 8.3.2 on page 8-10).
20. Unpack all accessories from the separate cardboard box.

INFO

Keep the packaging to allow for safe transportation in case the instrument must be shipped at some future date.

**WASTE BAG
HOLDER, BOTTLES
AND CONTAINERS**

21. Install the waste bag holder (9) on the front side with two screws (10).

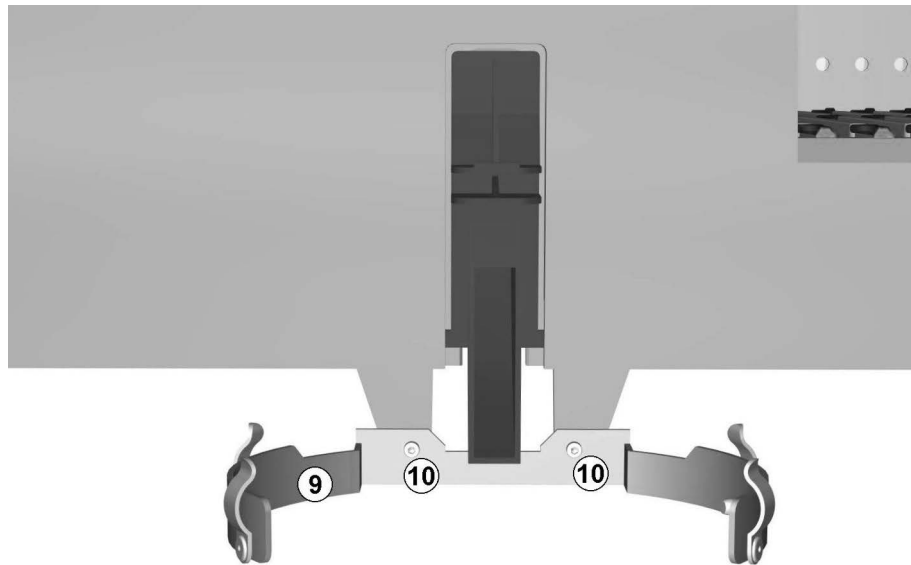


Figure 3-7: Waste bag holder

22. Insert both metal base plates into the dilution or archive plate positions (see chapter 2.1.3 on page 2-5).
23. Insert a waste bag into the waste bag holder.
24. Install both washer waste bottles (see chapter 2.1.4 on page 2-7).
25. Fill all washer bottles and install it (see chapter 2.1.4 on page 2-7).
26. Fill the system liquid container and install it (see chapter 2.1.4 on page 2-7).
27. Install the waste liquid container (see chapter 2.1.4 on page 2-7).
28. Connect the main power connector (see chapter 2.1.5 on page 2-10).

3.6 PLACING INTO OPERATION

WARNING



Risk of injury by moving pipettor

The pipettor could cause injury during movement.

- Never put your head, hand or arm into the opened instrument.
- Never put your hand into the loading bay.
- Respect alarm sound before X-/Y-movement.

NOTICE

Unchecked instrument

Only checked instruments enable correct operation.

- Note the Operation Qualification (OQ) form.
- Note the Performance Qualification (PQ) form.
- Check the instrument after installation, maintenance or repair.

1. Switch on the instrument.
2. Start the teacher software (see chapter 20.2.2 on page 20-4).
3. Check the reference position (see chapter 20.2.3 on page 20-11).
4. Exit the teacher software.
5. Start the service software.
The service software displays its main menu.
6. Start the washer service software module.
7. Start the selftest.
8. Check if the message **Selftest OK** is displayed in the bottom message line.
9. Prime all dispense pumps (wash buffer pumps) for at least 10 s (see chapter 17.8 on page 17-38).
10. Perform a pump calibration with washer calibration tool (jig) (see chapter 17.4.2 on page 17-10).
11. Close the washer service software module.
12. Start the plate transport service software module.
13. Start the selftest.
14. Check if the message **Selftest OK** is displayed in the bottom message line.
15. Check/teach the plate transport positions (see chapter 20.4 on page 20-44).
16. Start the cycle test once (see chapter 15.6.1 on page 15-25).
17. Close the plate transport service software module.
18. Start the reader service software module.
19. Start the selftest.
20. Check if the message **Selftest OK** is displayed in the bottom message line.
21. Check the photometer with the reader verification plate (RVP).
22. Close the reader service software module.

23. Start the incubator service software module.
24. Start the selftest.
25. Check if the message **Selftest OK** is displayed in the bottom message line.
26. Close the incubator service software module.
27. Start the COP service software module.
28. Start the selftest.
29. Check if the message **Selftest OK** is displayed in the bottom message line.
30. Close the COP service software module.
31. Start the pipettor service software module.
32. Enter your name into the setup parameters dialog and press on the **OK** button.
33. Open the **Pipettor** dialog and initialize the pipettor (see chapter 12.7.1 on page 12-66). No additional coordinates need to be loaded.
34. Close the **Pipettor** dialog.
35. Open the **Prime** dialog.
36. Prime the pipettor with at least 20 s purging with the bypass pump and 20 prime cycles (see chapter 12.7.5 on page 12-76).
37. Close the **Prime** dialog.
38. Perform the **Automatic Module Test** (see chapter 12.7.7 on page 12-80).
39. Perform the **APM test** (see chapter 12.7.4 on page 12-75).
40. Close the pipettor service software module dialogs
41. Exit the service software.
42. Start the user software to initialize the instrument.

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4 REMOVING OF THE INSTRUMENT

As the **GEMINI** instrument is a complex instrument and contains delicate electrical and mechanical components it must be packed by a qualified service engineer.

4.1 PLACING OUT OF OPERATION

1. If necessary, save all files of the user software (results, assays etc.), see "Instructions for use Manual" chapter "Maintenance and Cleaning".
2. Clean and disinfect the complete instrument (tubings, washer, wash station, liquid bottles, and containers), see "Instructions for use Manual" chapter "Maintenance and Cleaning".
3. Remove all test tubes, microplates, disposable tip racks, reagent bottles and the waste bag.



4. Shut down the computer and switch off the instrument.
5. Disconnect main power from the instrument.
6. Disconnect all electrical connections (see chapter 2.1.5 on page 2-10).
7. Disconnect all liquid connections (see chapter 2.1.4 on page 2-7).

4.2 PACK UP THE INSTRUMENT

NOTICE

Follow all steps of the section "Placing out of Operation" (see chapter 4.1 on page 4-1).

WASTE BAG HOLDER

1. Remove the waste bag holder.

⚠ WARNING



Risk of injury due to high weight

Improper lifting/carrying of the instrument can cause serious injuries to the personnel and/or serious material damage.

- Use suitable transport aids (e.g. fork lift, crane, lift truck) for lifting/carrying the instrument.
- Observe the technical specifications of the instrument (see chapter 22.4 on page 22-4) to avoid misjudgments.
- Observe the valid work safety directives and use auxiliary means if necessary.

TRANSPORT PALLET

2. Place the instrument onto the transport pallet. The largest of the molded components (1) must be on the front side of the instrument. The instrument must fit between all molded components.



Figure 4-1: Molded component of the transport pallet (front side)

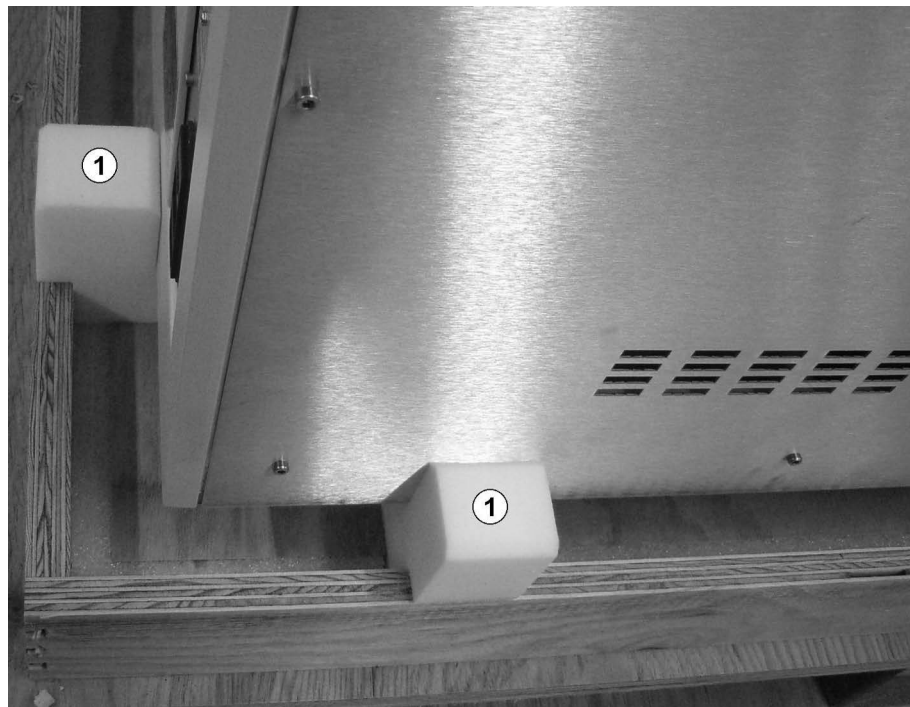


Figure 4-2: Molded components of the transport pallet (right and back side)

TRANSPORTATION LOCKS

3. Open the washer service cover (see chapter 8.3.2 on page 8-10).
4. Lift up the washer and insert the incubator transportation lock (2).

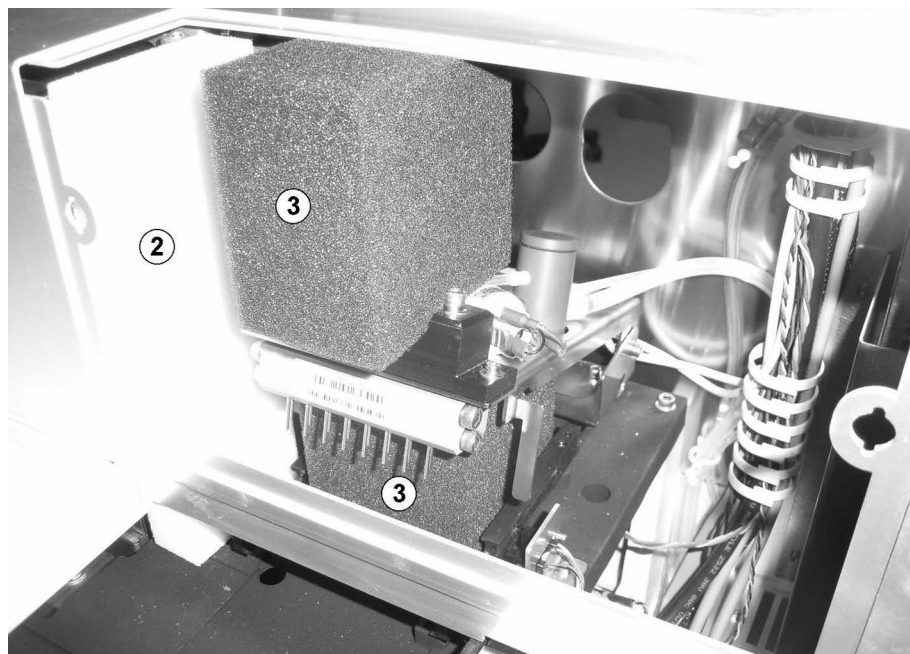


Figure 4-3: Incubator and washer transportation locks

5. Insert both washer transportation locks (3). The lower transportation lock **must not** touch the wash head needles!
6. Close the washer service cover (see chapter 8.3.2 on page 8-10).

REMOVING OF THE INSTRUMENT

PACK UP THE INSTRUMENT

7. Move the pipettor arm to the left side.
8. Move the Y-sledge to the rear.
9. Insert the pipettor transportation lock (4) carefully.

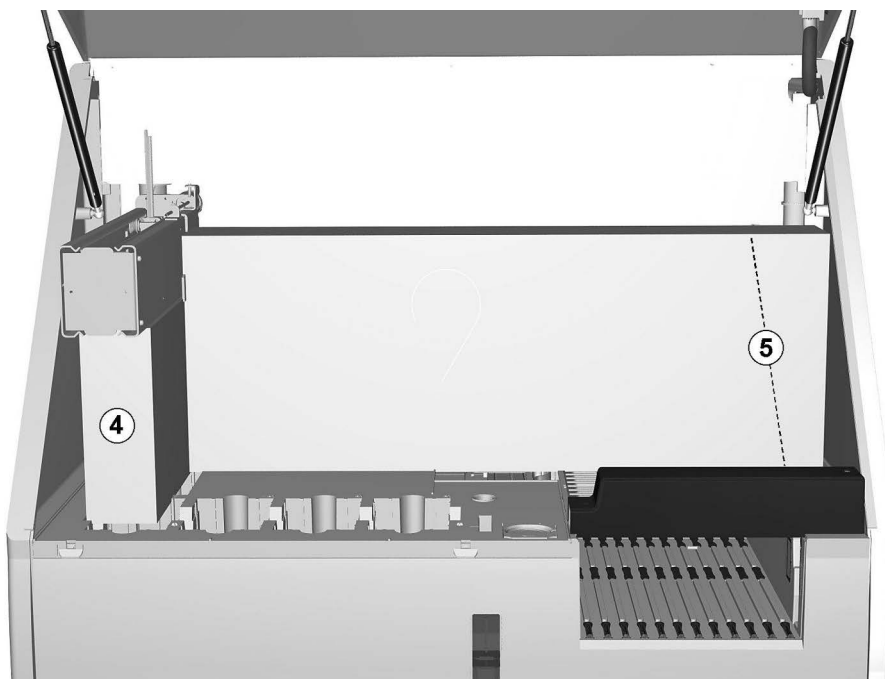


Figure 4-4: Pipettor transportation locks

10. Insert the pipettor transportation lock (5). Both transportation locks must be tight.
11. Close the cover.

INFO

Generations of the instrument

Use the correct removal procedure for the touch screen.

TOUCH SCREEN
ON THE COVER

12. Loose the knurled screws of the monitor and insert the monitor transportation lock (6).



Figure 4-5: Monitor transportation lock

13. Tighten the knurled screws of the monitor.

REMOVING OF THE INSTRUMENT

PACK UP THE INSTRUMENT

TOUCH SCREEN WITH PC ON THE RIGHT SIDE

14. Unplug the power and the USB cables.

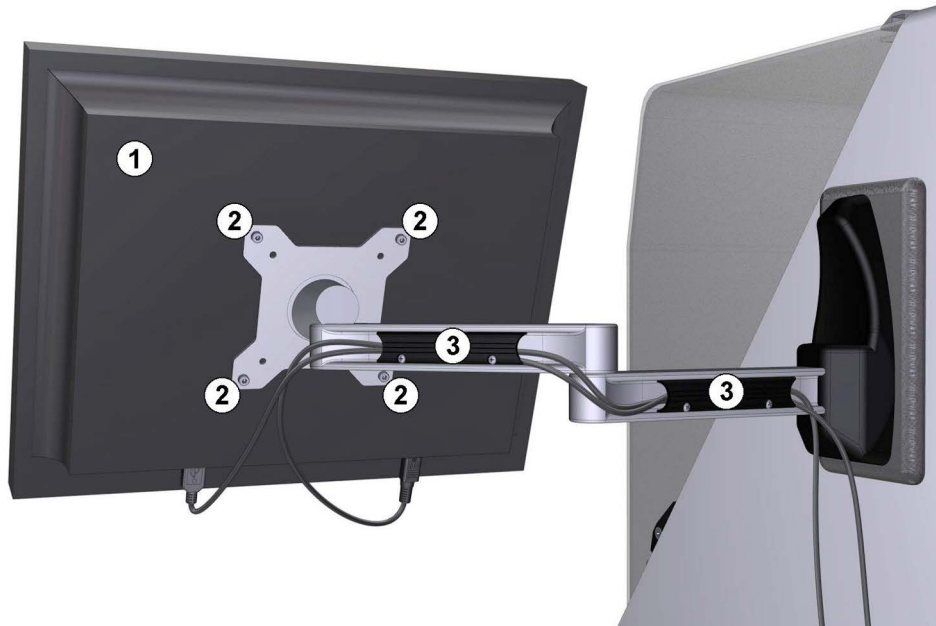


Figure 4-6: Rear side of an installed All-In-One-PC (PA-6322)

15. Hold the All-In-One-PC (1) and remove the four screws (2).
16. Remove the All-In-One-PC (1).
17. Remove both cable supports (3).
18. Remove the All-In-One-PC power supply.
19. Install both cable supports (3).
20. Screw the four screws (2) into the All-In-One-PC (1).

RACKS AND TRANSPORTATION LOCK

21. Insert all racks into the loading bay.
22. Insert the loading bay transportation lock (7).

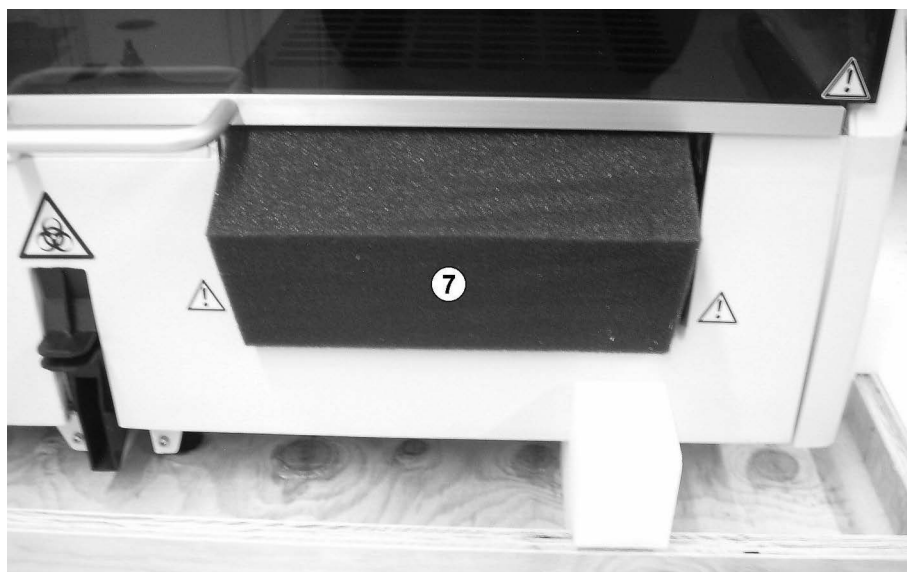


Figure 4-7: Loading bay transportation lock

PACKAGING

23. Cover the instrument with the plastic bag.
24. Put the cardboard box (9) over the instrument.
25. Insert the protection brackets:
 - Corners of the backside: two protection brackets (10)
 - Corners of the front side: two wooden protection brackets (11)
 - Centre of the backside: one protection bracket (12)



Figure 4-8: Protection brackets

26. Put the wooden protection cover (13) on the instrument.



Figure 4-9: Wooden protection cover

27. Close the cardboard box (9) and paste it up.

4.3 PACK UP THE ACCESSORIES

NOTICE

Follow all steps of the section "Placing out of Operation" (see chapter 4.1 on page 4-1).

1. Put all accessories into a cardboard box.
 - Do not kink tubings.
 - Fill head space with fillers.
 - Pack up metal accessories with bubble wrap.



Figure 4-10: Accessories in a cardboard box

4.4 CERTIFICATE OF DECONTAMINATION

1. Create a document to certificate the decontamination.
2. Add the certificate of decontamination to the transportation documents.

 **DANGER**



Risk of infection!

The manufacture accepts only analyzers or parts of the analyzer with a certificate of decontamination!

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5 MAINTENANCE SCHEDULE

The **GEMINI** instrument was designed to be as maintenance free as possible. However, given the functional, precision and reliability requirements of the complex applications the instruments are used for, regular care and attention is necessary to maintain the high quality of instrument performance. For some components regular maintenance procedures could not be avoided in the design process.

The maintenance intervals given below assume a working time of the instrument of 8 h per day, 5 days a week, in a normal laboratory environment. Upon more intense usage of the instrument or usage in demanding environmental conditions (dust, heat, humidity) the maintenance intervals should be shortened accordingly.

5.1 SAFETY

WARNING



Defects in the liquid system

Defect or leaky tubes, syringes, valves or pumps lead to deterioration of the pipetting results and consequently corruption of final results. Furthermore incorrectly flushed tips can cause mixing up of sample material.

- Check the instrument for drops and pooling of liquid on surfaces.
- Check tubes, syringes, valves or pumps periodically.

NOTICE

Damage of touch screen while cleaning

Improper cleaning could damage the touch screen surface.

- Use a soft and lint-free cloth with neutral detergent or with ethanol to clean the touch screen.
- Do not use any chemical solvent, acidic or alkali solution.
- Do not allow liquid from soaking into the joint of film and glass which may result in peeling or malfunctioning.
- If dust is accumulated on the case surface, remove it by using a special vacuum cleaner for computers.

5.2 PREVENTIVE MAINTENANCE SCHEDULE AND PROCEDURES FOR USERS

See "Instructions for use Manual".

5.3 PREVENTIVE MAINTENANCE SCHEDULE FOR SERVICE ENGINEER

⚠ DANGER



Risk of infection!

Before beginning maintenance it is necessary to clean and disinfect the instrument, see "Instructions for use Manual" chapter "Maintenance and Cleaning".

NOTICE

Use the "Half-yearly maintenance kit" or the "Annual maintenance kit" for the preventive maintenance.

NOTICE

Read and perform the steps of the following table top down!

Module	Action	Chapter	Cycle
Cleaning, lubrication and replacement (without mains voltage)			
	<ul style="list-style-type: none"> Shut down the computer and switch off the instrument. Disconnect main power from the instrument. 		
General	Replace the filter in the instrument liquid container	see instructions of the "Maintenance Kit"	Half-yearly
General	Cleaning of the plate carriers	chapter 5.4.1 on page 5-6	If necessary
Pipettor	Replace the liquid level detection cable	chapter 12.6.2 on page 12-28 or chapter 13.6.3 on page 13-17(version 3)	Half-yearly
Pipettor	Clean the X-guiding. Check for excessive friction.	chapter 12.5.1 on page 12-22 or chapter 13.5.1 on page 13-11(version 3)	Yearly
Pipettor	Clean the Y-guiding rails and rollers. Check for excessive friction force in all axes.	chapter 12.5.2 on page 12-22 or chapter 13.5.2 on page 13-11(version 3)	Yearly
Photometer	Clean guiding rails	-	Yearly
Photometer	Check reader for dust built-up and clean if necessary.	see chapter 11.6.1 on page 11-6	Yearly

MAINTENANCE SCHEDULE

PREVENTIVE MAINTENANCE SCHEDULE FOR SERVICE ENGINEER

Module	Action	Chapter	Cycle
Incubator	Lubricate the Z-lead screw	chapter 10.6.1 on page 10-11	Half-yearly
Washer/Pumps	Replace tubings	see instructions of the "Maintenance Kit"	Half-yearly
Washer/Pumps	Replace all liquid filters	chapter 17.7.14 on page 17-35 and instructions of the "Maintenance Kit"	Half-yearly
Washer/Pumps	Replace the tubing cassette of the washer waste pump	chapter 17.7.9 on page 17-27	Half-yearly
Washer/Pumps	Clean wash head needles	chapter 17.6.1 on page 17-12	Half-yearly
Plate transport	Lubricate the X-/Y-drive	chapter 15.4.1 on page 15-6	Half-yearly
Check and adjustment (without mains voltage)			
<ul style="list-style-type: none"> Shut down the computer and switch off the instrument. Disconnect main power from the instrument. 			
General	Check plate carrier	chapter 5.4.2 on page 5-7	If necessary
Pipettor	Check the X-belt tension	chapter 12.3.1 on page 12-6 or chapter 13.4.2 on page 13-10(version 3)	Half-yearly
Pipettor	Check the Y-belt tension	chapter 12.3.2 on page 12-8 or chapter 13.4.2 on page 13-10(version 3)	Half-yearly
Pipettor	Check the Z-belt tension (old pipettor version) or check the Z-drive (version 3)	chapter 12.3.3 on page 12-10 or chapter 13.4.2 on page 13-10(version 3)	Half-yearly
Pipettor	Check the free movement of the disposable tip adapter (The APM tubing and the LLD cable must not touch the toothed rack during movement!)	-	If necessary
Plate transport	Check the X-/Y-belt tension	chapter 15.2.1 on page 15-3	Half-yearly
Check electrical safety			
<ul style="list-style-type: none"> Switch the instrument on. 			
Complete instrument	Perform the electrical safety check.	chapter 9.3.2 on page 9-8	Yearly
Cleaning, lubrication and replacement (with service software)			
<ul style="list-style-type: none"> Switch the instrument on. Start the service software. 			

Module	Action	Chapter	Cycle
Check and adjustment (with teacher software)			
	<ul style="list-style-type: none"> Switch the instrument on. Start the teacher software. 		
Pipettor	Check teaching positions of the pipettor via teacher software.	chapter 20.2 on page 20-2	Half-yearly
Check and adjustment (with service software)			
	<ul style="list-style-type: none"> Switch the instrument on. Start the service software. 		
Plate transport	Check teaching positions of the pipettor via service software.	chapter 20.4 on page 20-44	Half-yearly
Pipettor	Perform the module test.	chapter 12.7.7 on page 12-80	Half-yearly
Pipettor	Perform an automatic pressure measurement (APM) test.	chapter 12.7.4 on page 12-75	Half-yearly
Photometer	Perform filter wheel adjustment.	see chapter 11.6.4 on page 11-6	Half-yearly
Photometer	Perform plate auto adjustment.	see chapter 11.6.5 on page 11-7	Half-yearly
Photometer	Perform a board tests including reader verification plate run.	See 'Instructions for use' Manual for details.	Half-yearly
Incubator	Perform the module test.	chapter 10.8.4 on page 10-33	Half-yearly
Washer/Pumps	Perform X- and Z-adjustment with washer adjustment tool	see chapter 17.4.1 on page 17-8	Half-yearly
Washer/Pumps	Prime the washer pumps and perform a pump calibration with washer calibration tool (jig)	chapter 17.8 on page 17-38 and chapter 17.4.2 on page 17-10	Half-yearly
Plate transport	Perform the cycle test (one cycle).	chapter 15.6 on page 15-21	Half-yearly
COP (Loading bay)	Perform the selftest.	chapter 16.6.2 on page 16-28	Half-yearly
Loading bay	Check barcode scanner.	chapter 16.4.4 on page 16-8	Half-yearly
Check (with user software)			
	<ul style="list-style-type: none"> Switch the instrument on. Start the user software. 		
All modules	Run any predefined performance evaluation assays that are supplied with the instrument.	See "Instructions for use Manual"	Half-yearly

Table 5-1: Maintenance schedule for service engineer

5.4 PROCEDURES FOR SERVICE ENGINEERS

5.4.1 CLEANING OF PLATE CARRIER

NOTICE

Do not use bleach to clean the plate carrier(s).

1. Remove the plate carrier(s) from the instrument.
2. Spray with disinfection solution and wipe the plate carrier(s) dry.

5.4.2 CHECK PLATE CARRIER

In case one of the following problems occurs, the respective plate carrier must be checked:

- Plate adjustment test of the reader module test fails only for one plate carrier.
- When checking the pipetting position with different plate carriers using the pipettor teaching, the pipettor position relative to one plate carrier is not accurate.
- Problems in plate transport cycle test with one plate carrier.

Possible reasons for such problems and how to identify them:

- The plate carrier is twisted so that it can wobble if you put it onto a flat surface. The part must be replaced.
- When snapped into the plate transport sledge, the plate carrier is not fixed completely by the spring loaded ball in the coupling mechanism, so that there is a play of more than 0.5 mm (0.0197 inch) left-right. The part must be replaced.
- The plate carrier is not straight so that the 1 mm (0.0394 inch) gap between the right edge of the plate carrier and the plate transport sledge is noticeably not constant:

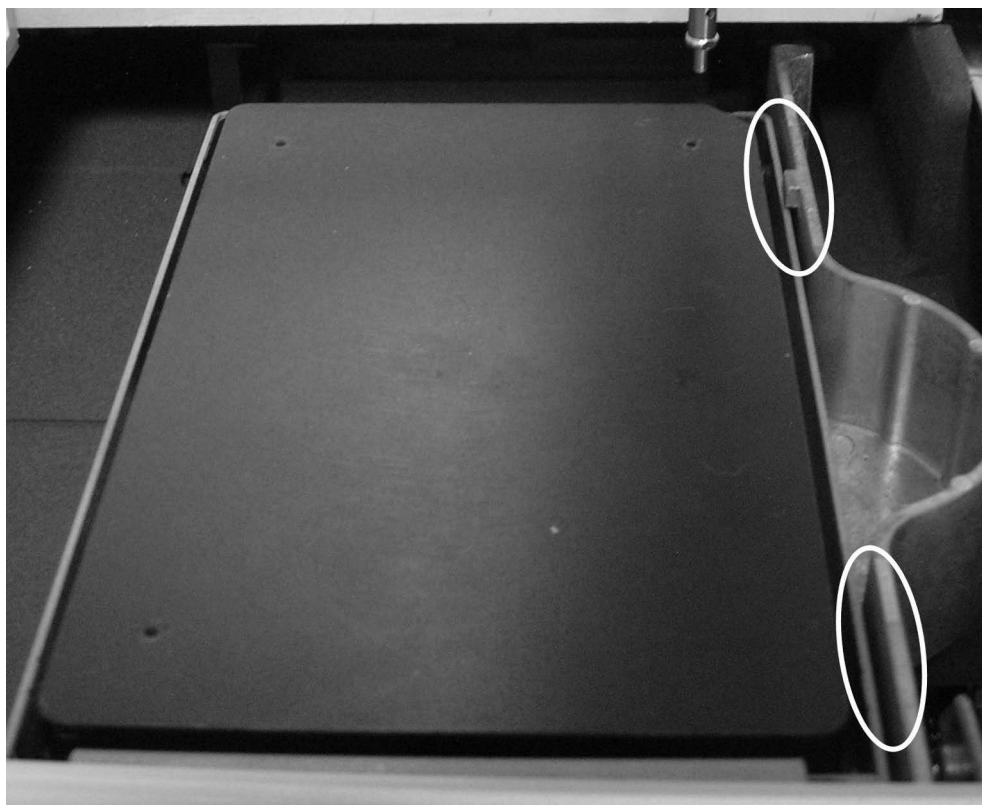


Figure 5-1: MTP teaching tool in the load/unload/pipetting position

- The plate carrier does not lie flat on the plate transport sledge, so that it can be pushed down in one of the rear corners. A play in Z-direction of more than **0.1 mm (0.0039 inch)** is not acceptable. The part must be replaced.

- The tensions of the springs of the plate carrier coupling mechanism are too low so that the plate carrier can be pushed backwards (towards the washer) easily. In this case, the springs can be bent upwards so that their holding force is increased. However, the friction during loading and unloading of the plate carrier must not be too high (see below).
- The tensions of the springs of the plate carrier coupling mechanism are too high so that the plate carrier cannot be loaded or unloaded easily. Worst case is that the plate transport cycle test fails during unloading or loading of this carrier.

NOTICE

Correction of the instructions given in chapter 20.2.5 on page 20-14.

NOTICE

After loading the MTP teaching tool in the plate carrier, make sure that the plate carrier is snapped into the plate transport sledge correctly. There must be a 1 mm (0.0394 inch) gap on the right side of the carrier. Also check if all carriers are straight and lie even on the sledge. When pushing the plate carrier or the MTP teaching tool down, there must be no play exceeding **0.1 mm (0.0039 inch)**. Twisted plate carriers must be exchanged.

- Check if the plate carrier on the plate transport sledge is parallel to the pipettor arm (without mains power):
 - Move the pipettor tip adapter to the edge of the plate carrier manually.
 - Move the y axis (sledge) of the pipettor arm manually along the plate carrier edge without moving the toothed rack.
 - The height of the tip adapter tip over the plate carrier edge must not change more than one millimeter when the sledge is moved along the plate carrier.

5.5 OVERVIEW BELT OR MOVEMENT FORCE

Module	Belt or Movement	Force	Chapter
Pipettor	X-belt	4 N (+2 N)	see chapter 12.3.1 on page 12-6
	X-movement	10 N	see chapter 12.3.1 on page 12-6
	Y-belt	15 N (+ 2 N/- 1 N)	see chapter 12.3.2 on page 12-8
	Y-movement	10 N	see chapter 12.3.2 on page 12-8
	Z-belt	Force depending on Z-movement	see chapter 12.3.3 on page 12-10
	Z-movement	5 N (+1 N/-2 N)	see chapter 12.3.3 on page 12-10
Plate transport	X-transport belt	Elongation of 6.5 mm (force 1 N)	see chapter 15.2.1 on page 15-3
	Y-transport belt	Elongation of 6.5 mm (force 1 N)	see chapter 15.2.1 on page 15-3

Table 5-2: Overview belt or movement force

MAINTENANCE SCHEDULE

OVERVIEW BELT OR MOVEMENT FORCE

Intentionally left blank.

6 TROUBLESHOOTING AND ERROR MESSAGES

In this section it is assumed that the service engineer is generally familiar with the software tools and hardware components to describe the diagnostic approaches in a short form. In case more detailed background information is needed, please refer to the individual module chapters.

The process of problem localization usually goes through several levels. The **GEMINI** instrument is equipped with various software tools to aid problem diagnostics on several levels.

1. The service software can address each individual module and can perform sensor read-outs and individual component actions.
Some modules require specialized software tools for adjustment and diagnostic purposes.
2. Many boards are equipped with signaling LEDs that show the state of e.g. a sensor.

INFO

Note information about the CAN-bus (see chapter 9.3.1 on page 9-7)!

6.1 ERROR MESSAGES OF THE USER SOFTWARE

The following table lists error messages reported by the user software. Mostly, it shows the recovery options available for the operator rather than mechanical or electronically troubleshooting hints for the service engineer. More detailed information is available in the subsequent chapters (see below) that list the raw error codes that can be reported by the individual modules.

Instrument messages appear in the status bar of the user software, error messages are displayed in a separate window, which has to be confirmed.

"%1" and "%2" are place holders for a instrument module or the designation of a plate, a reagent or an error number.

Error message:	Cause:	Action:
A result file already exists for plate "xxxx"	The instrument will automatically generate a result file not for each worklist but for each plate included in a worklist. This result file will be named after the Plate ID displayed in the Load Plate dialog (e.g. "HBc01.res"). Therefore, if you choose a Plate ID that has already been used in a former worklist, when you click on the OK button, the instrument will display this warning message.	Unless you specifically want to overwrite the former result file, click on the No button and go back to the Load Plate dialog to change the Plate ID. To do so just delete the name shown in the Plate ID field and enter a new name. Therefore, when choosing a Plate ID, try to find a precise name that will differentiate each test from previous or future tests. Do not retain the "Plate 1", "Plate 2"... default ID and do not enter just the test ID "HBc", "HIV", etc. The instrument does not expect any specific format so any chain of alphanumeric characters (with or without blank spaces) can be entered. To replace the existing result file, click on the Yes button. Note that the overwritten result file will be lost.
ABORT button pressed	The Stop button has been clicked during a run.	The run has been interrupted and may be continued or aborted completely.
Aborting plate ...	The operator clicked the Stop button during a run and then, in the Pause dialog, requested that the processing of one or more plates be aborted	You can decide to resume the run for the remaining plates or abort it completely.

Error message:	Cause:	Action:
All of the dilution resources have been used	Allow changing of bottles during a dispense is deactivated.	See 'Instructions for use Manual'.
Argument error in command	During initialization procedure. Faulty firmware is installed.	Start the complete firmware update (see chapter 21.1 on page 21-1). If error recurs the board of concerning module has to be checked.
Aspirate check failed for reagent %1	During the run. Aspirate step of reagent was faulty. Possible causes: <ul style="list-style-type: none"> Incorrect tracking due to wrong bottle type. 	Recovery options: <ul style="list-style-type: none"> Retry button: Pipettor will dispense back the aspirated liquid and repeats the aspirate step. Abort Plate button: Plate will be aborted. Continue button: Instrument goes on but all concerning samples will be flagged. Troubleshooting: <ul style="list-style-type: none"> Check, if correct bottles were used. Check in the reagent database for the bottle size, measure the bottle and compare. Check the teaching of Z max.
Aspiration pressure to high	APM error.	The result will be flagged: P_max_high
Aspiration pressure to low	APM error.	The result will be flagged: P_min_low
Barcode IC error	The barcode cannot be read.	Verify the readability of the barcodes. Select the Utilities > System Set-up menu item, click on the Sample Rack tab and check the barcode parameters. Try reading the barcodes once more (withdraw and insert your rack again). If this attempts fail, call your service engineer.

Error message:	Cause:	Action:
Clot detected in sample sample %1	<p>During the run. Clots⁽¹⁾ were detected in sample sample %1.</p> <p>Possible causes:</p> <ul style="list-style-type: none"> • Deficient sample preparation • Incorrect tracking due to wrong sample rack type • Incorrect tracking due to wrong tube diameter • Tip touches the (wet) wall of a tube. 	<p>Recovery options:</p> <ul style="list-style-type: none"> • Skip Sample button: Instrument will skip the concerning sample and will go on with the worklist. • Abort Plate button: Plate will be aborted. • Continue button: Instrument goes on but concerning sample will be flagged. <p>Troubleshooting:</p> <ul style="list-style-type: none"> • Check, if correct tubes were used. • Check the teaching. Check for diameter during teaching process.
Clot detected in reagent ...	Clots ⁽¹⁾ were detected in the respective reagent.	Pause the run and replace reagent.
Colorimeter A/D error	During the initialization procedure or during a run. Error of the analog / digital converter of the photometer.	Please, restart the instrument. If the error recurs, the photometer module has to be checked.
Colorimeter A/D over range error	During the initialization procedure or during a run. Upper limit of colorimeter A/D has been exceeded due to the signal height of the pre-selected resolution.	<p>Recovery options:</p> <ul style="list-style-type: none"> • Retry button: Instrument will try to repeat the last step. • Ignore button: Not advisable cause instrument cannot go on without sequence errors. <p>Push the Retry button, if the error recurs, abort the worklist and check the filters and the reader lamp.</p> <p>Troubleshooting:</p> <p>If error recurs after checking the filters and the lamp, the whole photometer module has to be checked.</p> <p>Check if all covers are in place.</p> <p>Analyse the values from the selftest in the Service Software.</p>

Error message:	Cause:	Action:
Colorimeter A/D under range error	During the initialization procedure or during a run. Too less light reaches the electronic of photometer.	<p>Recovery options:</p> <ul style="list-style-type: none"> • Retry button: Instrument will try to repeat the last step. • Ignore button: Not advisable cause instrument cannot go on without sequence errors. • Abort button: The worklist will be aborted. <p>Press the Retry button. If the error recurs, abort the worklist. The whole photometer module has to be checked.</p> <p>Troubleshooting:</p> <p>The halogen lamp of the photometer is faulty and has to be replaced. If the error persists, the optical components in the photometer (filter, upper or lower optic block) may be dirty. Clean the photometer or replace it.</p> <p>Check if all covers are in place.</p> <p>Analyse the values from the selftest in the Service Software.</p>
Colorimeter backgrounds out of range	During the initialization procedure or during a run. Typically occurs when light entered the measurement chamber.	<p>Restart the software to initialize the photometer again. Please check if the photometer cover, all instrument sheet metal covers and the deck top are installed correctly and all filters are installed.</p> <p>Check if all covers are in place.</p> <p>Analyse the values from the selftest in the Service Software.</p>
Colorimeter EEPROM error	During the communication between photometer and PC.	<p>Initialize the module again. If the error recurs the photometer board has to be checked. Replace the instrument CU board or replace the photometer.</p>
Colorimeter filter motor home error	During the initialization procedure. The instrument does not recognize the current position of the filter motor.	<p>Restart the software. If the error recurs, check if the filter wheel is moving freely, and check the light barriers.</p>
Colorimeter filter motor movement error	During the initialization procedure. The movement of the filter wheel is faulty.	<p>Restart the software. If the error recurs, the filter wheel has to be checked.</p>

Error message:	Cause:	Action:
Colorimeter invalid filter %1 error	During initialization procedure. The gain factor for the respective filter cannot be identified.	Restart the software to initialize the photometer again, after checking the filter configuration (and repeat the filter adjustment in case of changes of the configuration). If error recurs, change the concerning filter (see chapter 11.7.4 on page 11-14).
Colorimeter lamp error	During the initialization procedure. Halogen lamp of photometer is faulty.	Replace the halogen lamp (see chapter 11.7.3 on page 11-12) and restart the software to initialize the photometer again. If necessary, replace the instrument CU board (see chapter 9.4.2 on page 9-17).
Colorimeter optic channel %1 error	During the initialization procedure. One of the optical channels is faulty.	The lower or upper optic blocks have to be cleaned, or the fiber has to be replaced (see chapter 11.7.7 on page 11-21). Check if all covers are in place. Analyse the % values of the fibers from the selftest in the Service Software.
Colorimeter positioning error	Plate movement is faulty.	If the error recurs, check the plate transport teaching of the reader position, check the guide rails and plate carriers: do they move smoothly in the reader? Check the plate transport encoders. Check the plate transport belt tensions.
COMGEN error '%1'	At start-up. Cable connection between PC board and COP board is faulty.	Check correct connection between PC board and COP board. Start instrument again.
Command execution error	During initialization procedure. Faulty firmware is installed.	Start the complete firmware update (see chapter 21.1 on page 21-1). If error recurs the board of concerning module has to be checked.
Command execution error (Photometer)	Using of high level commands in the photometer service software module without initialization.	Initialize the photometer module.
Command not implemented	During initialization procedure. Faulty firmware is installed.	Start the complete firmware update (see chapter 21.1 on page 21-1). If error recurs the board of concerning module has to be checked.

Error message:	Cause:	Action:
COP serial port test error	At start-up. Error in serial interface on COP board.	Check connection between PC board and COP board. Start instrument again. Check the connections between COP board and the other components. If error recurs, the COP board has to be replaced.
Crash recovery file detected. Do you want to try and recover the worklist?	After power failure.	<p>Warning: It is not recommended to use the crash recovery. Any results produced in a recovered run have to be discarded.</p> <p>Details on recovery procedure: Message: "Do you want to try and recover the worklist?"</p> <ul style="list-style-type: none"> • No button: Software continuous with initializing the instrument. Old worklist will be deleted. • Yes button: The following message appears: "Is the instrument still running?" <ul style="list-style-type: none"> • No button: The instrument will initialize first the modules before continuing the next worklist step. • Yes button: The instruments continues with the next worklist step.

Error message:	Cause:	Action:
Disposable tip dropped	<p>The disposable tip has fallen off the adapter unexpectedly.</p> <p>Possible causes:</p> <ul style="list-style-type: none"> • Defective tip • Bad batch of disposable tips • Needle is not pushed correctly in the tip adapter • Insufficient tip pick-up force due to excessive friction inside the z drive • Insufficient tip pick-up force due to excessive flexibility in the tip tray or deck top. • Defective APM disposable tip adapter 	<p>Recovery options:</p> <p>The user should pick up the dropped tip, check for possible contamination and for what could have caused the problem and select the appropriate recovery option. Warning: Especially, if the error occurred while the pipettor was moving across any wells, vials or tubes, the affected plate must be aborted. The error is logged in the event log.</p> <p>Recovery options:</p> <ul style="list-style-type: none"> • Retry button: The instrument will repeat the pipetting step where the error occurred after initialization of the pipettor arm. • Abort Plate button: The whole plate will be aborted. • Ignore button: The concerning sample will be flagged. Instrument goes on with the next pre-dilution. <p>Troubleshooting:</p> <ul style="list-style-type: none"> • Check tip adapter if needle is pushed fully inside. • Check/adjust tip pick-up force. • Check the force, which is been used for Z-Movement, if necessary clean z-bar or readjust Z-motor. • Reteach tip positions. • Use different batch of tips. • Replace APM disposable tip adapter
Drive not moving	Motor error in scanner of reagent and sample rack. Scanner firmware does not work correctly. Electrical or mechanical problems of scanner.	If error occurs please use the possibility to allocate the reagents and samples, manually. The barcode scanner of the loading bay has to be checked.
Duplicate sample ID Edit the sample IDs so that only one tube is used per sample.	Two loaded sample tubes with identical barcodes.	Remove the sample tubes and use an other barcode for one of this tubes.
Error during assay layout reduction. Reduce the number of sample samples. Check that the assay layout is reducible.	After adding assay and sample to the plate. Too many samples are used on this plate.	Push the OK button and reduce the numbers of samples, that a maximum of 96 wells on one plate are used.

Error message:	Cause:	Action:
Error opening file ...	Error during reading or writing a file (network down or directory moved/deleted).	Check or change the target directory in the Directories tab of the Options dialog (see 'Instructions for us Manual').
Error scheduling plate '...'	After adding plate and assay. The Assay programming is not correct or the combination of different plates cannot be scheduled.	Push the OK button and modify the assay or worklist.
Error: Argument error in '%1'	During the initialization procedure. Component cannot be actuated.	Restart software and instrument. If the error recurs, the concerning module has to be checked. Start the complete firmware update (see chapter 21.1 on page 21-1).
Illegal parameter (length/type)	During initialization procedure. Faulty firmware is installed.	Start the complete firmware update (see chapter 21.1 on page 21-1). If error recurs the board of concerning module has to be checked.
Incubator heater %1 error	During the initialization procedure or during the run. The heater foil of incubator box %1 is faulty.	The heater foil of concerning incubator box has to be checked.
Incubator sensor %1 error	During the initialization procedure or during the run. The temperature sensor of incubator box is faulty.	The temperature sensor of concerning incubator box has to be checked.
Init not reached or Init not in init direction	During initialization procedure of the plate transport (can also be initiated by washer or reader). Error of the plate transport init light barrier or plate transport drive.	<p>Please, restart the software and instrument.</p> <p>If the error occurs during a run, please press the Abort button to cancel the worklist. After this error occurs a recovery isn't possible.</p> <p>If the error recurs the plate transport drive and its init light barrier have to be checked.</p> <p>If error occurs during pipettor init, check light barrier, check forces of X,Y,Z movement. Clean the guiding rails and check again. Check Z-bar if bend, if so replace it.</p>

Error message:	Cause:	Action:
Insufficient volume of pre-dilution %1	During the run. Instrument cannot find enough volume in pre-dilution.	<p>Recovery options:</p> <ul style="list-style-type: none"> • Retry button: Instrument will try to repeat the last measurement of level height. • Abort button: The concerning sample will be aborted. • Abort Plate button: The whole plate will be aborted. • Ignore button: The concerning sample will be flagged. Instrument goes on with the next pre-dilution. <p>Troubleshooting:</p> <ul style="list-style-type: none"> • Check if the metal plate was put under the dilution plate. • Check if the correct *.mpc file is selected for the pre-dilution plate used. • LLD problems can occur in the pre-dilution plate if liquid with low conductivity is pipetted (e.g. DI water). • The minimal volume that can be detected by the LLD in a well of a dilution plate is 120 µl to 150 µl (depending on the plate used). • Check the teaching of the pre-dilution position. • Double-check the teaching of the *.mpc file used.

Error message:	Cause:	Action:
Insufficient volume of reagent %1	At reagent check if volume of reagent is insufficient.	<p>Recovery options:</p> <ul style="list-style-type: none"> • Abort check button: Reagent check will be aborted. The instrument goes on with the worklist. • Refill bottle button: Software jumps back to the loading window where reagents can be filled up. • Continue button: Instrument will go on with checking the next reagent. <p>To make sure that worklist will run without miss pipetting errors, please push Refill bottle and make sure that enough reagent liquid is available.</p> <p>Troubleshooting:</p> <ul style="list-style-type: none"> • If this error occurs although there is enough liquid provided in the reagent bottle, check if the bottle type used is correct. • Check the teaching of Z start and Z max.
Insufficient volume of sample %1	During the run if volume of sample is insufficient.	<p>Recovery options:</p> <ul style="list-style-type: none"> • Retry button: Instrument will try to repeat the last measurement of level height. • Abort button: The sample will be aborted. • Abort Plate button: The whole plate will be aborted. • Ignore button: The concerning sample will be flagged. Instruments go on with the next sample. <p>Troubleshooting:</p> <ul style="list-style-type: none"> • Check the teaching of Z start and Z max.
Invalid pipettor coordinates on plate X, label sample "...". Check that the dispense labels and aspirate labels are consistent.	After adding plate and assay. The assay programming is faulty. A label of a sample is undefined.	<p>Push the OK button.</p> <p>Modify the assay definition and restart the worklist.</p>
Invalid unlock code	During initialization procedure. Faulty firmware is installed.	Start the complete firmware update (see chapter 21.1 on page 21-1). If error recurs the board of concerning module has to be checked.

Error message:	Cause:	Action:
Mean pressure to low	APM error.	The result will be flagged: P_mean_low
No disposable tips left	During the run. No more tips available or found.	<p>Automatically appearance of the loading window after instrument message occurs. Load the correct tips to the suggested position. After pushing the OK button the worklist will go on.</p> <p>Troubleshooting: Check if all tips got picked up during the run, if necessary reattach the affected positions.</p>
No liquid detected for reagent %1	During the run. No liquid for reagent %1 is detected, if reagents check was disabled.	<p>Recovery options:</p> <ul style="list-style-type: none"> • Retry button: Instrument will check level of reagent again. • Abort Plate button: Plate will be aborted. • Abort button: The worklist will be aborted. <p>To make sure that the worklist will run without miss pipetting errors, push Abort and enable the Reagent check in the panel options. After that, you have to start the worklist again. The old worklist cannot be recovered.</p>
No liquid detected for sample %1	During the run. No liquid for sample %1 is detected, if sample check was disabled.	<p>Recovery options:</p> <ul style="list-style-type: none"> • Retry button: Instrument will check level of sample again. • Ignore button: Instrument goes on but concerning sample will be flagged. <p>Note: air can be pipetted if you will push the Ignore button.</p> <ul style="list-style-type: none"> • Abort Plate button: Plate will be aborted. • Abort button: The concerning sample will be aborted.

Error message:	Cause:	Action:
No response to command '%1'	Instrument cannot communicate with PC.	<p>Recovery options:</p> <ul style="list-style-type: none"> • Retry button: PC will try to connect to instrument again. • Abort button: The worklist will be aborted. <p>If error message recurs after pushing Retry, restart the instrument.</p> <p>Troubleshooting:</p> <p>Check the cable between PC board COP. Check electronics using the service software.</p>
Open loop error at tip eject	Pipettor crash during tip eject.	<p>Remove tip manually from pipettor or trigger eject mechanism manually. Press the OK button after removing the tip manually. Press Retry. The instrument logs the failure in the event log and goes on with the next step.</p> <p>Tip waste could be overfilled, so that tips stack up and eject is not possible. If the error recurs the teaching of the eject position has to be checked. The Z start position (the second point taught at the tip eject position) might be too low.</p> <p>A further reason for eject problems could be excessive friction force in the Z drive (see chapter 12.4.2 on page 12-20). Tip eject position might be too high.</p>
Parameter not allowed/found	During initialization procedure. Faulty firmware is installed.	Start the complete firmware update (see chapter 21.1 on page 21-1). If error recurs the board of concerning module has to be checked.

Error message:	Cause:	Action:
Pipettor error 0x0E-LY (or LX) position not reached	During a pipettor movement. Pipettor crashes or mechanical problems.	<p>Recovery options:</p> <ul style="list-style-type: none"> • Retry button: After initialization, the instrument will try to reach the position again. • Ignore button: Not advisable cause instrument cannot go on without sequence errors. • Abort button: The worklist will be aborted. <p>Troubleshooting:</p> <p>Push the Retry button to repeat the last step, if the error recurs please open instrument flap and check if they're any obstacles that disturb the pipettor movement. If there are no obstacles, the pipettor module has to be checked. Check all pipettor axes for correct movement force (see chapter 12.4 on page 12-19).</p>
Pipettor Error 0x2C - Dilutor error '90'	Syringe volume is not sufficient for pipetting step.	<p>Either reduce the oversoak or Airgab in pipetting step (this can lead to unreliable results).</p> <p>Split the pipetting step into several parts, so that the disposable tip will be ejected and the oversoak and airgabs get out of the syringe.</p>

Error message:	Cause:	Action:
Pipettor open loop / overload error	Pipettor crash during a run.	<p>Recovery options:</p> <ul style="list-style-type: none"> • Retry button: After initialization, the instrument will try to repeat the former pipetting step. • Ignore button: Instrument will continue with the next pipetting step. • Abort button: The whole plate will be aborted. <p>Troubleshooting:</p> <p>Push the Retry button to repeat the last step, if the error recurs please open instrument flap and check if they're any obstacles that disturb the pipettor movement. If there are no obstacles, the pipettor module has to be checked. Check all pipettor axes for correct movement force (see chapter 12.4 on page 12-19).</p> <p>If error occurs during pipettor init, check light barrier, check forces of X,Y,Z movement. Clean the guiding rails and check again.</p> <p>Check Z-bar if bend, if so replace it.</p>
Plate not detected	<p>During plate transport movement. A plate carrier is not detected where it is expected.</p> <p>Possible reasons for the error</p> <ul style="list-style-type: none"> • Wrong teaching • Plate carrier does not interrupt a "plate in" light barrier in an incubator (or room temperature) slot: Defective light barrier, tolerance issue in the room temperature slots with the guiding rails (try to push the guiding rails farther to the back or exchange the plate carrier). Defective shake mechanism. 	<p>Recovery options:</p> <ul style="list-style-type: none"> • Retry button: Plate transport will try to load / unload the plate again. • Ignore button: Not advisable cause instrument cannot go on without sequence errors. • Abort button: Instrument will try to abort the plate. <p>Troubleshooting:</p> <p>Plate transport and incubator slots must be checked.</p> <p>Teaching of plate transport on affected positions has to be checked. Check if the light barriers are working.</p>

Error message:	Cause:	Action:
Plate transport %1 positioning error	<p>During the initialization procedure or during the run. Plate transport can't reach the demanded position.</p> <p>Possible reasons for the error:</p> <ul style="list-style-type: none"> • Inaccurate teaching. Especially, the teaching of the z position of the incubator drive and the "plate in" y position are critical for the loading and unloading of plate carriers. • Defective encoders. • Wrong belt tension maladjustment of the incubator slots • Insufficient lubrication 	<p>Recovery options:</p> <ul style="list-style-type: none"> • Retry button: Instrument will try to repeat the last movement step. • Ignore button: Not advisable cause instrument cannot go on without sequence errors. • Abort button: Plate will be aborted. <p>Troubleshooting:</p> <p>After error message occurs, make sure that there are no obstacles that jammed the plate transports movement.</p> <p>Push Retry button, if the error recurs the plate transport module has to be checked.</p> <p>Reteach plate transport for affected position (see chapter 20.4 on page 20-44).</p>
Plate transport EEPROM error	EEPROM error while reading / writing procedure.	Restart instrument again. If error recurs, the instrument CU board has to be exchanged.
Please close the system cover	During initialization or when resuming from pause. Instrument cover isn't closed.	<p>Close the instrument flap and push the OK button.</p> <p>If the error recurs after closing the flap the cover sensor has to be checked.</p>
Please configure the system in preparation for a standard WL. Ensure that the dilution tube rack is inserted.	After adding plate and assay. Wrong pre-dilution area is defined.	Push OK button. Make sure that correct pre-dilution area is chosen for this assay and start worklist again.
Please remove the plate from the system	During starting or stopping of a worklist. In order to save time in case OK is accidentally clicked before the plate is actually loaded, the software will not close the Load Plate dialog in case no opening and closing of the cover for loading a plate has been detected.	Open the instrument cover and (after approx. one second) close it again. Then, the dialog can be closed by pressing OK .
Positioning error	Motor error in scanner of reagent and sample rack. Scanner firmware does not work correctly. Electrical or mechanical problems of scanner.	If error occurs please use the possibility to allocate the reagents and samples, manually. The barcode scanner of the loading bay has to be checked.
Pressure at pump stop to high	APM error.	The result will be flagged: P_stop_high

Error message:	Cause:	Action:
Pressure rise delayed	APM error.	The result will be flagged: P_delay
Rack scanner focusing error	During a reading step of barcoded sample / reagent rack. The barcode scanner cannot be focused.	If error occurs please use the possibility to allocate the reagents and samples, manually. The barcode scanner of the loading bay has to be checked.
Rack scanner motor error	Motor error in scanner of reagent and sample rack. Scanner firmware does not work correctly. Electrical or mechanical problems of scanner.	If error occurs please use the possibility to allocate the reagents and samples, manually. The barcode scanner of the loading bay has to be checked.
Rack scanner not detected	During the initialization procedure. Scanner of loading bay is not connected.	If error occurs please use the possibility to allocate the reagents and samples, manually. The barcode scanner of the loading bay has to be checked.
Reagent ... is undefined	After adding plate, assay and sample. A reagent has not been defined.	Open assay and add the missing reagent into reagent database. Restart the worklist. Note: the changes have to be saved, with the Save Button before they will get active.
Some required resources have not allocated to system positions	After the loading dialog. Not all required reagents have been allocated to a position.	Push OK button. Load all resources from the unallocated resources field into the appropriate position (reagents, samples, dilution tubes/plates, tips, buffers).
Static pressure to high	APM error.	The result will be flagged: P_static_high
Static pressure to low	APM error.	The result will be flagged: P_static_low
Suspect tip pick up	During tip pick up. The disposable tip adapter reached the Zmax position, the tip sensor detects a tip, but the pick-up force was not as high as expected.	This is a warning that is logged in the event log. No results are flagged. The software continues pipetting with the tip without user interaction. If the error recurs frequently, the teaching positions (mainly Zmax at the tip trays) and the disposable tip adapter have to be checked (see chapter 20.2 on page 20-2).
System fluid low	During the initialization procedure or during the run.	Fill up the system liquid container with deionized water and push OK . If the error recurs after filling up the container, the level sensor has to be checked.

Error message:	Cause:	Action:
System waste full. Empty the waste container.	During initialization procedure or during the run.	Empty the waste container and push OK button. If the error recurs after emptying the waste container the level sensor has to be checked.
The disposable tips have been incorrectly loaded.	During the tip type detection. Software detected a wrong type of tip.	After pushing the OK button the software displays the loading dialog where you have to check if the correct type of tips (300 µl or 1100 µl) are loaded to the correct position. Check force of Z-Movement, if to high clean z-bar. Check teaching position for tip size detection.
The IFA slide bay is currently inserted. ELISA worklists can only run if the slide bay is removed. Please remove the slide bay and try again.	ELISA operation mode, but installed IFA bay or defective IFA bay sensor.	Remove the IFA bay. If no IFA bay is inserted, the IFA bay sensor has to be checked (function, connection to instrument CU board).
The IFA slide bay is currently removed. IFA worklists can only run if the slide bay is inserted. Please insert the slide bay and try again.	The IFA bay is not inserted correctly or IFA bay sensor defective.	Insert the IFA bay correctly. If the IFA bay is inserted, the IFA bay sensor has to be checked (function, connection to instrument CU board).
The slide bay was inserted but is not needed by this worklist. Please remove the slide bay from the instrument.	The IFA bay was installed during a ELISA run or IFA bay sensor defective.	Remove the IFA bay. If no IFA bay is inserted, the IFA bay sensor has to be checked (function, connection to instrument CU board).
The slide bay was removed but is needed by this worklist. Please re-insert the slide bay to it's correct position.	The IFA bay was removed during a IFA run or IFA bay sensor defective.	Insert the IFA bay correctly. If the IFA bay is inserted, the IFA bay sensor has to be checked (function, connection to instrument CU board).

Error message:	Cause:	Action:
There was an error found when printing the Document to XXX: The device is not connected. Do you want to retry or cancel the job?	After finishing a plate and getting a result.	Recovery options: <ul style="list-style-type: none"> Retry button: Software will try to start the print job, again. Cancel button: The print job will be canceled. <p>Please check that the printer is switched ON and all cables are connected.</p> <p>Make sure that the right printer driver is installed.</p> <p>If the error recurs after checking the printer.</p>
Tip eject failure	Error during the tip ejection in the tip eject station. The tip could not be ejected (the tip sensor still detects a tip although the pipettor performed a tip eject movement)	<p>Remove tip manually from pipettor or trigger eject mechanism manually. Press the OK button after removing the tip manually. The instrument logs the failure in the event log and goes on with the next step.</p> <p>If the error recurs the teaching of the eject position and the disposable tip adapter has to be checked.</p> <p>The tip eject position might be too high.</p>
Unable to create text file ...	Error during writing a file (network down or directory moved/deleted).	Check or change the target directory in the Directories tab of the Options dialog.
Unknown colorimeter error code %1	Unknown photometer error.	Restart instrument and software, if the error recurs, the whole photometer module has to be checked.
Unknown command	During initialization procedure. Faulty firmware is installed.	Start the complete firmware update (see chapter 21.1 on page 21-1). If error recurs the board of concerning module has to be checked.
Unknown incubator error code %1	Unknown incubator error.	Restart instrument and software. If the error recurs, the whole incubator module has to be checked.
Unknown plate transport error code %1	Unknown plate transport error.	Abort the worklist, and restart software to initialize the plate transport. Restart the worklist. If the error recurs the plate transport has to be checked.
Unknown washer error code %1	Unknown washer error.	Restart instrument and software. If the error recurs, the whole washer module has to be checked.

Error message:	Cause:	Action:
Verification failed: %1	During the photometer verification.	If the error occurs, change the lamp and check the filter configuration. Repeat the photometer verification test. If the error recurs the photometer module has to be checked. Check alignment of board and alignment of plate, check filter wheel alignment.
Warning! Incubator tolerance of xx°C was exceeded.	For elevated temperature incubation, if the incubation temperature monitored during the run does not correspond to the incubation temperature defined in the assay.	See 'Instructions for use Manual'.
Washer aspirate pump failure	During the initialization procedure or during a wash step. The aspirate pump is faulty.	Recovery options: <ul style="list-style-type: none"> • Retry button: Software tries to repeat the dispensing step. • Abort Plate button: The plate will be aborted. Push the Retry button. If the error recurs the aspirate pump has to be checked.
Washer aspirate pump flow failure	During the initialization procedure or during a wash step. The poor vacuum quality is detected.	Recovery options during wash step: <ul style="list-style-type: none"> • Retry button: Software will try to activate the aspirate pump again. • Abort Plate button: Plate will be aborted. Before pushing the Retry button, please check that all tubes are connected correctly. Check that there are no kinks in the tubing. Check the bottle seals. Are the bottle lids closed correctly? If the error recurs the vacuum sensor and the washer aspiration pump have to be checked.
Washer diluter pump drive failure	During the initialization procedure or during a wash step. One of the dispense pumps (wash buffer pumps) is faulty.	Recovery options: <ul style="list-style-type: none"> • Retry button: Software tries to repeat the dispensing step. • Abort Plate button: The plate will be aborted. Push the Retry button. If the error recurs the dispense pumps have to be checked.
Washer EEPROM error	EEPROM error while reading / writing procedure.	Restart the instrument again. If the error recurs the instrument CU board has to be checked.

Error message:	Cause:	Action:
Washer reagent level low	After loading dialog or during the run. One of the washing liquids is empty.	Recovery options: <ul style="list-style-type: none"> • Retry button: Software checks the level sensor again. • Abort button: the worklist will be aborted. • Ignore button: the worklist goes on without filling up the buffer. Refill the washer reagent and push the Retry button. If the error recurs after refilling, check the cables connections of level sensors.
Washer strip error	Before wash step. One of the strips of micro plate isn't inserted correctly.	<ul style="list-style-type: none"> • Retry button: Strip check will be repeated. • Abort Plate button: Plate will be aborted. After error occurs push the Retry button. The instrument will go on, if the error recurs abort the plate.
Washer waste full	During initialization procedure or during the run. Washer waste bottle is full.	Recovery options: <ul style="list-style-type: none"> • Retry button: Instrument will check the level sensor again. • Abort Plate button: Plate will be aborted. Empty washer waste bottle manually and push the Retry button. If the error recurs, the washer level sensor has to be checked.

Table 6-1: General Error Messages

⁽¹⁾ Clot definition: After pipettor moves to dive out height it checks for a capacitive signal, if there is still a signal a clot message pops up and in the result file in a clot flag.

6.2 INSTRUMENT ERROR MESSAGES

The user software translates most of the error codes. However, when using the service software, only the raw error codes will be displayed in the status line of the command line display at the bottom of the service software dialog window. All error codes from the virtual module, plate transport, photometer/colorimeter, washer and incubator are prefixed with the:

- Module ID (e.g. 52),
- Command code (e.g. 03),
- Control byte (usually 03 for errors),
- Sub assembly code (e.g. 10) and
- Reply code.

The code following indicates the nature of the error as indicated below, depending on the module.

INFO

The other devices do not follow the structure described above. Instead they have individual codes.

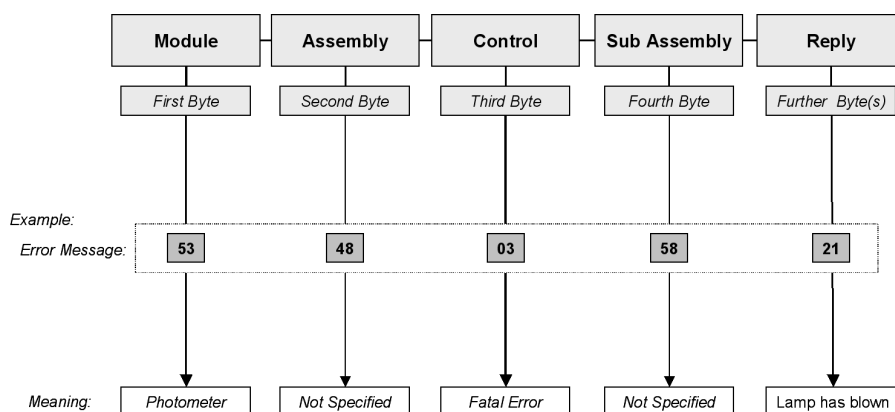


Figure 6-1: Structure and example of an hex error string

6.2.1 RECEIVED STRING

FIRST BYTE: MODULE

To recognize the module messages the first parameter in a command describes the transmitted module.

ID Hex	Module
41	Virtual module (see chapter 6.2.3 on page 6-24)
52	Plate transport (see chapter 6.2.4 on page 6-25)
53	Photometer (see chapter 6.2.5 on page 6-27)
54	Washer (see chapter 6.2.6 on page 6-31)
55	Incubator (see chapter 6.2.7 on page 6-34)
00	COP (see chapter 6.3.1 on page 6-37) Sample rack scanner (see chapter 6.3.2 on page 6-38)
FD	Pipettor (see chapter 6.4.1 on page 6-39)

Table 6-2: First byte: module

SECOND BYTE: COMMAND

Hex	Description
00 to FF	Assembly code

Table 6-3: Second byte: assembly

THIRD BYTE: CONTROL

Hex	Description
00	Normal reply
01	Warning
02	Critical error
03	Fatal error

Table 6-4: Third byte: control

FOURTH BYTE: SUB ASSEMBLY

Hex	Description
00 to FF	Sub assembly code

Table 6-5: Fourth byte: sub assembly

**FURTHER BYTE(S):
REPLY**

Hex	Description
00 to FF	Reply can be different length

Table 6-6: Further byte(s): reply

6.2.2 ASCII CODES USED IN PLATE INSTRUMENT ERROR MESSAGES

Hex	ASCII	Hex	ASCII	Hex	ASCII
41	A	4A	J	53	S
42	B	4B	K	54	T
43	C	4C	L	55	U
44	D	4D	M	56	V
45	E	4E	N	57	W
46	F	4F	O	59	X
47	G	50	P	59	Y
48	H	51	Q	5A	Z
49	I	52	R		

Table 6-7: Hex-/ASCII-Codes

6.2.3 VIRTUAL MODULE ERRORS (MODULE ID 41)

Reply:	Reason:	Action:
03	Parameter out of range	Invalid command was sent.

Table 6-8: Virtual module (module ID 41)

6.2.4 PLATE TRANSPORT ERRORS (MODULE ID 52)

Reply:	Reason:	Action:
01	Not initialized	Initialize the instrument. Perform selftest.
02	Unknown command	Abort the plate.
03	Argument error in command.	Check that the firmware is the correct version for the version of software being run.
04, 05	EEPROM error.	Reconfigure parameters, if it reoccurs replace the instrument CU board (see chapter 9.4.2 on page 9-17).
06	Voltage out of range	Check power supply voltage. Reported if power turned off while connected to the PC.
07	Voltage back in range	Press on the OK button.
0E	Command not possible	Module is in an invalid state or busy processing another command. Perform selftest to reset module.
10	Execution timeout	Abort the plate. Start the complete firmware update (see chapter 21.1 on page 21-1).
11	Illegal parameter	
12	Parameter not found	
13	Parameter not allowed	
14	Wrong parameter code	
15	Illegal parameter type	
16	Illegal parameter length	
20	Plate carrier sensor failure (plate not detected).	Check that plate carrier is breaking the sensor. Check connectors and function of light barrier. Teach affected position (see chapter 20.4 on page 20-44).

Reply:	Reason:	Action:
30	Motor jammed during movement.	Clear the obstruction. Check movement without motor power. Grease and oil again (see chapter 15.4.1 on page 15-6). Check belt tension (see chapter 15.2.1 on page 15-3).
32	Home (init) sensor not reached.	Check the function of the light barriers (X/Y/Z).
33	Home (init) sensor is wrong direction.	Check the function of the light barriers (X/Y/Z).
38	Encoder failure	Check encoder and motor electrical connections.

Table 6-9: Plate transport errors (module ID 52)

RECOVERY OPTIONS

- **OK:** The worklist continues being processed
- **Abort Plate:** The plate shall be presented for unloading and the worklist adjusted so that no further processing is carried out on that plate. (Only available if the command that generated the error can be traced to a specific plate. If no plate can be identified then it shall be replaced with "Abort" that shall abort the command and any associated "task".)
- **Retry:** The instrument shall retry the command that failed. If the command succeeds the worklist shall continue as normal. If the command fails again then another error shall be logged and displayed.
- **Ignore:** The instrument shall ignore the error and continue with the next worklist command. This recovery option may not be available to the user as it depends on their access rights.

NOTICE

Wrong results!

Do not use the **Ignore** button to continue a run with samples, because the results could be wrong!

6.2.5 PHOTOMETER/COLORIMETER ERRORS (MODULE ID 53)

Reply:	Reason:	Action:
01	Not initialized	Perform selftest.
02	Unknown command	Abort the plate.
03	Argument error in command.	Check that the firmware is the correct version for the version of software being run.
04, 05	Command execution error, EEPROM error.	Reconfigure parameters, if it reoccurs replace the photometer board (see chapter 11.7.5 on page 11-17).
06	Selftest failure	Depending on error code next actions pending
07	Voltage back in range.	-
0F	Command not implemented.	Abort the plate.
10	Execution timeout	Start the complete firmware update (see chapter 21.1 on page 21-1).
11	Illegal parameter	
12	Parameter not found	
13	Parameter not allowed	
14	Wrong parameter code	
15	Illegal parameter type	
16	Illegal parameter length	
20	Plate carrier sensor failure (plate not detected).	Check that plate carrier is breaking the sensor. Check connectors and function of light barrier. Teach the plate transport (see chapter 20.4 on page 20-44).
21	Lamp error.	Replace the lamp (see chapter 11.7.3 on page 11-12). Second action: Replace instrument CU board (save global data before, run Instrument setup, then load them back), see chapter 9.4.2 on page 9-17.

Reply:	Reason:	Action:
22	A/D conversion error.	<p>Check photometer board connections.</p> <p>Replace the photometer board (see chapter 11.7.5 on page 11-17).</p> <p>Replace the instrument board (see chapter 9.4.2 on page 9-17)</p>
23 n	A/D under-range error. n shows the filter position.	<p>Perform the filter drive auto adjustment.</p> <p>Check the lamp.</p> <p>Check filters.</p> <p>Check the filter wheel.</p> <p>Check if the filter wheel can move freely.</p> <p>Run selftest in Service Software and check the created file.</p> <p>Replace the photometer board (see chapter 11.7.5 on page 11-17).</p>
24 n	A/D over-range error. n shows the filter position.	<p>Check lamp position.</p> <p>Check filters for scratches.</p> <p>Check if the correct filters are installed (see chapter 11.7.4 on page 11-14).</p> <p>Check if the filter configuration is correct in the service software (see chapter 11.8 on page 11-25).</p> <p>Run selftest in Service Software and check the created file.</p> <p>Replace the lamp - it might be too bright (see chapter 11.7.3 on page 11-12).</p> <p>Replace the photometer board (see chapter 11.7.5 on page 11-17).</p>
25 n	Filter error. n shows the filter position.	<p>Check filter configuration in the service software (see chapter 11.8 on page 11-25).</p>
26	Background light levels too high.	<p>Check for ambient light.</p> <p>Check if the photometer cover, all instrument sheet metal covers and the deck top are installed correctly.</p> <p>Check position of lamp.</p> <p>Check filter positions.</p> <p>Replace the photometer board (see chapter 11.7.5 on page 11-17).</p>

Reply:	Reason:	Action:
27	Reading over-run error (well position).	Check the plate motor drive. Check end position parameter. Replace the photometer board (see chapter 11.7.5 on page 11-17).
28	Scan reading overflow.	Abort the plate.
29	No scan data available.	Abort the plate.
2A n	Transmission test failed. Faulty optic channel. n shows the filter position. Typically, one of the channels' transmission is below 30 % during the selftest. (The results of the selftest are logged when running the board or module test.)	Check that the optic channel is not obstructed. Check for kinks or other damage of the fiber optics. Check the lamp and the filters. Run selftest in Service Software and check the created file.
30	Positioning error. Motor jammed during movement.	Clear the obstruction. Check plate transport teaching. Check movement without motor power.
31	Command execution.	Check cables and connection Reinstall instrument firmware
32	Home (init) sensor not reached.	Check the function of the light barriers. Check for sluggishness.
33	Home (init) sensor is wrong direction.	Check the function of the light barriers.
38	Encoder failure	Check encoder and motor electrical connections.

Table 6-10: Photometer errors (module ID 53)

Other problems when using the service software or the module test:

Error message:	Reason:	Action:
Parameter out of range	Response of the service software after filter drive auto adjustment.	Check if the correct filters are installed. Check if the filter configuration is correct in the service software. Check if the filter drive can move freely. Check the fiber optics.

Error message:	Reason:	Action:
Module Test: Plate alignment test failed	Poor plate adjustment.	<p>If test fails only for one carrier: Check plate carriers (see Chapter ... Maintenance)</p> <p>If test fails with all plate carriers: Check the plate transport teaching. Repeat the plate auto adjustment. Check the mechanical guide rail adjustment / optic blocks adjustment.</p>
Filter drive noisy	Mechanical vibrations	<p>Check if there are loose parts (e.g. lock springs at empty filter positions) are creating the noise.</p> <p>Check the filter wheel and filter drive for excessive play.</p> <p>Note, that as the filter drive current is switched on all the time after selftest, some noise due to vibrations of the motor is normal. The criteria should be if the module test (including wet plate tests) is passed.</p>

Table 6-11: Other photometer errors

RECOVERY OPTIONS

- **OK:** The worklist continues being processed.
- **Abort Plate:** The plate shall be presented for unloading and the worklist adjusted so that no further processing is carried out on that plate. (Only available if the command that generated the error can be traced to a specific plate. If no plate can be found then an "Abort" button shall be displayed that shall abort the command and any associated "task".)
- **Retry:** The instrument shall retry the command that failed. If the command succeeds the worklist shall continue as normal. If the command fails again then another error shall be logged and displayed.
- **Ignore:** The instrument shall ignore the error and continue with the next worklist command. This recovery option may not be available to the user as it depends on their access rights.

NOTICE

Wrong results!

Do not use the **Ignore** button to continue a run with samples, because the results could be wrong!

6.2.6 WASHER ERRORS (MODULE ID 54)

Reply:	Reason:	Action:
01	Not initialized	Perform selftest.
02	Unknown command	Abort the plate.
03	Argument error in command.	Check that the firmware is the correct version for the version of software being run.
04, 05	EEPROM error.	Reconfigure parameters, if it reoccurs replace the instrument CU board (see chapter 9.4.2 on page 9-17).
06	Voltage out of range.	Check power supply voltage. Reported if power turned off while connected to the PC.
07	Voltage back in range.	-
0E	Command not possible.	Module is in an invalid state or busy processing another command. Perform selftest to reset module.
0F	Command not implemented.	Abort the plate. Start the complete firmware update (see chapter 21.1 on page 21-1).
10	Execution timeout	
11	Illegal parameter	
12	Parameter not found	
13	Parameter not allowed	
14	Wrong parameter code	
15	Illegal parameter type	
16	Illegal parameter length	
20	Aspirate pump error.	Set the vacuum sensor. Change the vacuum sensor. Check aspirate pump electrical connections. Replace the aspirate pump.
21	Aspirate pump drive error.	Check aspirate pump electrical connections. Replace the aspirate pump.
22	Dispense pump (wash buffer pump) error.	Check electrical connections. Check tubing connections. Replace the dispense pump (see chapter 17.7.13 on page 17-33).

Reply:	Reason:	Action:
23	Valve drive error.	Check valve electrical connections. Replace the valve.
24	Waste pump drive error	Check waste pump electrical connections. Replace the waste pump (see chapter 17.7.10 on page 17-29).
25	Washer waste bottle is full.	Empty the washer waste bottle. Check cable connectors. Check fill sensor
26	Reagent level is low.	Refill the reagent bottle. Check cable connectors. Check fill sensor
28	System waste full.	Empty waste container. Check cable connectors.
29	System fluid low.	Refill system fluid container. Check cable connectors.
2A	Fan speed too slow.	Check fan for obstructions.
2B	Fan speed too fast.	Check fan for obstructions. Check fan electrical connections.
2C	Fan speed back in range.	-
30	Motor jammed during movement.	Clear the obstruction. Check movement without motor power. Grease and oil again.
32	Home (init) sensor not reached.	Check the function of the light barriers. Check for sluggishness.
33	Home (init) sensor is wrong direction.	Check the function of the light barriers.

Table 6-12: Washer errors (module ID 54)

RECOVERY OPTIONS

- **Ignore:** The instrument shall ignore the error and continue with the next worklist command. This recovery option may not be available to the user as it depends on their access rights.
- **Abort Plate:** The plate shall be presented for unloading and the worklist adjusted so that no further processing is carried out on that plate. (Only available if the command that generated the error can be traced to a specific plate. If no plate can be found then an **Abort** button shall be displayed that shall abort the command and any associated "task".)

- **Retry:** The instrument shall retry the command that failed. If the command succeeds the worklist shall continue as normal. If the command fails again then another error shall be logged and displayed.
- **OK:** The worklist continues being processed

NOTICE**Wrong results!**

Do not use the **Ignore** button to continue a run with samples, because the results could be wrong!

FAN SPEED

If the fan speed goes out of range then the software shall log this in the event log for any affected plates (incubator fan problem detected).

6.2.7 INCUBATOR ERRORS (MODULE ID 55)

Reply:	Reason:	Action:
01	Not initialized	Perform selftest.
02	Unknown command	Abort the plate.
03	Argument error in command.	Check that the firmware is the correct version for the version of software being run.
04, 05	EEPROM error.	Reconfigure parameters, if it reoccurs replace the incubator board (see chapter 19.3.1 on page 19-16).
06	Voltage out of range	Check power supply voltage. Reported if power turned off while connected to the PC.
07	Voltage back in range.	-
0E	Command not possible	Module is in an invalid state or busy processing another command. Perform selftest to reset module.
0F	Command not implemented.	Abort the plate. Start the complete firmware update (see chapter 21.1 on page 21-1).
10	Execution timeout	
11	Illegal parameter	
12	Parameter not found	
13	Parameter not allowed	
14	Wrong parameter code	
15	Illegal parameter type	
16	Illegal parameter length	
20	Plate carrier sensor failure (plate not detected).	Check that plate carrier is breaking the sensor. Check connectors and function of light barrier.

Reply:	Reason:	Action:
21 n	Heater error. n shows the incubator group number: <ul style="list-style-type: none"> • 0 - Incubator 0, lower, outer • 1 - Incubator 0, lower, inner • 2 - Incubator 0, upper, outer • 3 - Incubator 0, upper, inner • 4 - Incubator 1, lower, outer • 5 - Incubator 1, lower, inner • 6 - Incubator 1, upper, outer • 7 - Incubator 1, upper, inner 	Check cable connections. Replace the incubator module.
22 n	Temperature sensor error. n shows the sensor number or name: <ul style="list-style-type: none"> • 0 - Incubator 0, lower • 1 - Incubator 0, upper • 2 - Incubator 1, lower • 3 - Incubator 2, upper 	Check cable connections. Replace the incubator or temperature sensor.
23	Shake position edge time out. No edge was detected to the frequency signal from the shake board.	Open incubator and look for mechanical obstructions. Check the shake board and hall-sensor are connected and functional.
24	Shake position frequency out of range. The shake frequency measured did not appear to be a valid measurement.	Check the shake board and hall-sensor are connected and functional.
25	Shake calibration failed.	Abort plate or retry. Perform a selftest before a retry.
26	Shake override idle position frequency out of range. The override off (or idle) position was outside of the acceptable limits.	Check the shake board and hall-sensor are connected and functional.
27	Shake override on position frequency out of range. The override on was outside of the acceptable limits.	Check the shake board and hall-sensor are connected and functional.
30	Positioning error	Abort plate or retry. Check incubator and plate transport teaching.

Table 6-13: Incubator errors (module ID 55)

RECOVERY OPTIONS

- **OK:** The worklist continues being processed.
- **Abort Plate:** The plate shall be presented for unloading and the worklist adjusted so that no further processing is carried out on that plate. (Only available if the command that generated the error can be traced to a specific

plate. If no plate can be found then an "Abort" button shall be displayed that shall abort the command and any associated "task".)

- **Retry:** The instrument shall retry the command that failed. If the command succeeds the worklist shall continue as normal. If the command fails again then another error shall be logged and displayed.
- **Ignore:** The instrument shall ignore the error and continue with the next worklist command. This recovery option may not be available to the user as it depends on their access rights.

NOTICE**Wrong results!**

Do not use the **Ignore** button to continue a run with samples, because the results could be wrong!

6.3 COP AND SAMPLE RACK SCANNER ERROR MESSAGES

All error codes from the COP and the sample rack scanner are prefixed with the:

- Module ID (e.g. 00),
- Command ID (e.g. D0),
- Command Parameters (e.g. 54) and
- Reply code (e.g. 10).

6.3.1 COP ERRORS (MODULE ID 00)

Code:	Reason:	Action:
00D05410	COP EEPROM error.	Replace the EEPROM.
00D05420	Error reading thermistor temperature, A/D read failure.	Replace the COP board (see chapter 16.5.3 on page 16-13).
00D05421	Ambient thermistor temperature sensor outside of 0 - 50°C	Check sensor is connected.

Table 6-14: COP (module ID 00)

Error message:	Meaning:
00D101 or Instrument Cover Error: 01	Cover not closed.

Table 6-15: Error messages

6.3.2 SAMPLE RACK SCANNER ERRORS (MODULE ID 00)

Code:	Reason:	Action:
00D55400	Command completed successfully.	-
00D55402	Argument error	Check that the firmware is the correct version for the version of software being run.
00D55430	Motor positioning error.	Check belt tension. Check obstacles. Check motor cable. Check encoder cable.
00D55432	Motor init position not found.	Clean the light barrier. Replace the light barrier.
00D55433	Motor home sensor in wrong direction.	Check light barrier. Check connectors.
00D55438	Motor encoder error.	Check cables and connections. Replace the motor.
00D5543C	Scanner command timeout.	Check scanner connection, cycle power of instrument. Replace scanner
00D5543D	Scanner not connected.	Check the scanner connections. Replace the scanner cable. Replace the scanner. Replace COP board.
00D5543E	Rack command could not be sent.	Check rack inserted light barriers on the back rear of the loading bay. Clean the light barriers of the COP board. Replace COP board.
00D5543F	Scanner motor error.	Replace the scanner.
00D55440	Scanner focusing error.	Replace the scanner.

Table 6-16: Sample Rack Scanner (module ID 00)

6.4 PIPETTOR ERRORS

All error codes from the Pipettor are prefixed with the:

- Module ID (e.g. FD),
- Error Classification:
 - Fatal Error (FF),
 - Warning (FE),
- Internal Time LSB and MSB (e.g. 3433),
- Error Code (e.g. 2A) and
- Parameters (e.g. 11).

6.4.1 PIPETTOR ERRORS (MODULE ID FD)

Error Code:	Meaning:	Fatal:	Action:
01	Unknown command.	No	Check sent command. Contact service station.
02	Execution delay. Unable to meet specified execution time.	No	Contact service station.
03	Transmission data lost. Receiver off line.	No	Check cables Contact service station.
04	The processor was reset by watchdog or trap. Software failure, processor hardware failure.	Yes	Replace affected electronic board. Contact service station.
0E	Sledge drive (X-axis) position not reached. Too much friction.	Yes	Check belt tension. Check for obstacles. Check encoder. Check cables. Check motors.
10	DC-drive (Y-axis) position not reached.	Yes	Check belt tension. Check for obstacles. Check encoder. Check cables. Check motors.

Error Code:	Meaning:	Fatal:	Action:
12	Z-position not reached.	Yes	Check toothed rack for damages. Check space between cogwheel and toothed rack. Check for obstacles.
18	Access to undefined target.	Yes	Check target definition. Check coordinate file. Check teaching.
1E	Command parameter out of range.	Yes	Check sent command. Check firmware parameter.
2A	Diluter answer time out.	Yes	table 6-19 on page 6-44
2B	Diluter checksum error.	Yes	table 6-19 on page 6-44
2C	Diluter error.	Yes	table 6-19 on page 6-44
2D	Overpressure error	Yes	
42	Can't clear reference switch. Reference switch does not turn OFF.	Yes	Check light barrier. Check motor Check encoder. Check cables. Check for obstacles.
43	Can't find limit switch / time out. Reference switch does not turn ON.	Yes	Check light barrier. Check connection.
50	Internal error.	Yes	
5A	No terminator in pump string.	Yes	
5C	Not enough parameters for specified command.	Yes	Check command.
70	Disposable dropped.	Yes	Check disposable tip adapter. Check teaching position. Check disposable tips.
7E	LLD cable defect	Yes	Replace liquid level detection cable.
82	Open loop / overload error. Missing encoder feedback. Motor doesn't move. Excessive load, high friction	Yes	Check encoder. Check motor. Check belt tension. Check connectors of motor and encoder. Check for obstacles. Check for sluggishness. Check teaching.
83	Left: No LLD signal. Missing cable connection to probe, hardware error.	No	Check liquid level detection cable. Check disposable tip adapter.

Error Code:	Meaning:	Fatal:	Action:
85	Left: Bad LLD signal. Bad cable connection to probe, bad grounding conditions, not enough liquid.	No	Check teaching position. Check firmware parameters. Check hardware assembly (inlays in dilution position).
87	SCTL timeout, DC drives does not respond	Yes	Check connection of PCB. Check firmware package. Contact service station.
88	Submodule error	Yes	Check firmware package. Check connections. Contact service station.
90	EEPROM I/O error	No	Contact service station.
FE	Parameter 'X' can stand for : 0x02: X-Drive 0x90: Pump 0x06: YZ-Drive 0x07: Head	Yes	Check affected module for obvious damages, then replace board and cable of the module. If several of these message pop up possible an issue with instrument CU board.

Table 6-17: Pipettor Error Commands (module ID FD)

In the case that an axis parameter is included within the error message the following assignment is valid:

Parameter	Axis
0	X-axis
1	Y-axis
4	Z-axis

Table 6-18: Axis parameter

RECOVERY OPTIONS

- **OK:** Proceed with the worklist. (This option is only available if the error cannot be associated with a particular step of the assay protocol. In this case it is the only recovery option possible.)
- **Retry:** Retry the pipetting step and proceed with the worklist. Retry will use a new tip. If a retry is successful then the result is not flagged.
- **Abort Plate:** The tip shall be ejected (if present) and the plate shall be presented for unloading. The worklist shall be adjusted so that no further processing is carried out on that plate.
- **Ignore:** The instrument shall ignore the error and continue processing the worklist. This recovery option may not be available to the user as it depends upon their access rights.

NOTICE

Wrong results!

Do not use the **Ignore** button to continue a run with samples, because the results could be wrong!

LLD-SIGNAL

During each Z-movement that the pipettor performs with LLD, the software shall check if no "inverted" LLD signal occurs.

In case such a signal is detected, the pipettor firmware shall create a fatal error, so that the run must be aborted, see table above.

6.4.1.1 DILUTER PUMP (VP9101) ERRORS

Parameter:	Reason:	Action:
00	No error	-
01	Initialization error	This error occurs if the pump cannot be initialized. Check the pump for possible obstructions or loose connections before you try a new initialization. The pump does not accept commands as long as it was initialized successfully.
02	Faulty command	This error occurs if a faulty command was given. Correct the command and send it again.
03	Faulty parameter	This error occurs if a faulty parameter (<n>) was entered with a command. Correct the parameter and send the corrected command.
04	Faulty command sequence	This error occurs if the command structure or the communication protocol is faulty. Check the command sequence and repeat the corrected command sequence.
06	EEPROM error	This error occurs if the EEPROM is faulty. Check the pipettor board.
07	Device not initialized	This error occurs if the pump was not initialized. To delete the error, initialize the pump.
08	No string found in EEPROM	In the EEPROM no string was found at the selected location. Select a correct location.
09	Piston overloaded	This error occurs if the injector piston loses steps. The pump must be initialized new, before a normal process can take place. This error can be deleted by initializing the pump new. Starting from firmware version 2.00, the pump reports the error, but is able to continue working. The actual absolute position is redetermined after losing steps. From this position the next movement command is executed. In connection with P- and D-commands (relative movements) this may lead to aftereffects. If for example, the plunger loses steps while moving to position 100 and in the end stands at position 97, then a following D100R-command leads to a parameter error. Therefore, the pump should be reinitialized after losing steps.
0A	Valve overloaded	This error occurs if the valve drive loses to many steps. Frequent or repeated errors of this kind indicate that the valve should be replaced. This error can be deleted by initializing the pump new.
0B	Piston movement not allowed	If the valve is in [Bypass (= flow-through position)] no piston movement commands are allowed.
0D	Symbol sequence for EEPROM too long	Symbol sequence is too long for the EEPROM (>63 bytes). Shorten the string.

Parameter:	Reason:	Action:
OE	Excess Pressure	This error occurs in connection with the Clot-Detection, if the pressure becomes excessive e.g. due to a total blockage. This error can only be cleared by a new initialization of the pump. If the error appears also during initialization, the attached line and the needle must be cleaned.
OF	Command overflow	This error occurs if the buffer memory contains too many symbols. Commands in the buffer must be carried out first before further commands can be sent.

Table 6-19: VP9101 precision syringe pump error codes parameter

6.4.2 PIPETTOR TROUBLESHOOTING

6.4.2.1 OPEN LOOP ERROR CAUSES

The 'Open Loop/Overload' Error is generated if the closed loop driver remains saturated too long. Distinguish the following cases for finding the problem:

1. The axis moves very fast (faster than normally)
 - Missing Encoder Feedback
 - Motor Polarity exchanged
2. The axis does not move at all.
 - Check for sluggishness.
 - Motor not connected.
 - Missing power supply for motors, fuse blown.
 - Power stage defect.
3. Initialization is successful, when moving fast the error occurs, sometimes as a rare event.
 - High friction, e.g. due to dust or dirt built-up on the rails or due to maladjustments. For further details on the adjustment of each of the pipettor axes see chapter 12.3 on page 12-6.
 - Axis can not move free, moving parts come in contact to housing.
 - Belt tension too high.
 - When initializing: Limit switch out of order. Drive moves against mechanical limitation.

6.4.2.2 LLD TROUBLE SHOOTING (CAPACITIVE LLD)

Wrong Positive Detection:

- Bad contact from coax cable to the tip. Adapter screw not tightened or corroded.
- Bad contact from coax cable shield to toothed rod. Screw not tightened or corroded.
- Coax cable defective.
- Cable connection from oscillator to main board defect (1-tip arm).
- Air bubbles on the liquid surface.
- When moving down the tip comes in contact with anything else than the liquid surface.
- Liquid inside the adapter makes a contact between tip and toothed rod.

Wrong Negative Detection:

- No contact from coax cable to the tip. Adapter screw not tightened or corroded.
- Zstart below the liquid level.
- Zmax adjusted above the liquid level.
- Not enough liquid.
- Liquid with very low conductivity (deionized water).
- Liquid containment with very low capacity.
- Liquid inside the adapter makes a contact between tip and toothed rod.

- Disposable tip not conductive.
- LLD disabled (The software of some instruments has an enable switch for the LLD).
- Instrument ground not connected to pipettor ground.

6.4.2.3 STANDARD MAINTENANCE PROCEDURE - LUBRICATION

Many of the problems are caused by insufficient lubrication of the guiding rack.

6.4.2.4 TIMING BELT TENSION

- A too high adjusted timing belt tension can cause higher friction and so problems in the positioning.
- A too low adjusted timing belt tension can cause a jumping of the timing belt on the timing belt pulley. This is causing fault positioning of the instrument which can not be recognized by the control software. So a too low adjusted timing belt tension is dangerous!

See:

- Adjustment of X-Belt and X-Movement Force (see chapter 12.3.1 on page 12-6)
- Adjustment of Y-Belt and Y-Movement Force (see chapter 12.3.2 on page 12-8)
- Adjustment of Z-Drive, Z-Belt, and Z-Movement Force (see chapter 12.3.3 on page 12-10)

6.4.2.5 PROBLEMS DURING INITIALIZATION OF THE Z-AXIS

Check free Movement of Z-Init Pin (see chapter 12.4.3 on page 12-20).

6.5 INITIALIZATION STEPS

6.5.1 INITIALIZATION STEPS OF THE USER SOFTWARE

START INITIALIZATION

There are two ways to start the initialization:

- Start the user software
- Select **Selftest** in the **Utilities** menu.

INITIALIZATION STEPS

1. Plate transport
2. Washer
3. Photometer
4. Incubator

- The Pipettor is initialized in parallel with the other module selftests.

6.5.2 INITIALIZATION STEPS OF THE SERVICE SOFTWARE

See sections "Service Software" (initialization and/or selftest button) in the module chapters:

- Incubator module, see chapter 10.8 on page 10-26 and chapter 10.8.3 on page 10-32
- Loading bay module, see chapter 16.6 on page 16-23 and chapter 16.6.1 on page 16-27
- Loading bay module COP, see chapter 16.7 on page 16-29
- Photometer module, see chapter 11.8 on page 11-25
- Pipettor module, see chapter 12.7.1 on page 12-66
- Plate transport module, see chapter 15.6 on page 15-21 and chapter 15.6.2 on page 15-29
- Washer module, see chapter 17.8 on page 17-38 and chapter 17.8.1 on page 17-45

6.6 PLATE CARRIER TROUBLESHOOTING

See chapter 5.4.2 on page 5-7.

6.7 FIRMWARE UPDATE

See chapter 21.2 on page 21-2.

7 SOFTWARE

This chapter describes basic functions of the software.

7.1 SERVICE SOFTWARE

INFO

Service Software version 1.05 (and above) supports all hardware versions of the **GEMINI** instrument.

7.1.1 INSTALLATION

To install, run the Setup application from whatever media the software was distributed. When you attempt to install and the installation program detects a previous installation, it will automatically uninstall it. This will require you to run the installation program again.

INFO

There are instruments with 3 or 4 disposable tip rack positions (see chapter 2.1.3 on page 2-5).

1. Exit all Windows programs before running the setup, as recommended.
2. Start the installation program `Setup.exe`.
3. Select the language for the installation program.
4. Press on the **Next** button (**Welcome** dialog).
5. Press on the **Next** button (**Choose Destination Location** dialog).
6. Press on the **Typical** button (**Set Type** dialog).
7. Next, the type of installation can be selected, choose **Typical**.
8. Press on the **Next** button (**Select Program Folder** dialog).
9. Press on the **Finish** button (**Complete** dialog).

7.1.2 USE OF THE SERVICE SOFTWARE

The main application gSERVICE must be run to access any of the service modules. The service modules will not run by themselves.

INFO

If the teaching software, or the user software, is running before, this programs has to be closed!

To start gSERVICE.EXE, double click the icon or select the menu item in the Windows Start menu. Before the application starts you must enter the service software password.



Figure 7-1: Service Login dialog

The user name (if entered) will become the default value used in reports, but can be overwritten. If a password is not entered, no EEPROM values can be changed and several error messages appear.

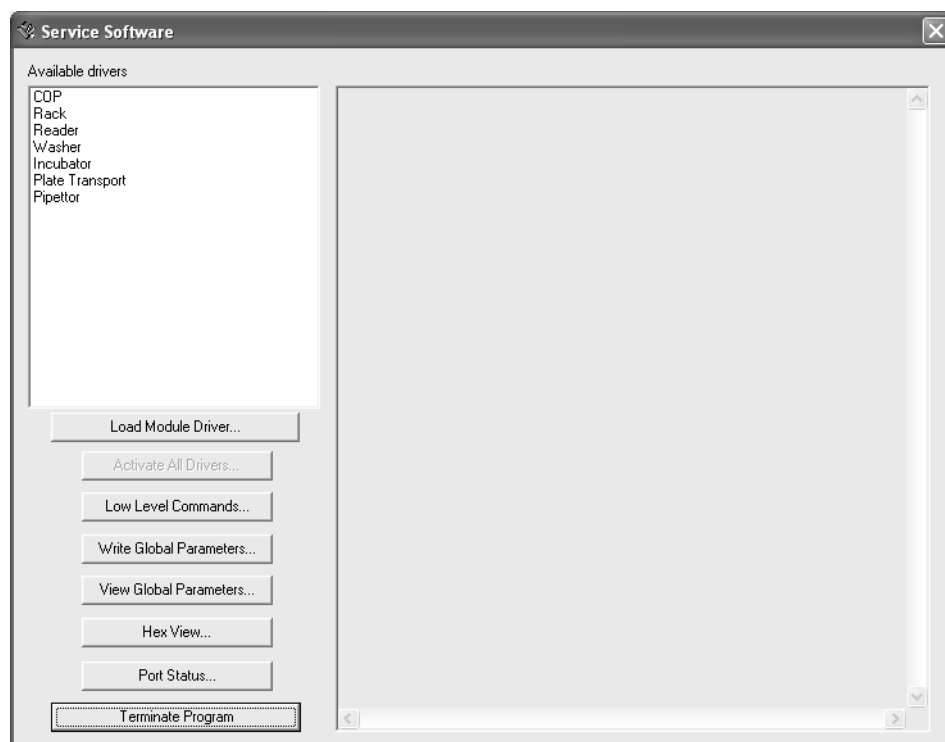


Figure 7-2: Service Software main dialog

The list of available drivers will vary depending on what you have installed. The window on the right hand side will show the communication log.

GENERAL

Function	Description
Available drivers	List of all available service software module drivers.
Load Module Driver	Loads the selected driver Available drivers list and opens its main dialog (see section "Service Software" in the module chapter). If the driver is already loaded, only the dialog is shown.
Activate All Drivers	Not applicable for GEMINI .
Low Level Commands	<p>When the Low Level Commands button is pressed, the a dialog box is displayed to allow the user to select or enter a low level command.</p> <p>Refer to module specifications for low level commands.</p> <p>Typing 44 41 04 49 and clicking Send will send the ABORT to the washer which will abort a current wash or aspirate operation for instance.</p> <p>The drop down list box displays the commands as described in the INI file, under the [LOW_LEVEL] directive. Data in command box must be correctly formatted.</p> <p>Example (gService.INI):</p> <pre>[LOW_LEVEL] COMMAND1=FD CF FF FF 00 00 10 00</pre> <p>Send To Port allows for different COM port to be selected.</p> <p>Warning: By sending low level commands, the configuration of the instrument can be corrupted.</p>
Write Global Parameters	Not applicable for GEMINI .
View Global Parameters	Not applicable for GEMINI .
Hex View	Invokes the Hex View Parameter dialog.
Port Status	Returns current status of communication port.
Terminate Program	Unloads all active drivers and exits the service program.

Table 7-1: Functions

7.1.2.1 ABOUT SERVICE SOFTWARE (VERSION)

Displayed in the top left hand corner is the **Service Software** icon, clicking on the icon displays a drop down menu, with the standard **Move** and **Close** (*Alt + F4*). Below this is the menu item **About Service Software....** This displays an about box, showing the versions of all components.



Figure 7-3: About Service Software dialog

When reporting any problems with the software, please include this information.

7.1.3 RESULTS OF THE SERVICE SOFTWARE

All modules generate result files. The result files are in a special folder in the service software folder. The name of the special folder is *Service_Log_yy-mm-dd* (yy=year; mm=month; dd=day). The following table shows the names of the result files:

Module:	File:
Communication between service software and instrument	LOGxxxxxx.txt
COP	CPxxxxxx.txt
Incubator	INxxxxxx.txt
Plate transport	PLxxxxxx.txt
Rack	RAxxxxxx.txt
Reader	RDxxxxxx.txt
Washer	WAxxxxxx.txt

Table 7-2: Result files (xxxxxx=Number)

Show a result file with the Microsoft Notepad:

1. Open the Windows Explorer.
2. Select the directory 'C:\Program Files\Stratec\2PS\Service_Log_yy-mm-dd'.
3. Open a result files.

In addition to the result files, the service software generates communication log files in the results folder: LOGxxxxxx.txt. The contents of these files can be analyzed by the manufacturer.

7.2 INSTRUMENT SETUP SOFTWARE

7.2.1 INSTALLATION

Installation of the Macro Interpreter to Execute Parameter Scripts:

INFO

For old instruments which are upgraded with the advanced pipettor design the following steps have to be performed before firmware and parameter download can be started.

INFO

If an older version of the program is installed, uninstall the old version before installing the new software.

NOTICE

GEMINI: Software version 2.0.6 or higher

The **GEMINI** instrument requires software version 2.0.6 or higher.

NOTICE

GEMINI COMBO: Software version 2.0.7 or higher

The **GEMINI COMBO** instrument requires software version 2.0.7 or higher for IFA Pipettor module **without** Y-sledge top cover.

NEW VERSIONS

The Instrument Setup is automatically installed with the instrument software.

Complete folder path: C:\Stratec\InstrumentSetup\

Folder path of the Log files: C:\Stratec\InstrumentSetup\logs

OLD VERSIONS OR MANUAL INSTALLATION

1. Execute the file StComCli2_V000014.exe.
2. Install the program **StComCli2** to the default folder.
3. Setup the Internet Explorer as described in the ReadMe file. The file will be started automatically.

Installation of the Instrument Setup:

4. Extract the zipped folder InstrumentSetup in C:\Stratec.

Note: No space between the InstrumentSetup.

Complete folder path: C:\Stratec\InstrumentSetup\

7.2.2 REPLACEMENT

1. Delete the folder `InstrumentSetup` in `C:\Stratec`.

7.2.3 USE OF THE INSTRUMENT SETUP

See Complete Firmware Update with Instrument Setup (Pipettor Version 3) (see chapter 21.1 on page 21-1)

7.3 COMPLETE SOFTWARE AND FIRMWARE PACKAGE

INFO

For the installation of the complete software and firmware package, see Software and Firmware Installation Manual.

This package contains drivers, the service software, the UniloadX software, firmware, the InstrumentSetup software, and the user software.

8 COVERS

This chapter describes the covers of the **GEMINI** instrument. In the first section "Safety" additionally to the general safety notes (see chapter 1.2 on page 1-6) safety notes are specified, which concern particularly this module. The section "Overview" gives a short overview about the covers. This section is followed by a larger part containing information about repairs (section "Troubleshooting and Repairs").

8.1 OVERVIEW

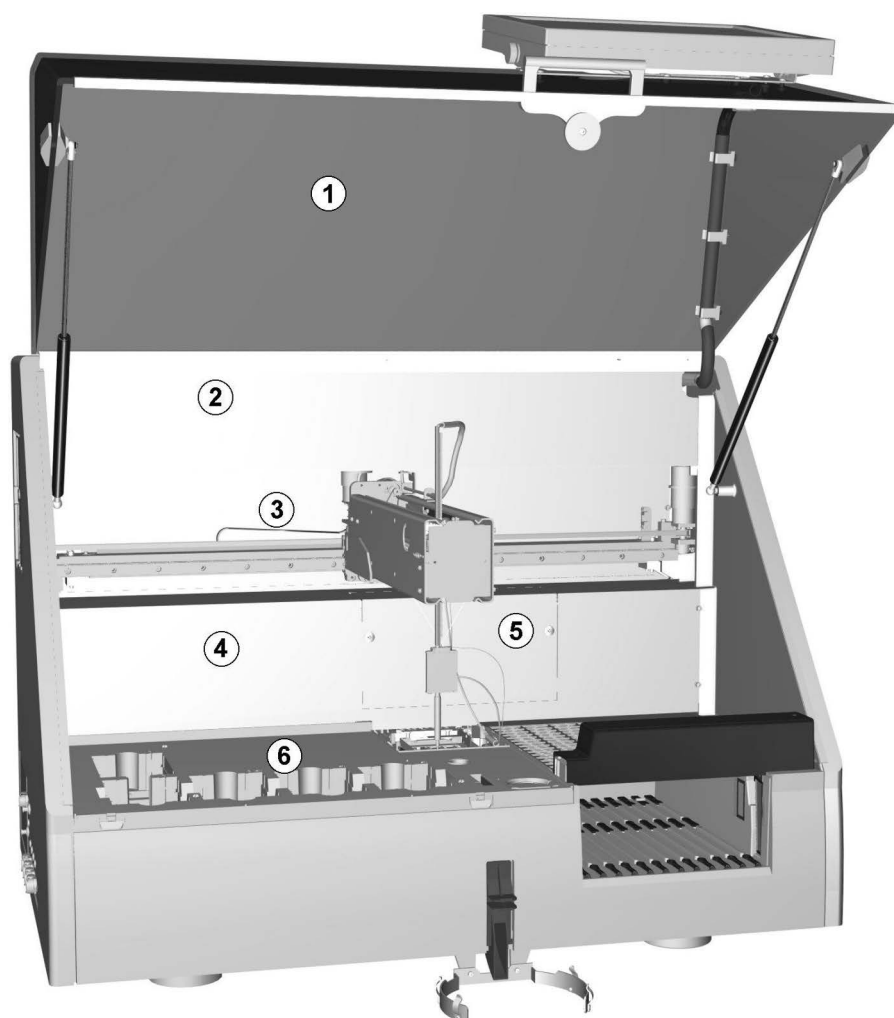


Figure 8-1: Opened instrument

- | | |
|---|-------------------------|
| 1 | Cover with touch screen |
| 2 | Top cover |
| 3 | Upper cover |
| 4 | Module cover |
| 5 | Washer service cover |
| 6 | Deck top |

8.2 ADJUSTMENT AND CALIBRATION

8.2.1 ADJUSTMENT OF LOCKING MECHANISM

ADJUSTMENT



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Close the instrument cover.
4. Check if the upper part of the locking mechanism centered on the electric magnet.
5. If not, adjust it:
 - **X-direction:**
Loose both screws (2).
Move the upper part of the locking mechanism to the correct position.
Tighten both screws (2).
 - **Y-direction:**
Loose both screws (3).
Move the upper part of the locking mechanism to the correct position.
Tighten both screws (3).

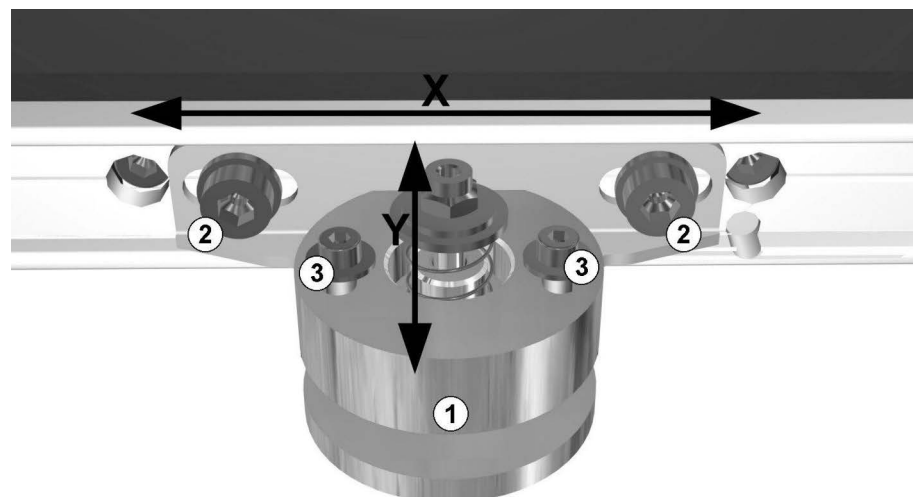


Figure 8-2: Upper part of the locking mechanism

CHECK

1. Switch the instrument on.
2. Start the service software.
The service software displays its main menu.
3. Start the COP service software module (see chapter 16.7 on page 16-29).
4. Close the instrument cover.
5. Press on the **Lock** button. An audible click will be sounded.
6. Try to open the instrument cover.
 - Instrument cover can be opened:
Readjust the upper part of the locking mechanism (see above) and check it again.
 - Instrument cover can **not** be opened:
The check is passed.
7. Press on the **Unlock** button. An audible click will be sounded.
8. Open the instrument cover.
9. Close the COP service software module.
10. Terminate the service software.

8.2.2 ADJUSTMENT OF THE INSTRUMENT COVER

SPARE PARTS

- 2 O-ring seals

ADJUSTMENT



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Open the instrument cover (1).
4. Loose both screws (4).

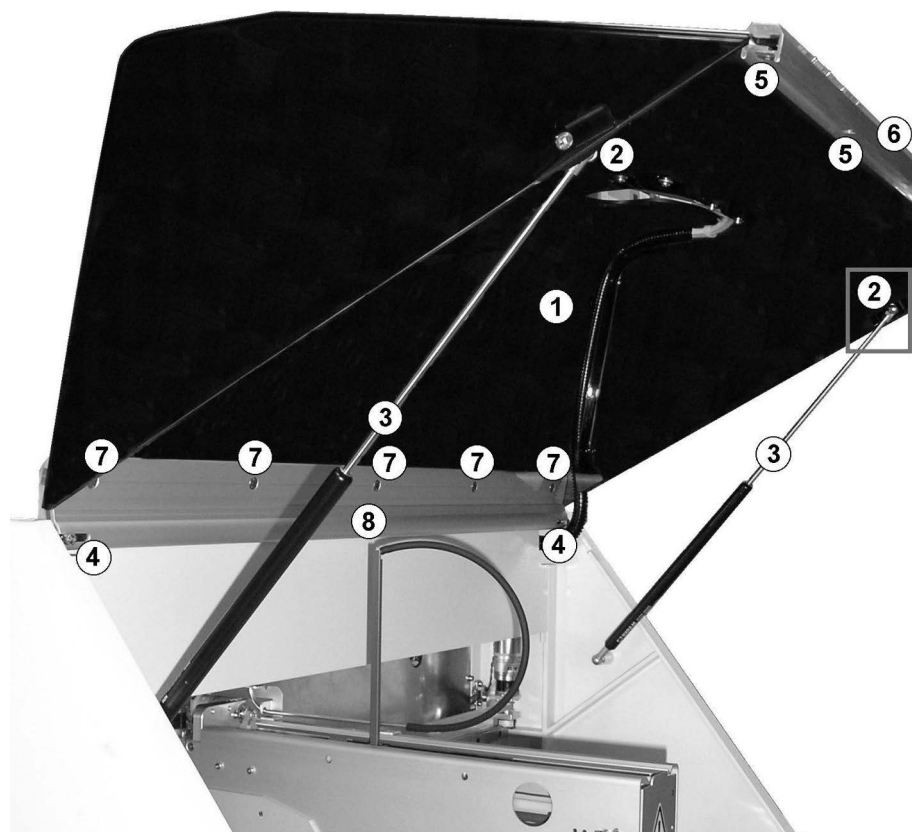


Figure 8-3: Installed instrument cover

5. Centre the instrument cover (1).
6. Move both screws/bolts (4) to the side covers and tighten it.
7. Loose the eight screws (5).
8. Push the holder (6) of the locking mechanism against the instrument cover (1).
9. Screw down both outer screws (5). Note, that the holder (6) must clamp the instrument cover (1).
10. Loose the five screws (7). Note, that the cover holder (8) must clamp the instrument cover (1).

11. Remove both O-ring seals (2), see both figures.

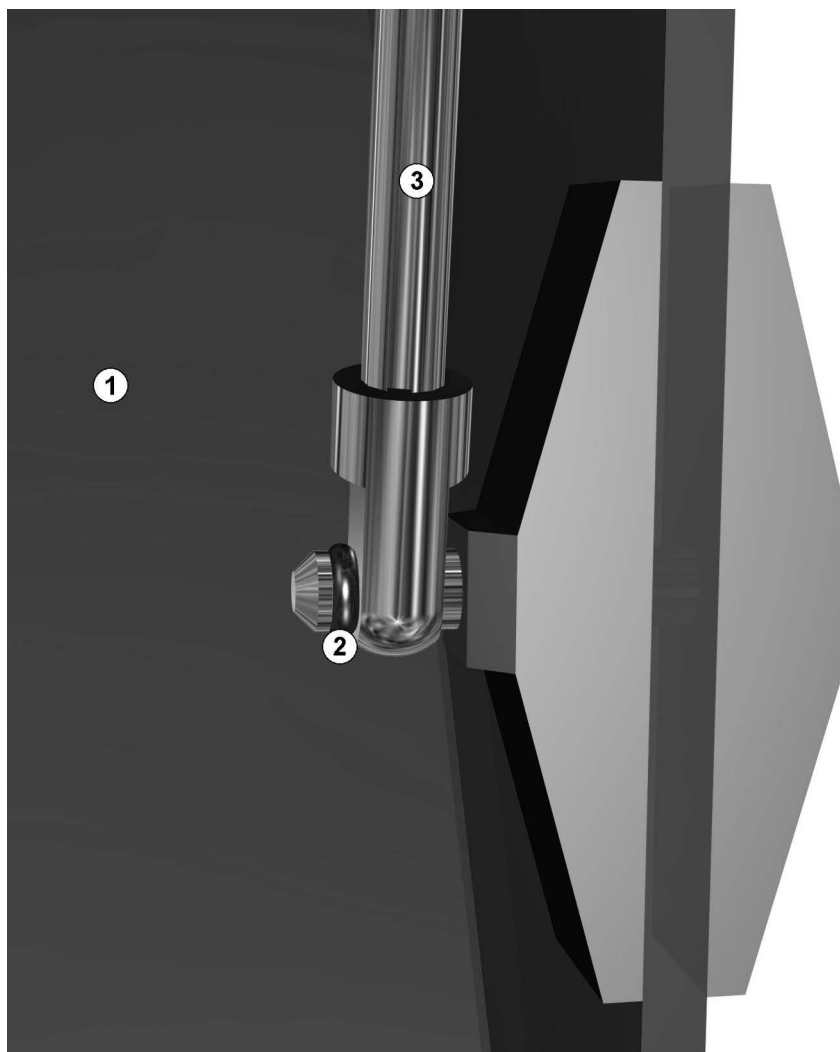


Figure 8-4: Pneumatic spring installed on the instrument cover

12. Put both pneumatic springs carefully into the instrument.
It is necessary to hold up the instrument cover (1).
13. Close the instrument cover (1).
14. Adjust the instrument cover (1). Both front edges must touch the side covers.
15. Carefully open the instrument cover (1).
16. Tighten both outer screws (7).
17. Close the instrument cover (1) to check the adjustment.
18. Carefully open the instrument cover (1).
19. Tighten all screws (7).
20. Close the instrument cover (1) to check the adjustment.
21. Push the holder (6) of the looking mechanism against the front edge.
22. Carefully open the instrument cover (1).
23. Tighten both outer screws (5).
24. Close the instrument cover (1) to check the adjustment.
25. Carefully open the instrument cover (1).
26. Tighten all screws (5).
27. Close the instrument cover (1) to check the adjustment.

28. Install both pneumatic springs (3).
29. Push the new O-ring seals (2) over the holding pins into the notches.
30. Check the function of the instrument cover.
31. Adjust the locking mechanism (see chapter 8.2.1 on page 8-3).

8.2.3 ADJUSTMENT OF THE IFA BAY (OPTIONAL)

TOOLS AND ACCESSORIES

- Spirit level
- Wrench (8 and 10)

ADJUSTMENT



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Insert the IFA bay (1).

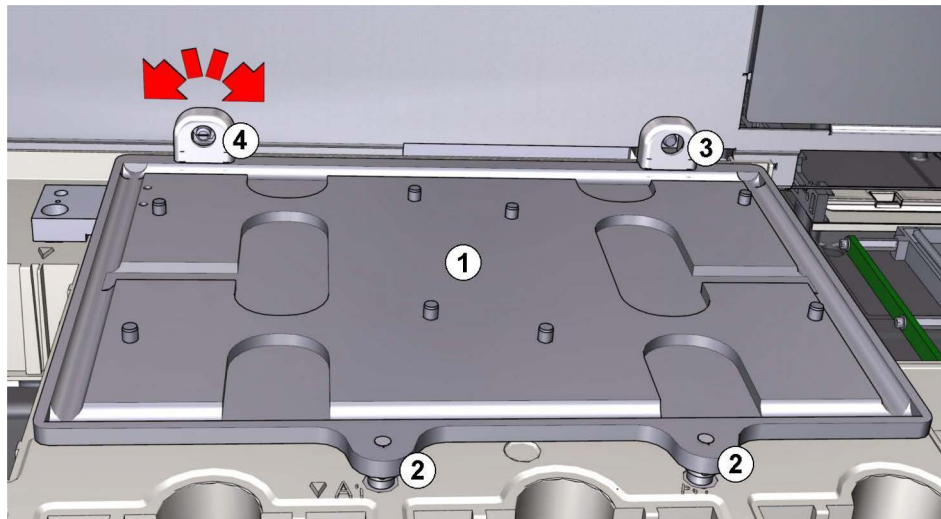


Figure 8-5: IFA bay and eccentric tappet

4. Check that both front holders (2) are properly engaged.
5. Check the following conditions:
 - The IFA bay must rest on bolt (3) and eccentric tappet (4).
 - The IFA bay must be in all directions horizontal (use spirit level).
6. If necessary adjust the eccentric tappet (4) with the wrenches (use the slit only for orientation):
 - Remove the IFA bay (1).
 - Remove the deck top (see chapter 8.3.1 on page 8-9).
 - Remove the module cover (see chapter 8.3.3 on page 8-11).
 - Adjust the eccentric tappet (4) with the wrenches.
 - Install the module cover (see chapter 8.3.3 on page 8-11).
 - Install the deck top (see chapter 8.3.1 on page 8-9).
 - Insert the IFA bay (1).
 - Check the IFA bay adjustment (see above).
7. Teach all IFA bay positions (see chapter 20.3.9 on page 20-40 and chapter 20.3.10 on page 20-41).

8.3 TROUBLESHOOTING AND REPAIRS

This section contains instructions for removing and installing individual covers of the instrument, which is necessary to access modules located underneath. Follow the instructions in the individual sections.

8.3.1 HANDLING OF DECK TOP

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Lift the deck top (1) on both clamps (2) up and remove it.

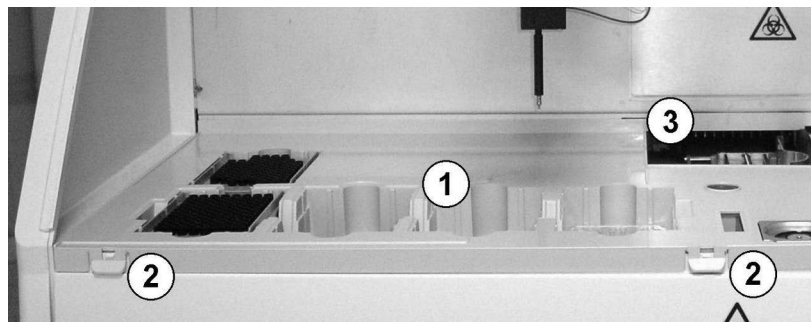


Figure 8-6: Deck top

INSTALLATION

4. Insert the deck top (1) into the notch of the module cover (3). The lower rim of the backside of the deck top must be inserted under the module cover. Flap the deck top carefully down onto the instrument platform. The deck top can be slightly bent so that it finds its way into the structure of the instrument platform.
Note the audible clicks of **both** clamps (2).
5. Make sure that the deck top is inserted completely into the structure of the instrument platform. It must not be possible to push the deck top further down. Otherwise, the precision of the pipettor positioning (especially in z direction) can be affected.

8.3.2 HANDLING OF WASHER SERVICE COVER

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Screw both retaining screws (2) 90° counter clockwise and remove the washer service cover (1).

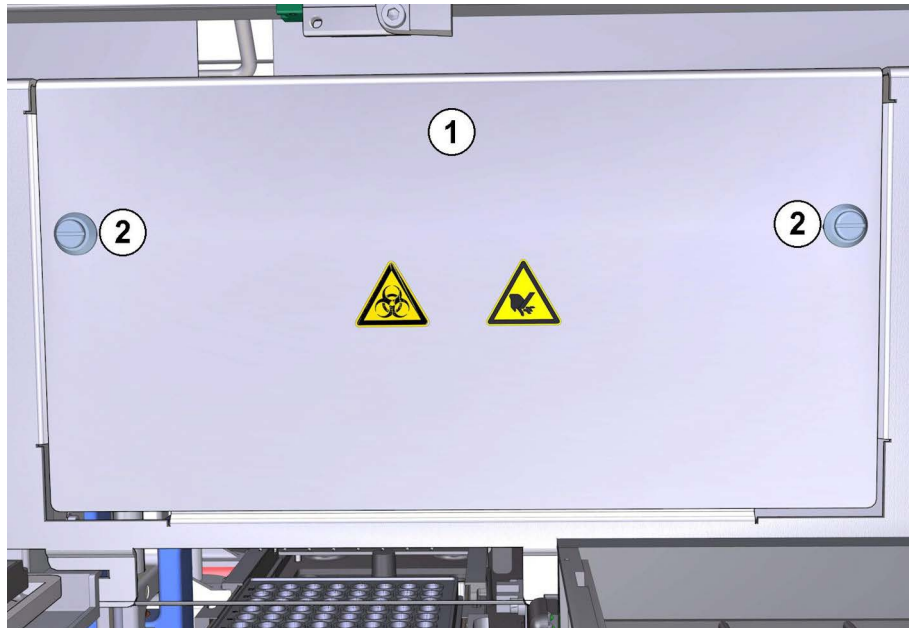


Figure 8-7: Washer service cover

INSTALLATION

4. Install the washer service cover (1) and screw both retaining screws (2) 90° clockwise.

8.3.3 HANDLING OF MODULE COVER

REMOVAL

1. Remove the washer service cover (see chapter 8.3.2 on page 8-10).
2. Remove the deck top (see chapter 8.3.1 on page 8-9).
3. Remove the four retaining screws (2).

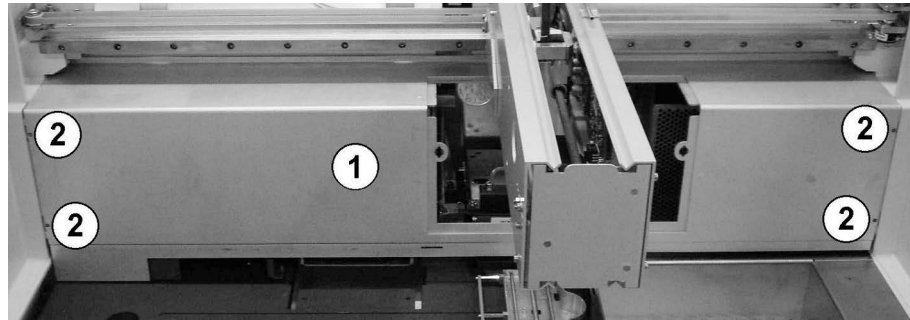


Figure 8-8: Module cover

NOTICE

Take attention to the pipettor!

4. Pull the module cover (1) to the front and remove it.

INSTALLATION

5. Install the module cover (1).
6. Tighten the four retaining screws (2).
7. Install the deck top (see chapter 8.3.1 on page 8-9).
8. Install the washer service cover (see chapter 8.3.2 on page 8-10).
9. **Gemini Combo:** Adjust the IFA bay (see chapter 8.2.3 on page 8-8).

8.3.4 HANDLING OF TOP COVER

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the four retaining screws (2).

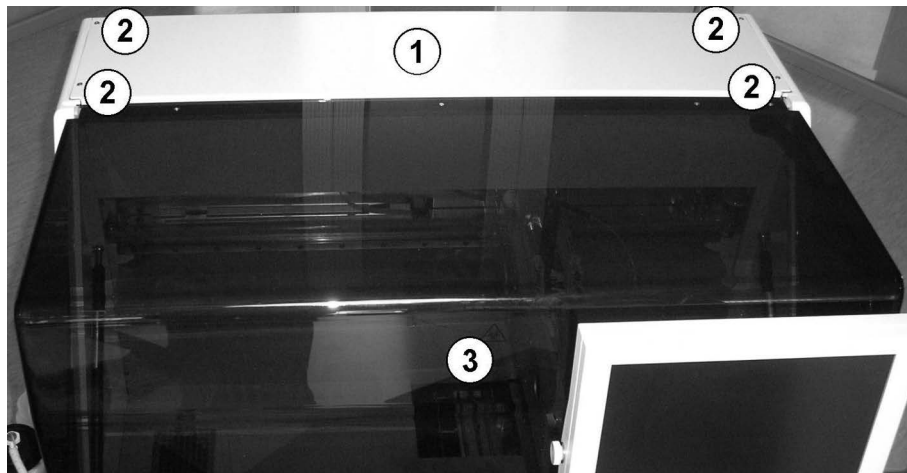


Figure 8-9: Top cover

4. Open the movable cover (3).

NOTICE

Take attention to the monitor cable!

5. Push the monitor cable (4) to the right side, pull the top cover (1) up and remove it.

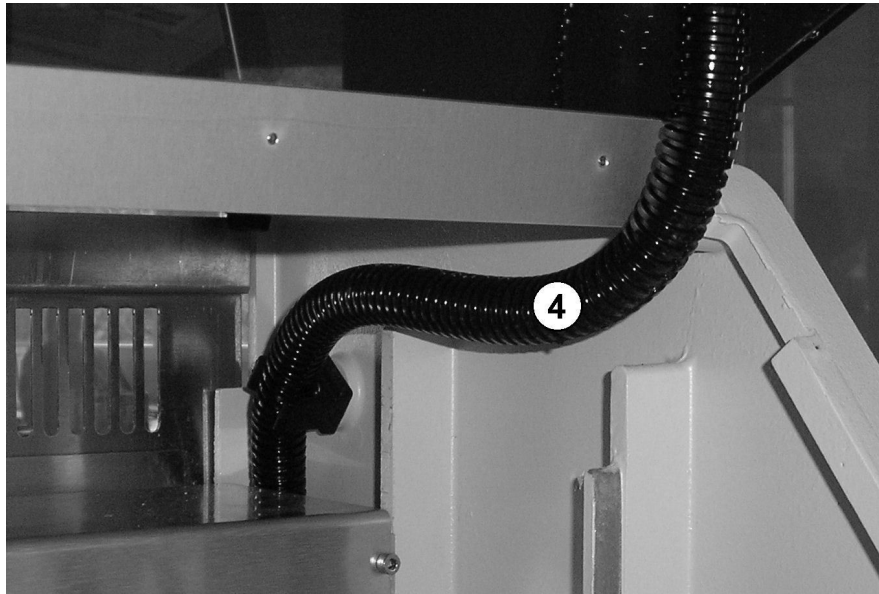


Figure 8-10: Monitor cable (with protection)

INSTALLATION

6. Push the monitor cable (4) to the right side and insert the top cover (1).
7. Tighten the four retaining screws (2).

8.3.5 HANDLING OF UPPER COVER

- Handling of Upper Cover (Old Pipettor Versions) (see chapter 8.3.5.1 on page 8-14)
- Handling of Upper Cover (Pipettor Version 3) (see chapter 8.3.5.2 on page 8-16)

8.3.5.1 HANDLING OF UPPER COVER (OLD PIPETTOR VERSIONS)

REMOVAL

1. Remove the top cover (see chapter 8.3.4 on page 8-12).
2. Pull the touch screen cable (with protection) (2) out of the cable clamp (3).

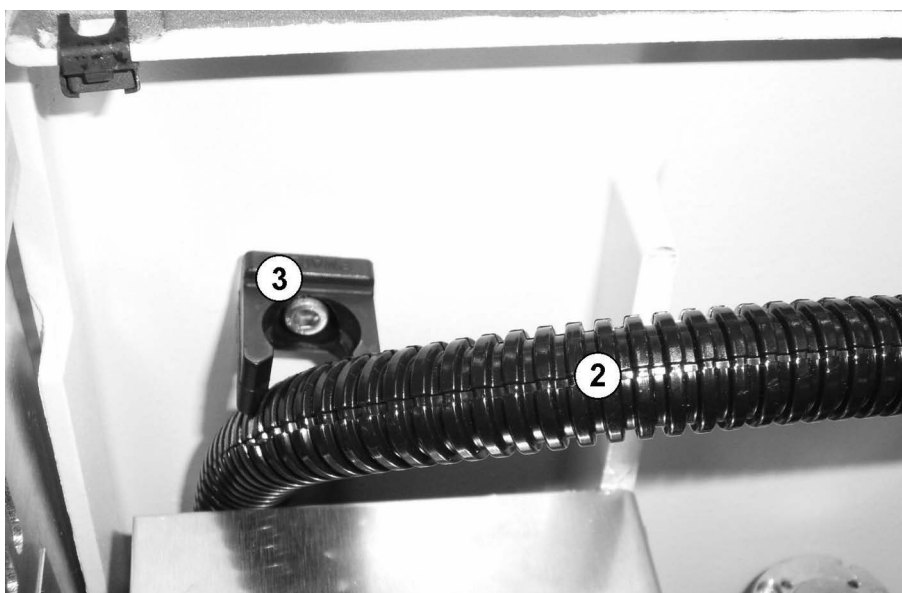


Figure 8-11: Monitor cable (with protection) and cable clamp

3. Open the retaining screw and remove the cable clamp (3) on the right side.
4. Remove the four retaining screws (7).

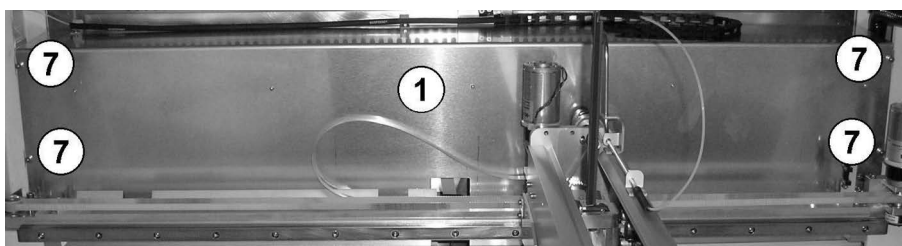


Figure 8-12: Upper cover

5. Lift the upper cover (1) up (be careful with the pipettor tubing) and remove it.

NOTICE

Necessary strain relief for the touch screen cable after removing the upper cover.

6. Install the cable clamp (3) on the right side and tighten the screw.
7. Push the flexible tube of the touch screen cable (2) into the cable clamp (3).

INSTALLATION

8. Pull the touch screen cable (with protection) (2) out of the cable clamp (3).
9. Open the retaining screw and remove the cable clamp (3) on the right side.
10. Install the upper cover (1).
11. Tighten the four screws.
12. Install the cable clamp (3) on the right side and tighten the screw.
13. Push the flexible tube of the touch screen cable (2) into the cable clamp (3).
14. Move the pipettor arm to check the clearance of the pipettor tubing and pipettor cable.
15. Install the top cover (see chapter 8.3.4 on page 8-12).

8.3.5.2 HANDLING OF UPPER COVER (PIPETTOR VERSION 3)

REMOVAL

1. Remove the top cover (see chapter 8.3.4 on page 8-12).
2. Put the upper cover (1) up.

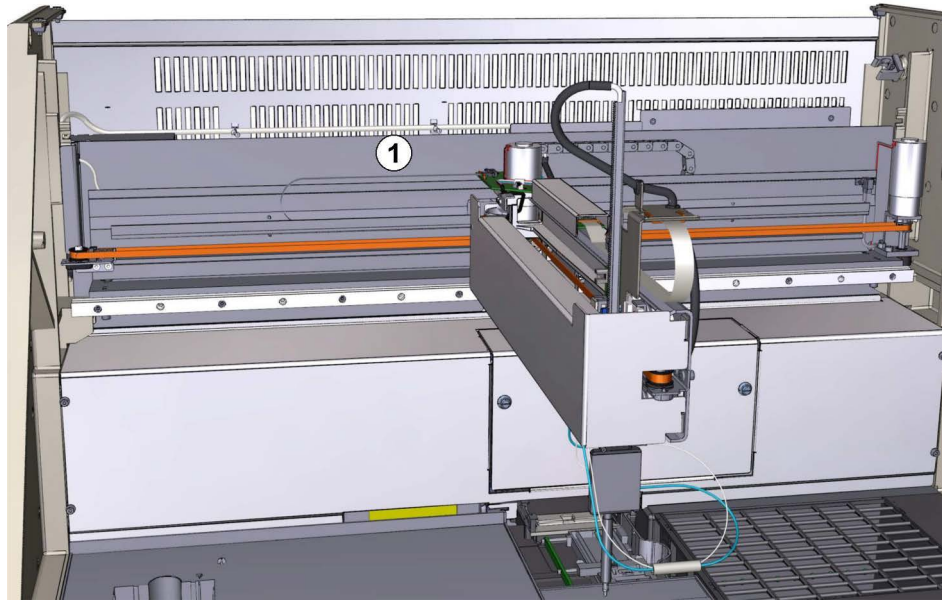


Figure 8-13: Installed upper cover

3. Move the upper cover (1) to the rear side and remove it.

INSTALLATION

4. Insert the upper cover and fit it with the keyholes to the holding screw.
5. Install the top cover (see chapter 8.3.4 on page 8-12).

8.3.6 HANDLING OF REAR PANEL

REMOVAL

1. Remove the top cover (see chapter 8.3.4 on page 8-12).
2. Remove the upper cover (see chapter 8.3.5 on page 8-14).
3. Remove the module cover (see chapter 8.3.3 on page 8-11).
4. Pull all cables and tubings, appending on the rear panel, out of the cable clamps.
5. Remove the ten retaining screws(2).

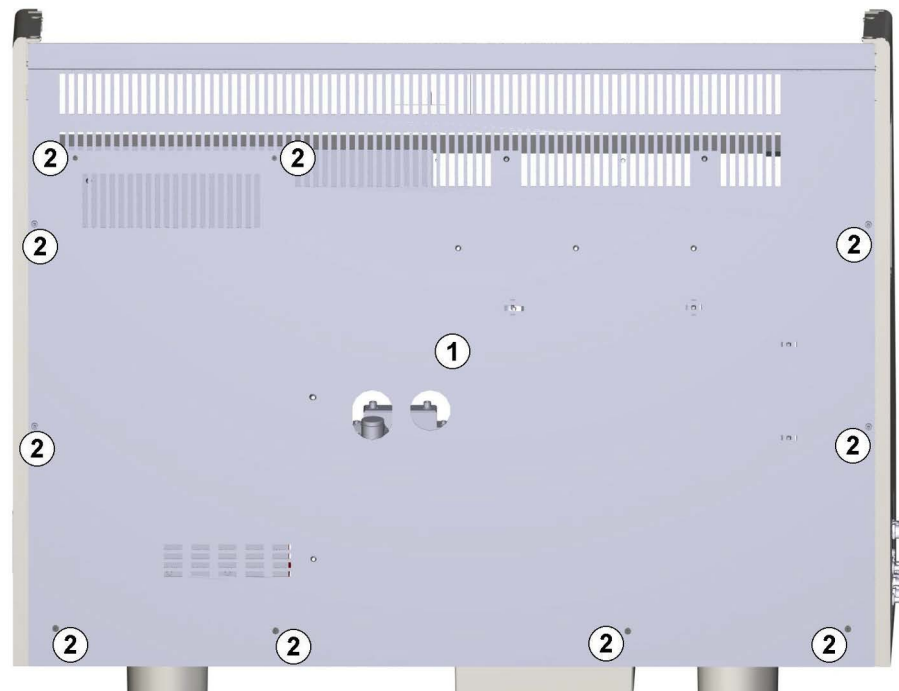


Figure 8-14: Rear panel

6. Remove the rear panel (1).

INSTALLATION

7. Install the rear panel (1) and tighten the ten retaining screws(2).
8. Push all cables and tubings into the cable clamps.
9. Install the module cover (see chapter 8.3.3 on page 8-11).
10. Install the upper cover (see chapter 8.3.5 on page 8-14).
11. Install the top cover (see chapter 8.3.4 on page 8-12).
12. Perform the electrical safety check (see chapter 9.3.2 on page 9-8).

8.3.7 REPLACEMENT OF INSTRUMENT COVER

NOTICE

Two persons are necessary for replacement!

SPARE PARTS

- Instrument cover
- 2 O-ring seals (components of the instrument cover spare part)

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Open the instrument cover.
4. Remove the touch screen and its brackets (see chapter 9.4.9 on page 9-34).
5. Remove both O-ring seals (2), see both figures.
It is necessary to hold up the instrument cover (1).

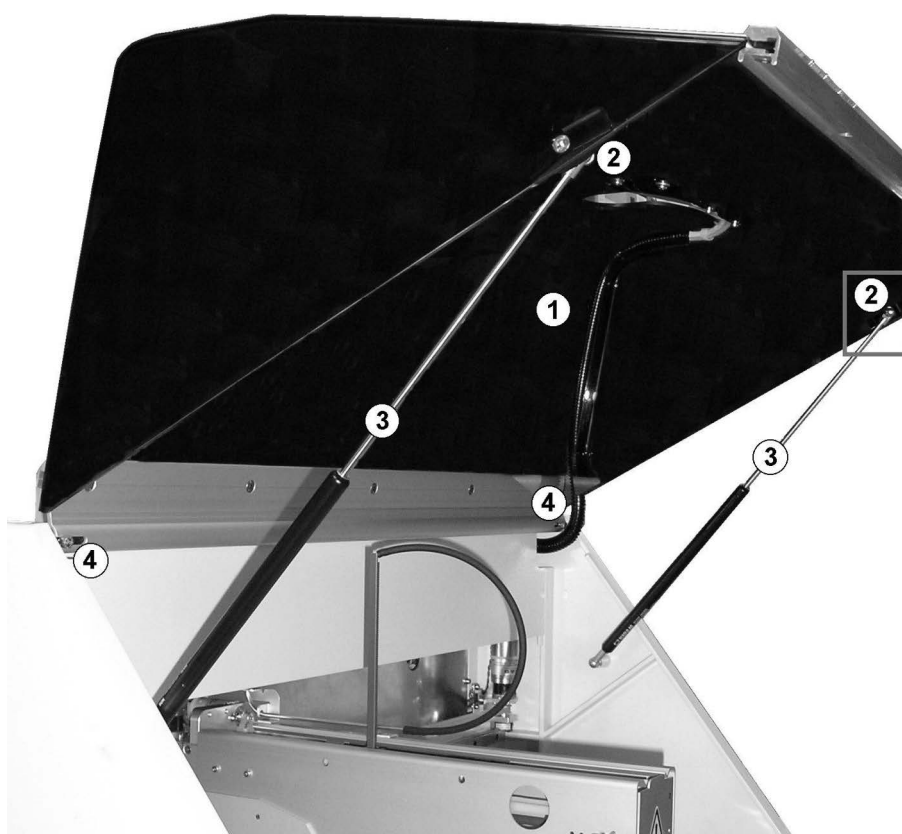


Figure 8-15: Installed instrument cover

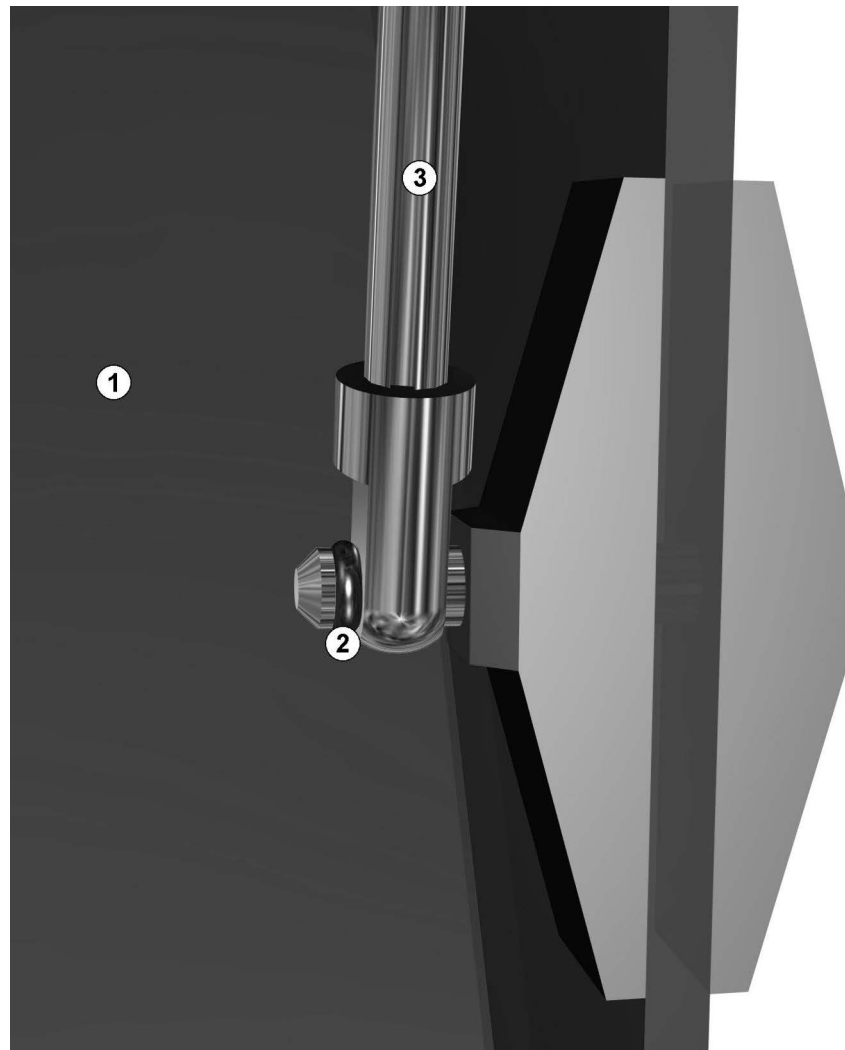


Figure 8-16: Pneumatic spring installed on the instrument cover

6. Remove both pneumatic springs (3) from the instrument cover (1).

NOTICE

Pneumatic springs

Note that the pressure of the right pneumatic spring are higher than the pressure of the other one.

7. Loose both screws (4).
8. Move both screws/bolts (4) away from the side covers.
9. Remove the instrument cover (1).

INSTALLATION

10. Install the new instrument cover (1).
11. Move both screws/bolts (4) to the side covers and Centre the instrument cover (1) tighten it.
12. Move both screws/bolts (4) to the side covers and tighten it.
13. Install the touch screen and its brackets (see chapter 9.4.9 on page 9-34).
14. Adjust the instrument cover (see chapter 8.2.2 on page 8-5).

15. Install both pneumatic springs (3).
16. Push the new O-ring seals (2) over the holding pins into the notches.
17. Check the function of the instrument cover.
18. Adjust the locking mechanism (see chapter 8.2.1 on page 8-3).

9 ELECTRONICS MODULE

This chapter describes this module in detail. In the first section "Safety" additionally to the general safety notes (see chapter 1.2 on page 1-6) safety notes are specified, which concern particularly this module. The section "Overview" gives a short overview about this module. This section is followed by a larger part containing information about maintenance, repair and testing of this module (sections "Adjustment and Calibration", "Check and Verification", "Troubleshooting and Repairs" and "Connections, Signals and Switches"). The last section "Service Software" describes only the service software module which only concerns this module.

9.1 OVERVIEW

INFO

Generations of the instrument

Note the different generations of instruments:

INSTRUMENTS
WITH SEPARATED
TOUCH SCREEN
AND INTERNAL-PC

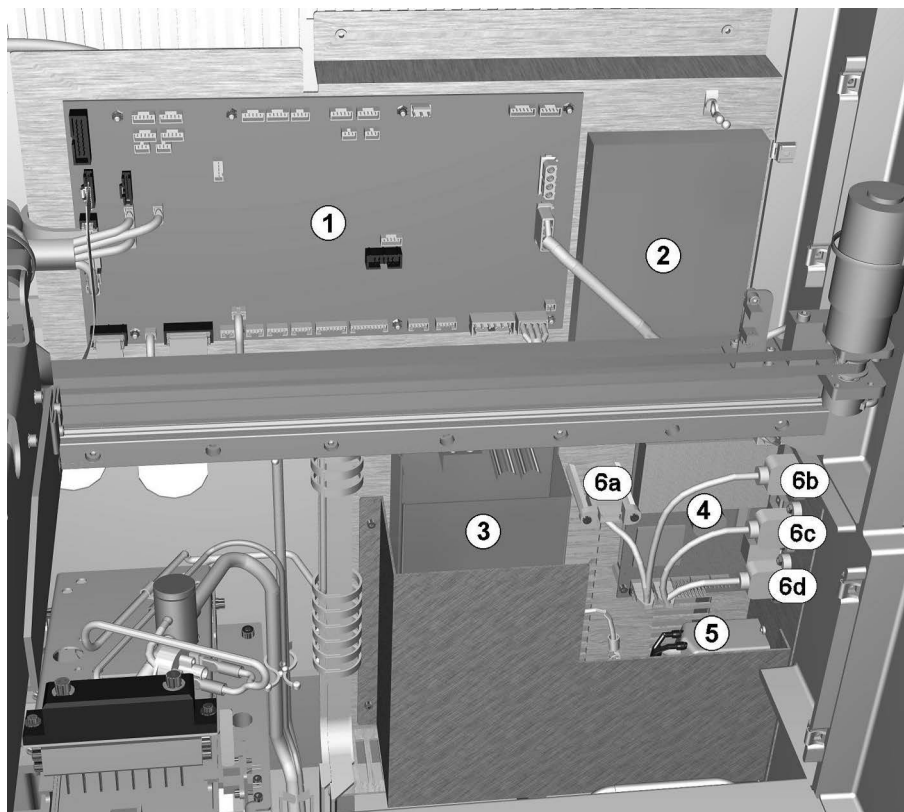


Figure 9-1: Overview electronics module (instruments with Internal-PC)

- | | |
|---|---|
| 1 | Instrument CU board |
| 2 | Hard drive |
| 3 | Power supply |
| 4 | PC motherboard |
| 5 | Main power connector with power switch and main fuses |
| 6 | USB connectors: |
| | • COP USB connector |
| | • Upper USB connector |
| | • Middle USB connector |
| | • Lower USB connector |

INSTRUMENTS
WITH ALL-IN-ONE-
PC

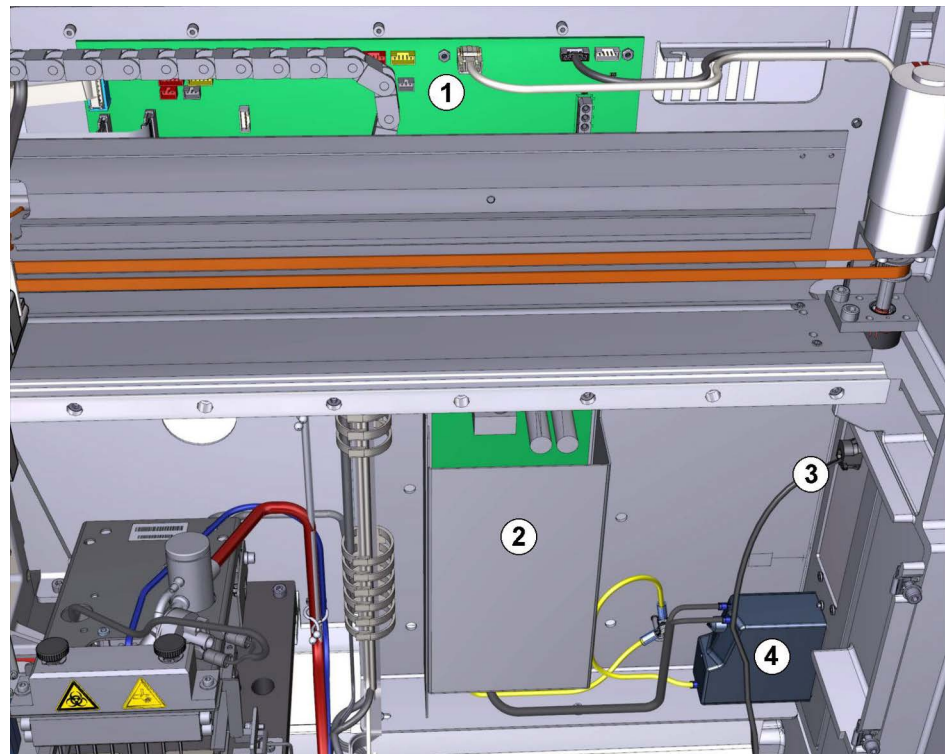


Figure 9-2: Overview electronics module (instruments with All-In-One-PC)

- | | |
|---|--|
| 1 | Instrument CU board |
| 2 | Power supply |
| 3 | USB connection from the All-In-One-PC to the COP board |
| 4 | Main power connector with power switch and main fuses |

9.2 ADJUSTMENT AND CALIBRATION

The electronics module (exception touch screen) does not need to be adjusted or calibrated. However, the EEPROM memory of the instrument CU board and the hard disk drive of the PC module stores the calibration and teaching parameters of the instrument, which, if possible, must be saved on an external medium before replacing the modules. The firmware parameters of all modules can be stored using the service software drivers of those modules (see Service Software sections of the modules). Backups of the data of the hard disk drive should be created regularly.

9.2.1 CALIBRATION OF TOUCH SCREEN

INFO

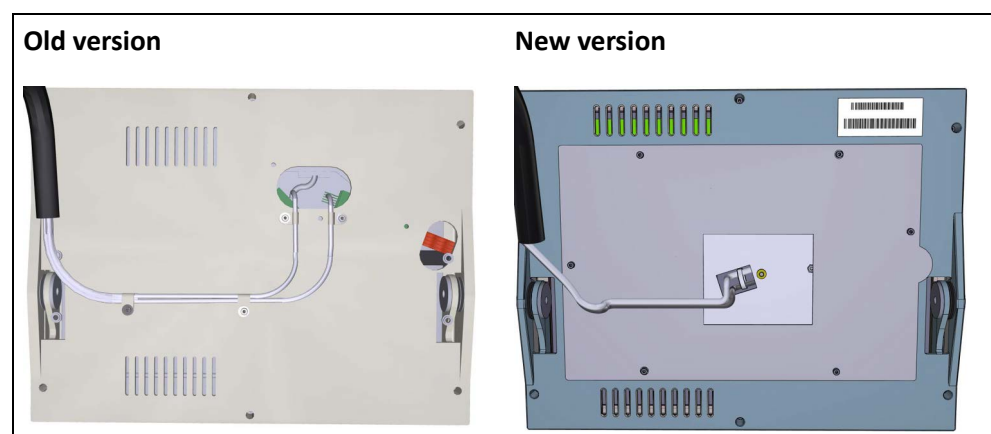
Generations of the instrument

This procedure is only for instruments with separated touch screen and Internal-PC.

INFO

It is necessary to use an external keyboard for calibration!

Differentiation of the touch screen versions (rear side):



1. Remove the touch screen (see chapter 9.4.9 on page 9-34).
2. Only new version:
 - Remove the metal cover from the rear side (four screws).
 - Open the cable cover (two screws).
3. Place the touch screen into the **GEMINI**.

4. Plug the touch screen cables into the motherboard and instrument CU board.
5. Switch on the instrument.
6. Start the Liyitouch software. You will find it on C:\Program Files\Liyitouch\Liyitouch.exe.
7. Press on the **Scan RS232** button.
The touch screen must be found on COM2. Close the message window.
8. Press **Alt + E** on the keyboard.
The Liyitouch software shows an additional tab **Engineer**.
9. Press on this additional tab.
10. Press on the **4 Wire** button.
11. Disconnect the connector (1) from the touch screen controller.

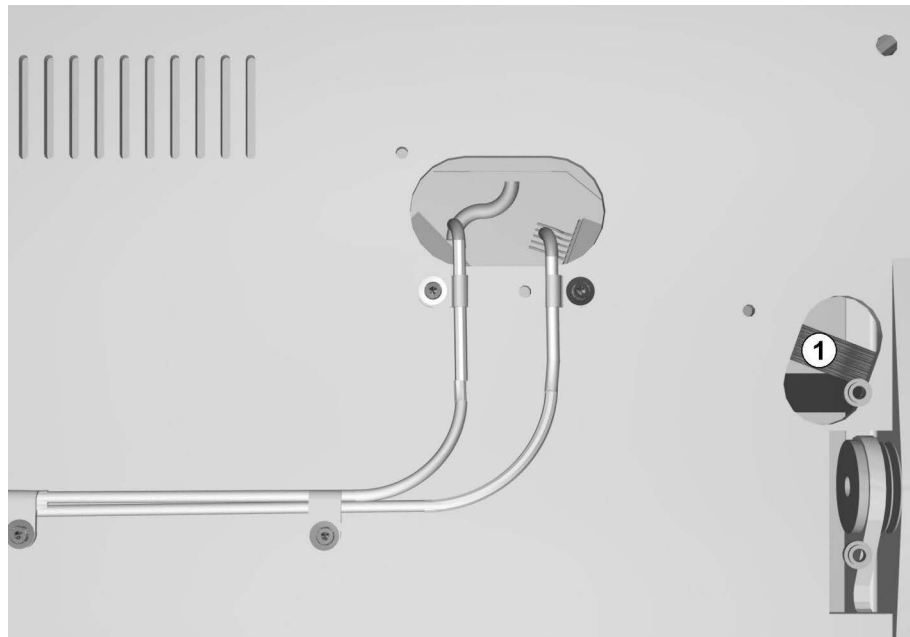


Figure 9-3: Touch screen controller connector (old version)

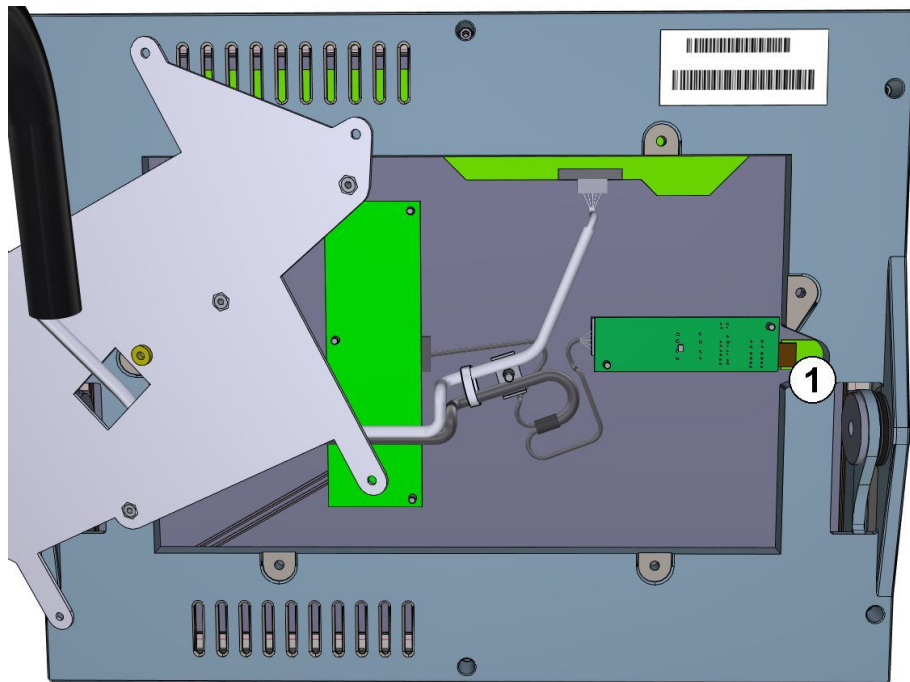


Figure 9-4: Touch screen controller connector (new version)

12. Press on the **OK** button to confirm the message.
13. Press on the **?** button of position **XL(X-)**.
14. Press on the **Set** button.
15. Repeat both steps for the other positions in the following order:
 - **XR(X+)**
 - **YU(Y+)**
 - **YD(Y-)**
16. Plug connector (1) into the touch screen controller (use the upper plug).
17. Press on the **OK** button to confirm the message.
18. Touch the flash points on the touch screen until it change to yellow, then lift.
19. Write a word (e. g. Test) on the touch screen to check the calibration.
20. Press on the **Exit** button to finish the calibration.



21. Shut down the computer and switch off the instrument.
22. Disconnect main power from the instrument.
23. Only new version:
 - Close the cable cover and tighten both screws.
 - Install the metal cover on the rear side and tighten the four screws.
24. Install the touch screen (see chapter 9.4.9 on page 9-34).

9.3 CHECK AND VERIFICATION

In this section information about the testing of certain components can be found. As the instrument CU board controls the reader, the pipettor, the washer and the plate transport, it can be checked by using the service software drivers of these modules.

9.3.1 REQUIREMENTS TO CHECK THE INSTRUMENT CU BOARD

CAN communication between the modules will be only reliable if all CAN devices are connected to the instrument CU board.

That means, if for trouble shooting all cables are disconnected from the instrument CU board in order to find out which might be the "bad" cable, the flat cables to the COP board, the pipettor module, the incubator module and the diluter pump (VP9101) must be still connected to "their" respective boards. Otherwise, the CAN bus is not terminated, which can cause communication problems.

9.3.2 ELECTRICAL SAFETY TEST

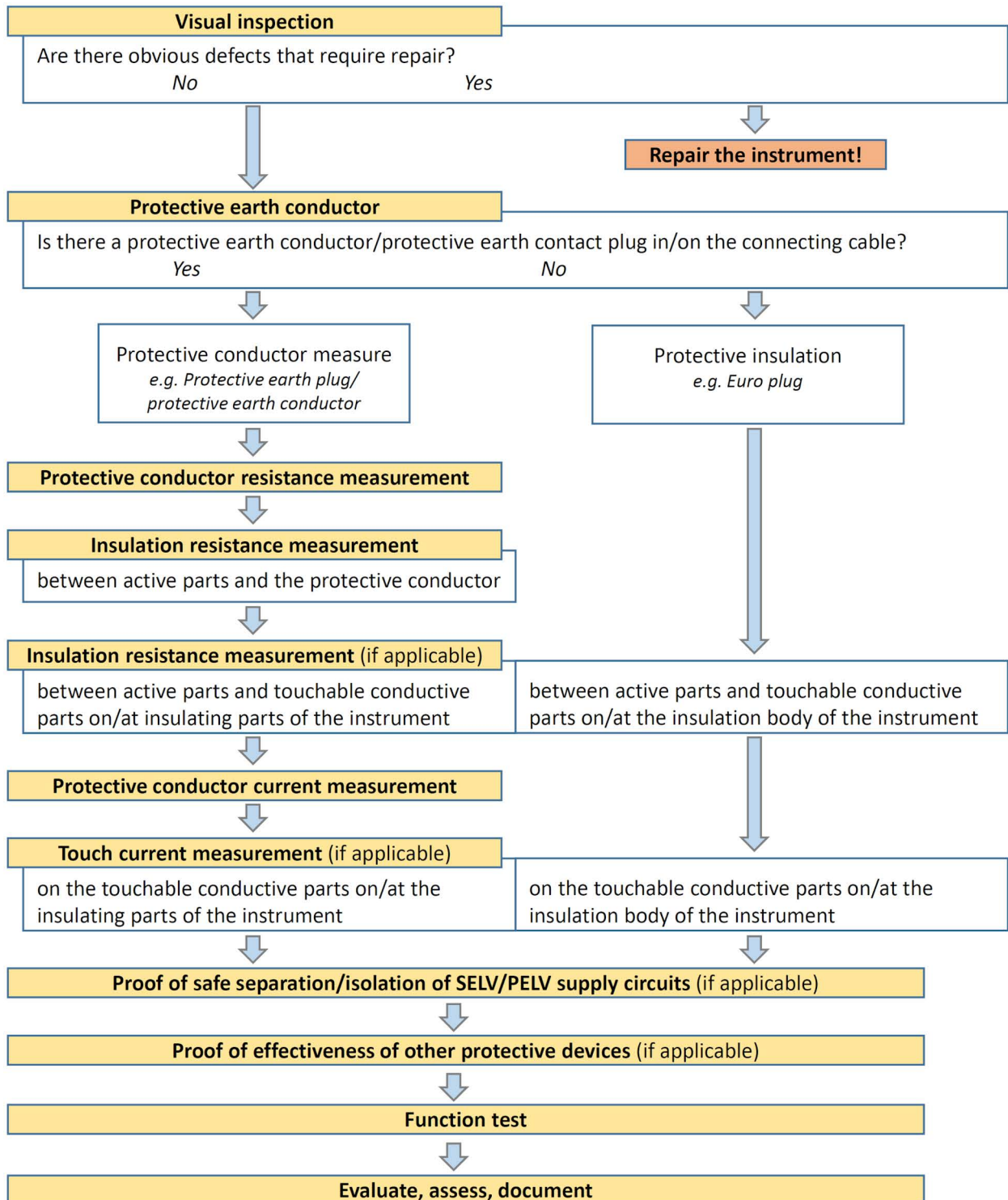
This chapter defines the procedure for performing an electrical safety test according to the EN 50678 standard on installed instruments.

The electrical safety test must be performed:

- after installation
- after repair work on:
 - mains inlet module (EMC filter and main power switch included)
 - wiring between main power switch and power supply
 - power supply
 - parts connected to protective earth contact

Periodical check shall be performed in case yearly.

TESTS AND TEST PROCEDURE



* SELV = Safety Extra Low Voltage without earth conductor or protective earth conductor

* PELV = Protective Extra Low Voltage with protective earth conductor

Figure 9-5: Tests and test procedure

**REQUIREMENTS
FOR THE TEST
EQUIPMENT**

The test instrument used for the test shall comply with the EN 50678 standard. The test instrument shall be calibrated. The calibration should be traceable to a reference standard. The calibration period shall be specified accordingly:

- Manufacturer's recommendation
- Frequency of use

**TEST FAILURES
AND THE
CONSEQUENCES
THEREOF**

If one or more tests fail, a fault investigation shall be carried out and documented in the service report.

After a successful repair and a successful electrical safety test, the instrument can be released for use.

If an instrument cannot be repaired, it shall not be released for use. In this case, disconnect it from the power supply and label it.

**SUCCESSFUL
SAFETY TEST AND
TEST PROTOCOL**

After a successful electrical safety test, the instrument can be released for use. The electrical safety test should be documented in the service report. If the instrument generates a test protocol, then this should be included with the service report.

9.3.2.1 ELECTRICAL SAFETY TEST PROCEDURE OF INTERNAL POWER SUPPLY

DANGER



High Voltage

The instrument is tested with a high voltage of up to 2000 V. Contact can be deadly or result in serious injury.

- Do not touch the instrument while it is being tested.

NOTICE

Use of the test equipment

Incorrect operation of the test equipment can lead to damage to the instrument or to incorrect test results.

- The handling of the test device shall be trained.
- Follow the instructions on the test equipment or the operating instructions (user manual).

1. Switch off the instrument.
2. Check the mains connector cable for visible damages (e.g. cable insulation, connectors).
3. If damaged, **replace** the mains connector cable.
4. Disconnect all connectors to external devices (e.g. network cables).
5. Remove all mass storage devices plugged into the PC (e.g. USB flash drive).
6. Connect the test equipment to the instrument.
Use the market test point!
Use the mains connector of the internal power supply!



Figure 9-6: Mains connector and test point

7. Start the electrical safety check.

8. Test was successful:
 - a. Remove the test equipment.
 - b. Reconnect all external devices to the instrument.
9. Test was **not** successful:
 - a. Remove the test equipment.
 - b. Repair the instrument or lock it for use.
 - c. Repeat the test after the repair.

9.3.2.2 ELECTRICAL SAFETY TEST PROCEDURE OF EXTERNAL POWER SUPPLY

⚠ DANGER



High Voltage

The instrument is tested with a high voltage of up to 2000 V. Contact can be deadly or result in serious injury.

- Do not touch the instrument while it is being tested.

NOTICE

Use of the test equipment

Incorrect operation of the test equipment can lead to damage to the instrument or to incorrect test results.

- The handling of the test device shall be trained.
- Follow the instructions on the test equipment or the operating instructions (user manual).

1. Switch off the instrument.
2. Check the external power supply for visible damages (e.g. cable insulation, housing, connectors).
3. If damaged, **replace** the external power supply.
4. Disconnect all connectors to external devices (e.g. network cables).
5. Remove all mass storage devices plugged into the PC (e.g. USB flash drive).
6. Connect the test equipment to the instrument.
Use the market test point!
Use the mains connector of the internal power supply!



Figure 9-7: Mains connector and test point

7. Start the electrical safety check.

8. Test was successful:
 - a. Remove the test equipment.
 - b. Reconnect all external devices to the instrument.
9. Test was **not** successful:
 - a. Remove the test equipment.
 - b. **Replace** the external power supply or lock the complete instrument for use.
 - c. Repeat the test after the replacement.

9.4 TROUBLESHOOTING AND REPAIRS

This section contains instructions for the repair of individual components of the electronics module. After several repair works it is required that the individual components are readjusted. Follow the instructions in the individual sections.

9.4.1 REPLACEMENT OF MOTHERBOARD COVER (INTERNAL-PC)

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the deck top (see chapter 8.3.1 on page 8-9).
4. Remove the module cover (see chapter 8.3.3 on page 8-11).
5. Remove the four retaining screws (2).

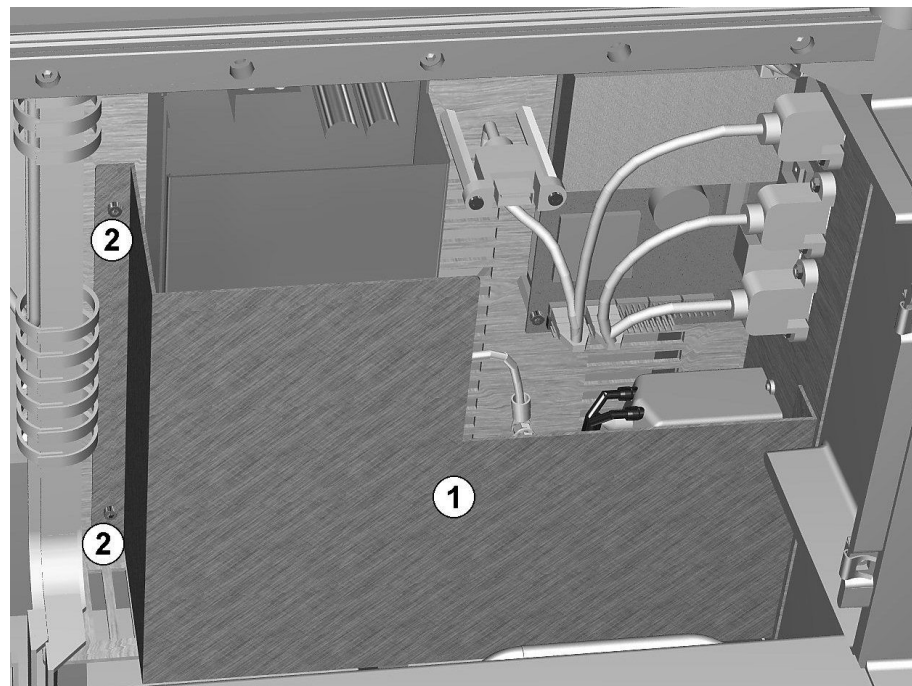


Figure 9-8: Motherboard cover

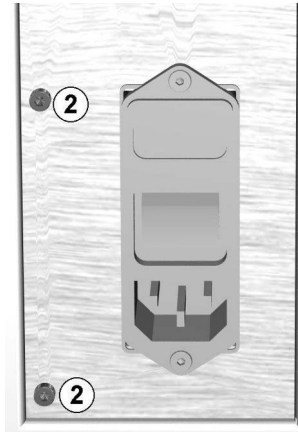


Figure 9-9: Screws next to the main power connector

6. Remove the motherboard cover (1).

INSTALLATION

7. Install the motherboard cover (1).
8. Tighten the four retaining screws (2).
9. Install the module cover (see chapter 8.3.3 on page 8-11).
10. Install the deck top (see chapter 8.3.1 on page 8-9).

9.4.2 REPLACEMENT OF INSTRUMENT CU BOARD

INFO

Note information about the CAN-bus (see chapter 9.3.1 on page 9-7)!

SAVE PARAMETERS

1. If possible, start the service software.
2. Load the washer module driver (see chapter 17.8 on page 17-38).
3. Press on the **Save Params** button to store the adjustment values of the washer.
4. Close the washer module driver.
5. Load the reader module driver (see chapter 11.8 on page 11-25).
6. Press on the **Save** button to store the adjustment values of the photometer.
7. Close the reader module driver.
8. Load the plate transport module driver (see chapter 15.6 on page 15-21).
9. Press on the **Save** button to store the adjustment values of the plate transport.
10. Close the plate transport module driver.
11. Terminate the service software.

REMOVAL



12. Shut down the computer and switch off the instrument.
13. Disconnect main power from the instrument.
14. Remove the top cover (see chapter 8.3.4 on page 8-12).
15. Remove the upper cover (see chapter 8.3.5 on page 8-14).
16. Remove the deck top (see chapter 8.3.1 on page 8-9).
17. Remove the module cover (see chapter 8.3.3 on page 8-11).

NOTICE

Note the socket number onto the plugs (see chapter 19.2.1 on page 19-11)!

18. Disconnect all connectors from the instrument CU board (1).
19. Remove the four nuts (2) and remove the instrument CU board (1).
Note: Newer instruments have on the lower side a board holder instead of screws.

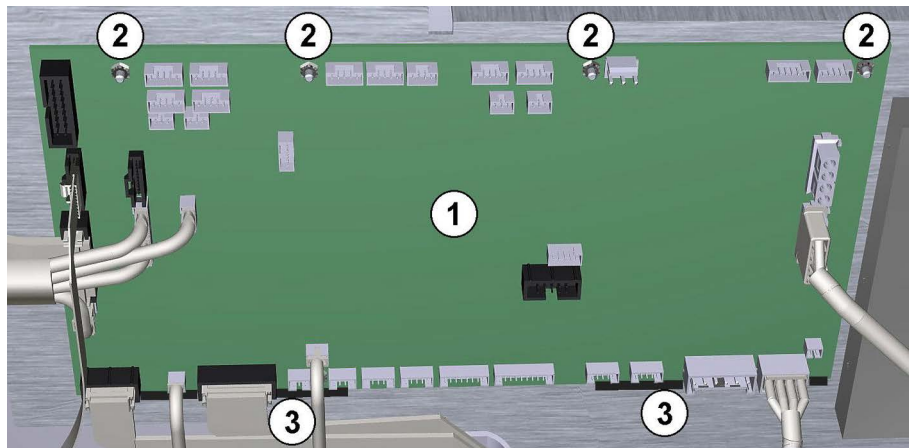


Figure 9-10: Instrument CU board

20. Remove the instrument CU board (1).

INSTALLATION

21. Push the new instrument CU board (1) into board holder (3) and tighten the four nuts (2).
Note: Newer instruments have on the lower side a board holder instead of screws.
22. Plug all connectors into the instrument CU board (1) (see chapter 19.2.1 on page 19-11).
23. Install the module cover (see chapter 8.3.3 on page 8-11).
24. Install the deck top (see chapter 8.3.1 on page 8-9).
25. Install the upper cover (see chapter 8.3.5 on page 8-14).
26. Install the top cover (see chapter 8.3.4 on page 8-12).
27. Install the firmware on the new instrument CU board (see chapter 21 on page 21-1).
28. Start the service software.
29. Load the washer module driver (see chapter 17.8 on page 17-38).
30. If you have a saved washer parameter file:
 - Press on the **Load Params** button and select the correct parameter file.
31. If you have **not** a saved washer parameter file:
 - Adjust and calibrate the washer (see chapter 17.4 on page 17-8).
32. Close the washer module driver.
33. Load the reader module driver (see chapter 11.8 on page 11-25).
34. If you have a photometer parameter file:
 - Press on the **Load** button and select the correct parameter file.
35. If you have **not** a saved photometer parameter file:
 - Check the filter configuration (see chapter 11.8 on page 11-25).
 - Execute the filter adjustment procedure (see chapter 19.4.1 on page 19-18).
 - Execute the verification plate process to verify the new filter(s).
36. Close the reader module driver.
37. Load the plate transport module driver (see chapter 15.6 on page 15-21).
38. If you have a saved plate transport parameter file:
 - Press on the **Load** button and select the correct parameter file.
39. If you have **not** a saved plate transport parameter file:
 - Teach the plate transport module (see chapter 20.4 on page 20-44).

40. Close the plate transport module driver.
41. Terminate the service software.

9.4.3 REPLACEMENT OF PC MOTHERBOARD (INTERNAL-PC)

INFO

Generations of the instrument

This procedure is only for instruments with separated touch screen and Internal-PC.

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the deck top (see chapter 8.3.1 on page 8-9).
4. Remove the module cover (see chapter 8.3.3 on page 8-11).
5. Remove the motherboard cover (see chapter 9.4.1 on page 9-15).

NOTICE

Twist and disrupt hazard!

Connector CN8 has very thin pins and cables!

6. Disconnect the connectors (CN3, CN6, CN8, and CN9) from the PC motherboard (1).

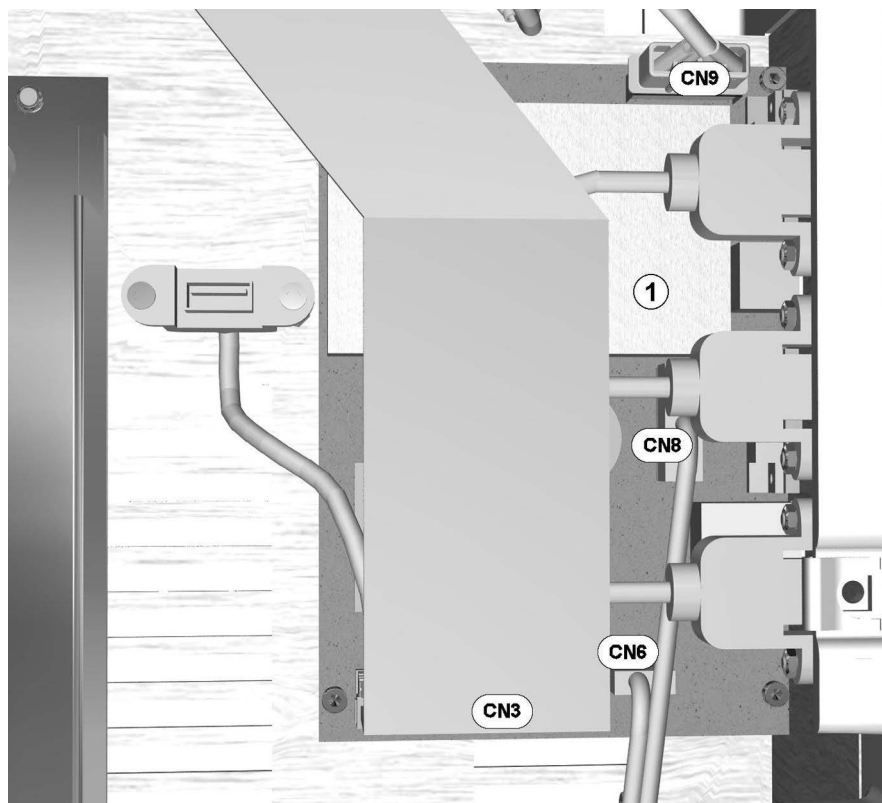


Figure 9-11: Installed PC motherboard

7. Disconnect both USB connectors (CN1, and CN2) from the PC motherboard (1).

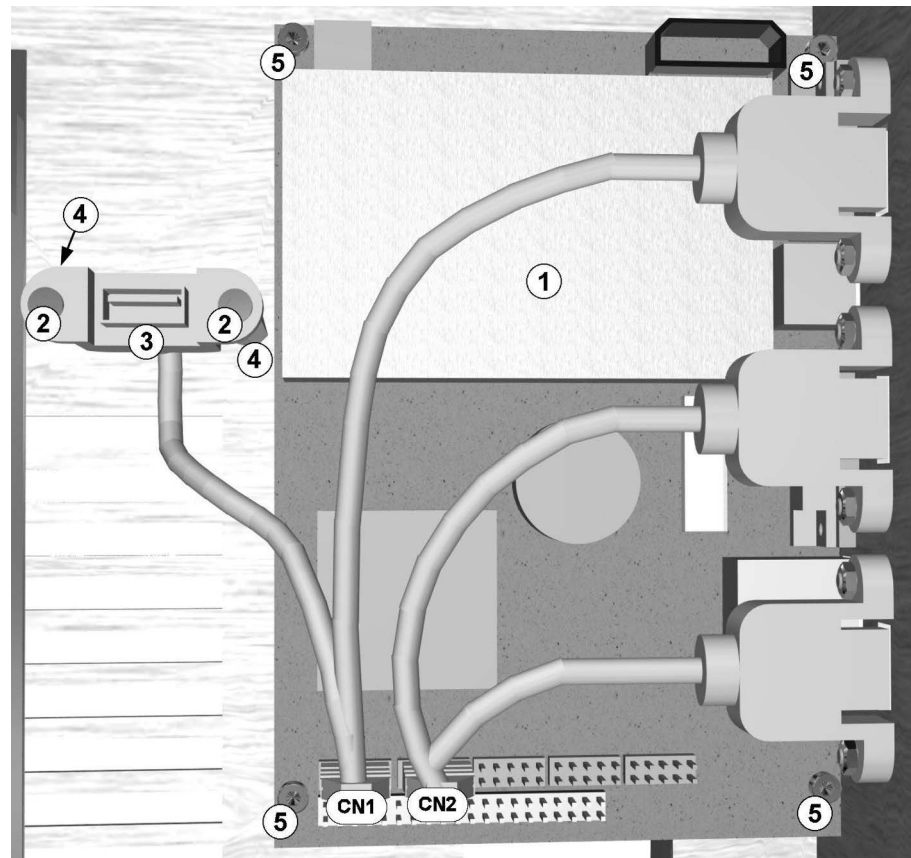


Figure 9-12: PC motherboard (only with USB connectors)

8. Remove both screws (2).
 9. Remove the USB connector (3).
 10. Remove both spacers (4).
 11. Remove the four screws (5).
 12. Remove the PC motherboard (1).
- INSTALLATION**
13. Install the new PC motherboard (1) and tighten the four screws (5).
 14. Tighten both spacers (4).
 15. Install the USB connector (3) and tighten both screws (2).

NOTICE

Twist and disrupt hazard!

Connector CN8 has very thin pins and cables!

16. Plug the connectors (CN1, CN2, CN3, CN6, CN8, and CN9) into the PC motherboard (1).

Notes:

- **CN1:**
Upper row: Upper USB connector (external)
Lower row: Loading bay USB connector

- **CN2:**
Upper row: Middle USB connector (external)
Lower row: Lower USB connector (external)
 - **CN3:** The red mark (pin1) must be on the left side!
 - **CN6:** The blue cable must be on the left upper pin!
 - **CN8:** The notch of the plug must be on the right side!
17. Install the motherboard cover (see chapter 9.4.1 on page 9-15).
 18. Install the module cover (see chapter 8.3.3 on page 8-11).
 19. Install the deck top (see chapter 8.3.1 on page 8-9).
 20. If you have installed a **new** PC motherboard, it is necessary to check the correct working of the operating system.

BIOS SETTINGS

BIOS settings of exchanged PC motherboards have to be adjusted. With default settings, the touch screen is not recognized:

INFO

It is necessary to use an external keyboard and an external monitor!

21. Plug in the external keyboard and the external monitor.
22. Start the instrument and press on the *Delete* key to enter the BIOS Setup Utility.
23. Select the option **Load Optimized Defaults** in the BIOS main menu and confirm the following query with *Y*.
24. Set the following settings in the menu **Advanced Chipset Features**:
 - On-Chip VGA: Enabled
 - On-Chip Frame Buffer Size: 8MB
 - Boot Display: CRT+LCD
 - Panel Scaling: Auto
 - Panel Type (LVDS): 1024x768 18Bit
 - TV Standard: NTSC
25. Save all changes by selecting **Save & Exit Setup** in the main menu. Confirm the following query with *Y*.
26. The internal monitor is recognized now by the instrument. In case of any additional display problems, adjust the display properties in Windows to:
 - Screen resolution: 1024 x 768
 - Color quality: highest (32 bit)

WINDOWS

27. Enter the **Product Key** from the Windows label on the right side of the instrument (near by the mains switch).
28. To activate Windows, please select **Activate Windows** from the **Start** menu. Follow the instructions. Please use the option via phone and follow the instructions. You will get an activation key which you have to enter.
29. Check the correct working of the operating system.

9.4.4 REPLACEMENT OF RAM MODULE (INTERNAL-PC)

INFO

Generations of the instrument

This procedure is only for instruments with separated touch screen and Internal-PC.

REMOVAL

1. Remove the PC motherboard (see chapter 9.4.3 on page 9-20).
2. Turn the PC motherboard on its backside.
3. Pull on both clamps (2 - see arrows) and lift up the RAM module (1 - see arrow).

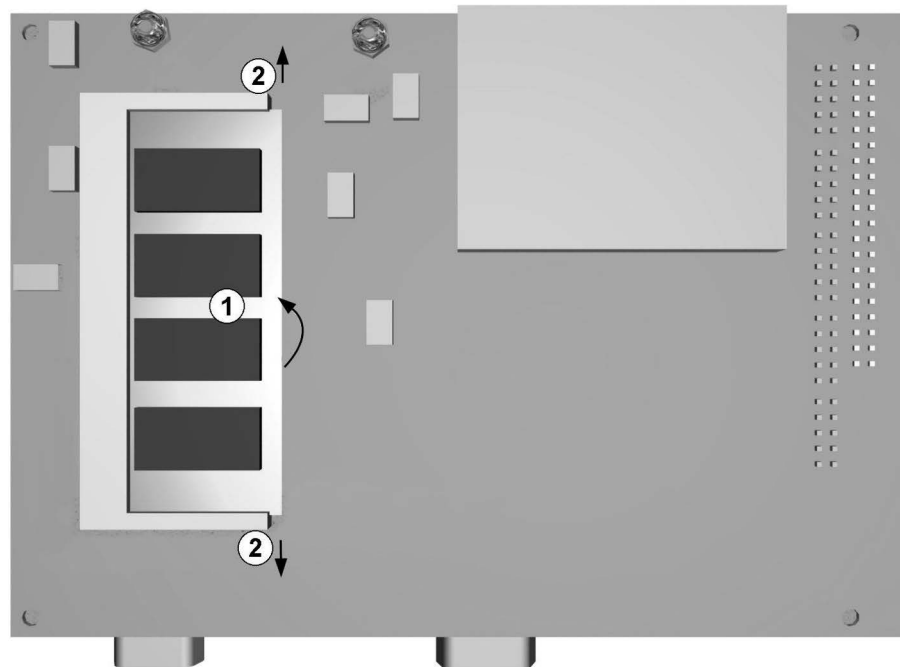


Figure 9-13: Backside of the PC motherboard

4. Pull the RAM module (1) out of its socket and remove it.

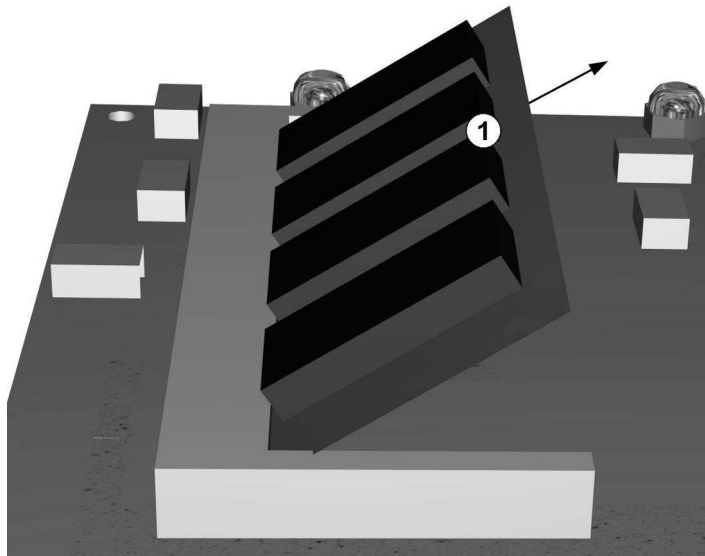


Figure 9-14: RAM module - removal position

INSTALLATION

5. Insert the new RAM module (1).
Put the RAM module by hand into the socket. Do not use force!
6. Press the RAM module (1) down.
Note the audible click of the clamps.
7. Install the PC motherboard (see chapter 9.4.3 on page 9-20).

9.4.5 REPLACEMENT OF HARD DRIVE (OLD VERSION OF INTERNAL-PC)

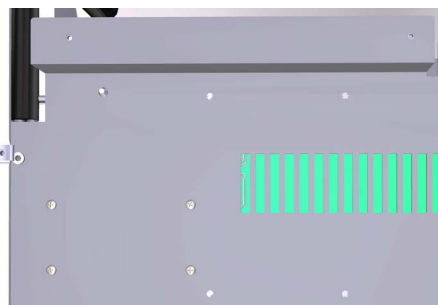
INFO

Generations of the instrument

This procedure is only for instruments with separated touch screen and Internal-PC.

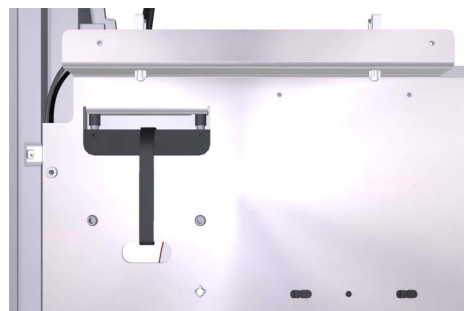
Differentiation of the hard disk versions (rear side, behind the rear panel):

Old version



Held with four screws (see below)

New version



Held with a hook-and-loop fastener and two screws (see chapter 9.4.6 on page 9-28)

INFO

Data security

It is necessary to erase user/sample data from an old or defect hard disk.

- Use appropriate tools to erase the data or to destroy the hard disk.

PRELIMINARY STEPS

1. If possible, save the `koordina.dat` file of the instrument from the system folder of the software to a backup media.
2. If possible and necessary, save the user/sample data files of the instrument from the user software folder to a backup media.
3. Erase the user/sample data files (see info above)!

REMOVAL



4. Shut down the computer and switch off the instrument.
5. Disconnect main power from the instrument.
6. Remove the rear panel (see chapter 8.3.6 on page 8-17).
7. Disconnect the IDE hard drive connector (2).

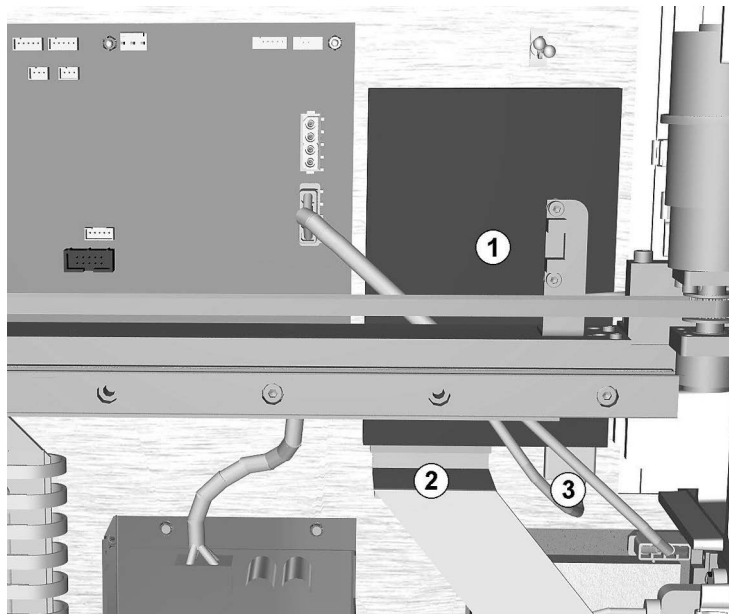


Figure 9-15: Installed hard drive

8. Disconnect the power connector (3) from the hard drive (1).
9. Hold tight the hard drive (1) and remove the four retaining screws (4) on the backside of the instrument.

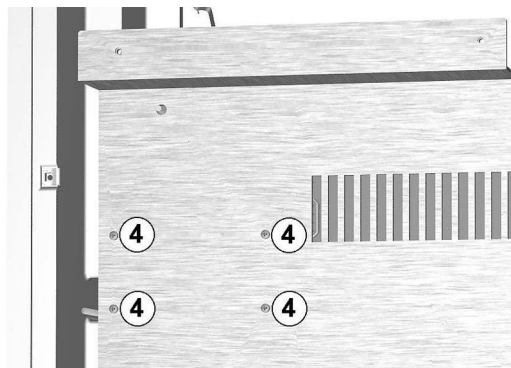


Figure 9-16: Backside of the electronics module

10. Remove the hard drive (1).

INSTALLATION

11. Insert the new hard drive (1) and tighten the four retaining screws (4) on the backside of the instrument.
12. Plug the power connector (3) into the hard drive (1).
13. Plug the IDE hard drive connector (2) into the hard drive (1).
Note: The red mark (pin1) must be on the right side!
14. Install the rear panel (see chapter 8.3.6 on page 8-17).

SOFTWARE INSTALLATION

15. Plug the instrument to the main power supply.
16. Install the software image and activate windows (see chapter 9.4.7 on page 9-31).
17. If available, copy the `koordina.dat` file of the instrument to the system folder of the software.

CHECK TEACHING

18. Check the teaching of the pipettor. If no backup is available, all positions of the pipettor must be taught.

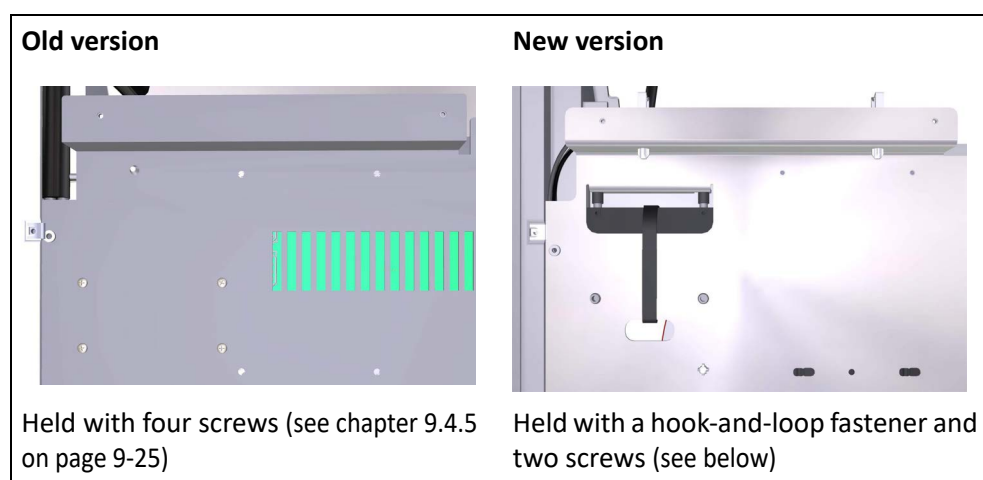
9.4.6 REPLACEMENT OF HARD DRIVE (NEW VERSION OF INTERNAL-PC)

INFO

Generations of the instrument

This procedure is only for instruments with separated touch screen and Internal-PC.

Differentiation of the hard disk versions (rear side, behind the rear panel):



INFO

Data security

It is necessary to erase user/sample data from an old or defect hard disk.

- Use appropriate tools to erase the data or to destroy the hard disk.

PRELIMINARY STEPS

1. If possible, save the `koordina.dat` file of the instrument from the system folder of the software to a backup media.
2. If possible and necessary, save the user/sample data files of the instrument from the user software folder to a backup media.
3. Erase the user/sample data files (see info above)!

REMOVAL



4. Shut down the computer and switch off the instrument.
5. Disconnect main power from the instrument.
6. Remove the rear panel (see chapter 8.3.6 on page 8-17).
7. Remove the top cover (see chapter 8.3.4 on page 8-12).
8. Disconnect the IDE hard drive connector (2).

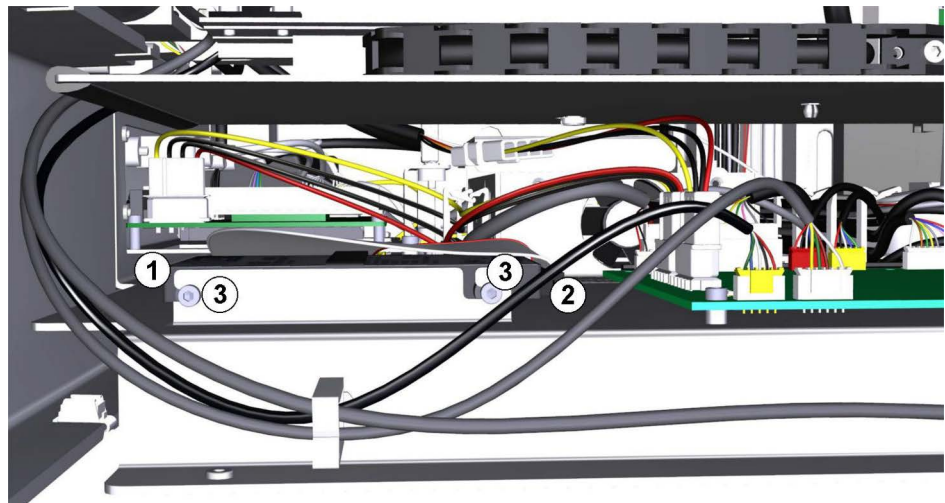


Figure 9-17: Installed hard drive (top view)

9. Open the hook-and-loop fastener.

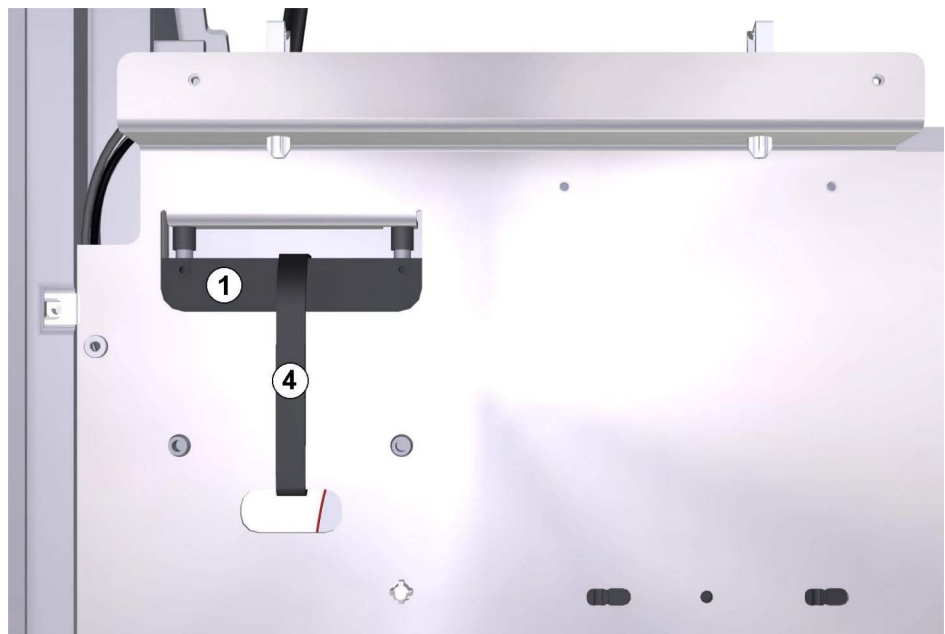


Figure 9-18: Installed hard drive (rear view)

10. Loosen the two screws (3) and hang out the hard drive (1).
11. Remove the hard drive (1).
12. Remove the screws (3), the screw spacers (5) and spacers (6).

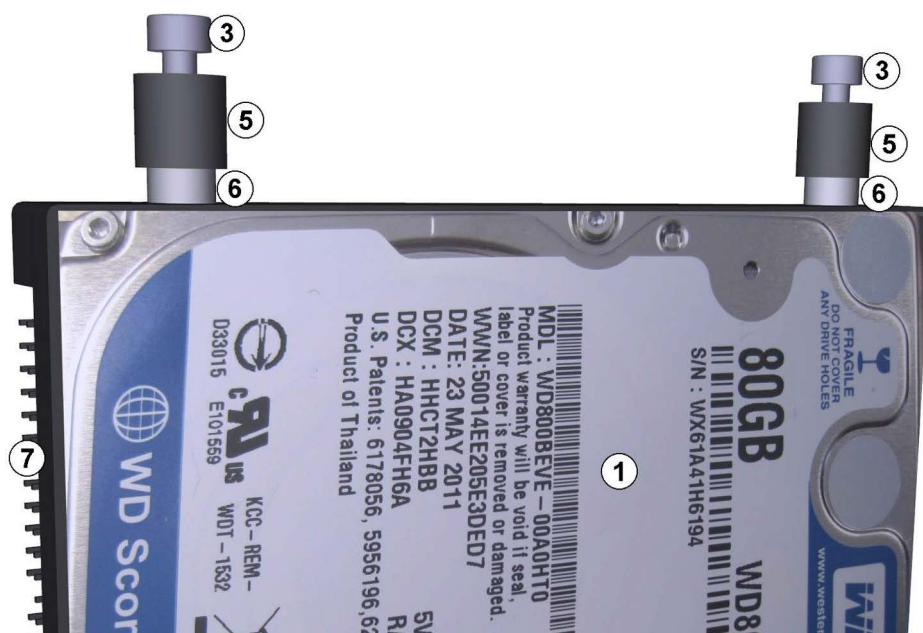


Figure 9-19: Hard disk with holders

INSTALLATION

13. Install the screws (3), the screw spacers (5) and spacers (6) on the new hard drive (1).
Note the direction of connector (7).
Do not tighten the screws (3).
14. Remount the hard disk (1) and tighten both screws (3).
Note the direction of connector (7). It shows to the instrument CU board.
15. Install and close the hook-and-loop fastener.
16. Plug the IDE hard drive connector (2) into the hard drive (1).
Note: The red mark (pin1) must be on the bottom side!
17. Install the top cover (see chapter 8.3.4 on page 8-12).
18. Install the rear panel (see chapter 8.3.6 on page 8-17).

SOFTWARE INSTALLATION

19. Plug the instrument to the main power supply.
20. Install the software image and activate windows (see chapter 9.4.7 on page 9-31).
21. If available, copy the `koordina.dat` file of the instrument to the system folder of the software.

CHECK TEACHING

22. Check the teaching of the pipettor. If no backup is available, all positions of the pipettor must be taught.

9.4.7 INSTALL SOFTWARE IMAGE

INFO

Use of a new software Image

It is only necessary to install a new software image after the replacement of a hard disk or after a fatal windows crash without other ability to recover windows!
The new software image deletes all data on the hard disk! It is not possible to recover deleted data without professional experience and special tools!

INFO

It is necessary to use an external USB keyboard to install the software image!

1. Shut down the computer and switch off the instrument.
2. Insert the bootable USB flash drive with the software image into an USB port of the Internal-PC or All-in-One-PC.
3. Switch on the instrument to boot the computer from the USB flash drive.
4. If necessary change the USB flash drive within the BIOS boot priority to priority one.
5. The computer starts. For a short moment you can see the windows symbol. The command prompt appears and shows information about available disks.
6. To delete/format the hard disk (disk 0), press on the **y** key.
The hard disk (disk 0) is formatted.
After formatting, the image is automatically installed
7. To shutdown the computer, press on the **y** key.
The computer will shutdown.
8. Switch off the instrument after the computer is powered off.
9. Remove the USB flash drive.
10. Switch on the instrument.
11. The system preparations are carried out.
12. After the system preparations, the computer is restarted.

FIRST START OF WINDOWS

13. Follow the instructions on the screen.
14. Enter the **Product Key** from the Windows label on the right side of the instrument (near by the mains switch).
15. To activate Windows, please select **Activate Windows** from the **Start** menu. Follow the instructions. Please use the option via phone and follow the instructions. You will get an activation key which you have to enter.

9.4.8 REPLACEMENT OF POWER SUPPLY

DANGER



Replacement of power supply

The power supply contains no serviceable parts! Repairs will cause accidents with serious injuries with deadly consequences, fire or serious instrument damage.

- Replace the whole power supply when it is faulty!

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the rear panel (see chapter 8.3.6 on page 8-17).
4. Remove the 24 V power cables (2).

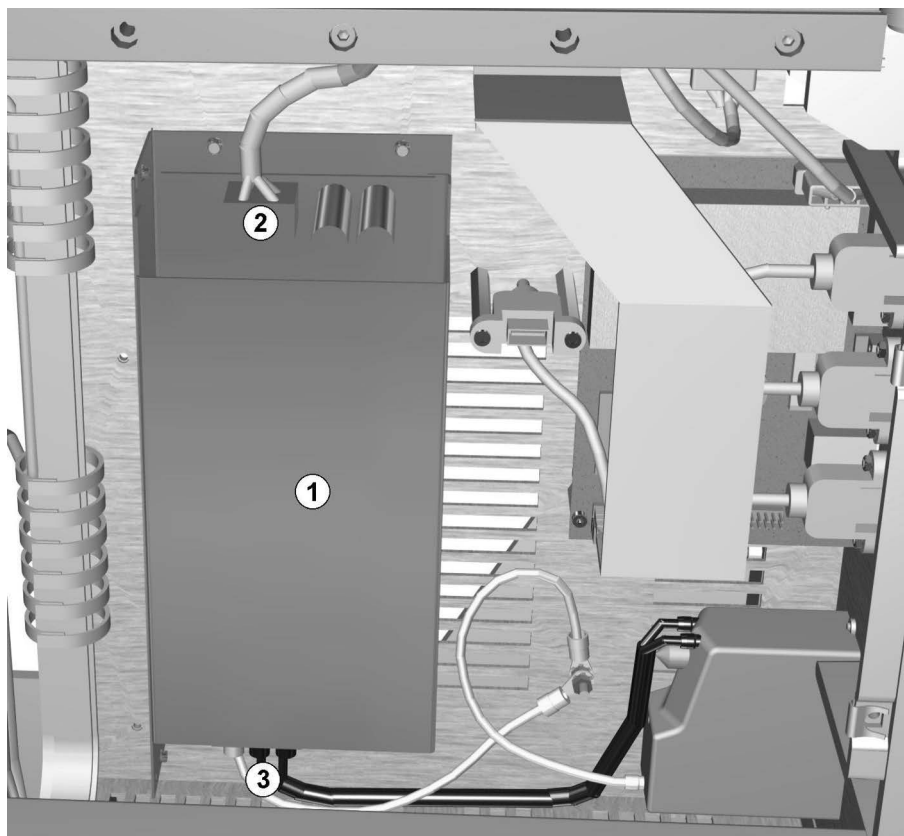


Figure 9-20: Installed power supply

5. Hold tight the power supply (1) and remove the four retaining screws (4) on the backside of the instrument.

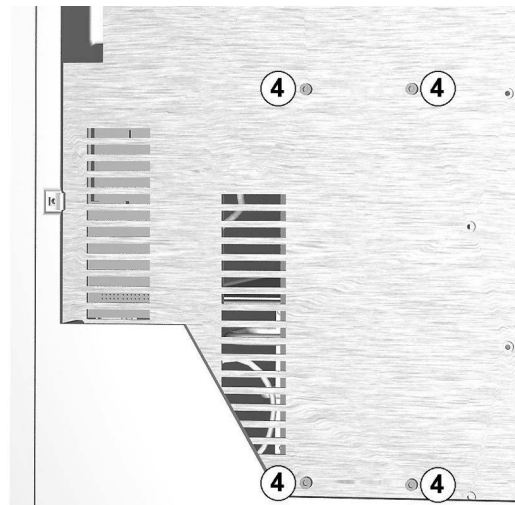


Figure 9-21: Backside of the electronics module

6. Remove the main power cables (3).
7. Remove the power supply (1).

INSTALLATION

8. Install the main power cables (3) and tighten the screws.
Note the position of the protective conductor!
9. Insert the new power supply (1) and tighten the four retaining screws (4) on the backside of the instrument.
10. Install the 24 V power cables (2) and tighten the screws.
Note the positions of the cables (black = v- / brown = v+).
11. Install the rear panel (see chapter 8.3.6 on page 8-17).
12. Perform the electrical safety check (see chapter 9.3.2 on page 9-8).

9.4.9 REPLACEMENT OF TOUCH SCREEN WITH CABLE

INFO

Generations of the instrument

This procedure is only for instruments with separated touch screen and Internal-PC.

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Remove the upper cover (see chapter 8.3.5 on page 8-14).
5. Remove the deck top (see chapter 8.3.1 on page 8-9).
6. Remove the module cover (see chapter 8.3.3 on page 8-11).
7. Remove the motherboard cover (see chapter 9.4.1 on page 9-15).

NOTICE

Twist and disrupt hazard!

Connector CN8 has very thin pins and cables!

8. Disconnect the connectors CN6 and CN8 from the PC motherboard (see chapter 19.2.2 on page 19-14).
9. Disconnect the connector ST56 from the instrument CU board (see chapter 19.2.1 on page 19-11).
10. Remove both cable clamps from the cover (behind the touch screen).
11. Remove both knurled screws (7) and the touch screen (8).

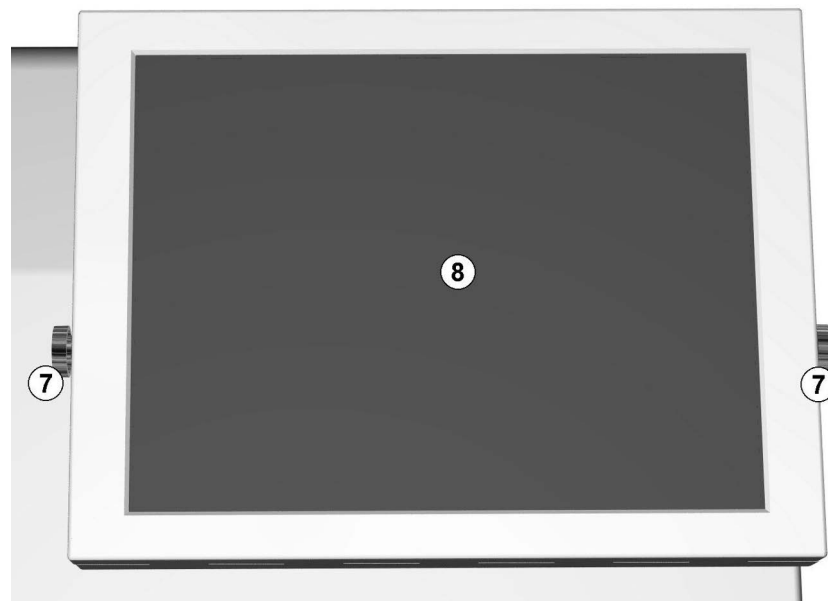


Figure 9-22: Touch screen (front side)

12. Remove the touch screen (8) with cable.

INSTALLATION

13. Install the new touch screen (8) with cable and tighten both knurled screws (7).
14. Install both cable clamps on the cover (behind the touch screen).
15. Plug the connector ST56 into the instrument CU board (see chapter 19.2.1 on page 19-11).

NOTICE

Twist and disrupt hazard!

Connector CN8 has very thin pins and cables!

16. Plug the connectors CN6 and CN8 into the PC motherboard (see chapter 19.2.2 on page 19-14).
17. Remove the motherboard cover (see chapter 9.4.1 on page 9-15).
18. Remove the module cover (see chapter 8.3.3 on page 8-11).
19. Remove the upper cover (see chapter 8.3.5 on page 8-14).
20. Remove the top cover (see chapter 8.3.4 on page 8-12).
21. Remove the deck top (see chapter 8.3.1 on page 8-9).

9.4.10 REPLACEMENT OF COP BOARD

See chapter 16.5.3 on page 16-13.

9.4.11 REPLACEMENT OF ALL-IN-ONE-PC

INFO

Generations of the instrument

This procedure is only for instruments with All-In-One-PC.

INFO

Data security

It is necessary to erase user/sample data from an old or defect hard disk of the All-In-One-PC.

- Use appropriate tools to erase the data or to destroy the hard disk.

PRELIMINARY STEPS

If possible (the old All-In-One-PC still works):

1. Save the `koordina.dat` file of the instrument from the system folder of the software to a backup media.
2. If necessary, save the user/sample data files of the instrument from the user software folder to a backup media.
3. Erase the user/sample data files (see info above)!
4. Open the registry editor.
5. Confirm the windows security message with **Yes**.
6. Search the registry key
`Computer\HKEY_CURRENT_USER\Software\Stratec\Gemini`
This registration key contains all user software settings.
7. Move the mouse over the registry key.
8. Press the right mouse button and select **Export** from the context menu.
9. Search the backup media, enter a file name (e.g. Gemini.reg), and click on the **Save** button.
10. Close the registry editor.
11. Remove the backup media.

REMOVAL



12. Shut down the computer and switch off the instrument.
13. Disconnect main power from the instrument and the All-In-One-PC power supply.
14. Disconnect the power and the USB cables.

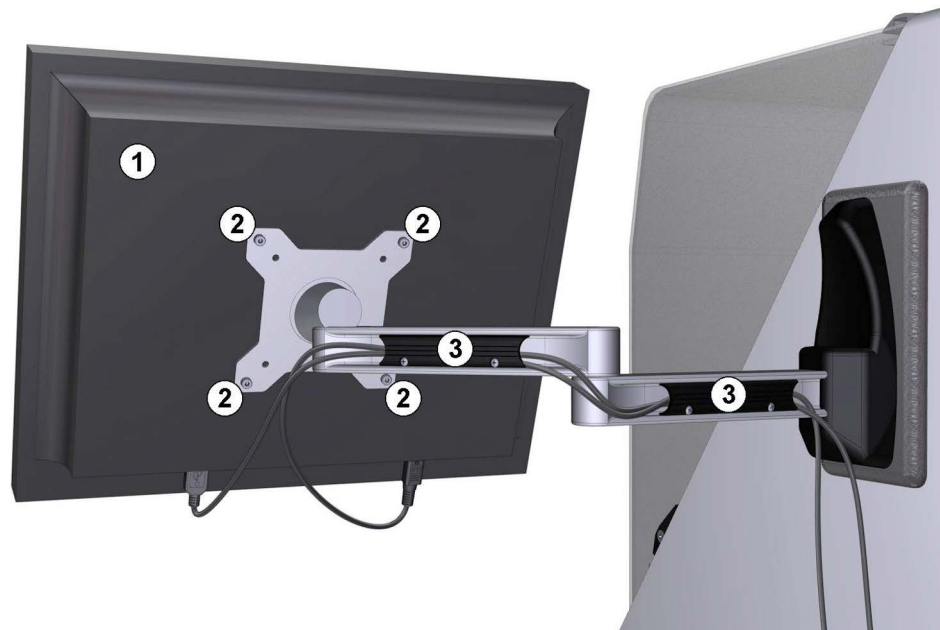


Figure 9-23: Rear side of an installed All-In-One-PC (PA-6322)

15. Hold the All-In-One-PC (1) and remove the four screws (2).
16. Remove the All-In-One-PC (1).
17. Remove both cable supports (3).
18. Remove the All-In-One-PC power supply.

INSTALLATION

19. Install the new All-In-One-PC (1) and tighten the four screws (2).
20. Plug the cable of the new power supply into connector DC-IN of the All-In-One-PC (1).
21. Plug the USB cable, depending on the instrument generation, into one of the following USB ports of the All-In-One-PC (1).
 - USB 3.0 port (blue), newest instrument generation
 - USB port with the label "Instrument (GEMINI)" next to the USB port
 - USB port 1
22. Guide the USB and the power cables along the arm and install both cable supports (3).

SOFTWARE INSTALLATION

23. Plug the instrument and the power supply of the All-In-One-PC to the main power supply.
 24. Install the software image and activate windows (see chapter 9.4.7 on page 9-31).
- If available:
25. Insert the backup media.
 26. Copy the `koordina.dat` file of the instrument into the system folder of the software.
 27. If necessary, copy the user/sample data files of the instrument into the user software folder.
 28. Double click on the file of the saved registry key.
 29. Confirm the windows security message with **Yes**.

30. Confirm the registry editor information message with **Yes**.
31. Confirm the success message with **OK**.
32. Remove the backup media.

CHECK TEACHING

33. Check the teaching of the pipettor. If no backup is available, all positions of the pipettor must be taught.

9.5 SERVICE SOFTWARE

See description of the service software of the individuals modules.

Intentionally left blank.

10 INCUBATOR MODULE

This chapter describes this module in detail. In the first section "Safety" additionally to the general safety notes (see chapter 1.2 on page 1-6) safety notes are specified, which concern particularly this module. The section "Overview" gives a short overview about this module. This section is followed by a larger part containing information about maintenance, repair and testing of this module (sections "Adjustment and Calibration", "Check and Verification", "Maintenance", "Troubleshooting and Repairs" and "Connections, Signals and Switches"). The last section "Service Software" describes only the service software module which only concerns this module.

10.1 SAFETY

CAUTION



Risk of burn

The heatings (incubators) will reach high temperatures during operation and testing. Contact will cause injuries.

- Use appropriate gloves!
- Let the heatings (incubators) cool down before cleaning or maintenance.

10.2 OVERVIEW

10.2.1 INCUBATOR MODULE OVERVIEW

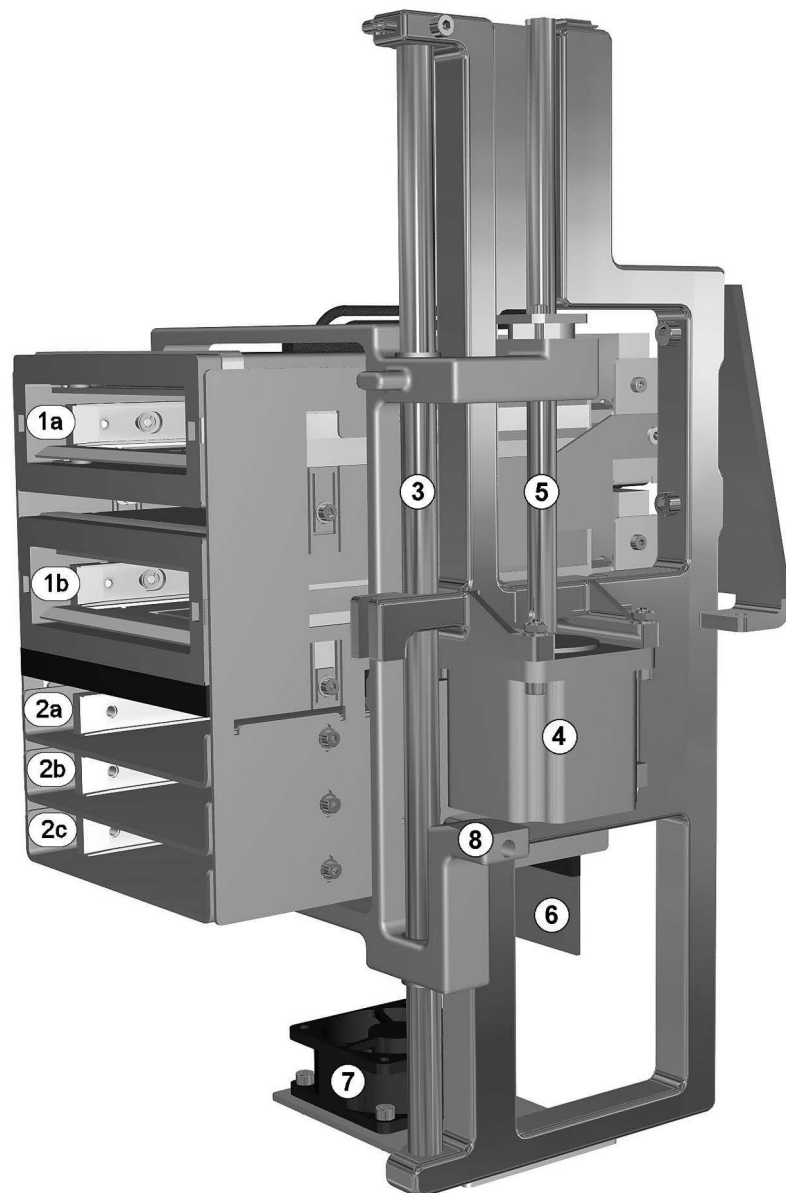


Figure 10-1: Incubator module

- 1 Incubator boxes:
 - 1a: Incubator box 1
 - 1b: Incubator box 2
- 2 Ambient boxes:
 - 2a: Ambient box 1
 - 2b: Ambient box 2
 - 2c: Ambient box 3
- 3 Z-guiding rod
- 4 Z-motor
- 5 Z-lead screw
- 6 Incubator board
- 7 Fan
- 8 Bracket for the up and down movement of the washer module

10.2.2 INCUBATOR BOX OVERVIEW

INCUBATOR BOX WITH SHAKING MOTOR

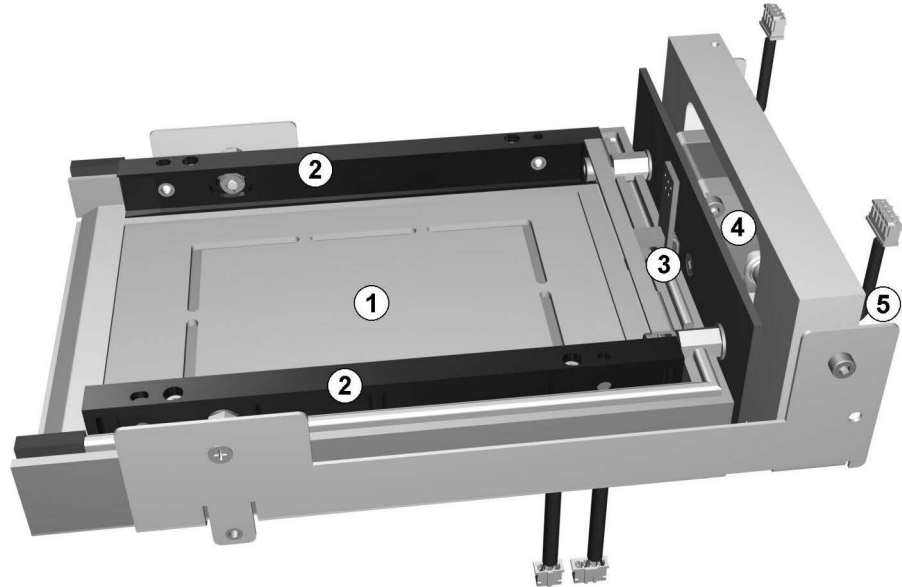


Figure 10-2: Opened incubator box with shaking motor (without upper heating plate and insulation)

- | | |
|---|--|
| 1 | Lower heating plate |
| 2 | Plate carrier guiding rails |
| 3 | Plate carrier in light barrier |
| 4 | Shaking motor |
| 5 | Shake frequency light barrier (on the back side) |

10.3 TIPS AND INFORMATION

10.3.1 INCUBATOR MODULE TOOLS

10.3.1.1 INCUBATOR SLOTS ADJUSTMENT TOOL

The incubator slots adjustment tool is used to adjust the incubator and the ambient boxes.

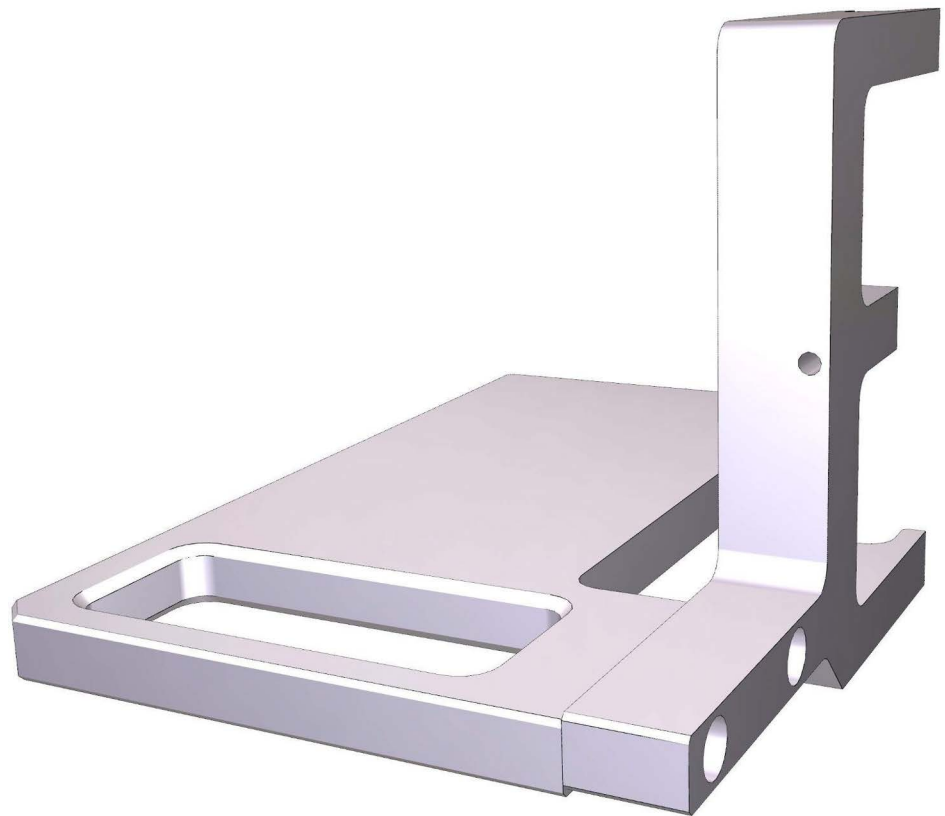


Figure 10-3: Incubator slots adjustment tool

10.4 ADJUSTMENT AND CALIBRATION

In this section, the adjustment of the incubator module is described.

10.4.1 ADJUSTMENT OF INCUBATOR FRONT COVER



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the deck top (see chapter 8.3.1 on page 8-9).
4. Remove the module cover (see chapter 8.3.3 on page 8-11).
5. Check the distance between incubator (1) and incubator front cover (2).
The distance must be 1 mm (0.039 inch) on both sides.
The incubator must not scratch on the incubator front cover while moving in Z-direction.

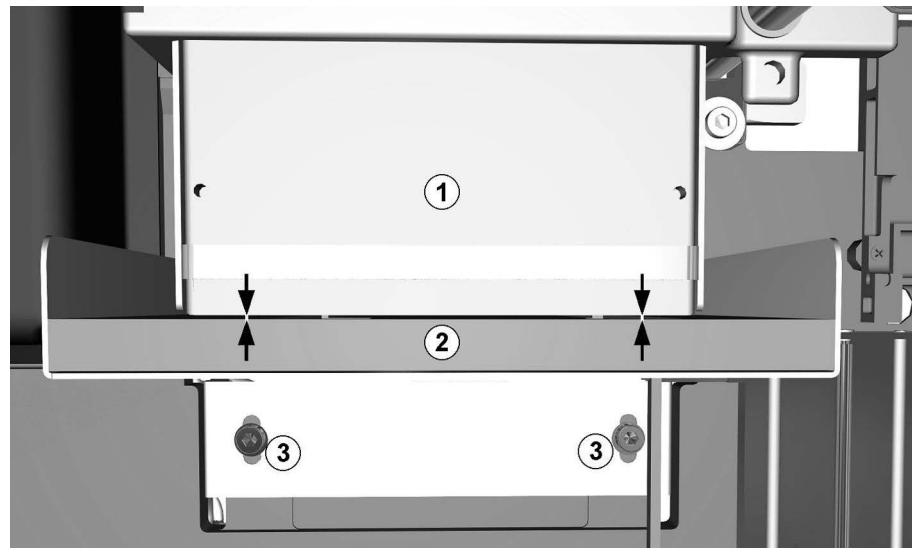


Figure 10-4: Distance between incubator and incubator front cover

6. Use both screws (3) to increase/decrease the distance.
7. Install the module cover (see chapter 8.3.3 on page 8-11).
8. Install the deck top (see chapter 8.3.1 on page 8-9).

10.4.2 ADJUSTMENT OF INCUBATOR

See chapter 10.7.2 on page 10-14

10.4.3 ADJUSTMENT OF INCUBATOR BOXES/ SLOTS

1. Remove the incubator module (see chapter 10.7.2 on page 10-14).
2. Loose the four retaining screws of the desired box/slot.
3. Insert the incubator slots adjustment tool (1, see chapter 10.3.1.1 on page 10-5) into the plate carrier guiding rails of the desired box/slot.



Figure 10-5: Incubator slots adjustment tool in the upper incubator box

4. Press the tool against the Z-guiding rod and tighten the four retaining screws.
5. Install the incubator module (see chapter 10.7.2 on page 10-14).

10.4.4 ADJUSTMENT OF Z-DRIVE

See chapter 10.7.5 on page 10-23

10.5 CHECK AND VERIFICATION

In this section information about the testing of certain components can be found.

10.5.1 PERFORM INCUBATOR MODULE TEST

Besides running the incubator module test (see chapter 10.8.4 on page 10-33) it is recommended to verify the absolute heating temperature of the incubator heating plates using a qualified thermometer or an incubation verification tool. The temperature measured shall be the target temperature +/- 1 K, see [Accuracy Test](#) in chapter 10.8 on page 10-26.

1. Switch on the instrument.
2. Start the service software (see chapter 7.1 on page 7-1).
3. Start the incubator service software module (see chapter 10.8 on page 10-26).
4. Press on the [Selftest](#) button to initialize the module and start the selftest (see chapter 10.8.3 on page 10-32).
5. Press on the [Module Test](#) button and follow the instructions (see chapter 10.8.4 on page 10-33).

10.6 MAINTENANCE

This section contains instructions for the maintenance of individual components of the incubator module. After several maintenance intervals it is required that the individual components are readjusted. Follow the instructions in the individual sections.

10.6.1 LUBRICATION OF INCUBATOR MODULE



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the washer service cover (see chapter 8.3.2 on page 8-10).
4. Remove all dirt and old grease with a cleaning paper from the Z-lead screw (see chapter 10.2.1 on page 10-2). Press the cleaning paper into the thread grounds of the Z-lead screw.
5. Use in a second step a cleaning paper with alcohol (standard disinfection fluids of the laboratories).
6. Place some grease on the Z-lead screw and wipe the grease with a brush into the Z-lead screw surface.

NOTICE

Do not place too much grease on the Z-lead screw! Do not grease other parts of the incubator module!

7. Install the washer service cover (see chapter 8.3.2 on page 8-10).
8. Switch on the instrument.
9. Start the service software.
The service software displays its main menu.
10. Start the incubator service software module.
11. Move the incubator across the whole length of the Z-lead screw 10 times to build up a complete oiled surface on the Z-lead screw.
12. Move the plate transport across the whole length of the Z-lead screw 10 times to build up a closed and homogeneous film of grease on the Z-lead screw.

10.7 TROUBLESHOOTING AND REPAIRS

This section contains instructions for the repair of individual components of the incubator module. After several repair works it is required that the individual components are readjusted. Follow the instructions in the individual sections.

10.7.1 REPLACEMENT OF INCUBATOR FRONT COVER

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the deck top (see chapter 8.3.1 on page 8-9).
4. Remove the module cover (see chapter 8.3.3 on page 8-11).
5. Remove both retaining screws (1).

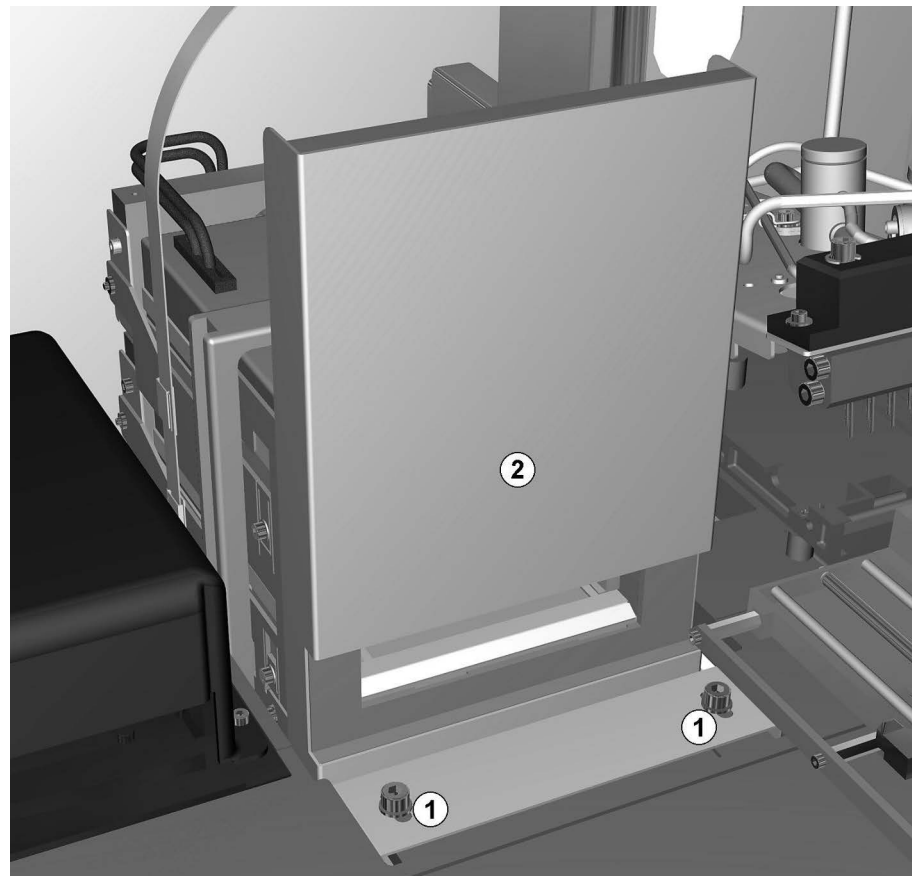


Figure 10-6: Installed incubator front cover

6. Remove the incubator front cover (2).

INSTALLATION

7. Install the incubator front cover (2). It is not necessary to tighten both retaining screws (1).
8. Adjust the incubator front cover (see chapter 10.4.1 on page 10-7).
9. Install the module cover (see chapter 8.3.3 on page 8-11).
10. Install the deck top (see chapter 8.3.1 on page 8-9).
11. Check/Teach the incubator positions of the plate transport (see chapter 20.4 on page 20-44).

10.7.2 REPLACEMENT OF INCUBATOR MODULE

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Remove the upper cover (see chapter 8.3.5 on page 8-14).
5. Remove the deck top (see chapter 8.3.1 on page 8-9).
6. Remove the module cover (see chapter 8.3.3 on page 8-11).
7. Remove the incubator front cover (see chapter 10.7.1 on page 10-12).
8. Disconnect the three connectors ST1, ST6, and ST32 from the instrument CU board (see chapter 19.2.1 on page 19-11).
9. Remove the cables from the cable clamps.
10. Move the incubator (4) to the top level (rotate the Z-lead screw (1)).

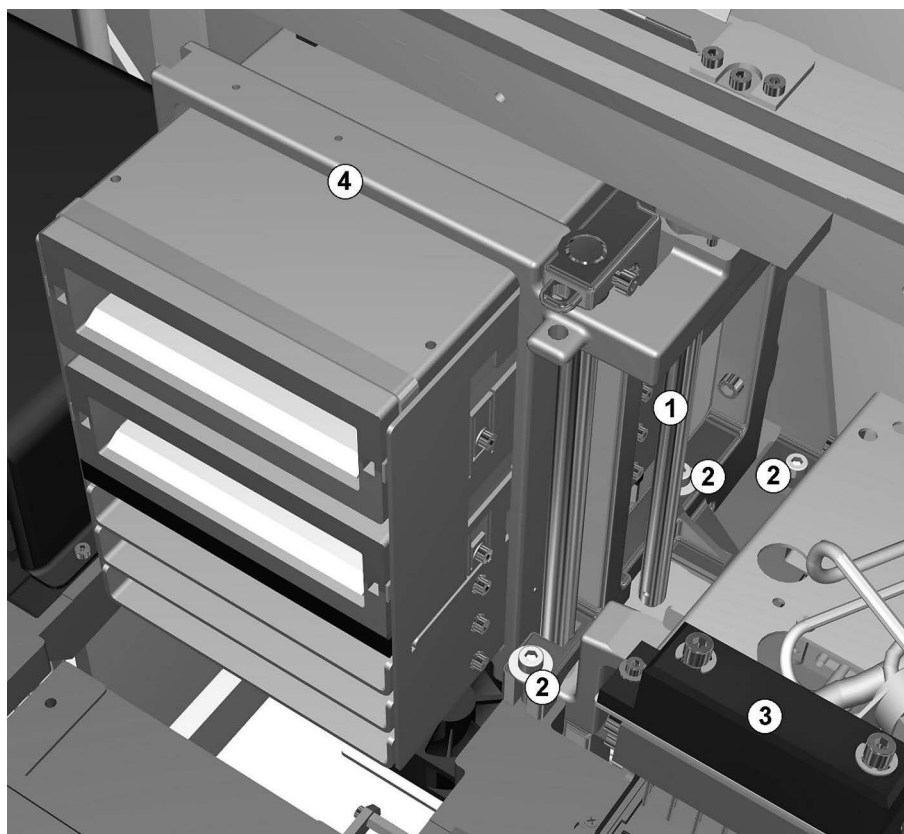


Figure 10-7: Installed incubator

11. Remove the three retaining screws (2).
12. Lift up the washer (3) and fix it with tape.
13. Lift the incubator (4) a little and carefully turn the incubator it 90° counter clockwise (from top view).
14. Tip the incubator (4) forward to the front and remove it.

INSTALLATION

15. Move the new incubator (4) to the top level (rotate the Z-lead screw (1)).
16. Turn the incubator slot openings to the right side.
17. Tip the incubator (4) forward to the front and insert it.
18. Turn the incubator (4) 90° clockwise. Lower the incubator (4) so that the guide block is inserted into the guide of the incubator (5).

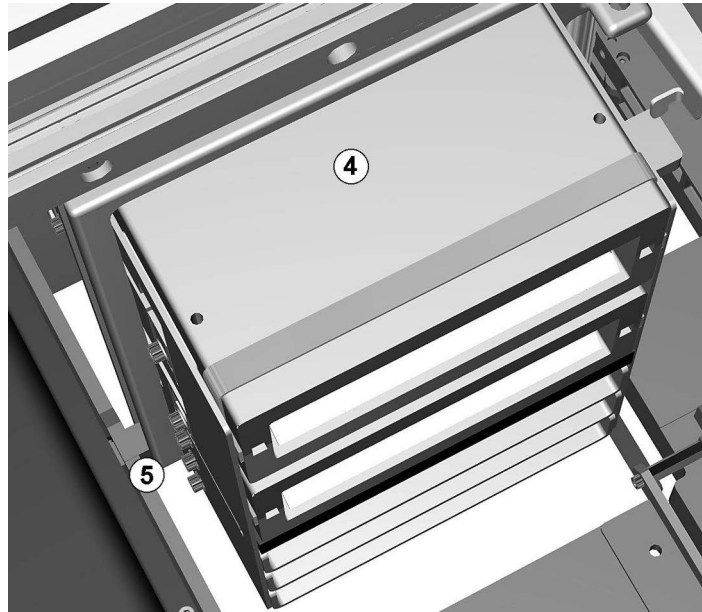


Figure 10-8: Incubator guide

19. Tighten the three screws (2).

INFO

Use a 90° try square (6) to adjust the incubator.

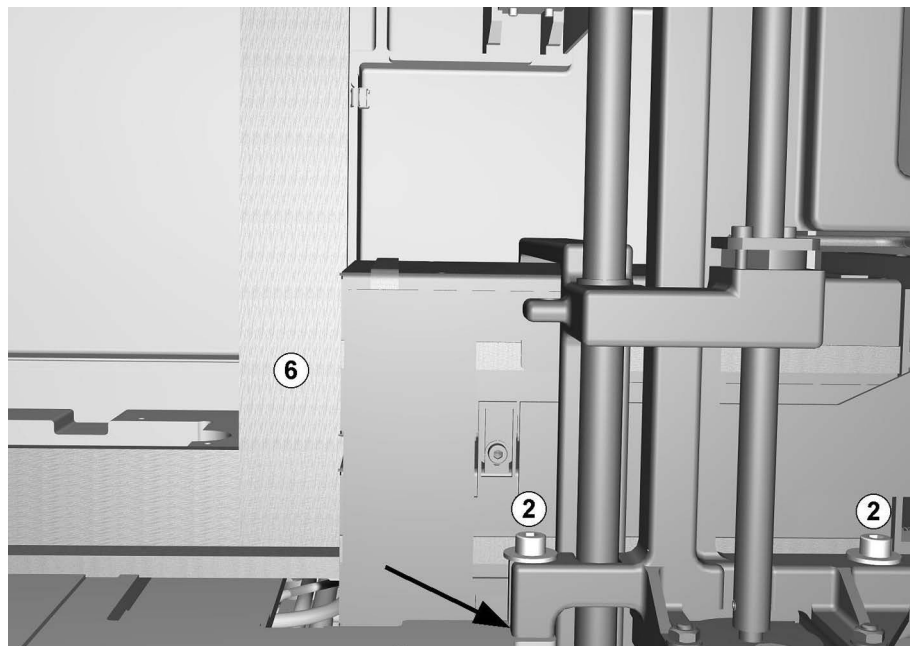


Figure 10-9: Adjust incubator (front)

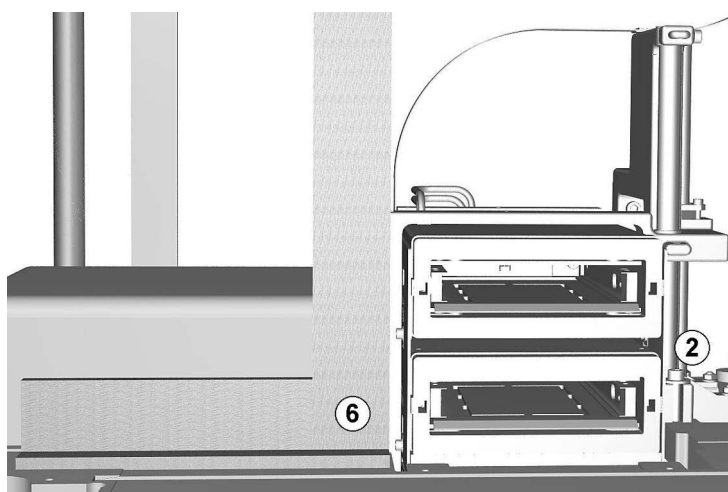


Figure 10-10: Adjust incubator (left side)

20. Remove the tape and put down the washer (3).
21. Plug the three connectors ST1, ST6, and ST32 into the instrument CU board (see chapter 19.2.1 on page 19-11).
22. Insert the cables into the cable clamps.
23. Teach all incubator/ambient slot positions of the plate transport (see chapter 20.4 on page 20-44).
24. Install the incubator front cover (see chapter 10.7.1 on page 10-12).
The plate transport must not scratch on the incubator front cover while moving in X-direction.
25. Install the module cover (see chapter 8.3.3 on page 8-11).
26. Install the deck top (see chapter 8.3.1 on page 8-9).
27. Install the top cover (see chapter 8.3.5 on page 8-14).
28. Install the upper cover(see chapter 8.3.4 on page 8-12).

10.7.3 REPLACEMENT OF INCUBATOR BOARD

REMOVAL

1. Remove the incubator module (see chapter 10.7.2 on page 10-14).
2. Remove the four retaining screws (2).

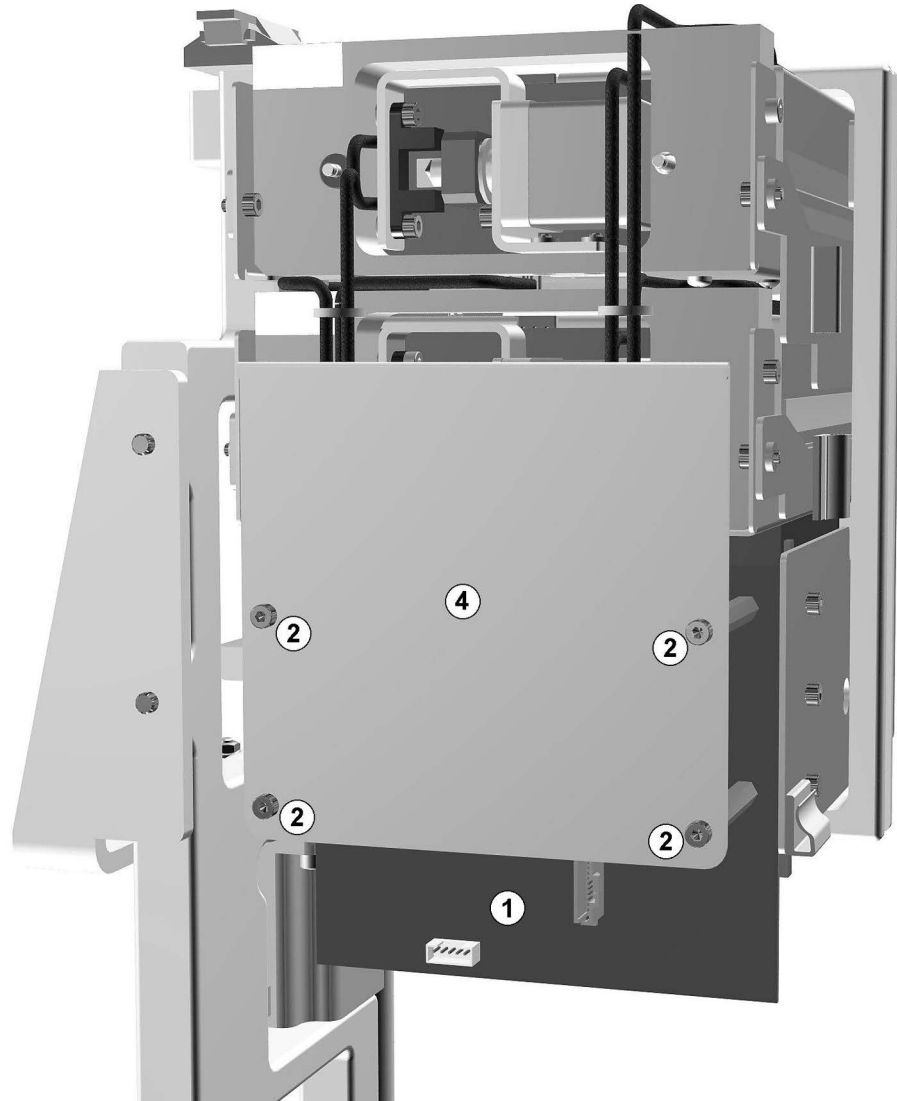


Figure 10-11: Backside of the incubator

3. Remove the backside cover (4).
4. Disconnect all connectors from the incubator board (1) (see chapter 19.3.1 on page 19-16).

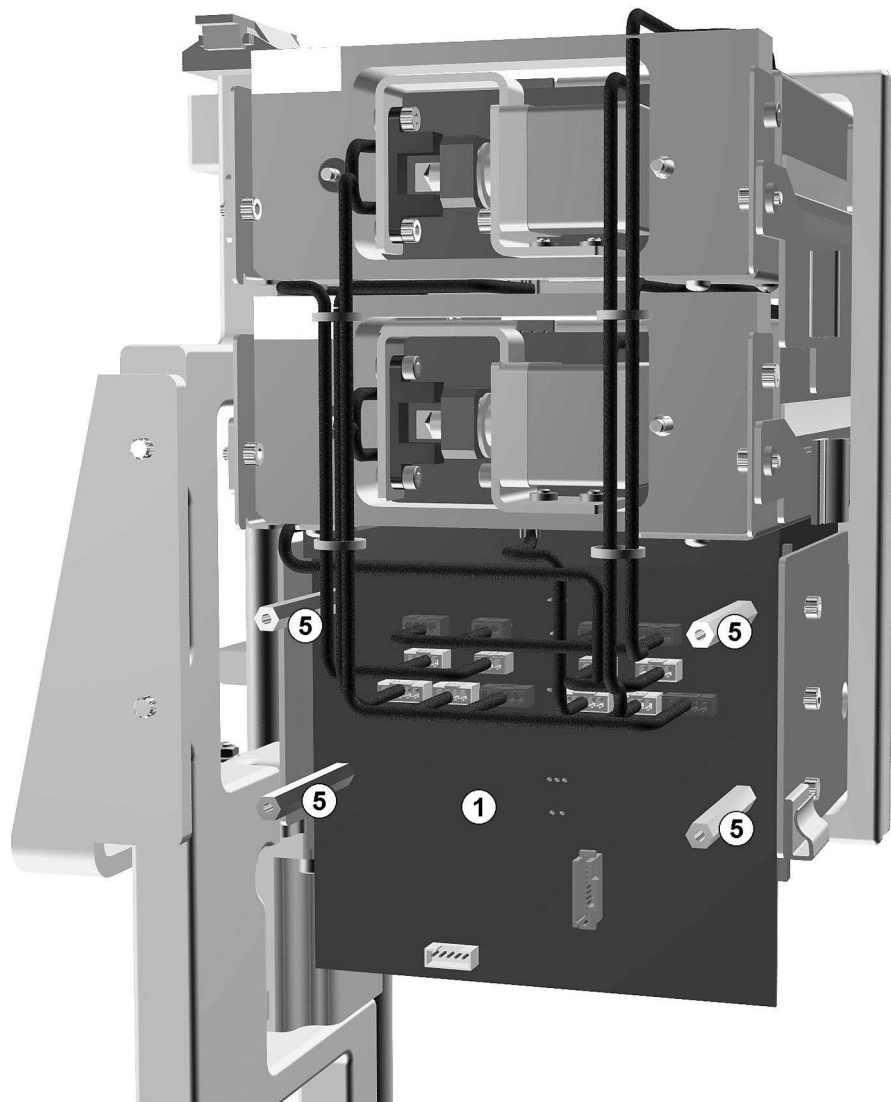


Figure 10-12: Backside of the incubator without backside cover

5. Remove the four spacers (5).
6. Remove the incubator board (1).

INSTALLATION

7. Stick the foam isolation (3) on the front side of the new incubator board (1). The foam isolation (3) has to overlap after gluing on the incubation board (1) on the left and on the right side evenly.

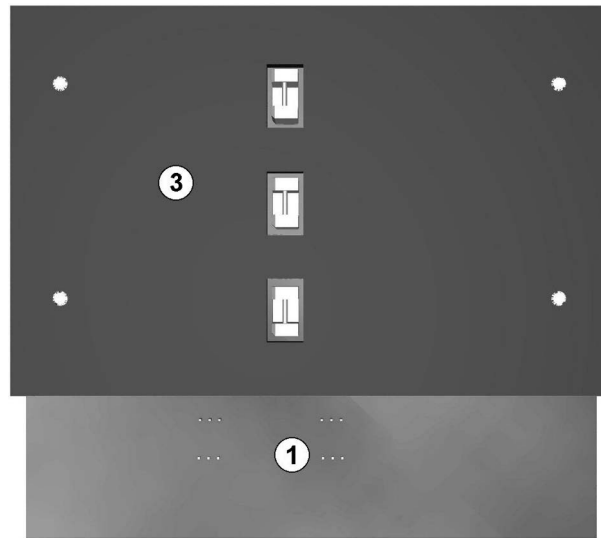


Figure 10-13: Incubator board with foam isolation

8. Install the new incubator board (1) and tighten the four spacers (5).
9. Plug all connectors into the incubator board (1) (see chapter 19.3.1 on page 19-16).
10. Install the backside cover (4) and tighten the four retaining screws (2).
11. Install the incubator module (see chapter 10.7.2 on page 10-14).

INFO

Check firmware version before calibrating and teaching the incubator module! If necessary, install the latest firmware version (see chapter 21.1 on page 21-1).

10.7.4 REPLACEMENT OF INCUBATOR BOX

INFO

Difference between lower and upper Incubator Box

The lower incubator box has a foam plate on its topside.

REMOVAL

1. Remove the incubator module (see chapter 10.7.2 on page 10-14).
2. Remove the four retaining screws (2).

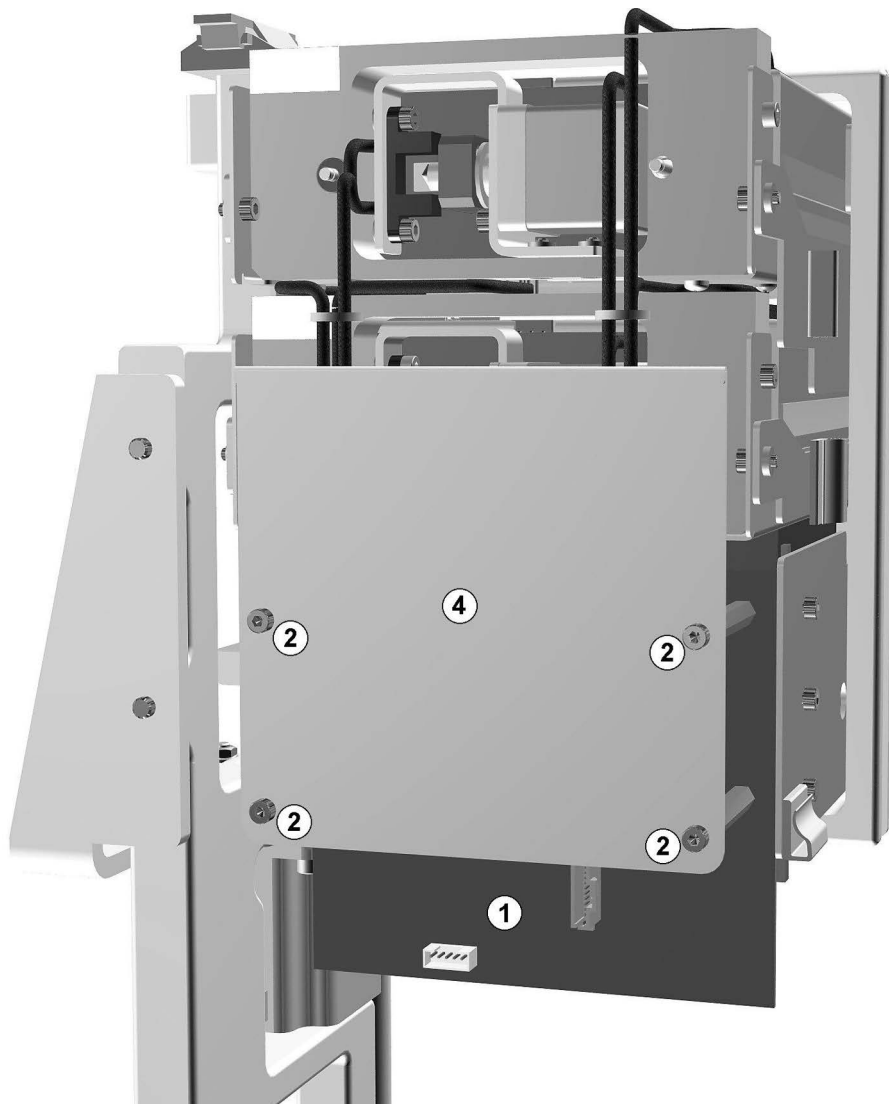


Figure 10-14: Backside of the incubator

3. Remove the backside cover (4).
4. Disconnect all affected connectors from the incubator board (1) (see chapter 19.3.1 on page 19-16).
 - Incubator box 1 (6, upper box): ST1 to ST6, and ST16
 - Incubator box 2 (8, lower box): ST7 to ST13, and ST17

5. Remove the four cable straps (3).

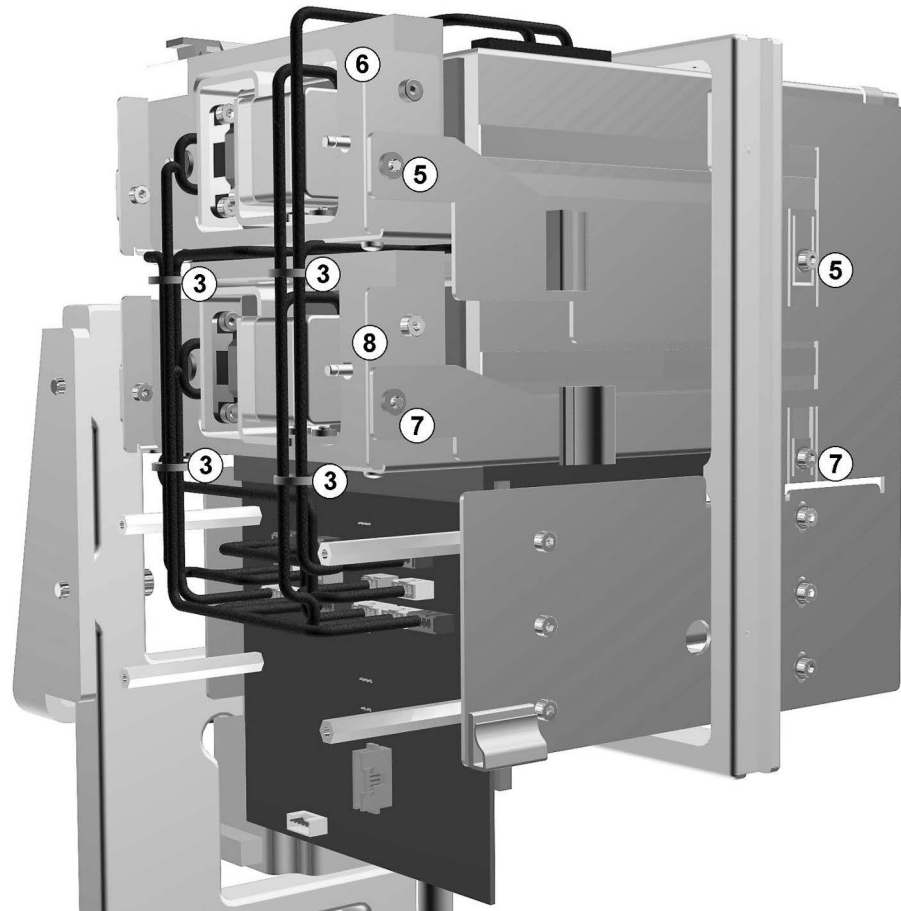


Figure 10-15: Backside of the incubator without backside cover

6. Remove the four screws (5, on both sides).
7. Remove the incubator box 1 (6, upper box).
8. Faulty incubator box 2 (8, lower box):
 - Remove the four screws (7, on both sides).
 - Remove the incubator box 2 (8, lower box).
9. New incubator box 2 (8, lower box with foam plate):
 - Lead the cables through the notches of the incubator isolation.
 - Insert the incubator box 2 (8, lower box).
 - Adjust the incubator box horizontally (see chapter 10.4.3 on page 10-8).
 - Install the four screws (7, on both sides).
10. Insert the incubator box 1 (6, upper box).
11. Adjust the incubator box horizontally (see chapter 10.4.3 on page 10-8)

INSTALLATION

NOTICE

For a failure-free loading and unloading of plate carriers by the plate transport, in particular the parallel adjustment of **all** incubation slots is required.

12. Insert the four screws (5, on both sides).

13. Plug all connectors into the incubator board (1) (see chapter 19.3.1 on page 19-16).
14. Install the four cable straps (3).
15. Install the backside cover (4) and tighten the four retaining screws (2).
16. Install the incubator module.

10.7.5 REPLACEMENT OF Z-MOTOR AND Z-LEAD SCREW

TOOLS

- Removable thread locker (medium-strength)

REMOVAL

1. Remove the incubator module (see chapter 10.7.2 on page 10-14).
2. Remove the two screws (1) and the adjustment plate (2).

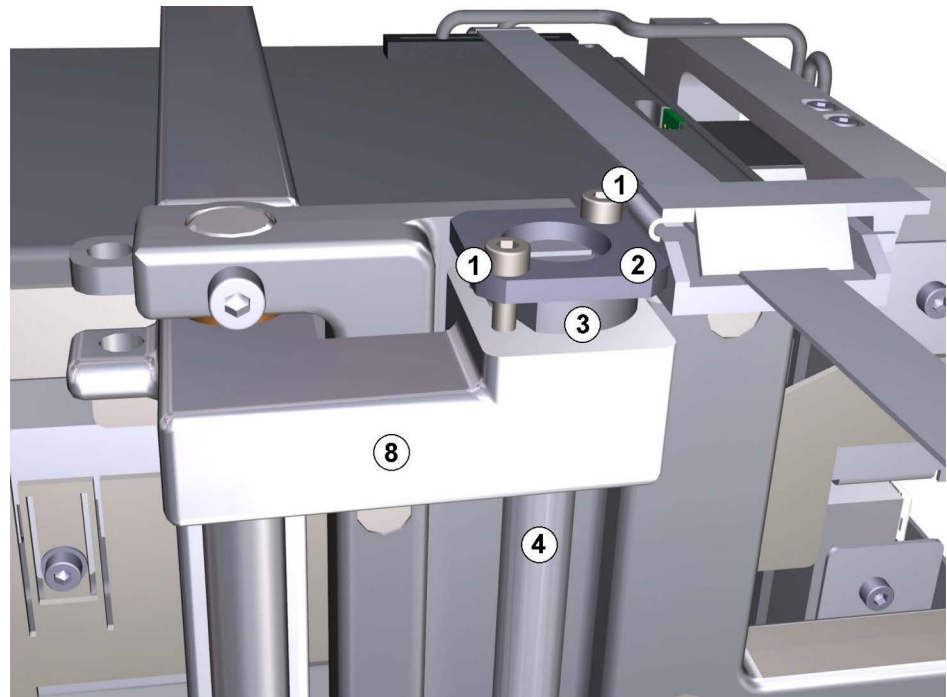


Figure 10-16: Z-holder

3. Remove the speed nut (3) from the Z-lead screw (4).
4. Remove the four nut, washer and screw combinations (5).

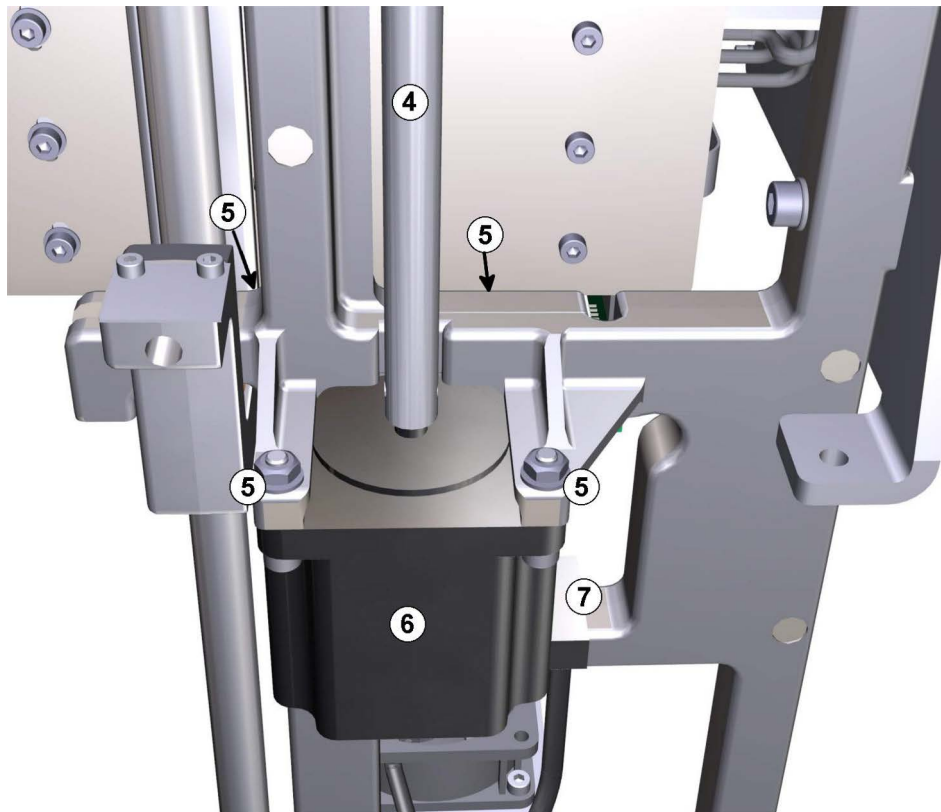


Figure 10-17: Z-motor and Z-lead screw

5. Remove the Z-motor (6) with the Z-lead screw (4).

INSTALLATION

6. Install the new Z-motor (6) with the Z-lead screw (4) with the four nut, washer and screw combinations (5).
Do not tighten the screws/nuts!
Note that the motor connector (7) shows to the backside!

INSTALLATION AND ADJUSTMENT OF THE SPEEDY NUT

7. Move the incubator to its lower position.
8. Screw the speedy nut (3) on the Z-lead screw (4).
9. Install the adjustment plate (2).
10. Wear some removable thread locker on the screws (1).
11. Screw in the two screws (1) loosely.
12. Tighten the four nut, washer and screw combinations (5).
13. Check that the speedy nut (3) does not touch the borehole of the holder (8).
14. Tighten the screws (1).
15. Use a screwdriver to move the incubator.
Check that the lift can be moved smoothly up and down without having to hook.
16. Remove excessive removable threadlocker.
17. Install the incubator module (see chapter 10.7.2 on page 10-14).

10.7.6 REPLACEMENT OF FAN

REMOVAL

1. Remove the incubator module (see chapter 10.7.2 on page 10-14).
2. Remove the four nut and screw combinations (1).

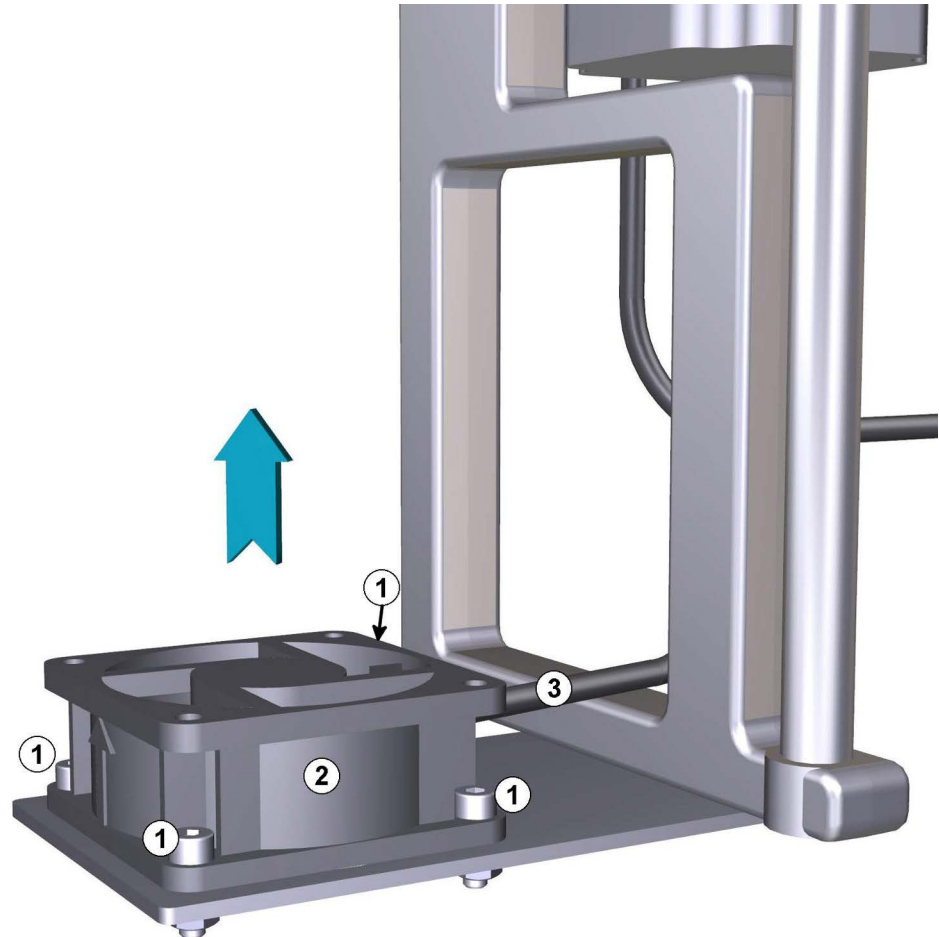


Figure 10-18: Incubator fan

3. Remove the fan (2).

INSTALLATION

4. Install the new fan (2) and tighten the four nut and screw combinations (1).
Note that the fan cable (3) shows to the right side!
Note the blow direction of the fan (see arrow on the fan and in the figure above).
5. Install the incubator module (see chapter 10.7.2 on page 10-14).

10.8 SERVICE SOFTWARE

When the incubator software is started, the application attempts to communicate to the instrument and incubator module. When successful, the following dialog will be displayed with the firmware version number, and serial number. Defaults such as instrument offsets will be read from the module EEPROM and shown. If no module is detected ??? will be shown for the firmware version number.

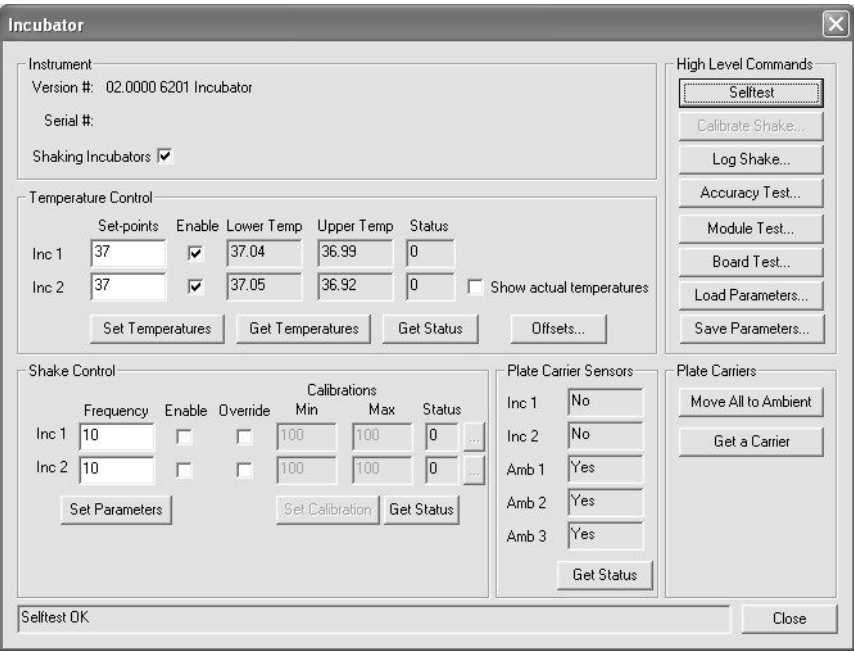


Figure 10-19: Incubator main dialog

INSTRUMENT

Function	Description
Version	Shows the firmware version number, if connection is established with the module.
Serial	Shows the serial number, if connection is established with the module.
Shaking Incubators	If a shaking incubator is installed in the instrument the checkbox is checked automatically.

Table 10-1: Functions of the Instrument area

TEMPERATURE CONTROL

Allows the user to set and control the heaters.

Function	Description
Set-points	Set point edit boxes for Incubator 1 and Incubator 2 are used to set temperatures for incubations. These will only accept integers between 21 and 55°C. Note that the active control of the incubators can be only effective for set point temperatures that are higher than the room temperature. (Room temperature + 7 K or above).
Enable	Enable check box to enable heaters. When the Set Parameters button is pressed, all set points and enable instructions are sent to the module.
Lower Temp	Displays lower heater temperature. Only updated when Show actual temperatures button is pressed.
Upper Temp	Displays upper heater temperature. Only updated when Show actual temperatures button is pressed.
Status	Displays 0 if heaters connected, 1 if an error is detected. Only updated when the Get Status button is pressed.
Show actual temperatures	shows the current temperatures without offsets (see chapter 10.8.2 on page 10-31).
Set Temperatures	Sends all enabled temperature values (field Set-Points and check box Enable) to the incubator.
Get Temperatures	Updates the current temperatures.
Get Status	Retrieves current status.
Offsets	see chapter 10.8.2 on page 10-31

Table 10-2: Functions of the **Temperature Control** area

SHAKE CONTROL Allows user to verify shake mechanism.

Function	Description
Frequency	Frequency edit boxes for Incubator 1 and Incubator 2 are used to set the chamber shake frequencies; these will only accept integers between 5 and 22 Hz.
Enable	Enable check box must be set to shake. These settings are only updated when the Set Parameters button is pressed.
Override	Override check box, if set, shaking will stop and solenoids will be activated to allow load/unload of plates by plate transport mechanism. These are only updated when the Set Parameters button is pressed.
Calibrations Min/Max	Not used.
Status	Displays the shake status for the incubator. A 0 indicates that the shake is good; a 1 indicates the shake is outside acceptable tolerances. The status is updated when the Get Status button is pressed. Once the status has been read the incubator automatically clears the value and sets it to read good (0). The status that is reported by the firmware is updated every 5 seconds. This allows for the mechanism to ramp up shaking before an invalid status is flagged. Whenever new incubator shake parameters are sent (using the Set Parameters button), the status is also reset to good (0) by the incubator firmware.
...	see chapter 10.8.1 on page 10-30
Set Parameters	Sends frequency, enable, and override settings to the module.
Set Calibration	Not used.
Get Status	Updates the Status fields and the Shake Status Details dialog values.

Table 10-3: Functions of the Shake Control area

PLATE CARRIER SENSORS

Function	Description
Inc 1/Inc 2/ Amb 1/Amb 2/ Amb 3	Displays status for each chamber of the plate in status. No displayed if empty, Yes if plate carrier detected.
Get Status	Updates the plate in sensor status.

Table 10-4: Functions of the Plate Carrier Sensors area

HIGH LEVEL COMMANDS

Function	Description
Selftest	see chapter 10.8.3 on page 10-32
Calibrate Shake	Not used.
Log Shake	Starts the shaking process and logs the results in a file.
Accuracy Test	<p>Allows the user to verify the accuracy of each incubator chamber. Turns ON the heaters and waits up to 12 minutes for all temperatures to reach a 37.0°C set point. A dialog box with Device Busy - Testing Temperature Accuracy is displayed while heating. When the set point is reached, a dialog box is shown requesting the user to enter an independent temperature measurement. The test passes if temperature entered is within 0.8°C of set point.</p> <p>(36.2°C ≤ T ≤ 37.8°C).</p> <p>A suitable calibrated temperature measurement device must be used to obtain the independent temperature measurement. The temperature device may need to be left within the incubation chamber for a period of time to reach the appropriate temperature.</p>
Module Test	see chapter 10.8.4 on page 10-33
Board Test	see chapter 10.8.5 on page 10-34
Load Parameters	Displays a warning message before the user can select a file containing module parameters.
Save Parameters	Saves module parameters to a file.

Table 10-5: Functions of the High Level Commands area

PLATE CARRIERS

Function	Description
Move All to Ambient	Puts all plate carriers one-by-one into their parking positions in the ambient slots.
Get a Carrier	Gets one plate carrier out of the instrument.

Table 10-6: Functions of the Plate Carriers area

GENERAL

Function	Description
Close	Closes application
Command Line Display	The line at the bottom of the screen displays the devices reply.

Table 10-7: Functions

10.8.1 SHAKE STATUS DETAILS

Shake Status Details

Calibrated	1	Lower Shake Limit	5096	117%
		Upper Shake Limit	5886	135%
Override Off Frequency	4349	100%	Last Error Frequency	0
				0%
Override On Frequency	6485	148%	Current Position	4374
				100%
		Shake Control	3	

These details are updated by using the Shake Control 'Get Status' button, or the 'Update' button.

OK Update

Figure 10-20: Shake Status Details dialog

Function	Description
Calibrated	0 if the shake selftest calibration has not been performed, 1 if it has.
Override Off Frequency	This is the position frequency obtained during a selftest calibration when the shake override is off.
Override On Frequency	This is the position frequency obtained during a selftest calibration when the shake override is on.
Lower Shake Limit	This will display the lower shake test limit. If the measured position frequency is below this value, the status of the incubator will be marked as bad.
Upper Shake Limit	This will display the upper shake test limit. If the measured position frequency is above this value, the status of the incubator will be marked as bad.
Last Error Frequency	This displays the last position frequency that was measured that caused a bad status to be reported.
Current Position	This is the measured position frequency.
Shake Control	Shows all self-adjustment steps since the last calibration of the shake mechanism. 15 steps are allowed.
OK	Closes the dialog.
Update	This will update the current position frequency and last error frequency (if the chamber status has gone bad since the previous status was read).

Table 10-8: Functions of the Shake Status Details dialog

10.8.2 TEMPERATURE OFFSETS

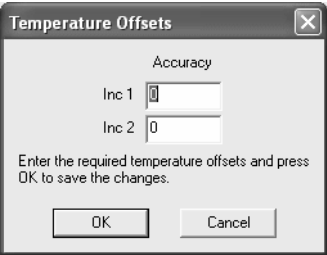


Figure 10-21: Temperature Offset dialog

Function	Description
Accuracy	Offsets to adjust individual incubator chambers. Positive values will increase the actual temperature.
OK	Takes all parameters and closes window and returns to main incubator window.
Cancel	Drops all parameters, closes window and returns to main incubator window.

Table 10-9: Functions of the Temperature Offsets dialog

10.8.3 INITIALIZATION AND SELFTEST

When the **Selftest** button is pressed, the incubator initialization and selftest commands are processed.

INITIALIZATION STEPS

1. Tests the EEPROM checksum.
2. Initialize the Z-drive.
3. Test the shake mechanism positions, check within range.
4. Check the temperature sensors are reading within a valid range (5 - 65°C).
5. Checks the heaters are connected.

If an error occurs during any test, the appropriate error response is given and the test stops see chapter 6.2.7 on page 6-34.

Otherwise command responds with **OK**, successful command execution.

10.8.4 TEST PROCEDURE FOR MODULE TESTS

Runs the sequence of tests that verify correct operation of the incubator module. When the **Module test** button is pressed, the following sequence is performed. The user must update the user field. This data is stored in the results file. The module test will manage the transportation of plate carriers for the various tests automatically. In case the plate transport module is unavailable or not taught, the board test can be used.

Test modes allow for automatic sequencing through all the tests or allows the user to select and skip tests manually.

Procedure	Explanation:
Unique Identifications	The data report produced will display the user ID, input from the above dialog box, as well as the test software version.
Serial Number	The serial number to be read from the module EEPROM. If this test fails, please contact the manufacturer.
Parameters	Verifies default values stored within the EEPROM.
Plate In Sensor	Verifies the plate in sensor. Pass, if set and clear states detected. The test runs automatically and uses the plate transport.
Temperature sensors	Verifies temperature sensors.
Selftest	Performs selftest. Pass, if selftest completes without error.
Heaters	Verifies heater circuits.
Shake Parameters	Checks if the shake parameters are within the valid ranges.
Shake Mechanisms	Verifies shake circuits.

Table 10-10: Module test procedures

10.8.5 TEST PROCEDURE FOR BOARD TEST

Runs the sequence of tests that verify correct board operation. When the **Board test** button is pressed, the following sequence is performed. The user must update the user field. This data is stored in the results file. The board test will prompt the user to handle the plate carriers for the various tests manually (e.g. in case the plate transport module is unavailable or not taught).

Test modes allow for automatic sequencing through all the tests or allows the user to select and skip tests manually.

Procedure	Explanation:
Unique Identifications	The data report produced will display the user ID, input from the above dialog box, as well as the test software version.
Serial Number	The serial number to be read from the module EEPROM. If this test fails, please contact the manufacturer.
Parameters	Verifies default values stored within the EEPROM.
Plate In Sensor	Verifies the plate in sensor. Pass, if set and clear states detected. The test runs manually. It is necessary to remove the module cover. Follow the instructions of the service software.
Temperature sensors	Verifies temperature sensors.
Selftest	Performs selftest. Pass, if selftest completes without error.
Heaters	Verifies heater circuits.
Shake Parameters	Checks if the shake parameters are within the valid ranges.
Shake Mechanisms	Verifies shake circuits.

Table 10-11: Board test procedures

11 PHOTOMETER MODULE

This chapter describes this module in detail. In the first section "Safety" additionally to the general safety notes (see chapter 1.2 on page 1-6) safety notes are specified, which concern particularly this module. The section "Overview" gives a short overview about this module. The section "Tips and Information" gives tips and information for the handling. This section is followed by a larger part containing information about maintenance, repair and testing of this module (sections "Adjustment and Calibration", "Check and Verification", "Maintenance", "Troubleshooting and Repairs" and "Connections, Signals and Switches"). The last section "Service Software" describes only the service software module which only concerns this module.

11.1 SAFETY

NOTICE

Handling and cleaning of optical surfaces

Improper optical surfaces (e. g. lenses, sensors) could generally degrade the quality of images, data, etc.

- Do not touch any optical surfaces.
- Only clean the optical surfaces with a soft and lint-free cloth.
- Do not use any aggressive detergents or solutions (e.g. acetone).

NOTICE

Wrong results!

Do not use the photometer without cover! Stray light alters the values!

11.2 OVERVIEW

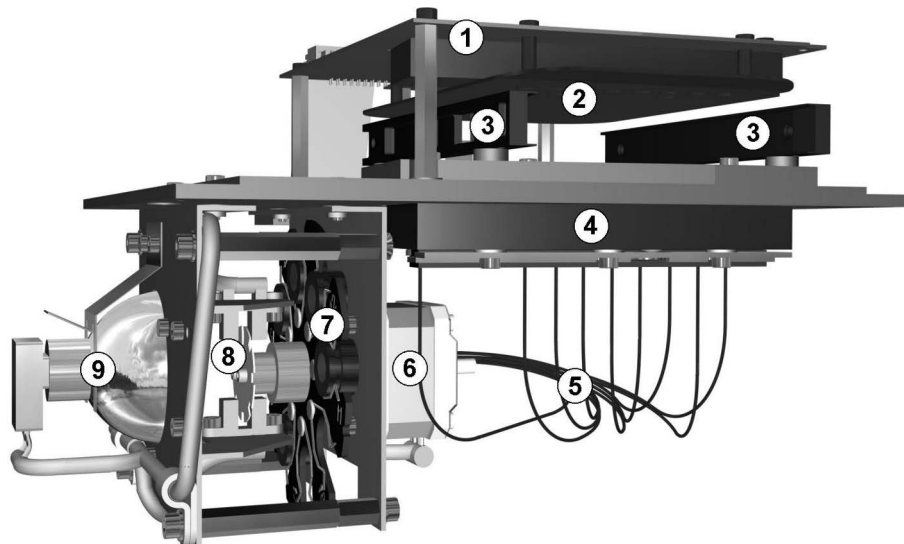


Figure 11-1: Photometer module without cover

- | | |
|---|---|
| 1 | Photometer board (with upper optic block) |
| 2 | Board cover |
| 3 | Plate carrier guiding rails |
| 4 | Lower optic block |
| 5 | Fiber optics bundle |
| 6 | Filter drive motor |
| 7 | Filter wheel with filters |
| 8 | Filter position wheel with two light barriers |
| 9 | Photometer lamp |

11.3 TIPS AND INFORMATION

This section describes tips and tricks for the handling of the photometer module.

11.3.1 PHOTOMETER MODULE TOOLS

11.3.1.1 ADJUSTMENT PINS AND PLATE

The adjustment pins and plate are used to adjust the photometer board, the plate carrier guiding rails and the lower optic block.

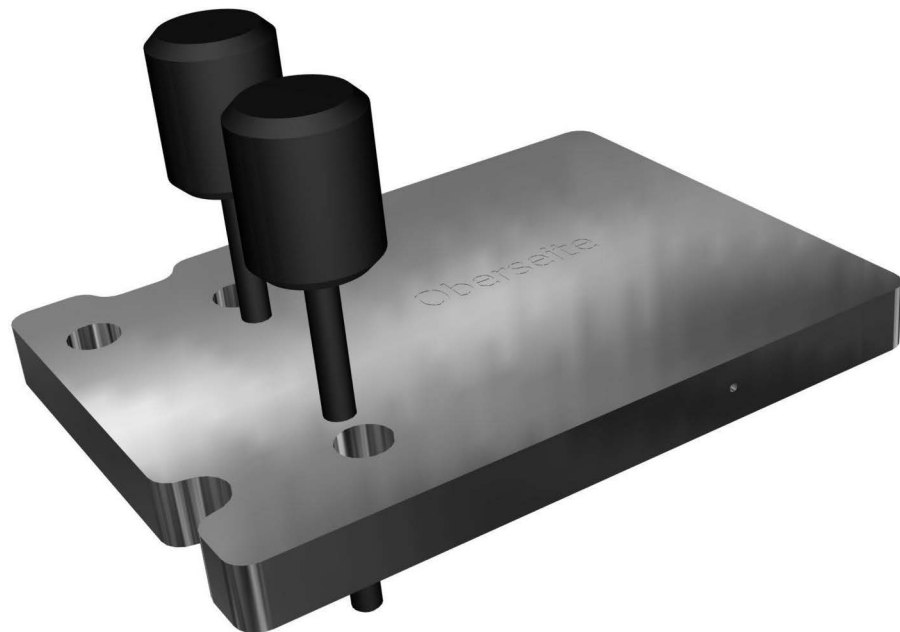


Figure 11-2: Adjustment pins and plate

11.4 ADJUSTMENT AND CALIBRATION

In this section, the adjustment methods for the photometer module are listed.

11.4.1 ADJUSTMENT OF PHOTOMETER BOARD

See chapter 11.7.5 on page 11-17

11.4.2 ADJUSTMENT OF GUIDING RAILS

See chapter 11.7.6 on page 11-19

11.4.3 FILTER WHEEL AUTO ADJUSTMENT

1. Start the instrument and the service software.
2. Start the photometer (reader) service software module (see chapter 11.8 on page 11-25).
3. Click on the **Initialize Drivers** button and wait.
4. Click on the **Auto Align** button in the **Filter Drive Parameter** area to start the filter wheel/drive alignment procedure.
5. Click on the **Set Offset** button to save the new offset value.
6. Close the service software.

11.4.4 PLATE AUTO ADJUSTMENT

1. Start the instrument and the service software.
2. Start the photometer (reader) service software module (see chapter 11.8 on page 11-25).
3. Click on the **Initialize Drivers** button and wait.
4. Click on the **Auto Alignment** button in the **High Level Commands** area to start the plate alignment procedure.
5. Follow the displayed instructions.
6. Confirm the displayed values.
7. Close the service software.

11.5 CHECK AND VERIFICATION

In this section information about the testing of certain components can be found.

11.5.1 PERFORM PHOTOMETER BOARD TEST

NOTICE

Wrong results!

Do not use the photometer without cover! Stray light alters the values!

1. Switch on the instrument.
2. Start the service software (see chapter 7.1 on page 7-1).
3. Start the photometer (reader) service software module (see chapter 11.8 on page 11-25).
4. Press on the **Selftest** button to initialize the module and start the selftest (see chapter 11.8.1 on page 11-30).
5. Press on the **Board Test** button and follow the instructions.

Special information about the photometer using the selftest of the board test:

- Check Background should be around 12400000-12600000.
- Check Filter Gains: Gains depending on the filter: If a filter lane is to low or high, filter alignment should be done and alignment of board.
- Check transmission: If transmission is low for one fiber, whole fiber bundle has to be exchanged.

The test results are also saved in a result file (see chapter 7.1.3 on page 7-4).

11.5.2 READER CONFIDENCE CHECK WITH READER VERIFICATION PLATE

See 'Instructions for use Manual'.

11.6 MAINTENANCE

This section contains instructions for the maintenance of individual components of the photometer module. After several maintenance it is required that the individual components are readjusted. Follow the instructions in the individual sections.

11.6.1 CLEANING PHOTOMETER

1. Remove the deck top (see chapter 8.3.1 on page 8-9).
2. Using a torch light inspect the reader slot carefully and check the reader for dust built-up.

NOTICE

Be careful with the reader optics. Do not touch the lower and upper optic blocks.

1. Carefully remove dust from the reader if necessary.
2. Carefully clean the guiding rails if necessary.

11.6.2 PERFORM X-ADJUSTMENT PROCEDURE WITH PHOTOMETER ADJUSTMENT TOOL

See chapter 11.8 on page 11-25.

11.6.3 CHECK THE PLATE TRANSPORT TEACHING OF THE PHOTOMETER POSITION

See chapter 20.4 on page 20-44.

11.6.4 PERFORM FILTER WHEEL ADJUSTMENT

See chapter 11.8 on page 11-25.

11.6.5 PERFORM PLATE AUTO ADJUSTMENT

See chapter 11.8 on page 11-25.

11.6.6 PERFORM A READER VERIFICATION PLATE RUN

See 'Instructions for use' Manual.

11.7 TROUBLESHOOTING AND REPAIRS

This section contains instructions for the repair of individual components of the photometer module. After several repair works it is required that the individual components are readjusted. Follow the instructions in the individual sections.

11.7.1 REPLACEMENT OF PHOTOMETER COVER

NOTICE

Wrong results!

Do not use the photometer without cover! Stray light alters the values!

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the deck top (see chapter 8.3.1 on page 8-9).
4. Remove the module cover (see chapter 8.3.3 on page 8-11).
5. Remove the four screws (2).

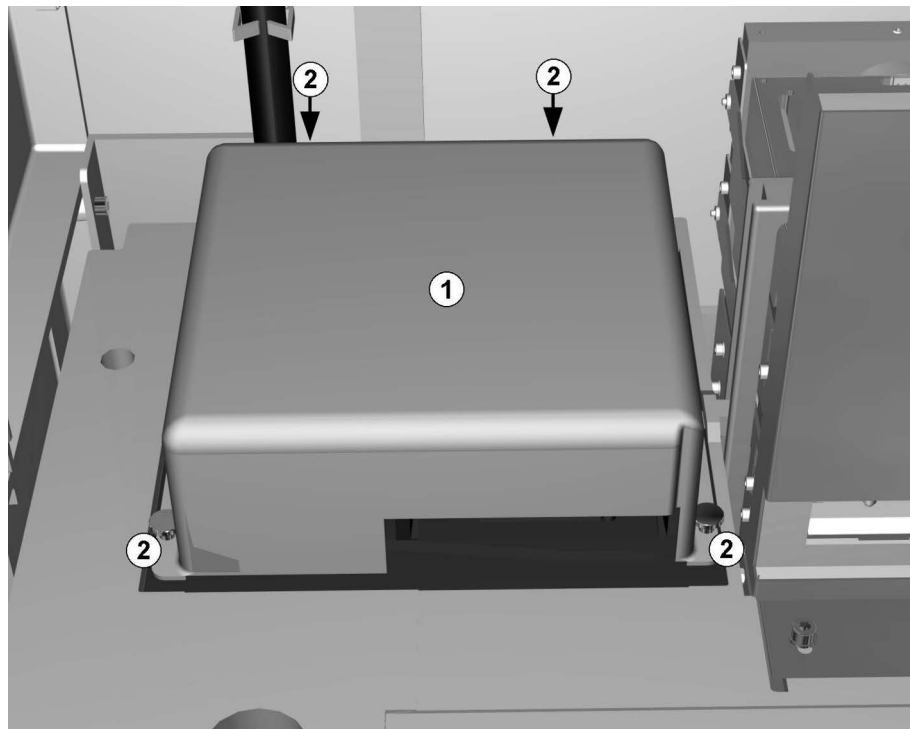


Figure 11-3: Photometer cover

6. Remove the photometer cover (1).
7. Install the photometer cover (1).
8. Tighten the four screws (2).
9. Install the module cover (see chapter 8.3.3 on page 8-11).
10. Install the deck top (see chapter 8.3.1 on page 8-9).

INSTALLATION

11.7.2 REPLACEMENT OF PHOTOMETER MODULE

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Remove the upper cover (see chapter 8.3.5 on page 8-14).
5. Disconnect the five connectors ST8, ST20, ST22, ST23, and ST25 from the instrument CU board (see chapter 19.2.1 on page 19-11).
6. Remove the photometer cover (see chapter 11.7.1 on page 11-8).
7. Remove the cables from the cable clamps.
8. Remove the three retaining screws (2).

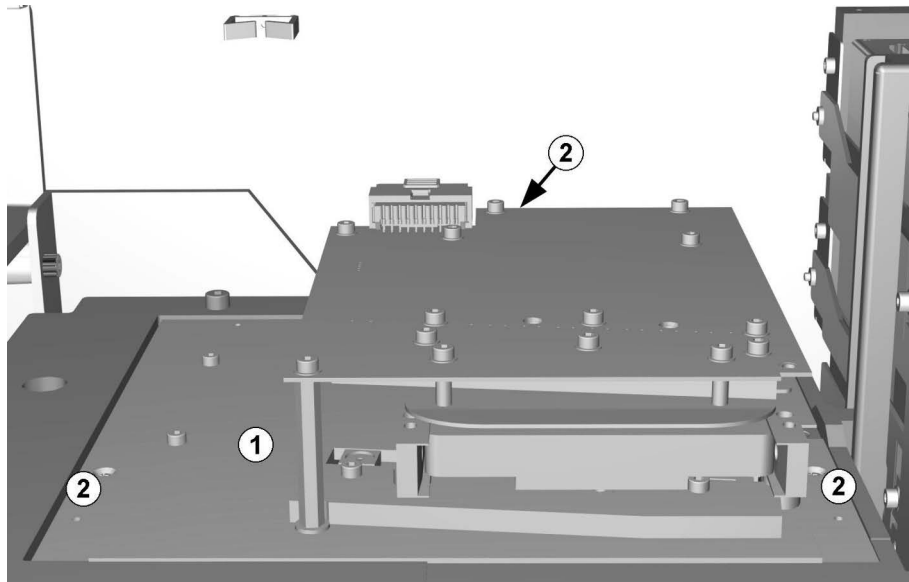


Figure 11-4: Photometer module without cover

9. Lift the photometer module (1) up and remove it.

NOTICE

Handle the fiber optics with care!

- Don't pull at the single fibers!
- Don't bend the fibers (min. radius 2.5 cm / 1 inch)!
- Don't touch the end of fibers!

INSTALLATION

10. Insert the photometer module (1).
11. Tighten the three retaining screws (2).
12. Plug the connector of the ribbon cable into the photometer board (see chapter 19.4.1 on page 19-18).
13. Insert the cables into the cable clamps.

14. Plug the four connectors ST8, ST20, ST22, ST23, and ST25 into the instrument CU board (see chapter 19.2.1 on page 19-11).
15. Install the photometer cover (see chapter 11.7.1 on page 11-8).
16. Install the upper cover (see chapter 8.3.5 on page 8-14).
17. Install the top cover (see chapter 8.3.4 on page 8-12).
18. Teach the photometer position of the plate transport (see chapter 20.4 on page 20-44).
19. Execute the photometer adjustment procedures (see chapter 11.8 on page 11-25).
20. Execute the board test to verify the new photometer module.

11.7.3 REPLACEMENT OF PHOTOMETER LAMP

⚠ CAUTION



Risk of burn

The halogen lamp will reach high temperatures during operation and testing. Contact will cause injuries.

- Use appropriate gloves!
- Let the halogen lamp cool down before cleaning or maintenance.

In the event of a lamp failure, replace the lamp with the recommended part only. Use of other lamps is not acceptable.

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove both retaining screws (2) and the photometer service cover (1).



Figure 11-5: Photometer service cover

4. Lift the lamp retaining clip (3) and remove the lamp (4).

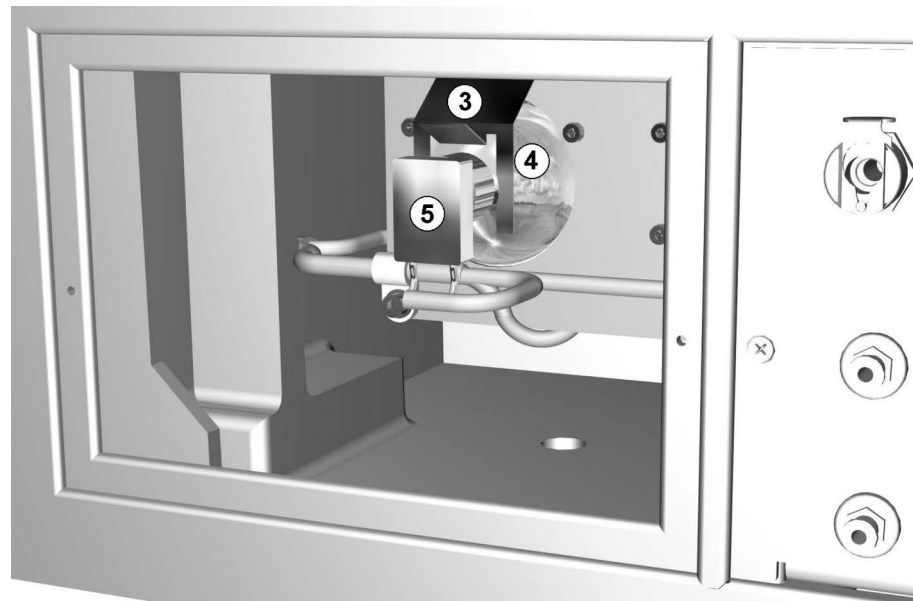


Figure 11-6: Photometer lamp

5. Disconnect the lamp connector (5).

INSTALLATION

6. Plug the new lamp (4) into the lamp connector (5).
7. Lift the lamp retaining clip (3) and insert the lamp (4).
8. Install the photometer service cover (1) and tighten both retaining screws (2).
9. Start Filter Wheel Auto Adjustment (see chapter 11.4.3 on page 11-4).
10. Execute the reader verification plate process to verify the new lamp (see 'Instructions for use' Manual).

11.7.4 REPLACEMENT OF FILTER(S)

NOTICE

Sensitive optic surfaces

Optic surfaces (e.g. filters) must be free of dust and fat.

- Do not touch any optic surfaces.
- Only clean optic surfaces with a suitable cleaning procedure.

Always use the recommended filter part. Use of other filters is not acceptable.

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove both retaining screws (2) and the photometer service cover (1).



Figure 11-7: Photometer service cover

4. Turn the filter wheel (3) to the desired filter (4).
Note that filter 1 has a notch (5) on the filter wheel!
Note that the filter is always above the numbering!

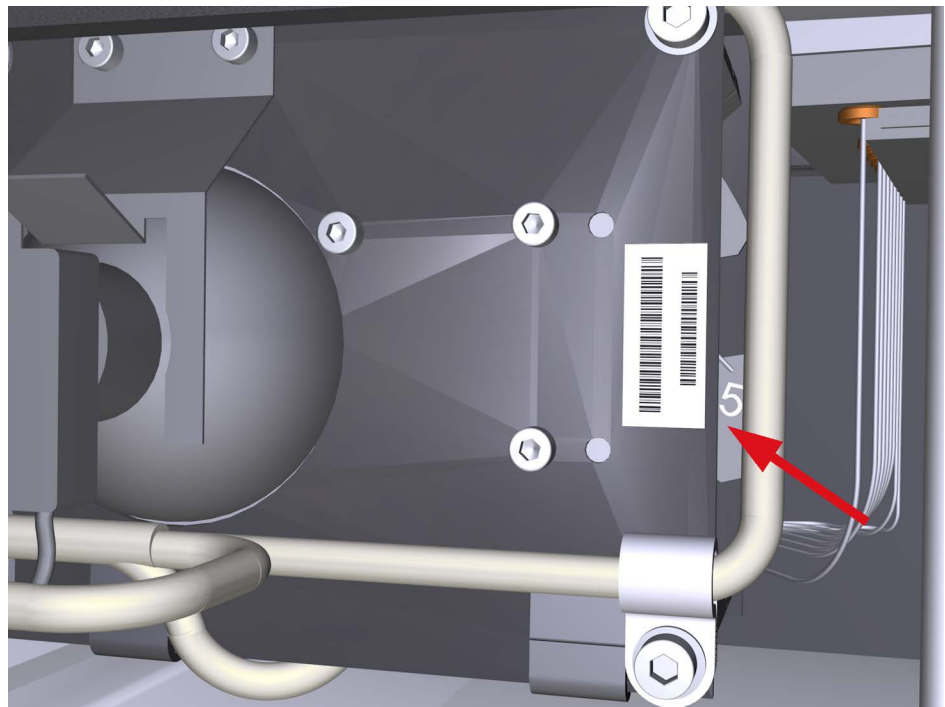


Figure 11-8: Installed filter wheel

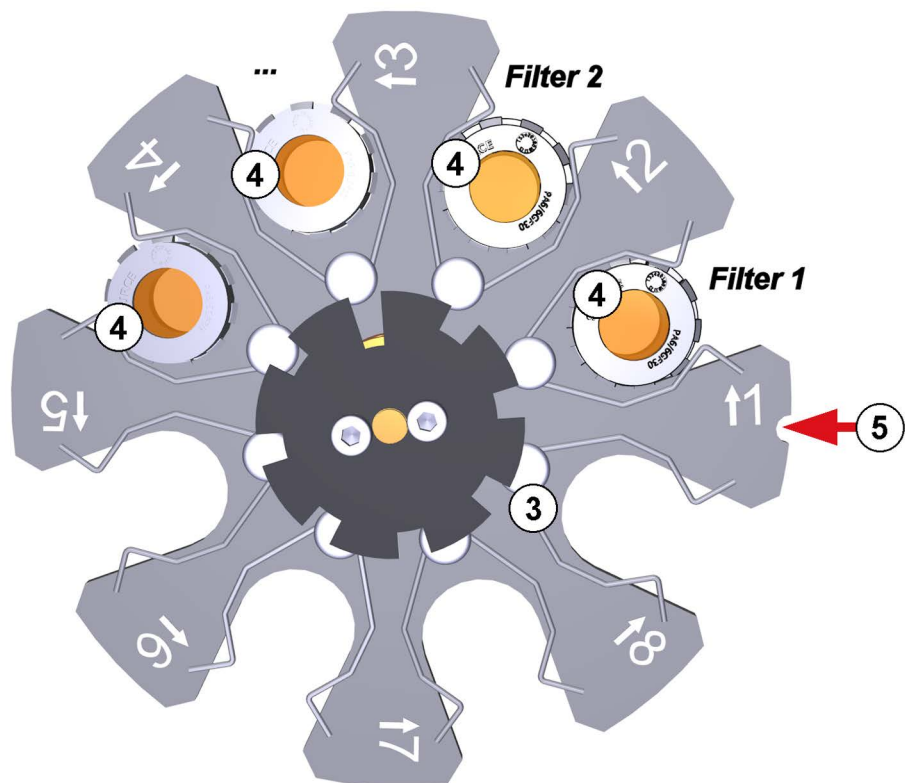


Figure 11-9: Filter wheel

5. Pull the desired filter (4) out of the filter wheel (3).

INSTALLATION

6. Push the new filter (4) into the filter wheel (3).
The standard configuration is:
 - Filter 1: 450 nm
 - Filter 2: 492 nm
 - Filter 3: 620 nm
 - Filter 4 to 8: -
7. Ensure filters are inserted correctly:
 - Arrow on filter indicates the direction of light through the filter.
 - Filters must be positioned starting from position 1.
 - Filters must occupy every position in sequence, no omissions.
8. After a new filter with a different wavelength has been installed the settings for the filters in the firmware have to be changed using the service software (see chapter 11.8 on page 11-25).
9. Install the photometer service cover (1) and tighten both retaining screws (2).
10. Perform filter wheel auto adjustment (see chapter 11.8 on page 11-25).
11. Execute the reader verification plate process to verify the new filter(s) (see 'Instructions for use' Manual).

11.7.5 REPLACEMENT OF PHOTOMETER BOARD

REMOVAL

1. Remove the photometer cover (see chapter 11.7.1 on page 11-8).
2. Remove the five retaining screws (2) and the photometer board (1).

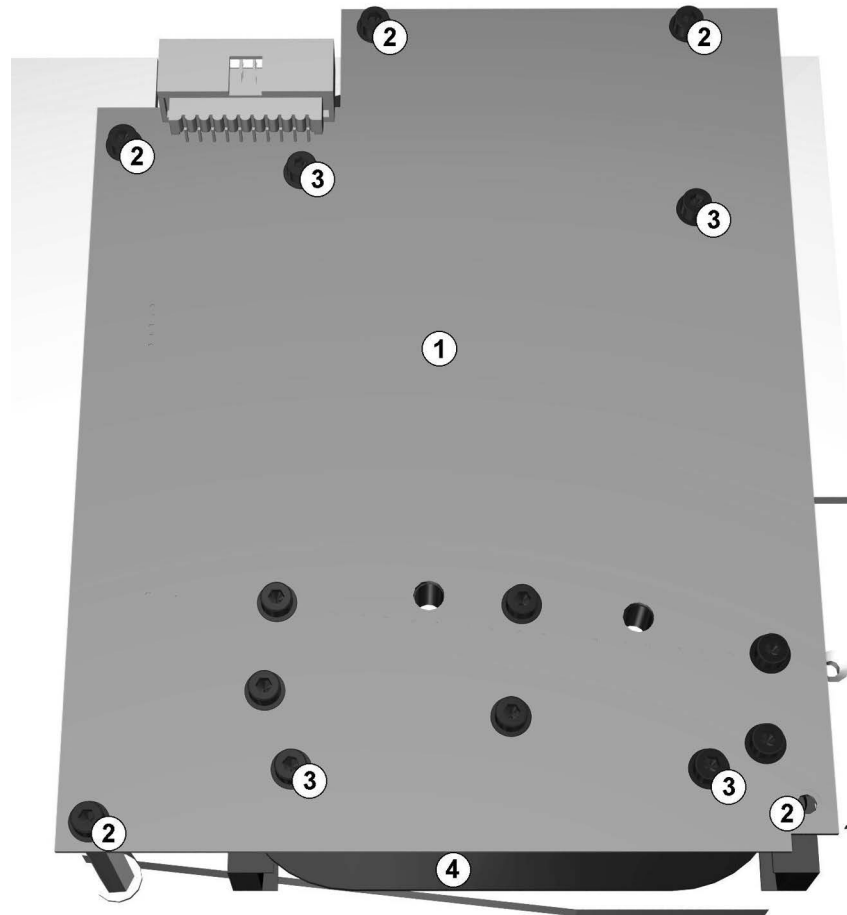


Figure 11-10: Photometer board

3. Remove the four retaining screws (3) and the board cover (4).

INSTALLATION

4. Install the board cover (4) on the new photometer board (1) and tighten the four retaining screws (3).
5. Insert the adjustment plate and stick the adjustment pins (5) (see chapter 11.3.1.1 on page 11-3) through the upper optic block and adjustment plate into the adjustment holes of the lower optic block.
Note the orientation of the adjustment plate!
The notch on the short side of the adjustment plate must be at the front side.
The notch on the long side of the adjustment plate must be at the left side.

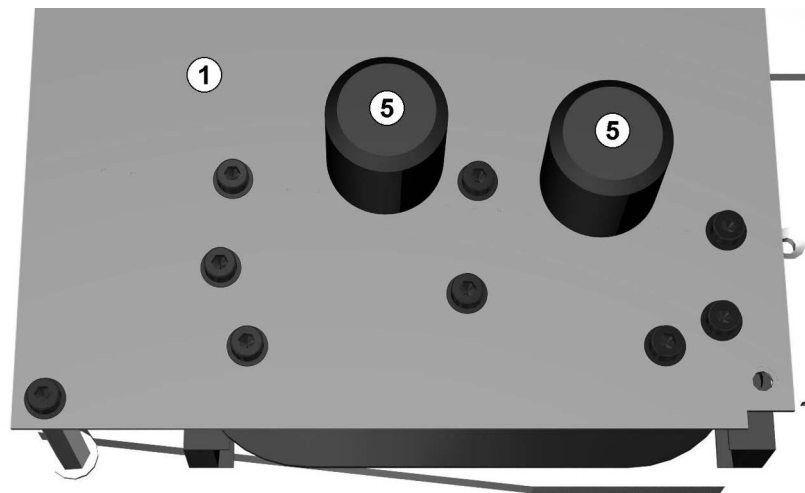


Figure 11-11: Photometer board with adjustment pins

6. Install the new photometer board (1) and tighten the five retaining screws (2).
7. Remove the adjustment pins (5) and the adjustment plate.
8. Install the photometer cover (see chapter 11.7.1 on page 11-8).

INFO

Check firmware version before execute the verification plate process! If necessary, install the latest firmware version.

9. Start Filter Wheel Auto Adjustment (see chapter 11.4.3 on page 11-4).
10. Execute the board test to verify the new photometer board.

11.7.6 REPLACEMENT OF GUIDING RAILS

REMOVAL

1. Remove the photometer board (see chapter 11.7.5 on page 11-17).
2. Remove both retaining screws (2) and the left guiding rail (1).

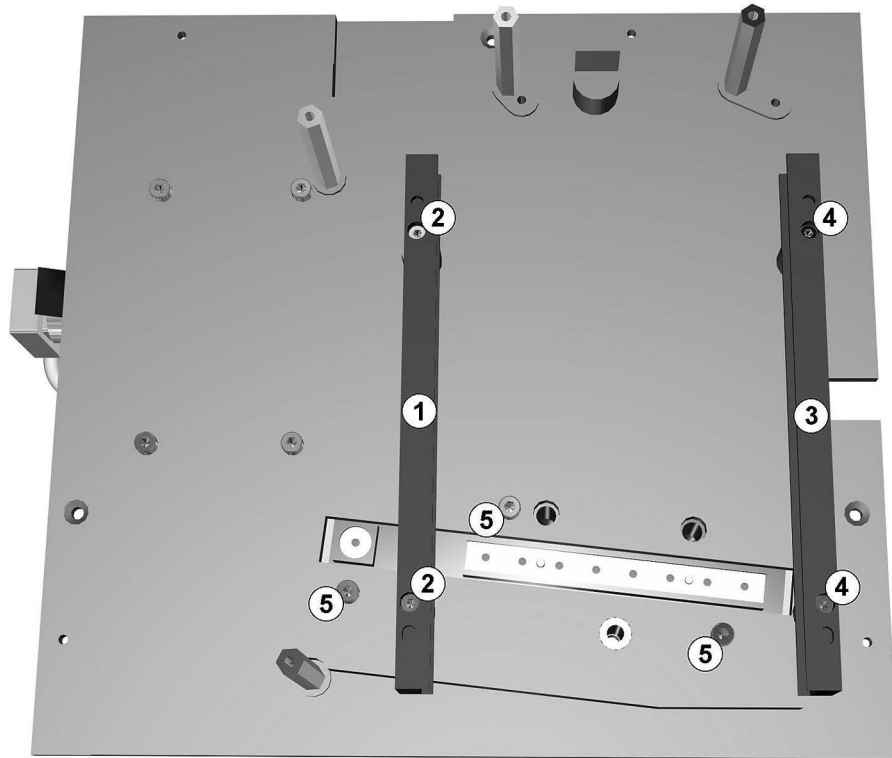


Figure 11-12: Guiding rails

3. Remove both retaining screws (4) and the right guiding rail (3).

INSTALLATION

4. Insert the left guiding rail (1) and screw both retaining screws (2) loose on. Do not tighten the screws!
Note the orientation of the left guiding rail! The spring and the small elongated hole on the top must shown to the front side.
5. Insert the right guiding rail (3) and screw both retaining screws (4) loose on. Do not tighten the screws!
Note the orientation of the right guiding rail! The small elongated hole on the top must show to the front side.
6. Loosen the three retaining screws (5) of the lower optic block (see figure above).
7. Insert the adjustment plate (6) and stick the adjustment pins (7) (see chapter 11.3.1.1 on page 11-3) through the adjustment plate into the adjustment holes of the lower optic block.
Note the orientation of the adjustment plate!
The notch on the short side of the adjustment plate must be at the front side.
The notch on the long side of the adjustment plate must be at the left side.

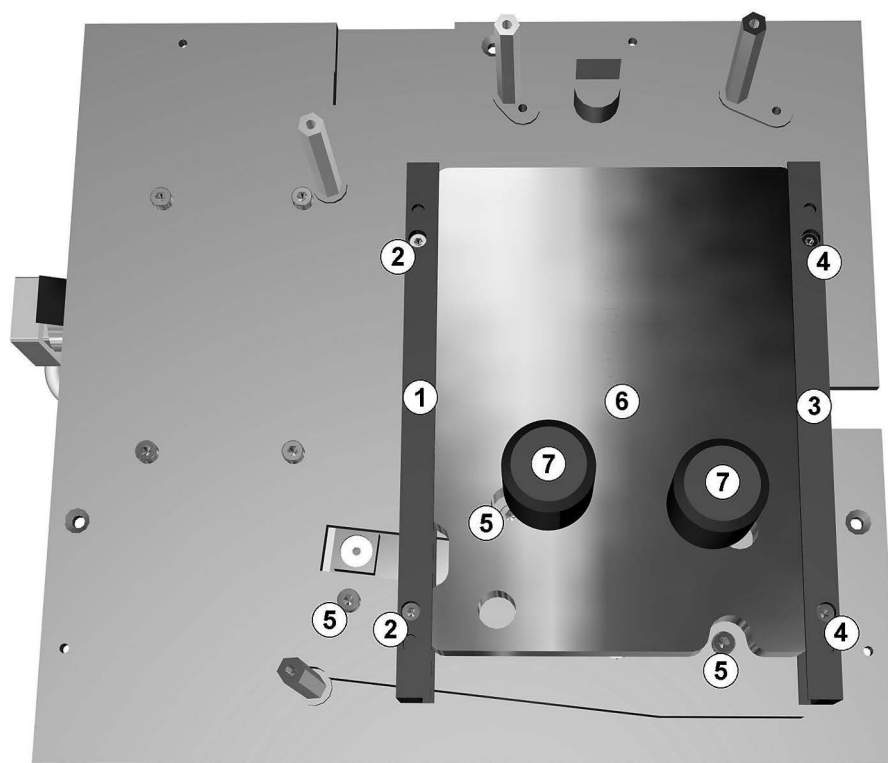


Figure 11-13: Adjustment of the guiding rails

8. Press both guiding rails (1 + 2) against the adjustment plate and tighten the four retaining screws (2 + 4).
9. Tighten the three retaining screws (5) of the lower optic block.
10. Remove the adjustment pins (5) and the adjustment plate (6).
11. Install the photometer board (see chapter 11.7.5 on page 11-17).
12. Teach the photometer position of the plate transport (see chapter 20.4 on page 20-44).
13. Start Filter Wheel Auto Adjustment (see chapter 11.4.3 on page 11-4).
14. Start Plate Auto Adjustment (see chapter 11.4.4 on page 11-4).
15. Execute the board test to verify the new photometer module.

11.7.7 REPLACEMENT OF FIBER OPTICS

The lamp light goes through an interference filter onto the collection of 9 plastic fibers directly behind the filter. Each fiber carries the light into the lower optic block. A lens within the block focuses the light onto the photometer board directly above. The depth each fiber end is inserted into the lower optic block is critical. Incorrect positioning will cause the light beam to scatter. The depth is set so that the image projected onto the photo diodes is a crisp, round circle, with no optic aberrations (like light seals). One method of reviewing the beam is to transmit white light (remove a filter) through the optics and project onto a sheet of paper held where the photometer board would be. The circles should all be consistently the same, in line and clearly defined. This is best viewed in a darkened room.

REMOVAL

1. Remove the photometer module (see chapter 11.7.2 on page 11-10).
2. Install the photometer cover (see chapter 11.7.1 on page 11-8). It is not necessary to tighten the screws.
3. Turn photometer module upside down.

NOTICE

Do not place the photometer module onto the photometer board!

- Use closed photometer cover!

4. Unscrew the black plastic pin (9).

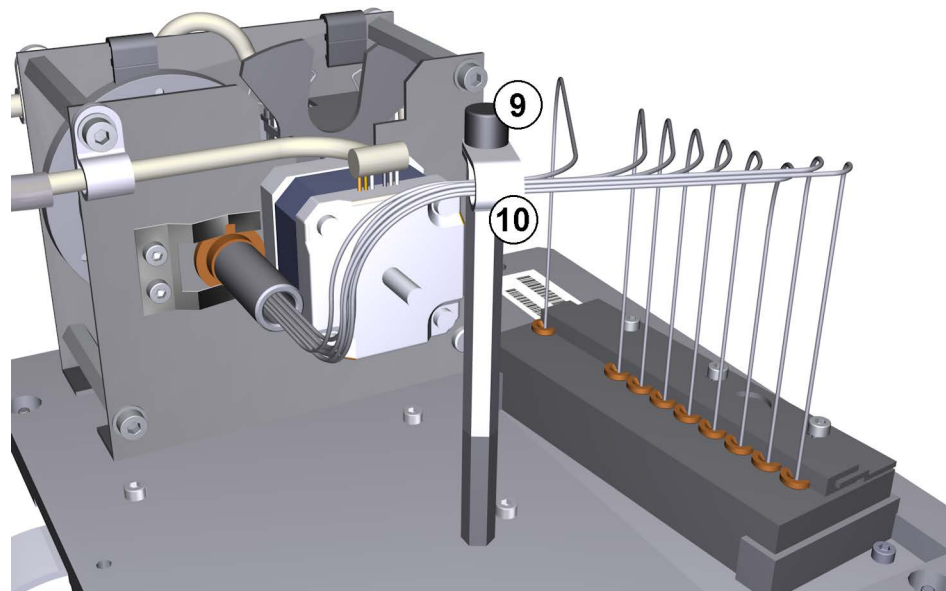


Figure 11-14: Fibre optic holder

5. Remove the cable holder (10) from the single fibers.
6. Loosen the three retaining screws (1) and the single fiber clamp (2) at the lower optic block (3).

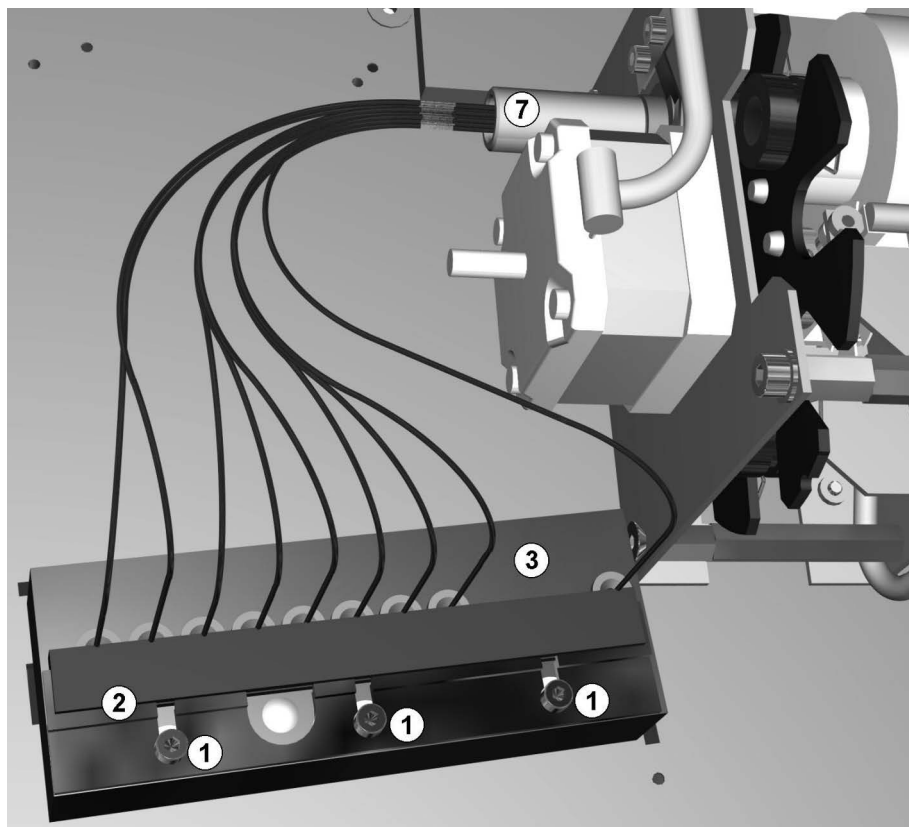


Figure 11-15: Lower optic block with fiber optics

7. Lift up the nine single fiber optic tubings (4) carefully without turning out. Use a flat screw driver to prize the nine single fiber optic tubing out of the lower optic block (see small arrow).

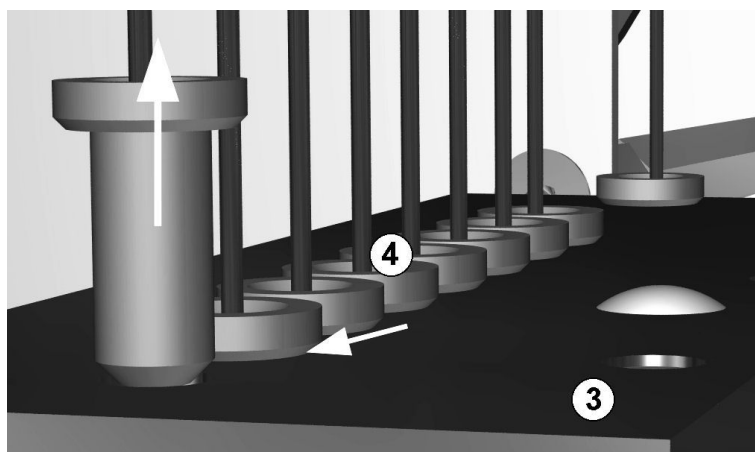


Figure 11-16: Single fiber optic tubings

8. Remove both screws (5) and remove the bundle fiber clamp (6) next to the filter drive motor.

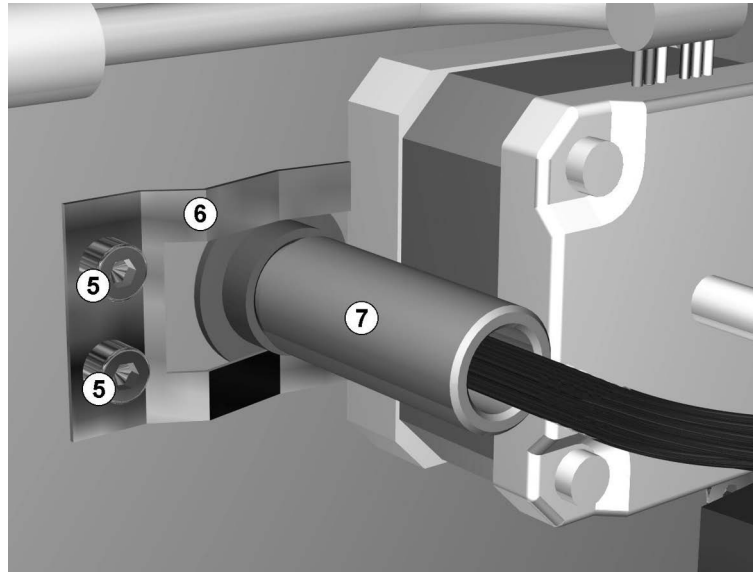


Figure 11-17: Fiber optic bundle

9. Remove the fiber optic bundle (7).

INSTALLATION

NOTICE

Handle the fiber optics with care!

- Don't pull at the single fibers!
- Don't bend the fibers (min. radius 2.5 cm / 1 inch)!
- Don't touch the end of fibers!

10. Insert the new fiber optic bundle (7).
11. Install the bundle fiber clamp (6) and tighten both screws (5).
12. Insert the single fiber optic tubings (4) carefully without turning in.

NOTICE

Use the single fiber optic with the max. value (100%) for the reference channel (8).

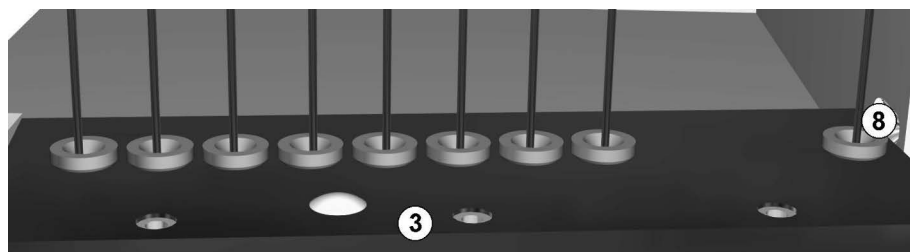


Figure 11-18: Reference channel

13. Install the single fiber clamp (2) at the lower optic block (3) and tighten the three screws (1).
14. Put the cable holder (10) onto the single fibers.

15. Align cable holder (10) and the single fibers so that the single fibers lead vertically into the lower optic block.
16. Tighten the black plastic pin (9).
Do not use too much force!
17. Remove the photometer cover (see chapter 11.7.1 on page 11-8).
18. Install the photometer module (see chapter 11.7.2 on page 11-10).
19. Execute the verification plate process to verify the new fiber optics.

11.8 SERVICE SOFTWARE

When the photometer (reader) software is started, the application attempts to communicate to the instrument and photometer module. When successful the following dialog will be displayed with the Version and serial number displayed. Defaults such as instrument offsets, will be read from the module EEPROM. If no module is detected, the version # will be left blank.

First thing to do in this dialog is usually **Selftest**, then **Initialize drives**, which is needed to use some high level commands that use the plate transport module.

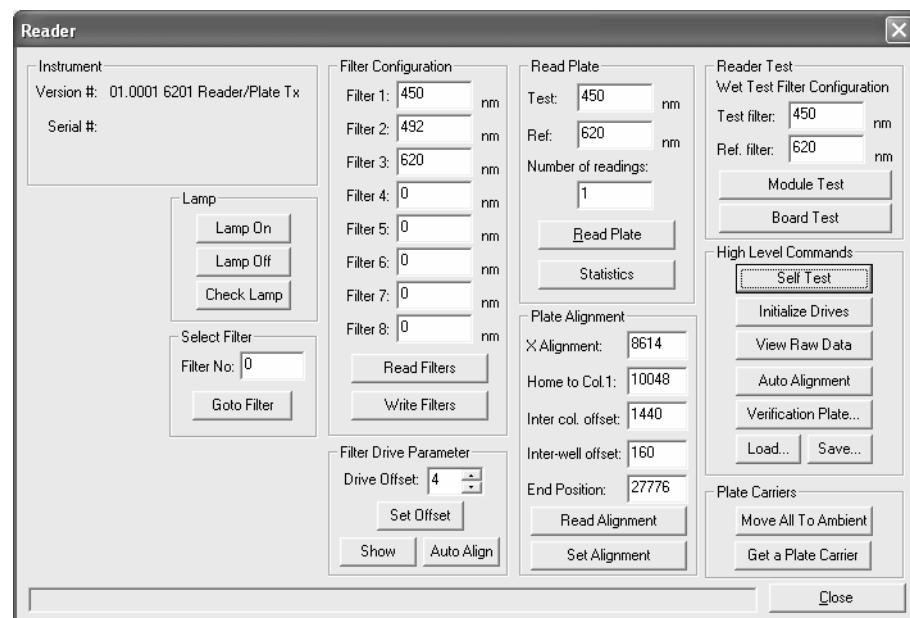


Figure 11-19: Reader main dialog

INSTRUMENT

Function	Description
Version	Shows the firmware version number, if connection is established with the module.
Serial	Shows the serial number, if connection is established with the module. The edit allows to change the serial number.

Table 11-1: Functions of the Instrument area

LAMP

Function	Description
Lamp On	Turns the lamp ON.
Lamp Off	Turns the lamp OFF.
Check Lamp	Checks lamp status.

Table 11-2: Functions of the Lamp area

SELECT FILTER

Function	Description
Filter No	Enter the required filter number (0 = Filter 1, ... , 7 = Filter 8) in the edit box.
Goto Filter	Moves to the selected filter (0 = Filter 1, ... , 7 = Filter 8).

Table 11-3: Functions of the Select Filter area

FILTER CONFIGURATION

Function	Description
Filter 1 - Filter 8	Shows the filter values or when edited allow the values to be updated (see chapter 11.7.4 on page 11-14).
Read Filters	Reads the current filter wavelengths and displays them in the edit boxes.
Write Filters	Writes filter wavelengths from the contents of the edit boxes.

Table 11-4: Functions of the Filter Configuration area

FILTER DRIVE PARAMETER

Allows user to read or set the filter wavelengths.

Function	Description
Drive Offset	Set filter drive offset.
Set Offset	Writes offset to EEPROM.
Show	Moves the filter wheel to position 1 using the current offset. Set offset must be pressed to change offset.
Auto Align	Runs auto adjust software to determine offset. After completion the user is prompted to confirm new offset, filter wheel will be at position 1 with the new offset. The user must visually check offset is correct before acceptance. After auto align routine, press on the Set Offset button to write the alignment values into the EEPROM.

Table 11-5: Functions of the Filter Drive Parameter area

READ PLATE

Allows user to read plate using specified measurement wavelength, reference wavelength, and number of readings.

Function	Description
Test	Allows entering the measurement wavelength.
Ref	Allows entering the reference wavelength. To read in single mode, leave reference wavelength blank.
Number of readings	Allows entering the number of readings.
Read Plate	Performs plate read, using parameters defined in the fields Test , Ref. and Number of readings .
Statistics	Displays multiple readings and statistics. When the number of reads is set below 5, a minimum of 5 reads is used anyway.

Table 11-6: Functions of the Read Plate area

PLATE ALIGNMENT

Function	Description
X Alignment	The plate adjustment values for X adjustment will be different for each instrument. This value is determined by the teaching of the plate transport.
Home to Col. 1	The plate adjustment values for Home to Col 1 offset will be different for each instrument. It is used to adjust for the position of well A1 and the drive home position. It should be checked if the photometer board has been moved - use the Plate Auto Adjustment (see chapter 11.4.4 on page 11-4) to do this.
Inter col. offset	Define the plate dimensions and should be the same on all readers.
Inter-well offset	Define the plate dimensions and should be the same on all readers.
End Position	End position of the plate reading.
Read Alignment	Reads and displays adjustment parameters in Home to Col.1 , Inter col. offset , and Inter-well offset .
Set Alignment	Writes values to EEPROM for adjustment.

Table 11-7: Functions of the Plate Alignment area

READER TEST

Allows user to test reader module using parameters defined in wet tests, test filter, and reference filter.

Function	Description
Test filter	Allows entering the measurement wavelength.
Ref. filter	Allows entering the reference wavelength.
Module Test	Not for service.
Board Test	See chapter 11.8.2 on page 11-31 Enables among other things the reading of the filter gains and transmission values (confirm all displays up to the selftest).

Table 11-8: Functions of the Reader Test area

HIGH LEVEL COMMANDS

Function	Description
Selftest	see chapter 11.8.1 on page 11-30
Initialize Drivers	Initializes filter and plate drive. Initialization steps: 1. Home filter motor 2. Turn off lamp 3. Measure background levels (dark) 4. For each filter, checks optimum gain to use with lamp on, check signal is not too noisy 5. Uses first filter, check fiber optics for consistent transmission.
View Raw Data	Displays selftest results.
Auto Alignment	Executes the auto adjustment routine. Requires operator to have a reader adjustment plate. After auto adjustment routine, press on the Set Alignment button to write the adjustment values into the EEPROM.
Verification Plate	Executes the verification plate tests. Requires operator to have a reader verification plate and valid certificate file for verification plate.
1 OD Wet Plate	Not for service.
Load	Displays a warning message before allowing the user to select a file containing module parameters.
Save	Allows the module parameters to be saved to a file.

Table 11-9: Functions of the High Level Commands area

PLATE CARRIERS

Function	Description
Move All To Ambient	Gets all plate carriers one-by-one out of the instrument.
Get a Plate Carrier	Gets one plate carrier out of the instrument.

Table 11-10: Functions of the Plate Carriers area

GENERAL

Function	Description
Close	Closes application
Command Line Display	The line at the bottom of the screen displays the devices reply.

Table 11-11: Functions

11.8.1 SELFTEST

When **Selftest** button clicked, selftest command is processed. Perform the following tests in sequence:

1. Tests the EEPROM checksum
2. Move X-axis home
3. Move Y-axis to each position 1 to 8, then check that it goes back to home at position 1.
4. Measure reference voltages of front end
5. Measure photo diode dark background signals
6. Test lamp signals
7. Test each filter for gain and noise
8. Measure optic channel transmissions

If an error occurs during any test, the appropriate error response is given and the test stops (see chapter 6.2.5 on page 6-27).

Otherwise command responds with **OK**, successful command execution.

11.8.2 TEST PROCEDURE FOR BOARD TEST

Runs the sequence of tests that verify correct board operation. When the **Board test** button is pressed, the board test dialog appears. The user must update the **User** field. This data is stored in the results file.

Test modes allow for automatic sequencing through all the tests or allows the user to select and skip tests manually.

Procedure	Explanation:
Unique Identifications	The data report produced will display the User ID, input from the above dialog, as well as the test software version.
Serial Number	The serial number to be read from the module EEPROM. If this test fails, please contact the manufacturer.
Parameters	Verifies current values stored in EEPROM. If this test fails: <ul style="list-style-type: none"> Start Complete Firmware Update with Instrument Setup (Pipettor Version 3) (see chapter 21.1 on page 21-1). Replace photometer board (see chapter 11.7.5 on page 11-17).
Filter Drive	Verifies filter drive. If this test fails, check for obstructions to the drive. Check the cables are secured. Check the sensors and motor electrical connections.
Selftest	Performs selftest. If this test fails, check the error code in the response and check against the Troubleshooting error list (see chapter 6.2.5 on page 6-27).

Table 11-12: Board test procedures

See chapter 11.5.1 on page 11-5 for test procedure.

Intentionally left blank.

12 PIPETTOR MODULE

This chapter describes this module in detail. In the first section "Safety" additionally to the general safety notes (see chapter 1.2 on page 1-6) safety notes are specified, which concern particularly this module. The section "Overview" gives a short overview about this module. The section "Tips and Information" gives tips and information for the handling. This section is followed by a larger part containing information about maintenance, repair and testing of this module (sections "Adjustment and Calibration", "Check and Verification", "Maintenance", "Troubleshooting and Repairs" and "Connections, Signals and Switches"). The last section "Service Software" describes only the service software module which only concerns this module.

12.1 OVERVIEW

INFO

For detailed liquid plan see chapter 17.2.3 on page 17-5.

12.1.1 PIPETTOR MODULE

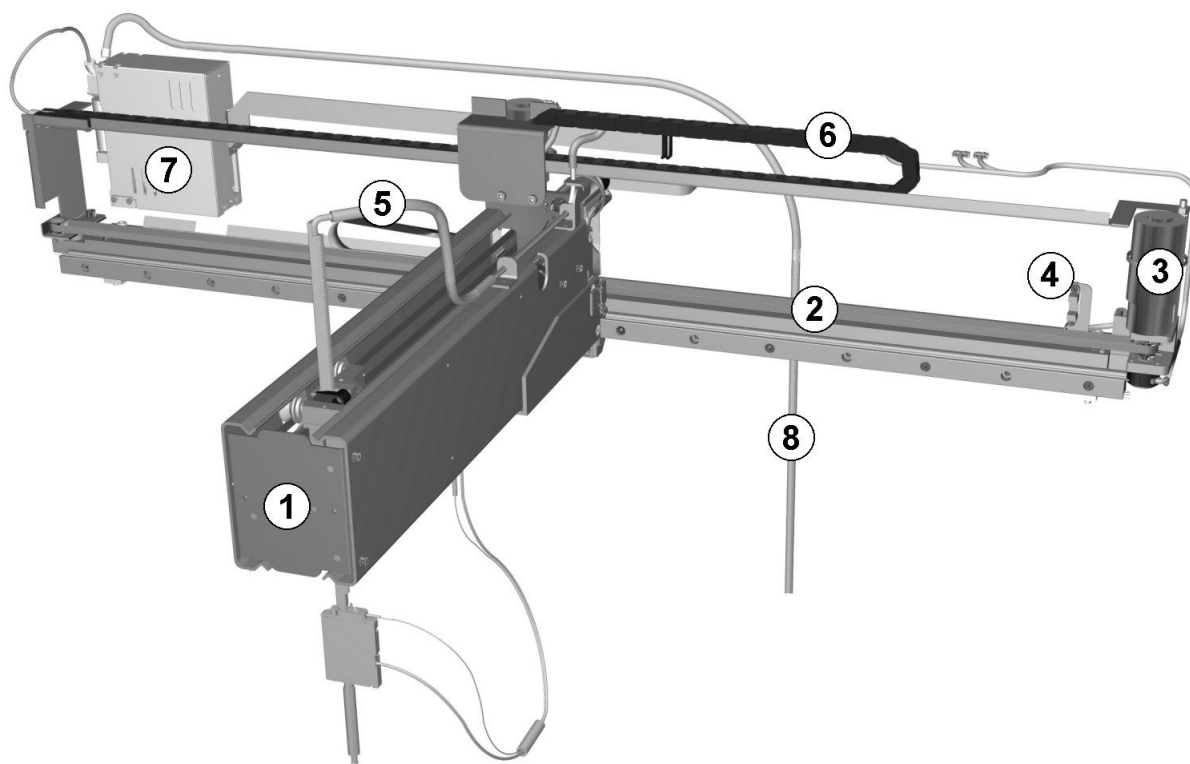


Figure 12-1: Pipettor module with diluter pump

- | | |
|---|---|
| 1 | Pipettor arm with disposal tip adapter and Y-/Z-drive (see chapter 12.1.2 on page 12-3) |
| 2 | X-belt |
| 3 | X-motor and X-encoder - (connected to the instrument CU board, ST57 + ST58) |
| 4 | X-init light barrier (X-home position) - (connected to the instrument CU board, ST54) |
| 5 | Pipettor system liquid tubing (between disposal tip adapter and diluter pump) |
| 6 | Energy chain |
| 7 | Diluter pump with syringe and 3-way valve (connected to the instrument CU board, ST59) |
| 8 | System liquid tubing (between diluter pump and system liquid pump, see chapter 17.2.2 on page 17-3) |

12.1.2 PIPETTOR ARM

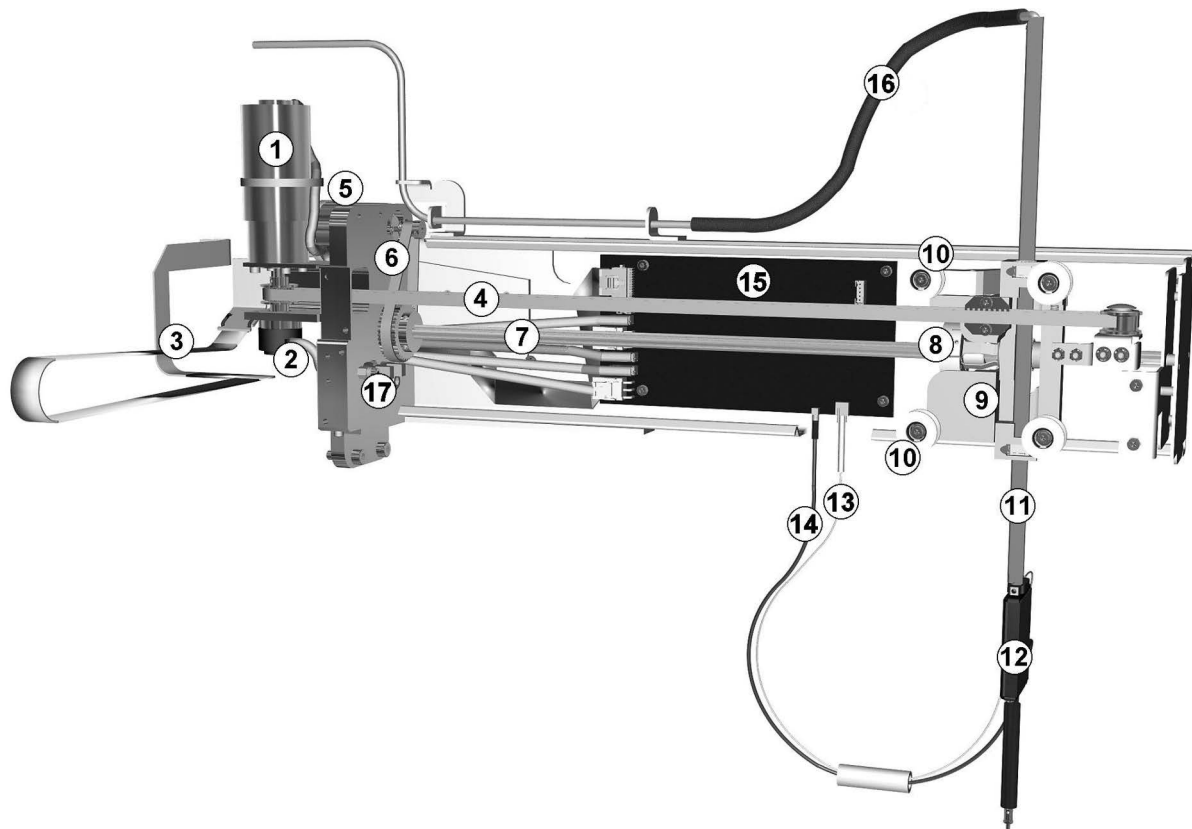


Figure 12-2: Pipettor arm without left cover

- | | |
|----|--|
| 1 | Y-motor |
| 2 | Y-encoder |
| 3 | Ribbon cable to instrument CU board (ST60) |
| 4 | Y-belt |
| 5 | Z-motor and Z-encoder |
| 6 | Z-belt |
| 7 | Z-drive shaft |
| 8 | Z-drive for the toothed rack |
| 9 | Y-sledge |
| 10 | Guiding rollers (4) |
| 11 | Toothed rack |
| 12 | Disposable tip adapter |
| 13 | APM tubing |

- | | |
|----|---|
| 14 | Liquid level detection cable (LLD cable) |
| 15 | Pipettor board |
| 16 | Pipettor system liquid tubing (between disposal tip adapter and diluter pump) |
| 17 | Y-init light barrier (Y-home position) |

12.2 TIPS AND INFORMATION

This section describes tips and tricks for the handling of the pipetting system.

12.2.1 PIPETTOR TOOLS

INFO

For pipettor module teach tools see chapter 20.2.1 on page 20-2.

12.2.1.1 TOOTHED RACK ADJUSTMENT TOOL

Tool to adjust the toothed rack and the pipettor module. The toothed rack adjustment tool could only used with the loading bay teach tool (see chapter 20.2.1.3 on page 20-3).



Figure 12-3: Toothed rack adjustment tool with the loading bay teach tool

12.3 ADJUSTMENT AND CALIBRATION

In this section, the adjustment of the pipetting system is described.

12.3.1 ADJUSTMENT OF X-BELT AND X-MOVEMENT FORCE

TOOLS

- Spring balance up to 10 N

ADJUSTMENT



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Remove the upper cover (see chapter 8.3.5 on page 8-14).
5. Disconnect the X-motor connector (ST58) from the instrument CU board (see chapter 19.2.1 on page 19-11).
6. Move the pipettor arm to the right side.
7. Hook the spring balance into the back X-belt side (1), next to the ribbon cable and pull it against the other X-belt side.
The force must be 4 N (+2 N).
 - Use the screws (2 + 3) of the belt tightener on the left side to increase/decrease the force.

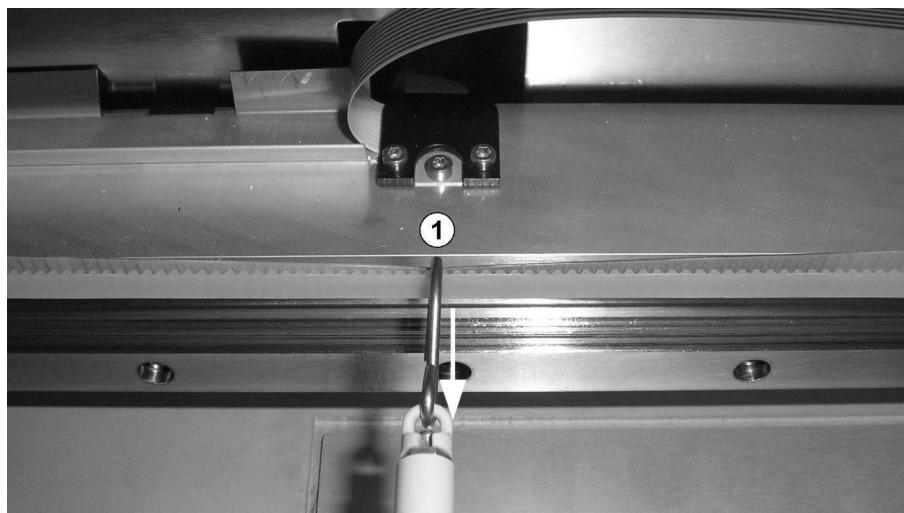


Figure 12-4: Spring balance on the X-belt

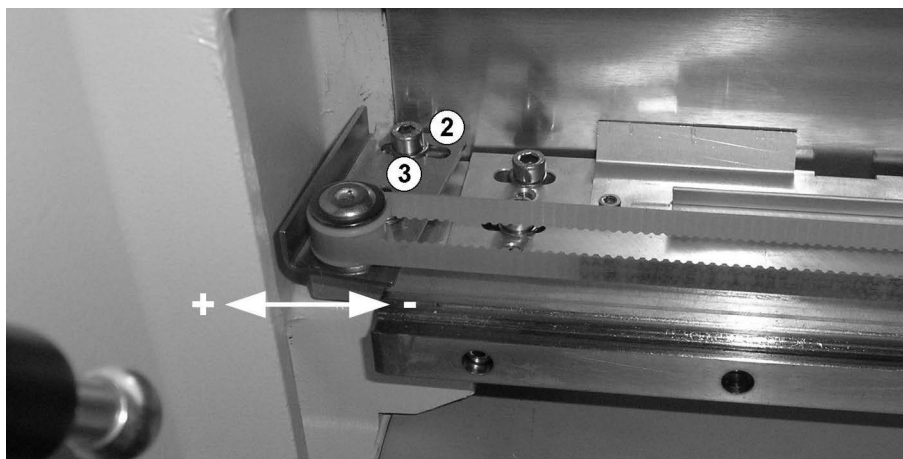


Figure 12-5: Adjustment screw

8. Hook the spring balance into the pipettor arm and pull it sideways so that it moves steadily and slowly.
The force must for this movement be less than 10 N.
If the force is higher check the guiding rail for dirt and the belt tension (again).
Note that the motor should be disconnected to avoid forces due to induction.
9. Plug the X-motor connector (ST58) into the instrument CU board (see chapter 19.2.1 on page 19-11).
10. Install the upper cover (see chapter 8.3.5 on page 8-14).
11. Install the top cover (see chapter 8.3.4 on page 8-12).
12. Check the taught positions of the pipettor module (see chapter 20.2 on page 20-2).

12.3.2 ADJUSTMENT OF Y-BELT AND Y-MOVEMENT FORCE

TOOLS

- Spring balance up to 25 N

ADJUSTMENT



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Disconnect the Y-motor connector (J7) from the pipettor board (see chapter 19.5.1 on page 19-20).
4. Move the Y-sledge (3) to the backside.
5. Hook the spring balance into the right Y-belt side (1) and pull it against the other side.

The value of the force must be 15 N (+ 2 N/- 1 N).

- Use the nuts (2) of the belt tightener to increase/decrease the force.

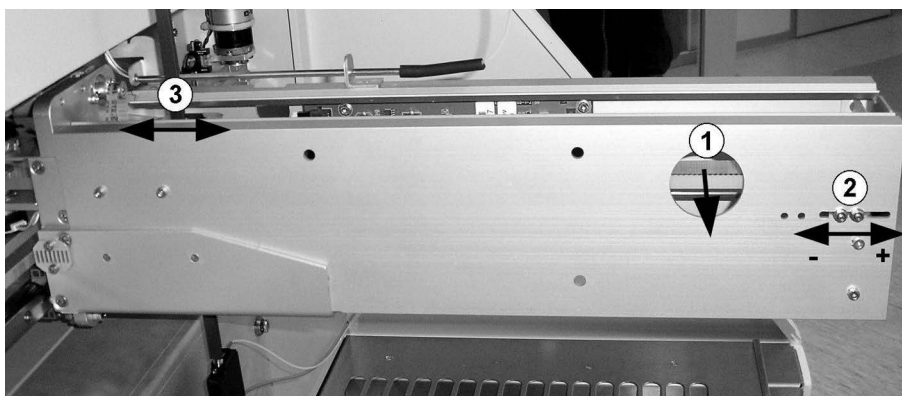


Figure 12-6: Pipettor arm

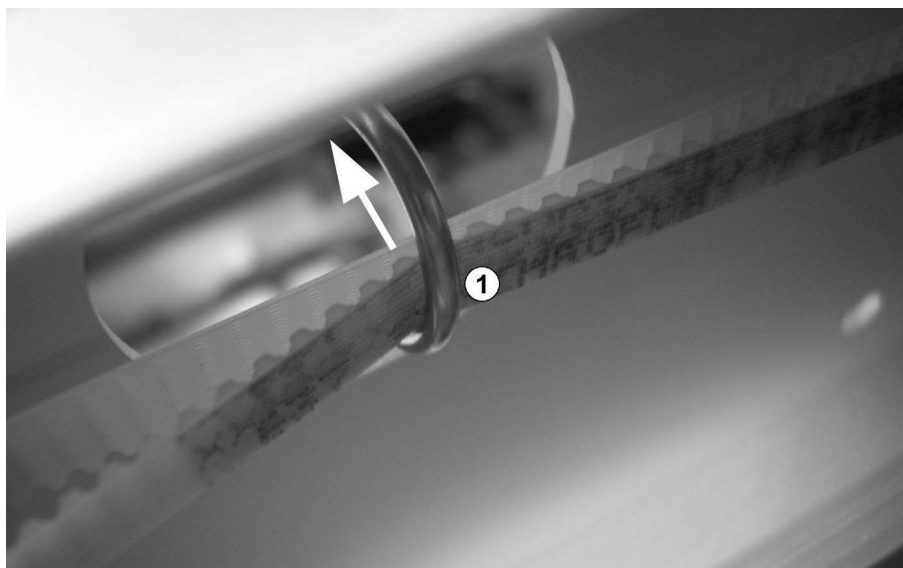


Figure 12-7: Spring balance on the Y-belt

6. Hook the spring balance into the Y-sledge (3) and pull it to the front so that it moves steadily and slowly.
The force must be lesser than 10 N.
If the force is higher:
 - check the guiding rails for dirt
 - check the belt tension (again)
 - check if the front bearing of the square shaft of the Z-drive can move easily sideways so it can compensate for adjustment tolerances in the Y-axis.
 - check if the rollers of the Y-sledge (see figure 12-16: on page 12-23) roll easily, and the spring mechanism that preload these Y-rollers is not jammed: It should be possible to compress the springs manually with some force
 - Note that the motor should be disconnected to avoid forces due to induction.
7. Plug the Y-motor connector (J7) into the pipettor board (see chapter 19.5.1 on page 19-20).
8. Check the taught positions of the pipettor module (see chapter 20.2 on page 20-2).

12.3.3 ADJUSTMENT OF Z-DRIVE, Z-BELT, AND Z-MOVEMENT FORCE

TOOLS

- Spring balance up to 10 N
- Sliding calliper

ADJUSTMENT



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Disconnect the Z-motor connector (J4) from the pipettor board (see chapter 19.5.1 on page 19-20).
4. Remove the Z-belt (1) from the gear wheel (2).

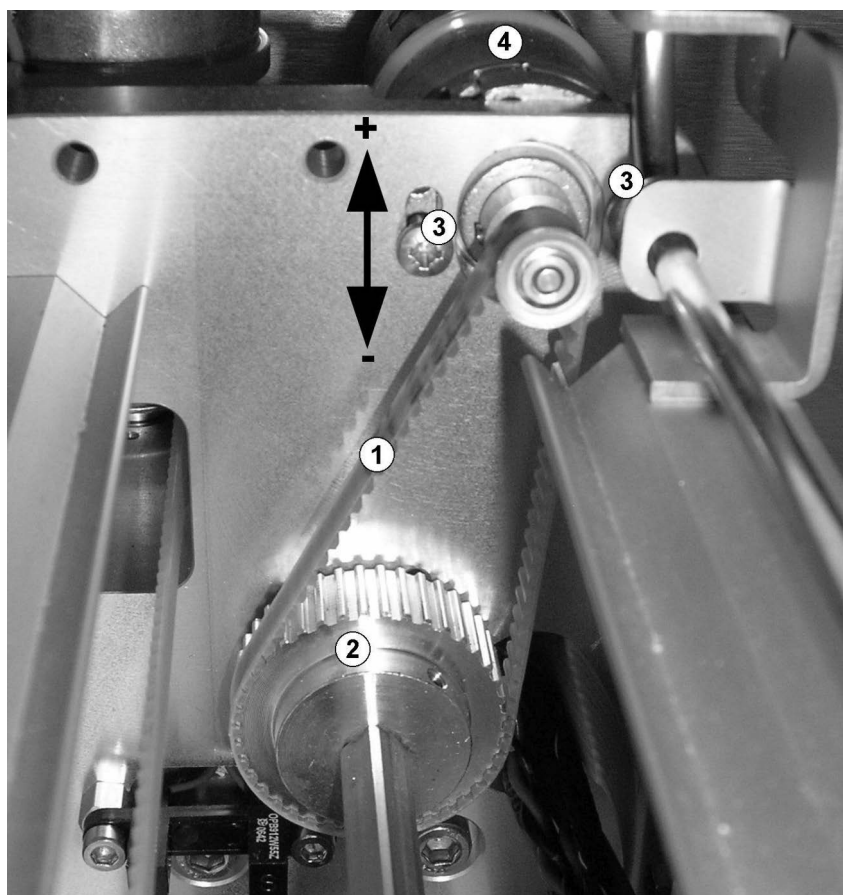


Figure 12-8: Z-drive

5. Hold the Z-clutch (5) tight. Move the toothed rack (6) up and down and measure the gear clearance with a sliding calliper. The gear clearance must be less than 0.4 mm (0.0157 inch). If the clearance is higher check the adjustment of the toothed rack (see chapter 12.3.4 on page 12-12).

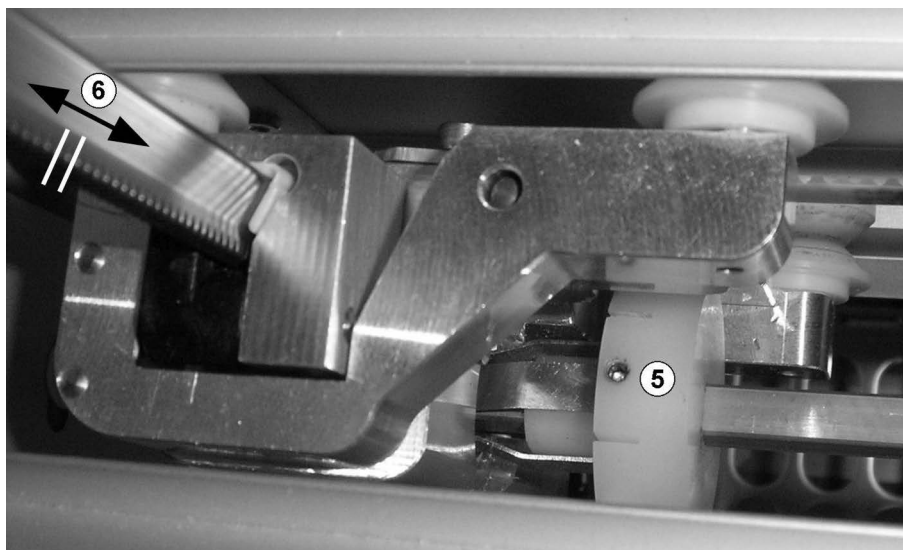


Figure 12-9: Z-drive: gear clearance

6. Install the Z-belt (1) to the gear wheel (2).
7. Move the toothed rack (6) up and down and measure the force with a spring balance.
The force must be 5 N (+1 N/-2 N).
 - Use the screws (3) of the Z-motor to increase/decrease the force.
8. Plug the Z-motor connector (J4) into the pipettor board (see chapter 19.5.1 on page 19-20).
9. Check the taught positions of the pipettor module (see chapter 20.2 on page 20-2).

12.3.4 ADJUSTMENT OF TOOTHED RACK (STRAIGHTNESS AND GEAR CLEARANCE)

TOOLS

- Angle gauge (90°)
or
- Loading Bay Teach Tool (see chapter 20.2.1.3 on page 20-3)
- Toothed Rack Adjustment Tool (see chapter 12.2.1.1 on page 12-5)

ADJUSTMENT



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the loading bay grid (see chapter 16.5.1 on page 16-9).
4. Move the pipettor arm over the loading bay.
5. Move the toothed rack down.

CHECK

6. Check the angle between toothed rack (1) and loading bay (2) with an angel gauge. The angle must be 90°.

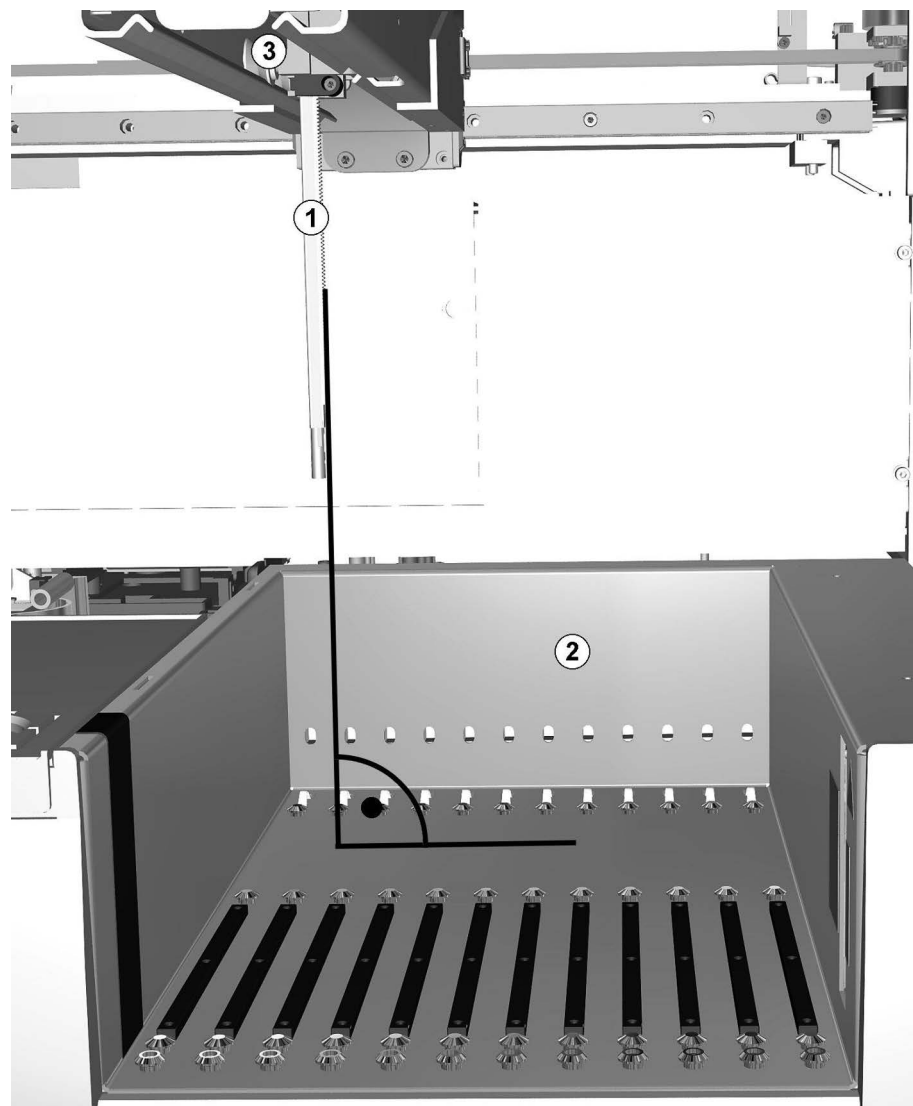


Figure 12-10: Angle between toothed rack and loading bay

ADJUSTMENT

7. Loose both screws (4) on the backside of the Y-sledge (3).

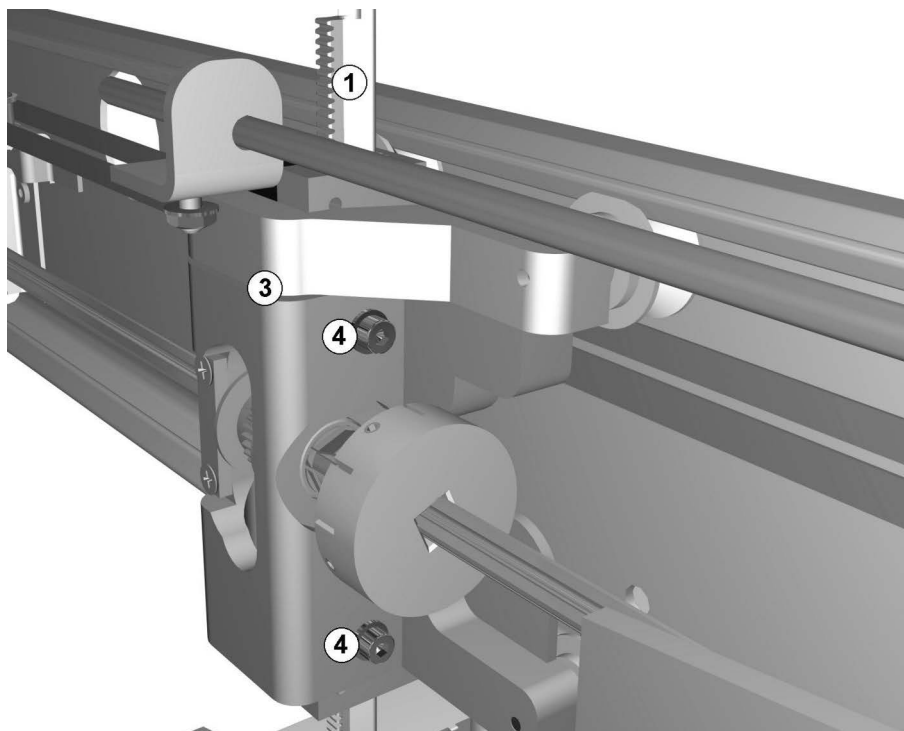


Figure 12-11: Y-sledge (pipettor arm without right side cover)

8. Rotate the toothed rack (1) in X-direction and check the angle between toothed rack (1) and loading bay (2) with an angel gauge. The angle must be 90°.

Beside the angular alignment, the guiding mechanism determines also the gear clearance of the toothed rack. This clearance can be adjusted by pushing the guiding mechanism in X-direction. The nominal gear clearance must be less than 0.4 mm (0.0157 inch), see chapter 12.3.3 on page 12-10.

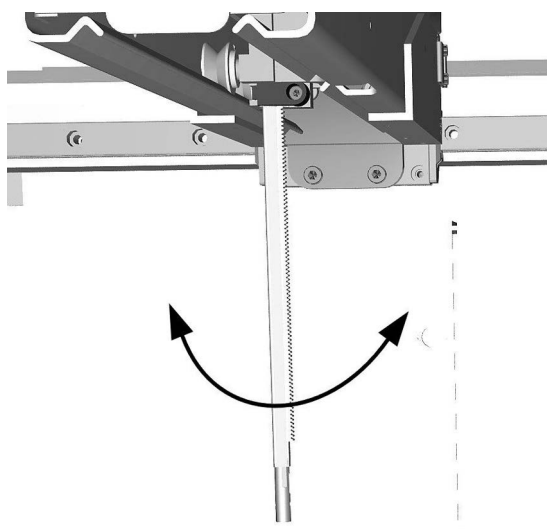


Figure 12-12: Rotate the toothed rack

9. Tighten both screws (4).
10. Check the angle and gear clearance again.
11. Adjustment of Z-drive and Z-belt (see chapter 12.3.3 on page 12-10).
12. Teach the pipettor module (see chapter 20.2 on page 20-2).
13. Check loading bay grid (LLD check) after teaching (see chapter 16.4.1 on page 16-5).

12.3.5 ADJUSTMENT OF PIPETTOR ARM (STRAIGHTNESS)

TOOLS

- Angle gauge (90°)
or
- Loading Bay Teach Tool (see chapter 20.2.1.3 on page 20-3)
- Toothed Rack Adjustment Tool (see chapter 12.2.1.1 on page 12-5)

ADJUSTMENT



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the loading bay grid (see chapter 16.5.1 on page 16-9).
4. Move the pipettor arm over the loading bay.
5. Move the toothed rack down.

CHECK

6. Check the angle between toothed rack (1) and loading bay (2) with an angel gauge. The angle must be 90°.

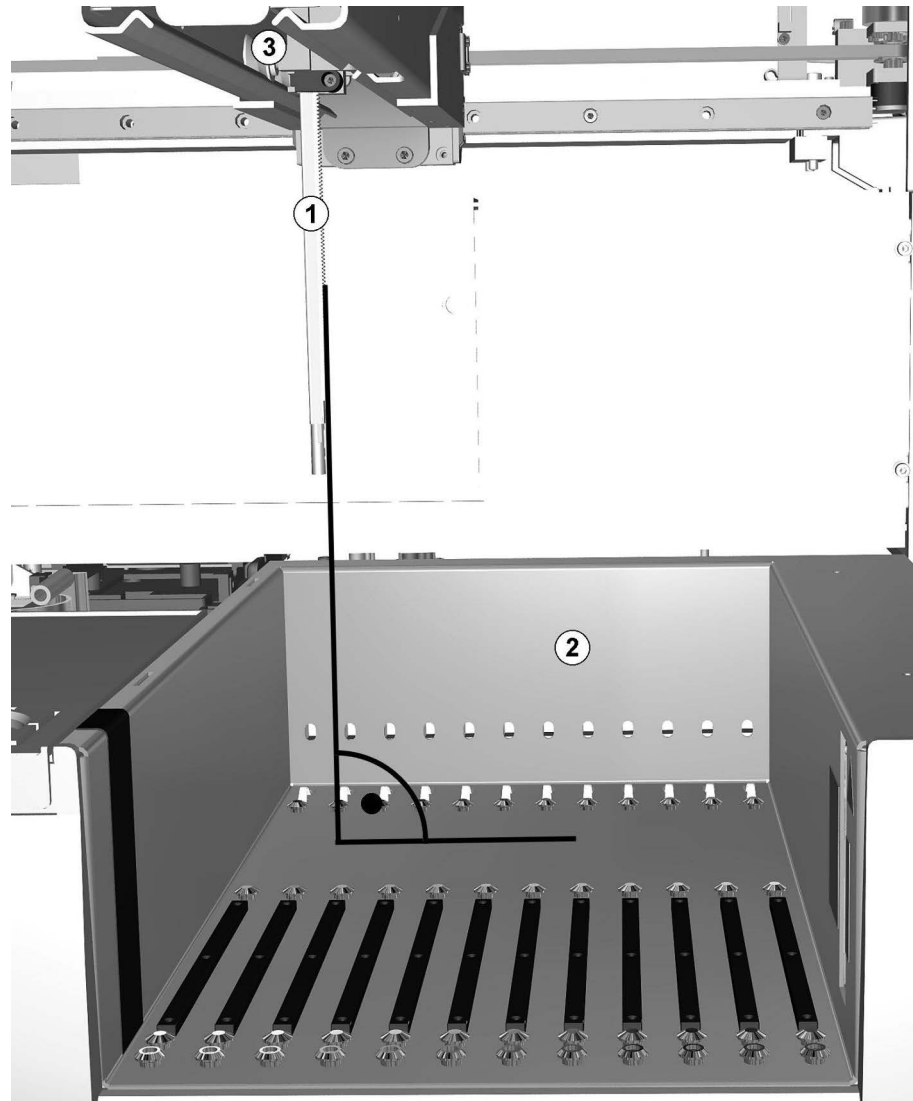


Figure 12-13: Angle between toothed rack and loading bay

ADJUSTMENT

7. Loose the four screws (4) on the backside of the pipettor arm (3) a bit.

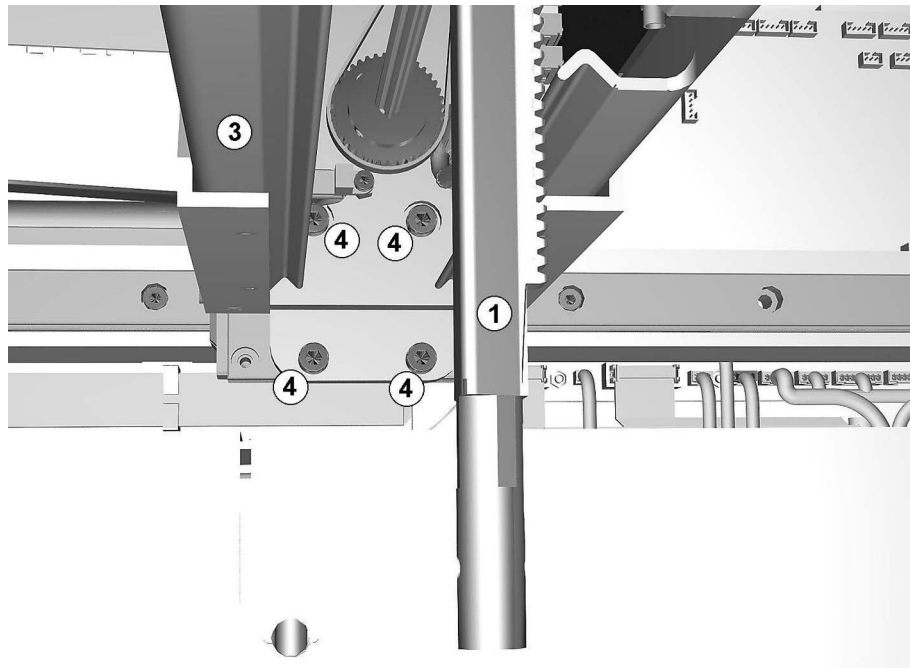


Figure 12-14: Pipettor arm fastening

8. Rotate the pipettor arm (3) and check the angle between toothed rack (1) and loading bay (2) with an angel gauge. The angle must be 90°.
9. Tighten the four screws (4).
10. Check the angle again.
11. Teach the pipettor module (see chapter 20.2 on page 20-2).
12. Check loading bay grid (LLD check) after teaching (see chapter 16.4.1 on page 16-5).

12.4 CHECK AND VERIFICATION

12.4.1 CHECK PIPETTOR TUBING (APM)

INFO

This section describes only a special procedure for the APM pipettor!

1. Switch on the instrument.
2. Start the service software (see chapter 7.1 on page 7-1).
3. Initialize the pipettor with the service software (see chapter 12.7 on page 12-62).
4. Press on the **APM** button in the **Pipettor Main Driver Dialog**.
The service software shows the **Automatic Pressure Measurement** dialog (see chapter 12.7.4 on page 12-75).
5. Press on the **Check Tubing** button.
The service software shows an instructions dialog.
6. Follow the instructions and put all required resources into the instrument.
7. Press on the **OK** button.
The instrument checks its pipettor tubings.
8. After the test the service software returns to the **Automatic Pressure Measurement** dialog and shows the test results.
If the result **FAILED**:
 - Check the pipettor and APM tubings for leakages.
 - Repeat the test.
 - Short the pipettor tubing with a razor blade by 5 mm (0.2 in) to ensure a tight fit of the fitting.
 - If the test fails several times and also the pipetting performance test fails:
Replace the APM disposable tip adapter (including pipettor liquid tubing and pressure tubing).
Check/replace pipettor board.

12.4.2 CHECK X-/Y-/Z-BELTS, Z-DRIVE AND TOOTHED RACK

To check tensions and movements see adjustment procedures:

- X-belt: chapter 12.3.1 on page 12-6
- Y-belt: chapter 12.3.2 on page 12-8
- Z-drive and Z-belt: chapter 12.3.3 on page 12-10
- Toothed rack: chapter 12.3.4 on page 12-12

12.4.3 CHECK FREE MOVEMENT OF Z-INIT PIN



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Press gentle on the Z-Init pin (1) to check its free movement.

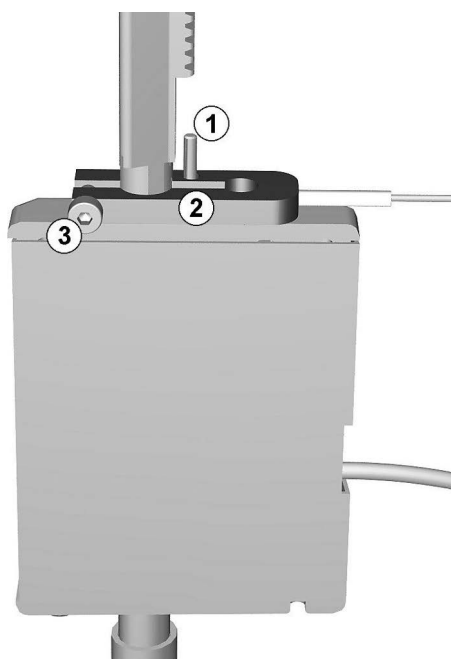


Figure 12-15: APM disposable tip adapter with air tube guiding

4. If necessary, loose/tighten screw (3) to adjust the air tube guiding (2).

12.4.4 PERFORM PIPETTOR MODULE TEST

1. Switch on the instrument.
2. Start the service software (see chapter 7.1 on page 7-1).
3. Start the pipettor service software module (see chapter 12.7 on page 12-62).
4. Enter your name into the setup parameters dialog and press on the **OK** button.
5. Press on the **Pipettor** button to open the **Pipettor** dialog (see chapter 12.7.1 on page 12-66).
6. Press on the **Left Arm** button to initialize the module.
7. Press on the **OK** button to close the dialog.
8. Press on the **Prime** button to open the **Prime** dialog (see chapter 12.7.5 on page 12-76).
9. Prime the pipettor with at least 20 s purging with the bypass pump and 20 prime cycles.
10. Press on the **OK** button to close the dialog.
11. Press on the **Automatic Module Test** button and follow the instructions (see chapter 12.7.7 on page 12-80).

12.5 MAINTENANCE

This section contains instructions for the maintenance of individual components of the pipetting system. Follow the instructions in the individual sections.

12.5.1 CLEANING OF X-GUIDING



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Wipe the X-guiding with isopropanol and a lint-free cloth.

NOTICE

Do not place too much oil on the rod! Dropping oil is absolutely not allowed!

4. Put oil on the X-guiding.
5. Move the pipettor arm several times from the left to the right and back.

12.5.2 CLEANING OF Y-GUIDING RAILS AND ROLLERS



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove all dirt with a cleaning paper from both Y-guiding rails (1) and the four Y-guiding rollers (2).
4. Check for excessive friction force in all axes.

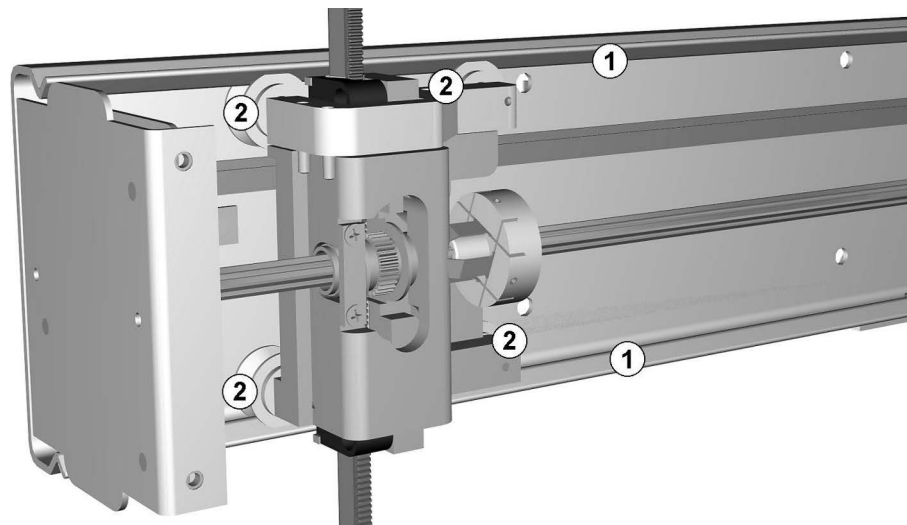


Figure 12-16: Pipettor arm without right cover

12.6 TROUBLESHOOTING AND REPAIRS

This section contains instructions for the repair of individual components of the pipetting system. After several repair works it is required that the individual components are readjusted. Follow the instructions in the individual sections.

12.6.1 REPLACEMENT OF APM DISPOSABLE TIP ADAPTER

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Screw the pipettor system liquid tubing (1) with the fitting (2) out of the diluter pump valve (5).

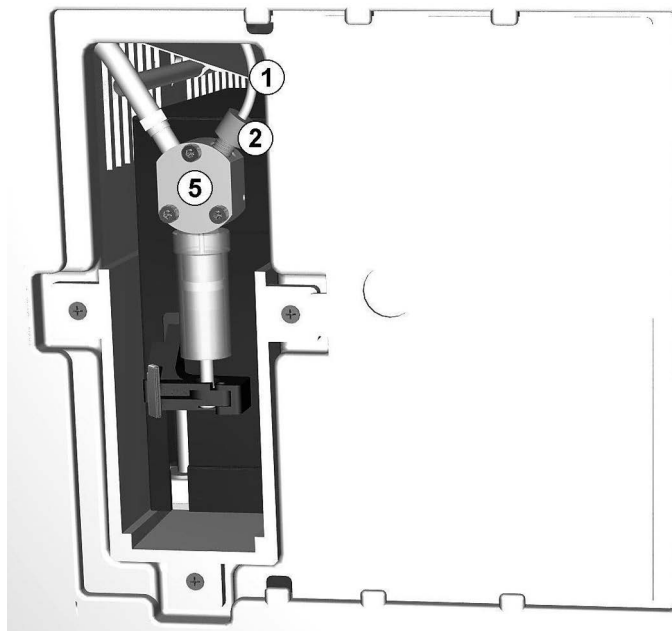


Figure 12-17: Installed diluter pump

5. Remove the complete fitting (2, 3, and 4) from the pipettor system liquid tubing (1).

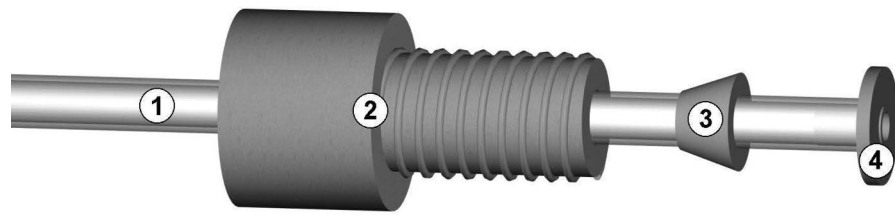


Figure 12-18: Fitting

6. Unhook the energy chain (6) on position (7).

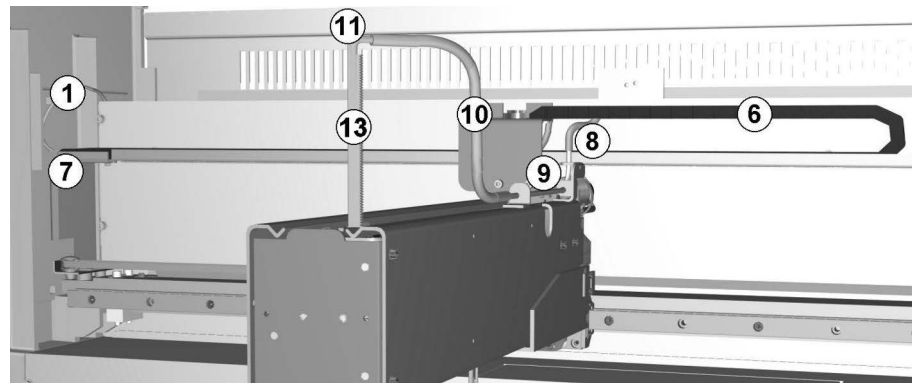


Figure 12-19: Pipettor arm

7. Pull the pipettor system liquid tubing (1) with protection tubing (8) out of the energy chain (6).
8. Pull off the protection tubing (8) from the metal tubing (9).
9. Pull the pipettor system liquid tubing (1) out of the protection tubing (8).
10. Pull off the protection tubing (10) from the metal tubing (9).
11. Pull the pipettor system liquid tubing (1) out of the metal tubing (9).
12. Pull the metal tubing (11) out of the toothed rack (13).
13. Pull the pipettor system liquid tubing (1) out of the protection tubing (10), and the metal tubing (11).
14. Remove the pipettor system liquid tubing (1).
15. Pull the APM tubing (14) with adapter tubing (16) out of the sensor (S1) on the pipettor board (17) (see chapter 19.5.1 on page 19-20).

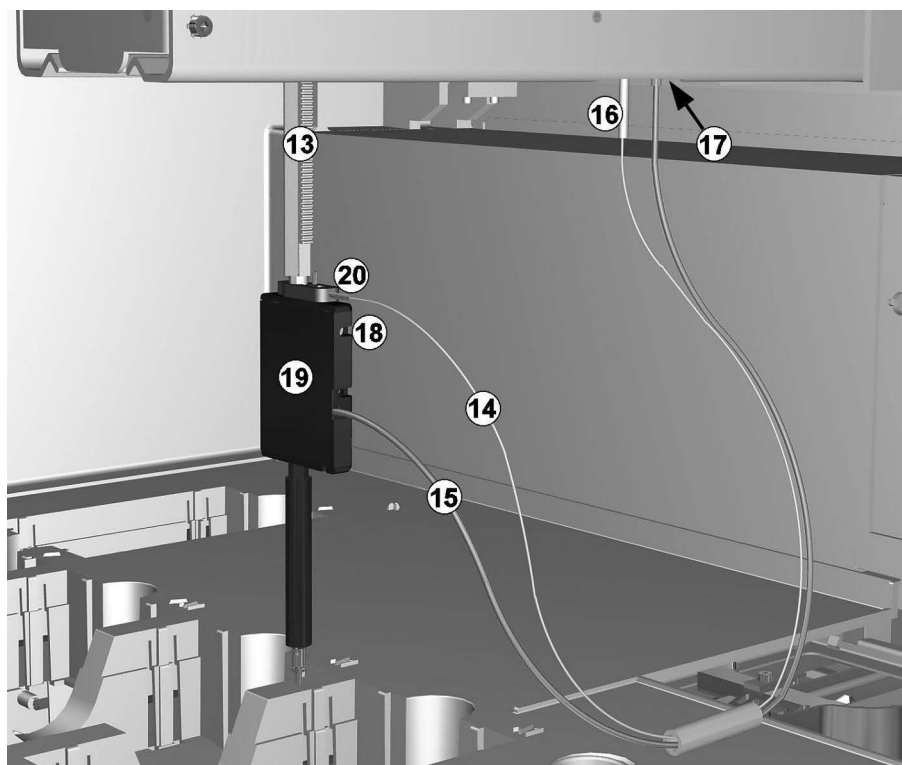


Figure 12-20: Installed disposable tip adapter

16. Pull the APM tubing (14) out of the adapter tubing (16).
17. Disconnect the LLD cable (15) from the connector (J3) on the pipettor board (17) (see chapter 19.5.1 on page 19-20).
18. Open the set screw (18).
19. Pull the disposal tip adapter (19) with both tubings (1 and 14) down from the toothed rack (13) and remove it.

INSTALLATION

NOTICE

Use of tubings:

- Avoid kinks in the tubings during the installation!
 - Do not pull the pipettor system liquid tubing, because the adhesive bonding of the tubing inside the tip adapter can be damaged easily.
20. Insert the APM tubing (14) of the new disposal tip adapter (19) into the toothed rack (13) and lead it out through the elongated hole.
 21. Push the pipettor system liquid tubing (1) through the toothed rack (13).
 22. Put the new disposal tip adapter (19) up to the toothed rack (13) and tighten the set screw (18).
 23. Push the APM tubing (14) through the air tube guiding (20).
 24. Put the adapter tubing (16) up to the APM tubing (14).
 25. Put the adapter tubing (16) up to the sensor (S1) on the pipettor board (17) (see chapter 19.5.1 on page 19-20).
 26. Plug the LLD cable (15) into the connector (J3) on the pipettor board (17) (see chapter 19.5.1 on page 19-20).

27. Push the pipettor system liquid tubing (1) through the protection tubing (10) and metal tubing (11).
28. Push the metal tubing (11) into the toothed rack (13).
29. Push the pipettor system liquid tubing (1) through the metal tubing (9).
30. Push the protection tubing (10) onto the metal tubing (9).
31. Push the pipettor system liquid tubing (1) through the protection tubing (8).
32. Push the protection tubing (8) onto the metal tubing (9).
33. Push the pipettor system liquid tubing (1) with protection tubing (8) into the energy chain (6). Use the third chain link to insert the protection tubing.

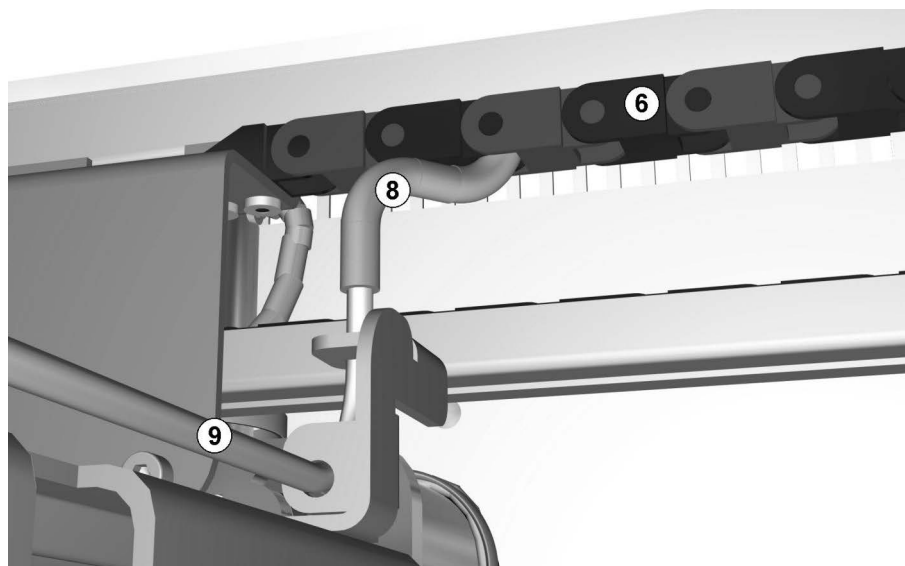


Figure 12-21: Energy chain with marked chain links

34. Hook the energy chain (6) on position (7).
35. Install the complete fitting (2, 3, and 4) on the pipettor system liquid tubing (1).

NOTICE

Do not use any tools to fit and tighten the fittings!

36. Screw the fitting (2) in the diluter pump valve (5).
37. Install the top cover (see chapter 8.3.4 on page 8-12).
38. Check free movement of Z-Init pin (see chapter 12.4.3 on page 12-20)
39. Move the pipettor arm and the toothed rack.

NOTICE

The APM tubing (14) and the LLD cable (15) must not touch the toothed rack during movement!

40. Teach the pipettor module (see chapter 20.2 on page 20-2).

12.6.2 REPLACEMENT OF LIQUID LEVEL DETECTION CABLE

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Open carefully the front cover of the disposable tip adapter (1) with a small screwdriver, see arrows:

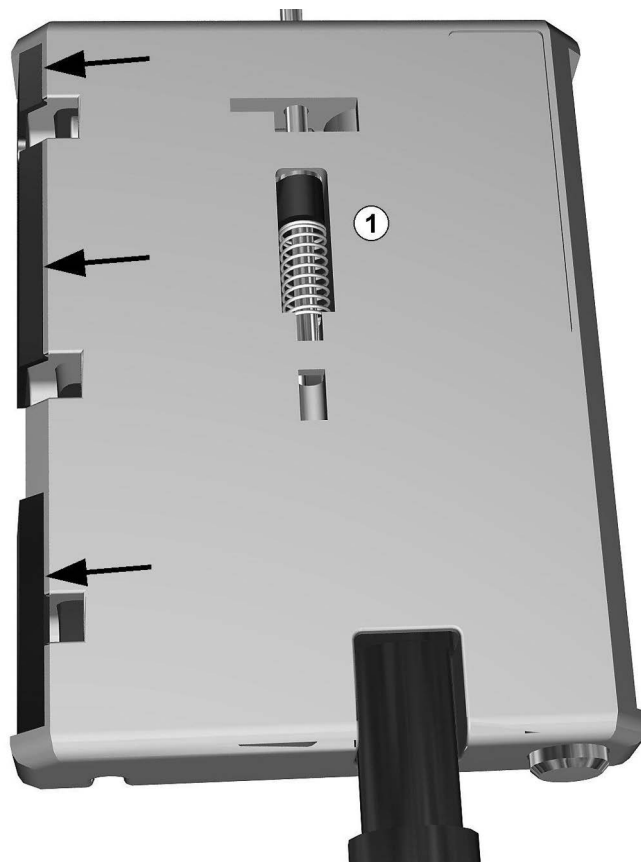


Figure 12-22: Disposable tip adapter (backside)

4. Turn the cable a bit and push very carefully a little screw driver between the small disposable tip adapter board and the LLD cable connector (see arrows). Remove the connector by slow and gentle movements of the screw driver.

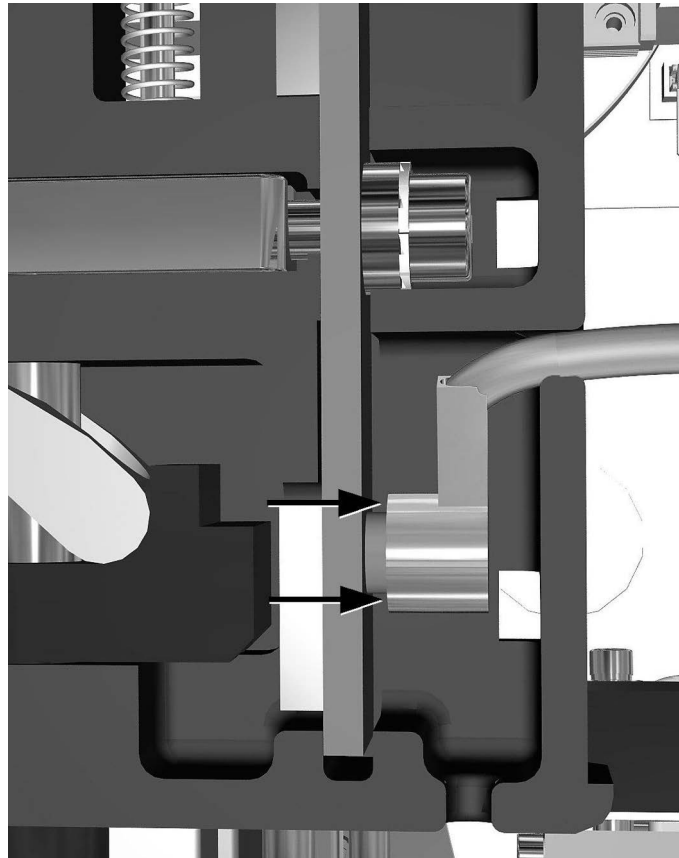


Figure 12-23: Liquid level detection cable connector

5. Disconnect the LLD cable from the connector (J3) on the pipettor board (see chapter 19.5.1 on page 19-20) and remove it.

INSTALLATION

6. Push the cable connector slowly onto the small disposable tip adapter board connector.
7. Place the LLD cable into the gap (see arrow).

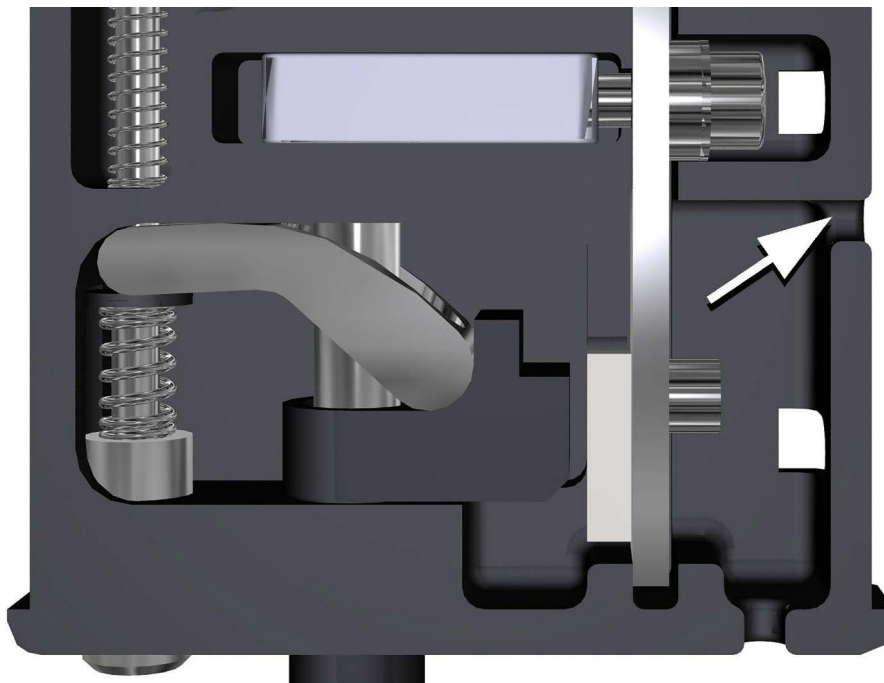


Figure 12-24: Opened disposable tip adapter without LLD cable

8. Close carefully the front cover of the disposable tip adapter (1).
9. Plug the new LLD cable into the connector (J3) on the pipettor board (see chapter 19.5.1 on page 19-20).
10. Move the pipettor arm and the toothed rack.

NOTICE

The APM tubing and the LLD cable must not touch the toothed rack during movement!

11. Teach the pipettor module (see chapter 20.2 on page 20-2).

12.6.3 REPLACEMENT OF APM SYRINGE-VALVE-SYSTEM (DILUTER PUMP)

TOOLS

- Torque wrench

REMOVAL

1. Start the service software.
The service software displays its main menu.
2. Start the pipettor service software module.
3. Press on the **Pipettor** button.
4. Press on the **Left Arm** button to initialize the pipettor.
5. Press on the **OK** button twice.
6. Press on the **Pumps** button.
7. Press on the **Init** button.
8. Release and open the syringe plunger bracket (1) of the damaged syringe-valve-system (2).

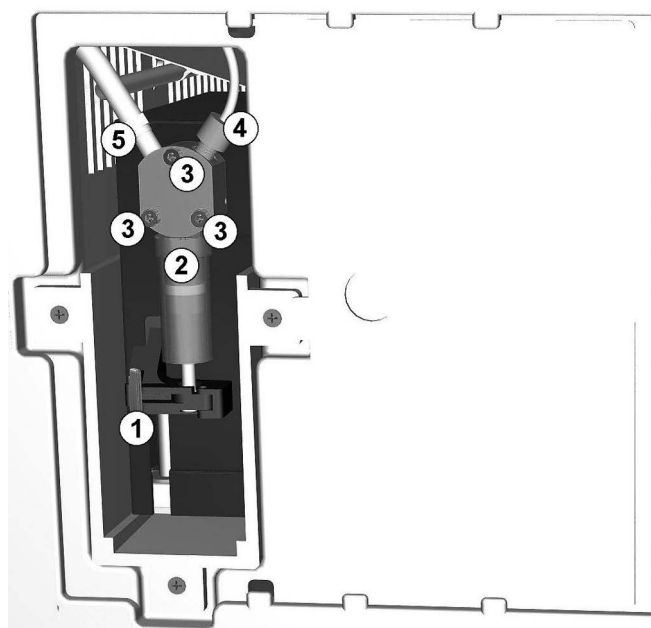


Figure 12-25: Installed diluter pump

9. Press on the **Move** button.
10. Remove the three screws (3) of the valve.
11. Remove both tubings and fittings (4 + 5) from the valve.
12. Remove the damaged syringe-valve-system (2).

INSTALLATION

NOTICE

Damaged gaskets

Gaskets of syringes or valves can be damaged if they are put into operation in a dry state.

- Fill a small amount of system liquid into the syringe or the valve before the installation.

13. If necessary, rotate the nose (6) of the new syringe-valve-system (2). **The borehole (see arrow) must shown to the left (rear view).**



Figure 12-26: Syringe-valve-system

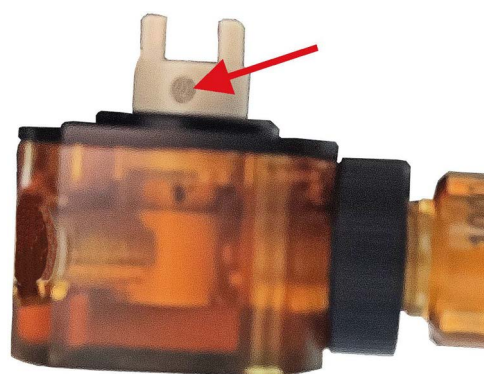


Figure 12-27: Syringe-valve-system (detail)

NOTICE

Do not use any tools to fit and tighten the fittings!

14. Screw both tubings and fittings (4 + 5) into the valve.
15. Insert the nose (6) of the valve into the valve guide of the pump and fit the centering pins into the center holes.
16. Attach the valve (2) with three screws (3).
The screws must be tightened with a torque wrench to 0.4 Nm (0.29 ft.lbf).
17. Gently shift the clamping collar of the syringe plunger to fit it into the plunger bracket (1).
18. Close and lock the syringe plunger bracket (1).
19. Click on the **Init** button.
20. Click on the **OK** button.
21. Click on the **Prime** button.
22. Click on the **OK** button.

23. Repeat the prime steps to take out all air-bubbles.
24. Click on the **Close** button.
25. Click on the **Terminate Program** button.

INFO

After changing the syringe-valve-system, it is recommended to check the correct function and the pipetting performance.

12.6.4 REPLACEMENT OF DILUTER PUMP (VP9101)

REMOVAL



1. Remove the syringe-valve-system (see chapter 12.6.3 on page 12-31).
If possible, use the service software to remove the syringe-valve-system.
2. Shut down the computer and switch off the instrument.
3. Disconnect main power from the instrument.
4. Remove the top cover (see chapter 8.3.4 on page 8-12).
5. Remove the three retaining screws (4) of the pump holding device (3).

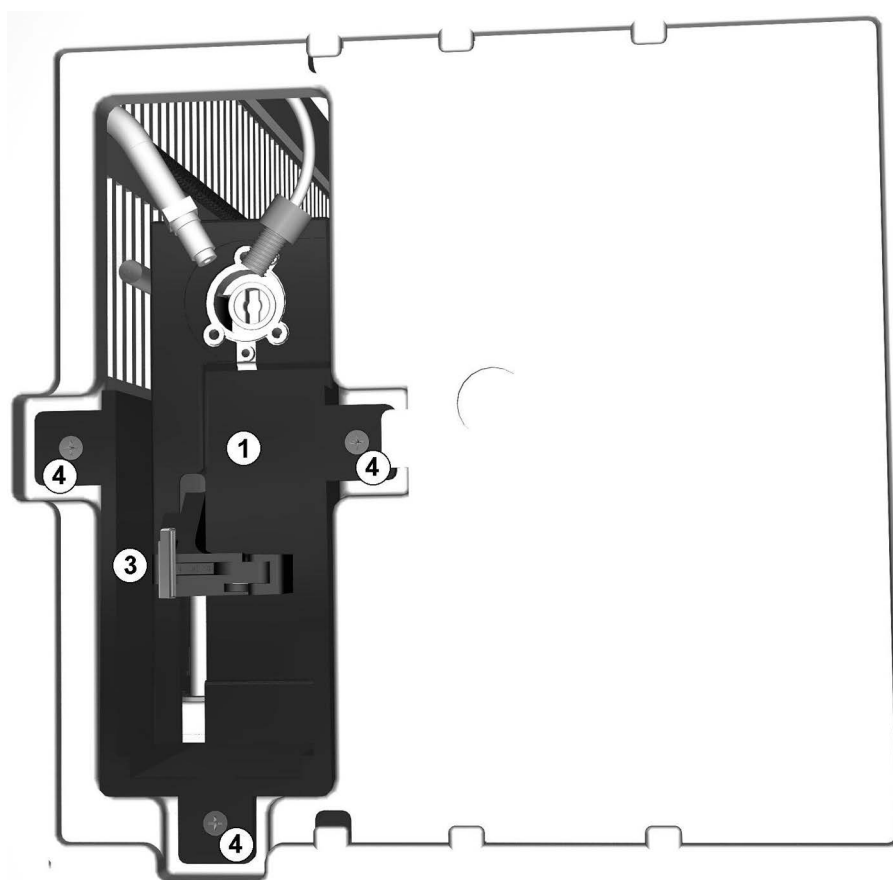


Figure 12-28: Installed diluter pump without syringe-valve-system (side view)

6. Pull the diluter pump (1) with pump holding device (3) out of the instrument.
7. Disconnect the connector (2) from the diluter pump (1).

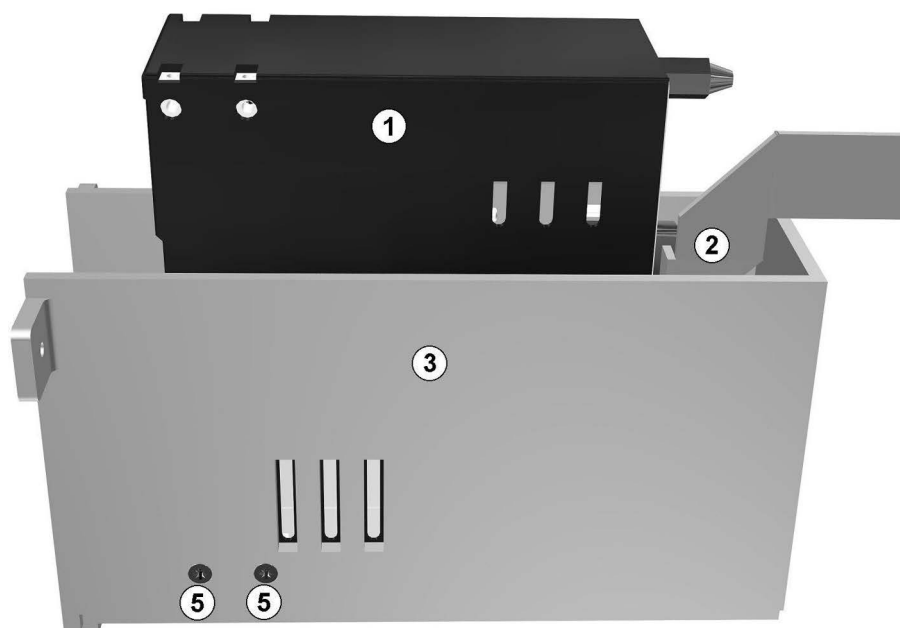


Figure 12-29: Diluter pump with pump holding device

8. Remove the four retaining screws (5) on both sides of the pump holding device (3).
 9. Remove the diluter pump (1).
- INSTALLATION**
10. Set the arrowhead of the address switch (6) of the new diluter pump (1) to address 0.

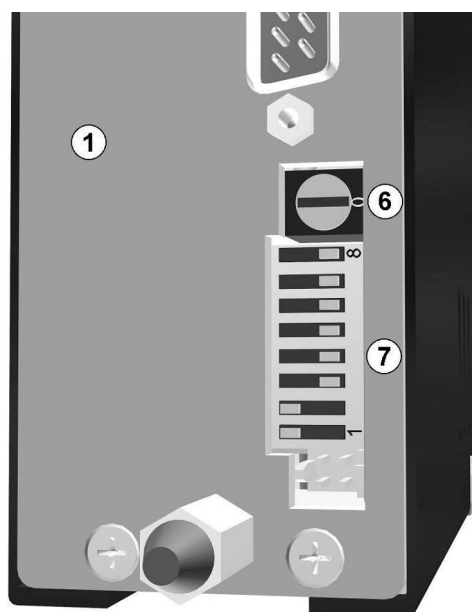


Figure 12-30: Diluter pump (back side)

11. Set the DIP switches (7):
 - 1 and 2: ON
 - 3 to 8: OFF

12. Insert the diluter pump (1) into the pump holding device (3) and tighten the four retaining screws (5) on both sides.
13. Plug the connector (2) into the diluter pump (1).
14. Push the diluter pump (1) with pump holding device (3) into the instrument.
15. Tighten the three retaining screws (4).
16. Install the top cover (see chapter 8.3.4 on page 8-12).
17. Connect main power to the instrument.
18. Switch on the instrument.
19. Install the syringe-valve-system (see chapter 12.6.3 on page 12-31).
If possible, use the service software to install the syringe-valve-system.

12.6.5 REPLACEMENT OF PIPETTOR Y-SLEDGE

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the disposal tip adapter (see chapter 12.6.1 on page 12-24).
4. Loose both nuts (1) from the belt tightener.

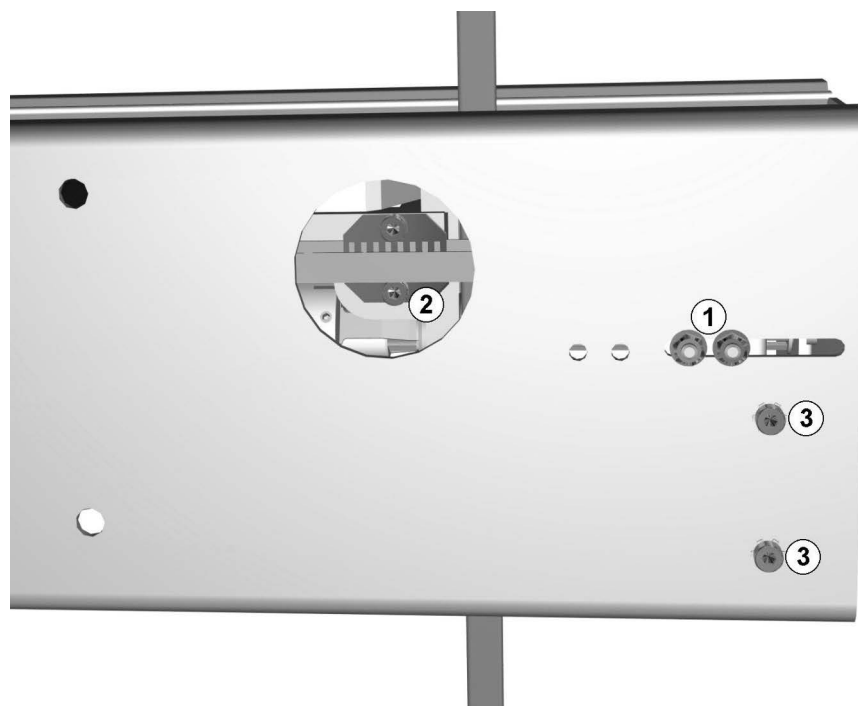


Figure 12-31: Pipettor arm (left side)

5. Remove both screws (2) and the belt fixing plate from the Y-sledge.
6. Remove the four retaining screws (3) and the pipettor arm front cover (4).

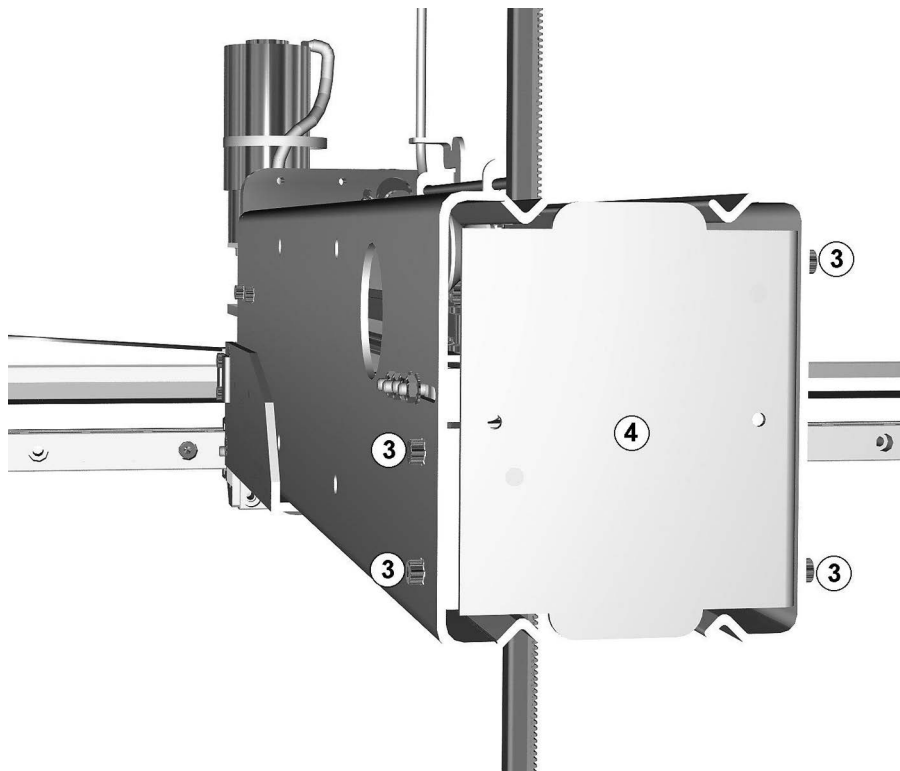


Figure 12-32: Pipettor arm

7. Remove the plastic bearing (5).

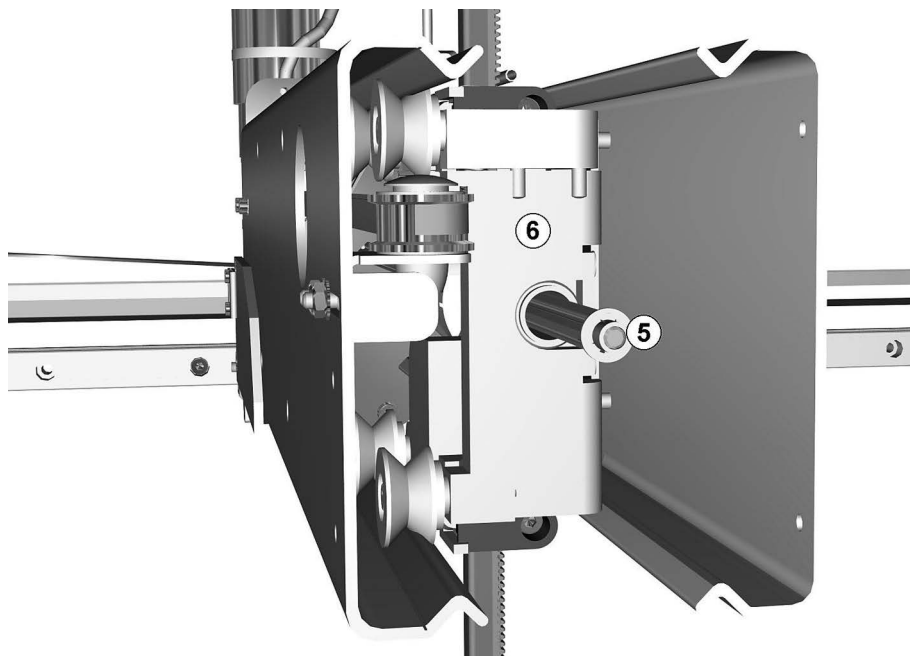


Figure 12-33: Pipettor arm (opened)

8. Pull out the Y-sledge (6).
Note, that the Y-sledge consists of two parts

INSTALLATION

9. Insert the new/repared Y-sledge (6).
Press both parts of the Y-sledge (6) together.
10. Put up the plastic bearing (5).
11. Install the pipettor arm front cover (4) and tighten the four retaining screws (3).
12. Install the belt fixing plate on the Y-sledge and tighten both screws (2).
Put four teeth of each Y-belt side under the belt fixing plate.
13. Install the disposal tip adapter (see chapter 12.6.1 on page 12-24).
14. Check the Z-drive and Z-belt (see chapter 12.3.3 on page 12-10).
15. Adjust the Y-belt (see chapter 12.3.2 on page 12-8).
16. Teach the pipettor module (see chapter 20.2 on page 20-2).

12.6.6 REPLACEMENT OF X-BELT

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Remove the upper cover (see chapter 8.3.5 on page 8-14).
5. Loose both screws (2) of the belt tightener.

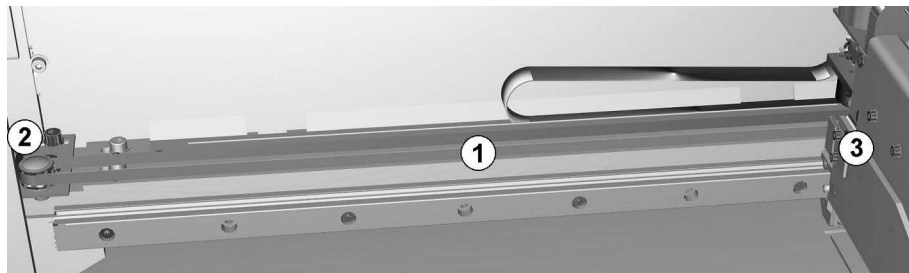


Figure 12-34: Left side of the X-drive

6. Remove both screws and the belt fixing plate (3) from the left pipettor arm side.
7. Remove both screws and the belt fixing plate (4) from the right pipettor arm side.

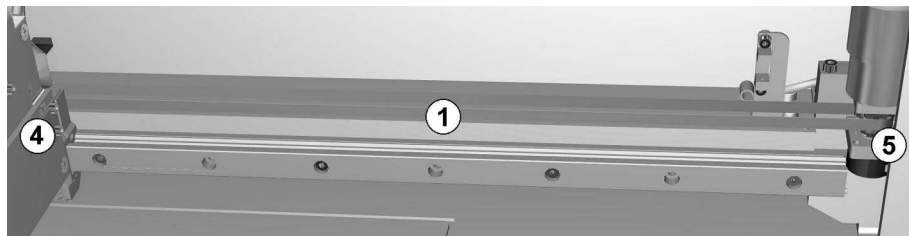


Figure 12-35: Right side of the X-drive

8. Remove the X-belt (1).

INSTALLATION

9. Insert the new X-belt (1) and lead it around the gear wheel (5) of the X-motor.
10. Install the belt fixing plate (4) and tighten both screws.
11. Lead the X-belt (1) around the wheel (2) of the belt tightener.
12. Install the belt fixing plate (3) and tighten both screws.
13. Adjust the X-belt (see chapter 12.3.1 on page 12-6).
14. Install the upper cover (see chapter 8.3.5 on page 8-14).
15. Install the top cover (see chapter 8.3.4 on page 8-12).
16. Teach the pipettor module (see chapter 20.2 on page 20-2).

12.6.7 REPLACEMENT OF X-MOTOR

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Remove the upper cover (see chapter 8.3.5 on page 8-14).
5. Disconnect the X-motor connector (ST58) from the instrument CU board (see chapter 9.4.2 on page 9-17).
6. Loose both screws of the belt tightener (see chapter 12.6.6 on page 12-40).
7. Remove the four screws (1) from the X-motor/encoder bracket (2).

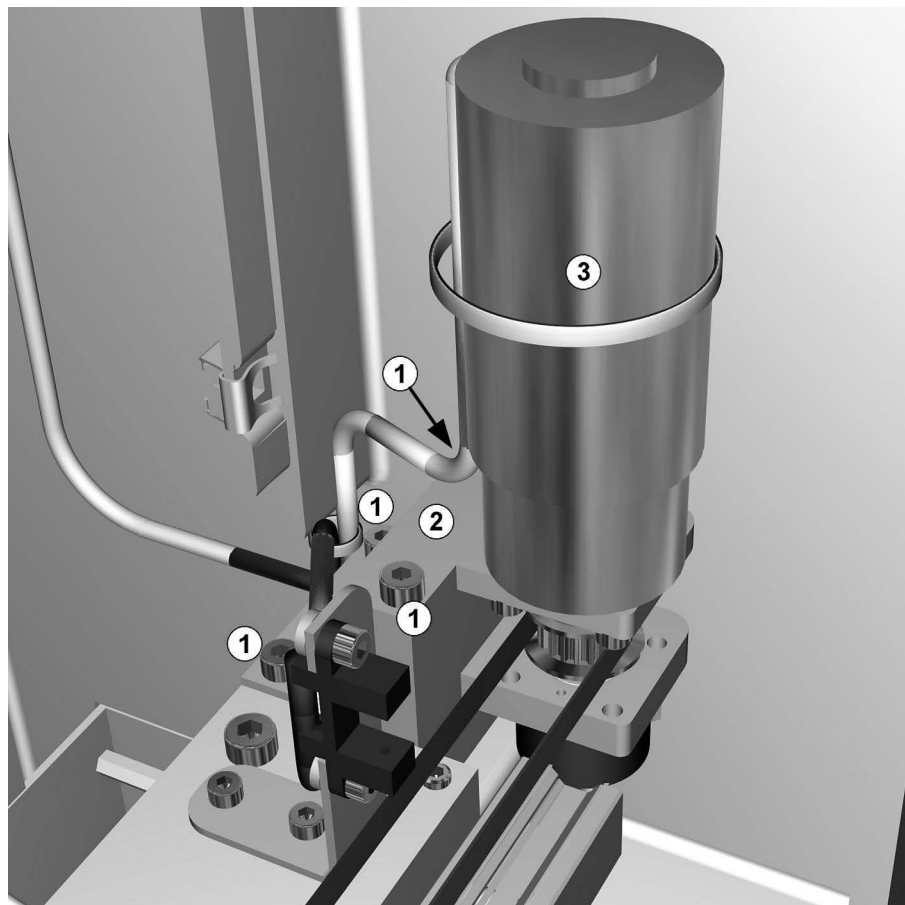


Figure 12-36: Installed X-motor/encoder

8. Loose both screws (4) of the gear wheel (5).

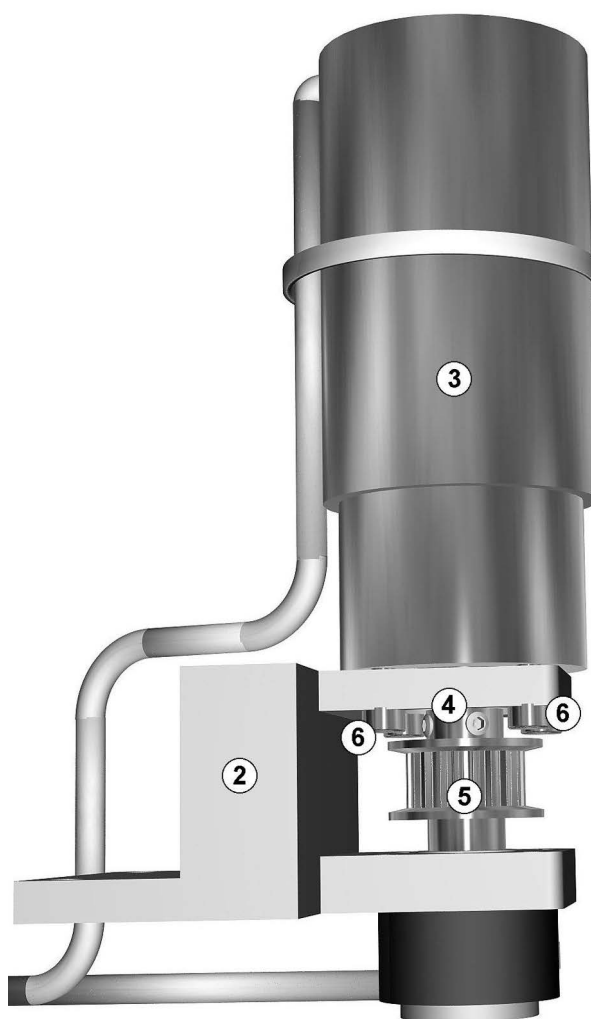


Figure 12-37: X-motor/encoder

9. Remove the four retaining screws (6).
10. Remove the X-motor (3).

INSTALLATION

11. Insert the X-motor (3) and tighten the four retaining screws (6).
12. Tighten both screws (4) of the gear wheel (5).
13. Install the X-motor/encoder bracket (2) and tighten the four screws (1).
14. Plug the X-motor connector (ST58) into the instrument CU board (see chapter 9.4.2 on page 9-17).
15. Adjust the X-belt (see chapter 12.3.1 on page 12-6).
16. Install the upper cover (see chapter 8.3.5 on page 8-14).
17. Install the top cover (see chapter 8.3.4 on page 8-12).
18. Teach the pipettor module (see chapter 20.2 on page 20-2).

12.6.8 REPLACEMENT OF X-ENCODER

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Remove the upper cover (see chapter 8.3.5 on page 8-14).
5. Disconnect the X-motor connector (ST58) from the instrument CU board (see chapter 9.4.2 on page 9-17).
6. Disconnect the X-encoder connector (ST57) from the instrument CU board (see chapter 9.4.2 on page 9-17).
7. Disconnect the X-encoder connector from the X-encoder.
8. Loose both screws of the belt tightener (see chapter 12.6.6 on page 12-40).
9. Remove the four screws from the X-motor/encoder bracket (2), see figure 12-36: on page 12-41.
10. Remove the X-encoder (3). It is necessary to destroy the X-encoder (3). Push a screw-driver into the slit between X-encoder (3) and the base plate (4), see arrow.

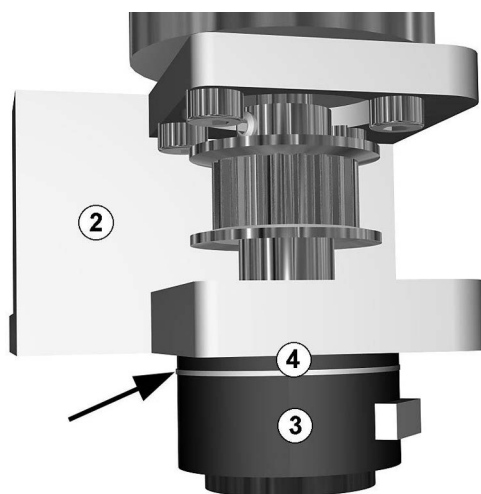


Figure 12-38: X-encoder

11. Remove both retaining screws (5) and the base plate (4).

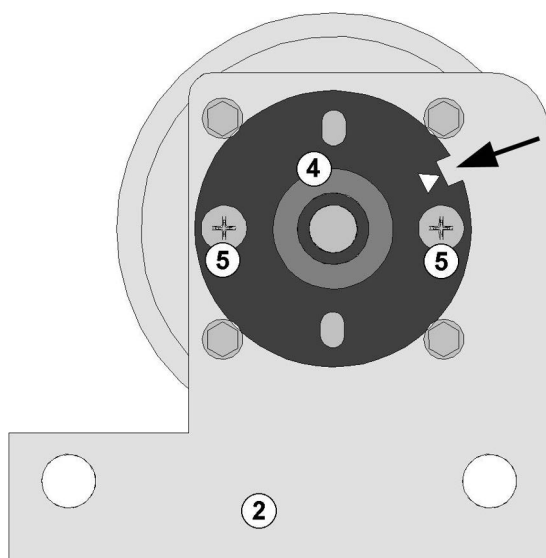


Figure 12-39: X-encoder base plate

INSTALLATION

NOTICE

Installation of a encoder

Incorrectly installed encoders may not be used again!
Already installed encoders may not be reused.

12. Install the new base plate (4) and tighten both retaining screws (5).
Note the position of the orientation slot (see arrow).
13. Press the new X-encoder (3) onto the base plate (4).
Note the position of the orientation pin above the socket.
Note the audible click.
14. Install the X-motor/encoder bracket (2) and tighten the four screws (1), see figure 12-36: on page 12-41.
15. Plug the X-encoder connector into the X-encoder.
16. Plug the X-encoder connector (ST57) into the instrument CU board (see chapter 9.4.2 on page 9-17).
17. Plug the X-motor connector (ST58) into the instrument CU board (see chapter 9.4.2 on page 9-17).
18. Adjust the X-belt (see chapter 12.3.1 on page 12-6).
19. Install the upper cover (see chapter 8.3.5 on page 8-14).
20. Install the top cover (see chapter 8.3.4 on page 8-12).
21. Teach the pipettor module (see chapter 20.2 on page 20-2).

12.6.9 REPLACEMENT OF Y-BELT

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the disposal tip adapter (see chapter 12.6.1 on page 12-24).
4. Loose both nuts (1) of the belt tightener.

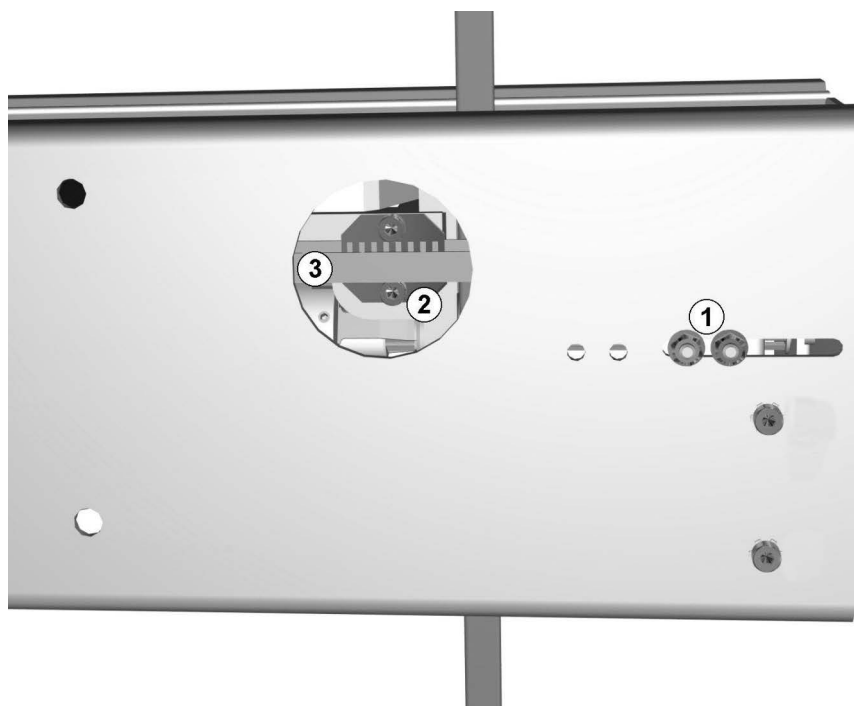


Figure 12-40: Pipettor arm (left side)

5. Remove both screws (2) and the belt fixing plate from the Y-sledge.
6. Remove the Y-belt (3).

INSTALLATION

7. Insert the new Y-belt (3) and lead it around the gear wheel (4) of the Y-motor.

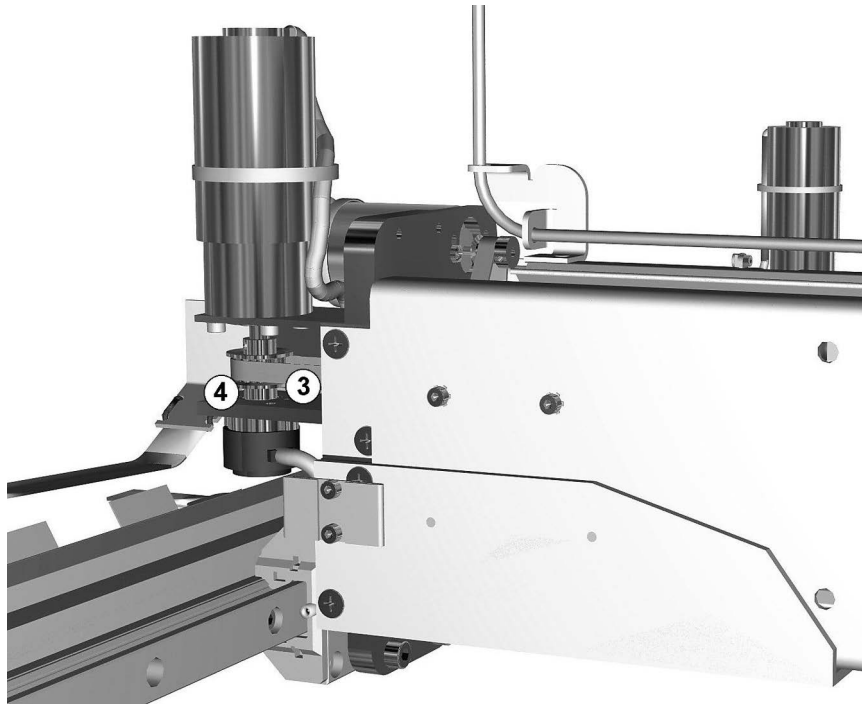


Figure 12-41: Pipettor Y-motor

8. Lead the Y-belt (3) around the wheel (5) of the belt tightener.

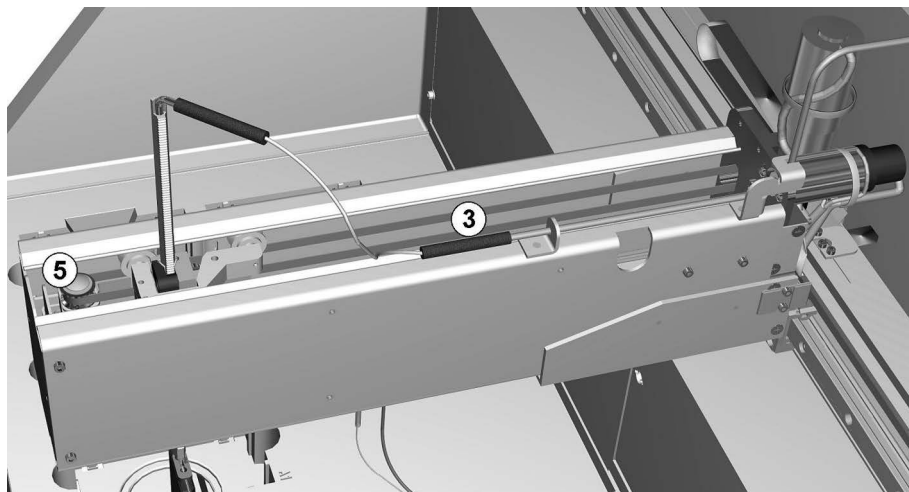


Figure 12-42: Pipettor arm (Y-belt)

9. Install the belt fixing plate on the Y-sledge and tighten both screws (2). Put four teeth of each Y-belt side under the belt fixing plate.
10. Install the disposal tip adapter (see chapter 12.6.1 on page 12-24).
11. Adjust the Y-belt (see chapter 12.3.2 on page 12-8).
12. Teach the pipettor module (see chapter 20.2 on page 20-2).

12.6.10 REPLACEMENT OF Y-MOTOR

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Disconnect the Y-motor connector (J7) from the pipettor board (see chapter 19.5.1 on page 19-20).
4. Loose both screws of the belt tightener (see chapter 12.6.9 on page 12-45).
5. Loose both screws (1) of the gear wheel (2).

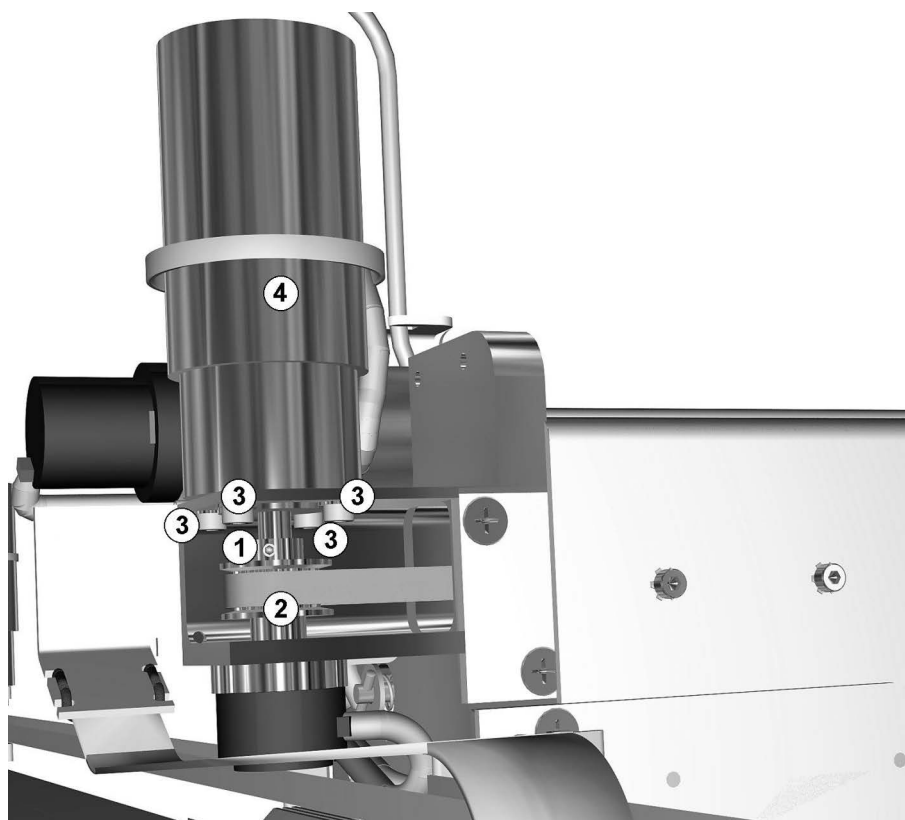


Figure 12-43: Installed Y-motor

6. Remove the four retaining screws (3).
7. Remove the X-motor (4).

INSTALLATION

8. Install the new X-motor (4) and tighten the four retaining screws (3).
9. Tighten both screws (1) of the gear wheel (2).
10. Adjust the Y-belt (see chapter 12.3.2 on page 12-8).
11. Teach the pipettor module (see chapter 20.2 on page 20-2).

12.6.11 REPLACEMENT OF Y-ENCODER

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the pipettor arm (see chapter 12.6.17 on page 12-58).
4. Disconnect the Y-encoder connector from the Y-encoder.
5. Loose both screws of the belt tightener (see chapter 12.6.9 on page 12-45).
6. Remove the Y-encoder (1). It is necessary to destroy the Y-encoder (1). Push a screw-driver into the slit between Y-encoder (1) and the base plate (2), see arrow.



Figure 12-44: Installed Y-encoder

7. Remove both retaining screws (3) and the base plate (2).

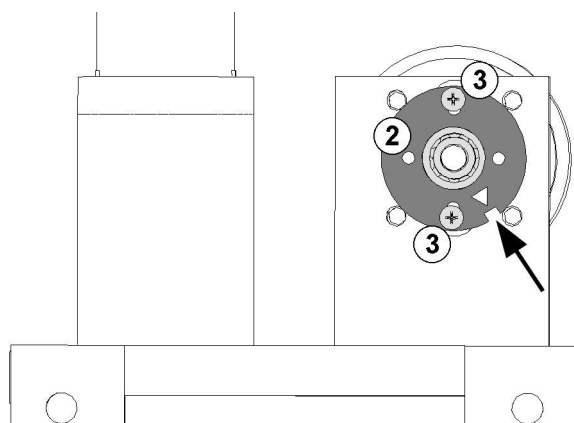


Figure 12-45: Y-encoder base plate

INSTALLATION

NOTICE

Installation of a encoder

Incorrectly installed encoders may not be used again!
Already installed encoders may not be reused.

8. Install the new base plate (2) and tighten both retaining screws (3).
Note the position of the orientation slot (see arrow).
9. Press the new X-encoder (1) onto the base plate (4).
Note the position of the orientation pin above the socket.
Note the audible click.
10. Plug the Y-encoder connector into the Y-encoder.
11. Install the pipettor arm (see chapter 12.6.17 on page 12-58).
12. Adjust the Y-belt (see chapter 12.3.2 on page 12-8).
13. Install the upper cover (see chapter 8.3.5 on page 8-14).
14. Install the top cover (see chapter 8.3.4 on page 8-12).
15. Teach the pipettor module (see chapter 20.2 on page 20-2).

12.6.12 REPLACEMENT OF Z-BELT

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the Y-sledge (see chapter 12.6.5 on page 12-37).
It is not necessary to remove the disposable tip adapter. Put the Y-sledge after removal carefully on the pipettor arm.
4. Remove the nut (1) of the metal tubing bracket (2).

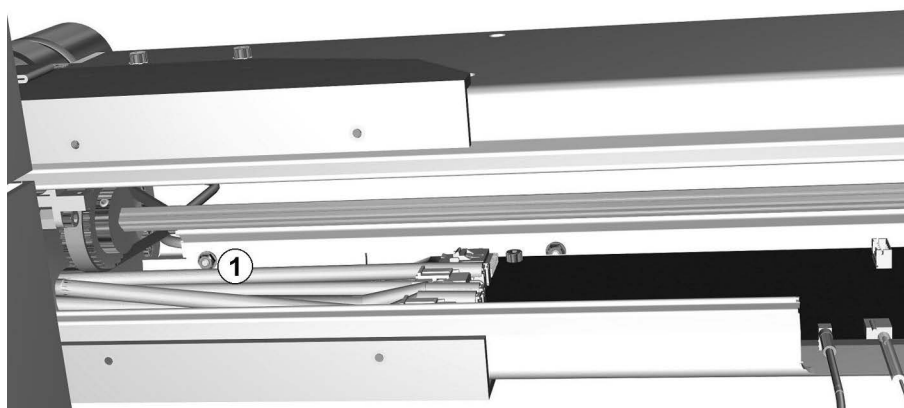


Figure 12-46: Pipettor arm (bottom side)

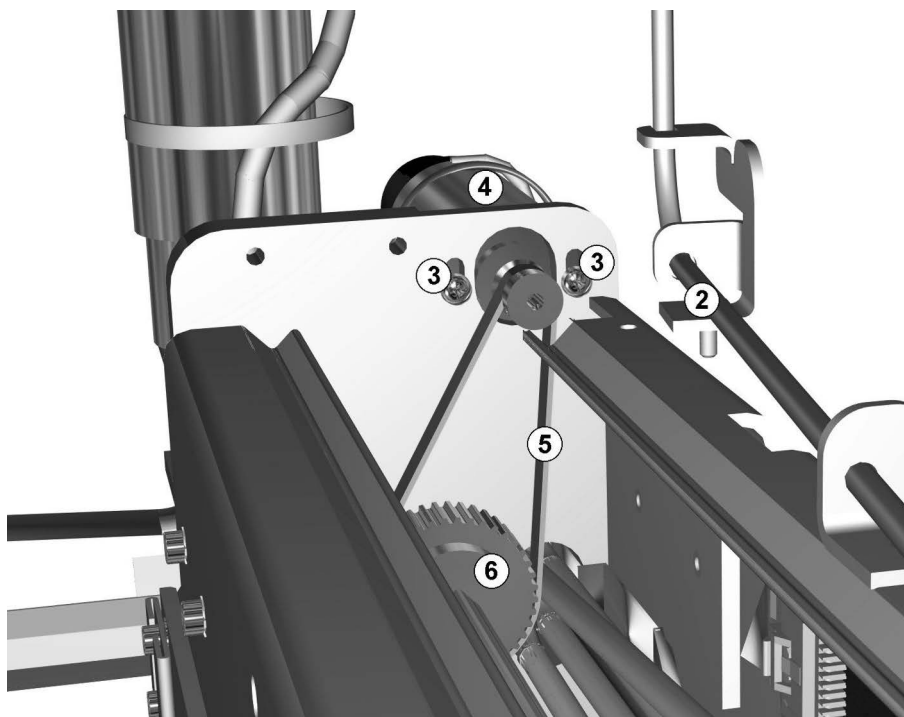


Figure 12-47: Z-motor

5. Loose both retaining screws (3) of the Z-motor (4).
6. Remove the Z-belt (5).

INSTALLATION

7. Insert the new Z-belt (5) and lead it around the gear wheel of the Z-motor (4) and the gear wheel (6).
8. Install the Y-sledge (see chapter 12.6.5 on page 12-37).
9. Adjust the Z-drive and Z-belt (see chapter 12.3.3 on page 12-10).
10. Install the metal tubing bracket (2) and tighten the nut (1).
11. Teach the pipettor module (see chapter 20.2 on page 20-2).

12.6.13 REPLACEMENT OF Z-MOTOR/ENCODER

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Disconnect to Z-motor connector (J4) from the pipettor board (see chapter 19.5.1 on page 19-20).
4. Disconnect to Z-encoder connector (J5) from the pipettor board (see chapter 19.5.1 on page 19-20).
5. Remove the nut (1) of the metal tubing bracket (2).

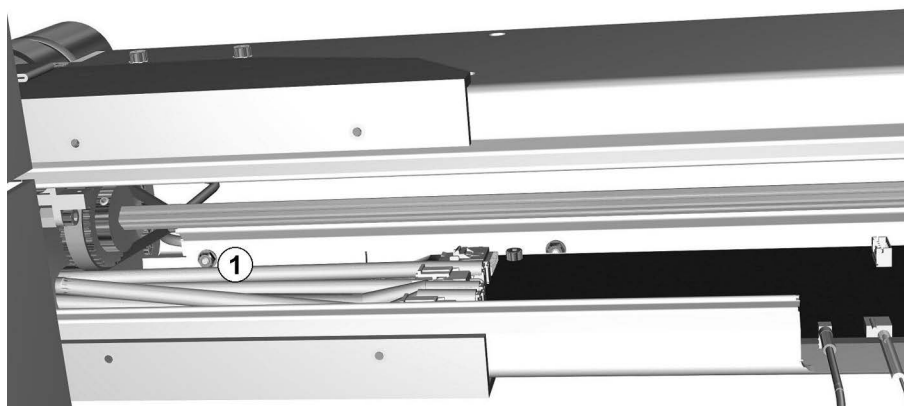


Figure 12-48: Pipettor arm (bottom side)

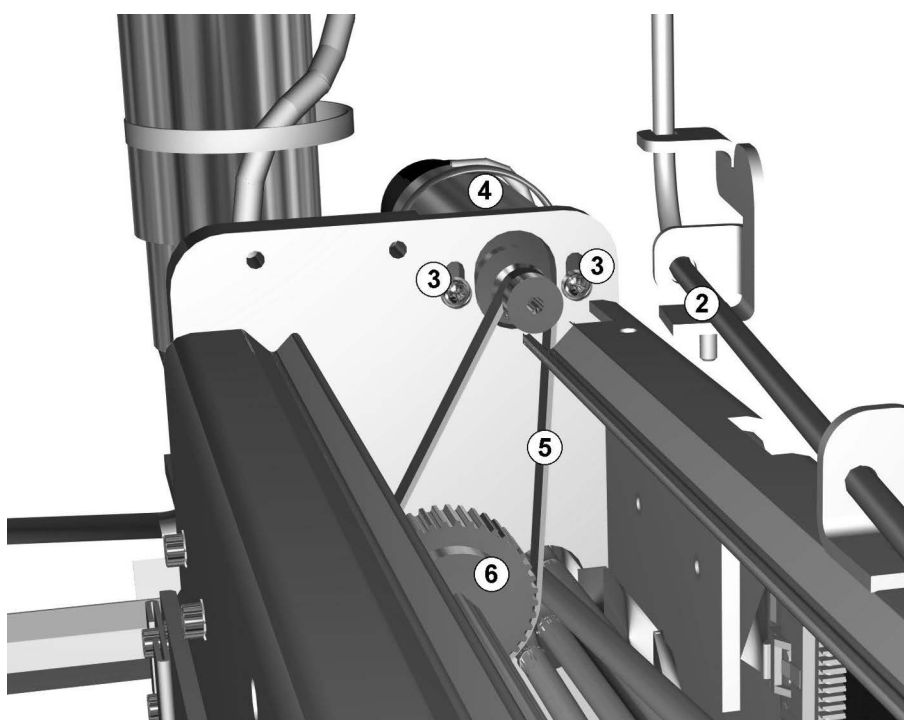


Figure 12-49: Z-motor

INSTALLATION

6. Remove both retaining screws (3) and the Z-motor/encoder (4).
7. Install the new Z-motor/encoder (4). It is not necessary to tighten both retaining screws (3).
8. Adjust the Z-Drive and Z-Belt (see chapter 12.3.3 on page 12-10).
9. Plug the Z-encoder connector (J5) into the pipettor board (see chapter 19.5.1 on page 19-20).
10. Install the metal tubing bracket (2) and tighten the nut (1).
11. Teach the pipettor module (see chapter 20.2 on page 20-2).

12.6.14 REPLACEMENT OF PIPETTOR ARM RIBBON CABLE

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Remove the upper cover (see chapter 8.3.5 on page 8-14).
5. Disconnect the ribbon cable connector (ST60) from the instrument CU board (see chapter 19.5.1 on page 19-20).
6. Loose both retaining screws of the ribbon cable bracket (1).

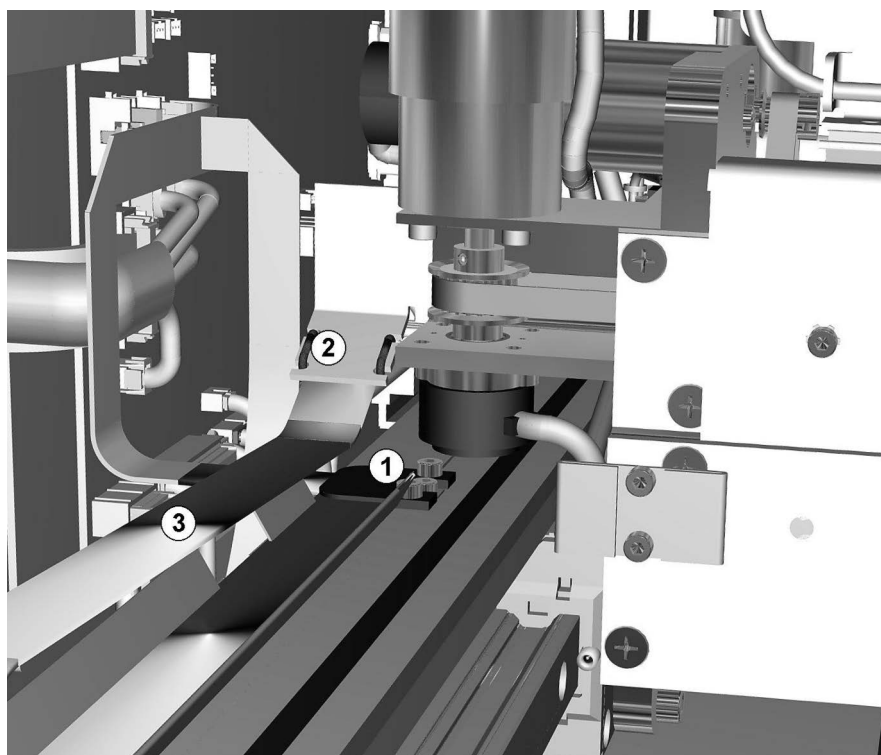


Figure 12-50: Ribbon cable bracket and retaining ring

7. Remove the retaining ring (2).
8. Loose both retaining screws of the ribbon cable bracket (4).

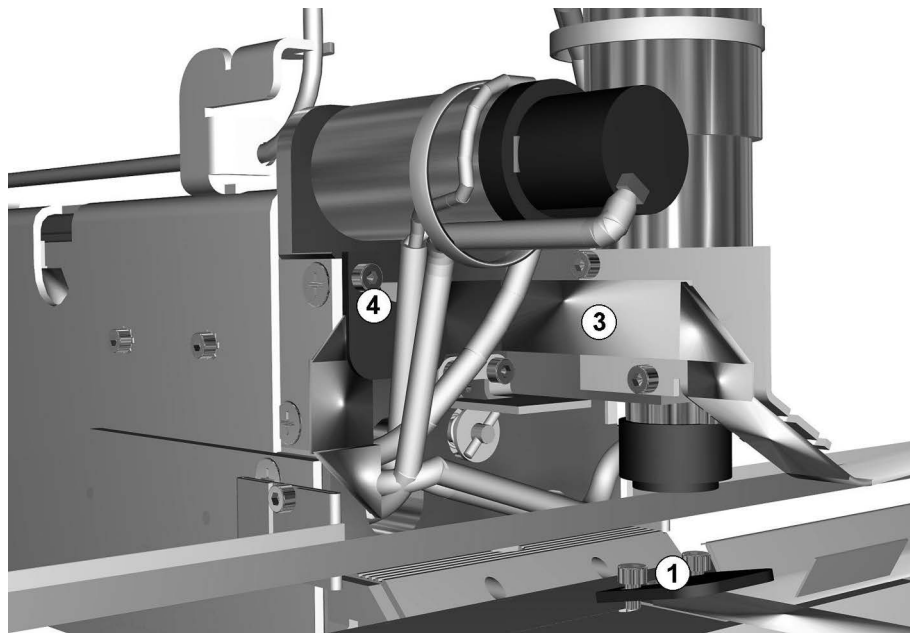


Figure 12-51: Ribbon cable bracket on the pipettor arm (backside)

9. Disconnect the ribbon cable connector (J1) from the pipettor board (see chapter 19.5.1 on page 19-20).
10. Remove the ribbon cable (3).

INSTALLATION

NOTICE

Handle the folds of the cable with care. Opening and closing the folds can damage the conductors.

11. Insert the new ribbon cable (3) into the pipettor arm.
12. Plug the ribbon cable connector (J1) into the pipettor board (see chapter 19.5.1 on page 19-20).
13. Push the ribbon cable under the ribbon cable bracket (4) and tighten both retaining screws.

NOTICE

Make sure that the ribbon cable is fixed straight in a way that it will roll smoothly when the pipettor is moving. The radii of the cable bending must not be too small when the pipettor is on the very left or very right end of the X-axis.

14. Install retaining ring (2).
15. Push the ribbon cable under the ribbon cable bracket (1) and tighten both retaining screws.
16. Plug the ribbon cable connector (ST60) into the instrument CU board (see chapter 19.5.1 on page 19-20).
17. Install the upper cover (see chapter 8.3.5 on page 8-14).
18. Install the top cover (see chapter 8.3.4 on page 8-12).

12.6.15 REPLACEMENT OF PIPETTOR BOARD

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Only for APM pipetting systems: Remove the APM tubing (S1) from the pipettor board (see chapter 19.5.1 on page 19-20).

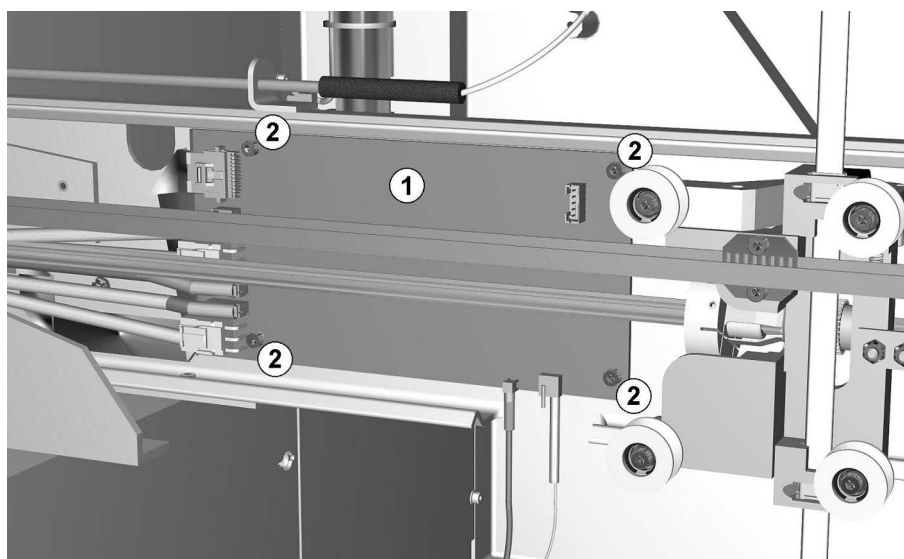


Figure 12-52: Pipettor arm (without left cover)

4. Disconnect the LLD cable connector (J3) from the pipettor board (see chapter 19.5.1 on page 19-20).
5. Disconnect the connectors (J1, J4, J5, J6, J7, J8, and J9) from the pipettor board (see chapter 19.5.1 on page 19-20).
6. Remove the four screws (2).
7. Remove the pipettor board (1).

INSTALLATION

8. Install the new pipettor board (1) and tighten the four screws (2).
9. Plug the connectors (J1, J4, J5, J6, J7, J8, and J9) into the pipettor board (see chapter 19.5.1 on page 19-20).
10. Plug the LLD cable connector (J3) into the pipettor board (see chapter 19.5.1 on page 19-20).
11. Only for APM pipetting systems: Put the APM tubing (S1) up to the pipettor board (see chapter 19.5.1 on page 19-20).

INFO

Check firmware version before teaching the pipettor system! If necessary, install the latest firmware version (see chapter 21.1 on page 21-1).

12. Teach the pipettor module (see chapter 20.2 on page 20-2).

12.6.16 REPLACEMENT OF TOOTHED RACK

INFO

Install the new toothed rack immediately after removal of the old toothed rack.

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the disposal tip adapter (see chapter 12.6.1 on page 12-24).
4. To remove toothed rack: Move the Y-sledge over one of the disposable tip rack positions on the front side.
5. Pull the toothed rack carefully downwards out of the Y-sledge.
6. Remove the toothed rack.

INSTALLATION

NOTICE

The slide bearings can collapse when you remove the Y-sledge. If they are collapsed push them carefully aside and slide the toothed rack up.

7. Push the new toothed rack carefully from the bottom up to the top into the Y-sledge.
8. Install the disposal tip adapter (see chapter 12.6.1 on page 12-24).
9. Teach the pipettor module (see chapter 20.2 on page 20-2).

12.6.17 REPLACEMENT OF PIPETTOR ARM

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Remove the upper cover (see chapter 8.3.5 on page 8-14).
5. Install the disposal tip adapter (see chapter 12.6.1 on page 12-24).
6. Remove the X-belt (see chapter 12.6.6 on page 12-40).
7. Disconnect the ribbon cable connector (ST60) from the instrument CU board (see chapter 19.5.1 on page 19-20).
8. Loose both retaining screws of the ribbon cable bracket (1).

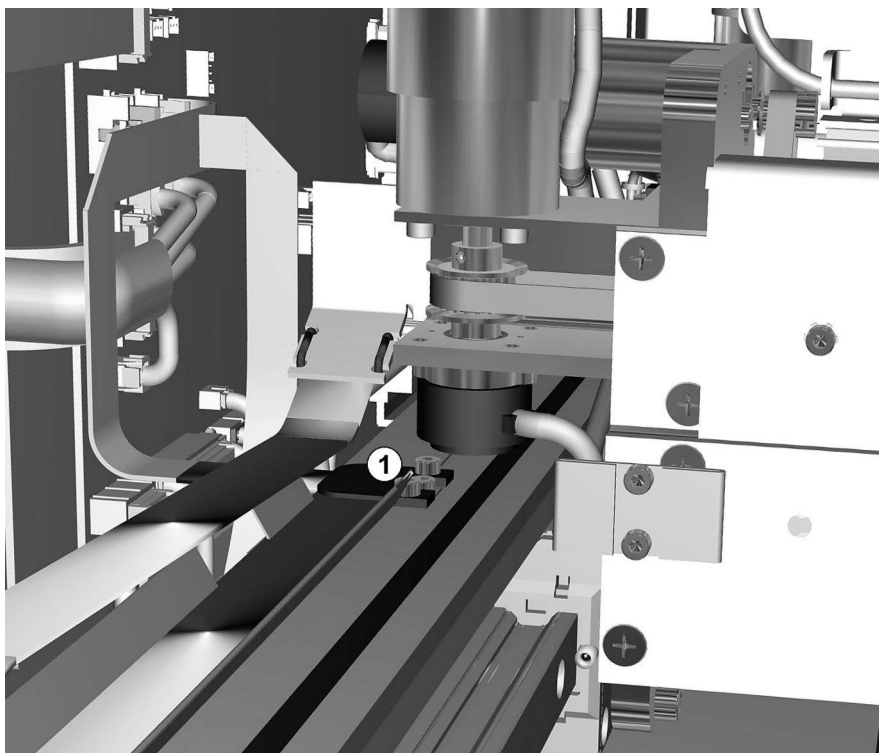


Figure 12-53: Ribbon cable bracket

9. Remove the four retaining screws (2) and the pipettor arm (3).

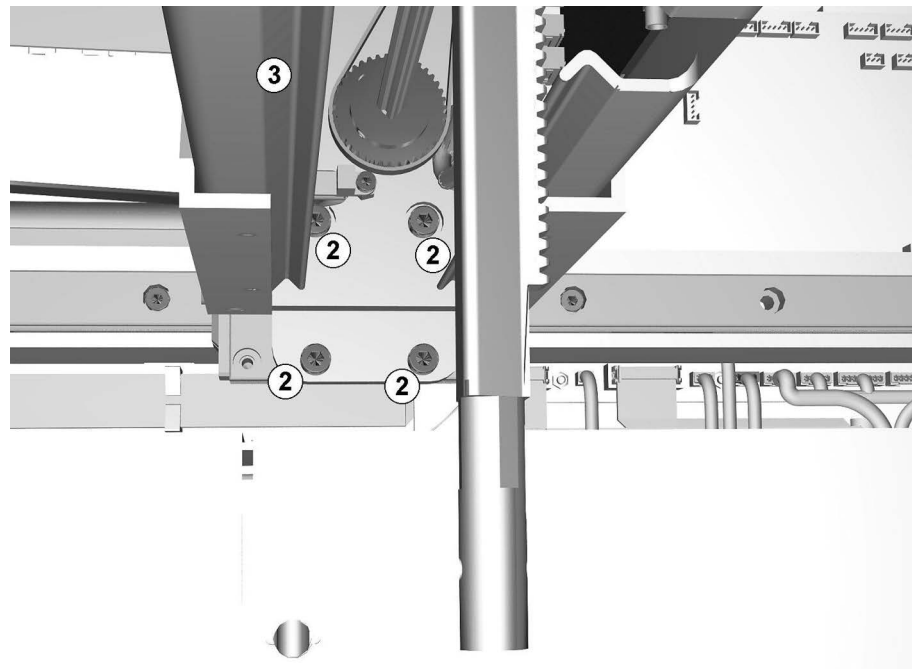


Figure 12-54: Pipettor arm fastening

INSTALLATION

10. Tighten the pipettor arm (3) and the four retaining screws (2).
11. Adjust the pipettor arm (see chapter 12.3.5 on page 12-16).
12. Push the ribbon cable under the ribbon cable bracket (1) and tighten both retaining screws.

NOTICE

Handle the folds of the cable with care. Opening and closing the folds can damage the conductors.

NOTICE

Make sure that the ribbon cable is fixed straight in a way that it will roll smoothly when the pipettor is moving. The radii of the cable bending must not be too small when the pipettor is on the very left or very right end of the X-axis.

13. Plug the ribbon cable connector (ST60) into the instrument CU board (see chapter 19.5.1 on page 19-20).
14. Install the X-belt (see chapter 12.6.6 on page 12-40).
15. Install the disposal tip adapter (see chapter 12.6.1 on page 12-24).
16. Install the upper cover (see chapter 8.3.5 on page 8-14).
17. Install the top cover (see chapter 8.3.4 on page 8-12).
18. Teach the pipettor module (see chapter 20.2 on page 20-2).
19. Check loading bay grid (LLD check) after teaching (see chapter 16.4.1 on page 16-5)

12.6.18 REPLACEMENT OF PIPETTOR MODULE

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Remove the upper cover (see chapter 8.3.5 on page 8-14).
5. Remove the disposal tip adapter (see chapter 12.6.1 on page 12-24).
6. Disconnect the ribbon cable connector (ST60) from the instrument CU board (see chapter 19.5.1 on page 19-20).
7. Disconnect the connectors (ST54, ST57, and ST58) from the instrument CU board (see chapter 19.5.1 on page 19-20).
8. Hold the pipettor module (1) and remove the four retaining screws (2).

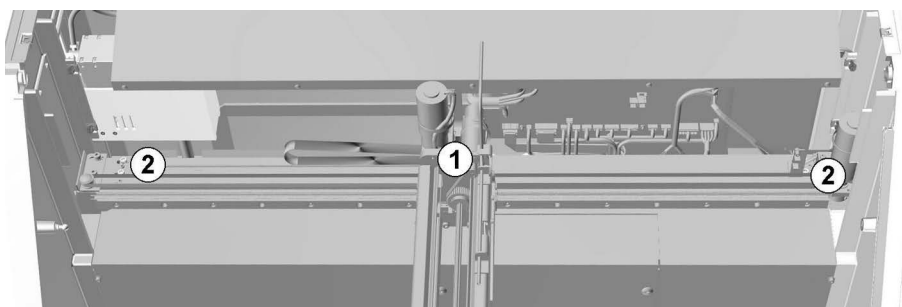


Figure 12-55: Attachment of the pipettor module left/right

9. Remove the pipettor module (1).

NOTICE

Some instruments are equipped with small steel pads that are positioned under the pipettor X-rail. These pads are required to distribute the load from the headless alignment screws.

INSTALLATION

10. Insert the new pipettor module (1).
11. Drive in the four retaining screws (2).
12. Plug the connectors (ST54, ST57, and ST58) into the instrument CU board (see chapter 19.5.1 on page 19-20).
13. Plug the ribbon cable connector (ST60) into the instrument CU board (see chapter 19.5.1 on page 19-20).
14. Install the disposal tip adapter (see chapter 12.6.1 on page 12-24).
15. Check the belts see chapter 12.4.2 on page 12-20.
16. Install the upper cover (see chapter 8.3.5 on page 8-14).
17. Install the top cover (see chapter 8.3.4 on page 8-12).
18. Start the firmware update (see chapter 21.1 on page 21-1).
19. Teach the pipettor module (see chapter 20.2 on page 20-2).
20. Check loading bay grid (LLD check) after teaching (see chapter 16.4.1 on page 16-5).

12.6.19 UPGRADE PIPETTOR MODULE TO VERSION 3

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the old pipettor module (see chapter 12.6.18 on page 12-60).
4. Remove the upper cover (old pipettor version) (see chapter 8.3.5.1 on page 8-14).

INSTALLATION

5. Install the new pipettor module version 3 (see chapter 13.6.17 on page 13-44).
6. Install the upper cover (pipettor version 3) (see chapter 8.3.5.2 on page 8-16).
7. Start the single firmware update for the COP board (see chapter 21.1 on page 21-1).
8. Start the instrument setup (see chapter 21.1 on page 21-1).
9. Teach the pipettor module (see chapter 20.2 on page 20-2).

12.7 SERVICE SOFTWARE

After start of service software and the selection of the pipettor (with double-click) the following dialog appears:

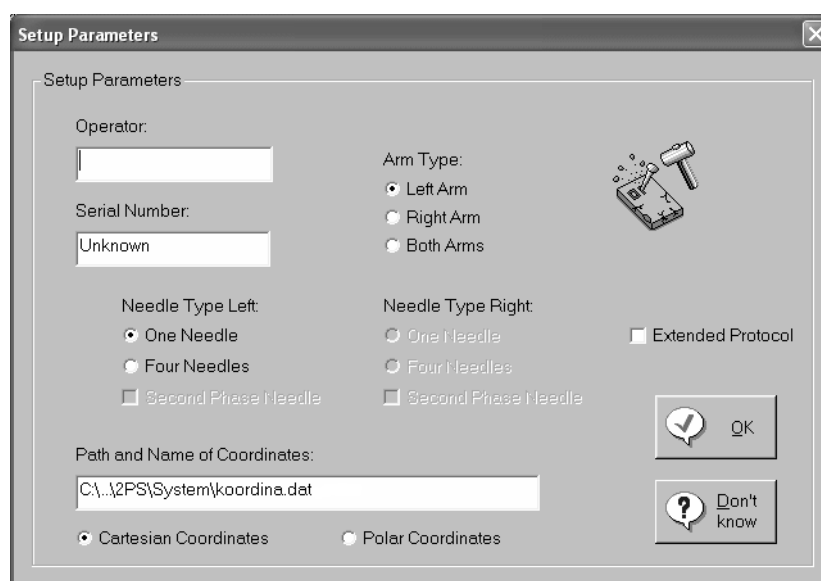


Figure 12-56: Setup Parameters dialog

GENERAL

Function	Description
Operator	Here the user name of the log in dialog box is shown. For the pipettor this name can be changed.
Serial Number	Enter the serial number of the machine.
Arm Type	Arm type of the pipettor: <ul style="list-style-type: none"> • Left Arm Don't use an other arm type!
Needle Type Left	Number of needle adapters: <ul style="list-style-type: none"> • One Needle Don't use the Four Needle entry!
Extended Protocol	Activates the recording of the communication in the protocol file (PIP000000.txt).
Path and Name of Coordinates	Path and name of the coordinate file should be automatically indicated. If this field is empty, the path in the configuration file (gService.ini) must be corrected.
Cartesian Coordinates	Type of coordinate system. Default!
Polar Coordinates	Don't use this coordinate system!
OK	Starts the pipettor main dialog.
Don't know	If you don't know the correct parameters and press the Don't Know button a warning is shown.

Table 12-1: Functions

NOTICE

The pipettor might crash if the parameters are not correct!

After successful input, the pipettor main dialog is shown.

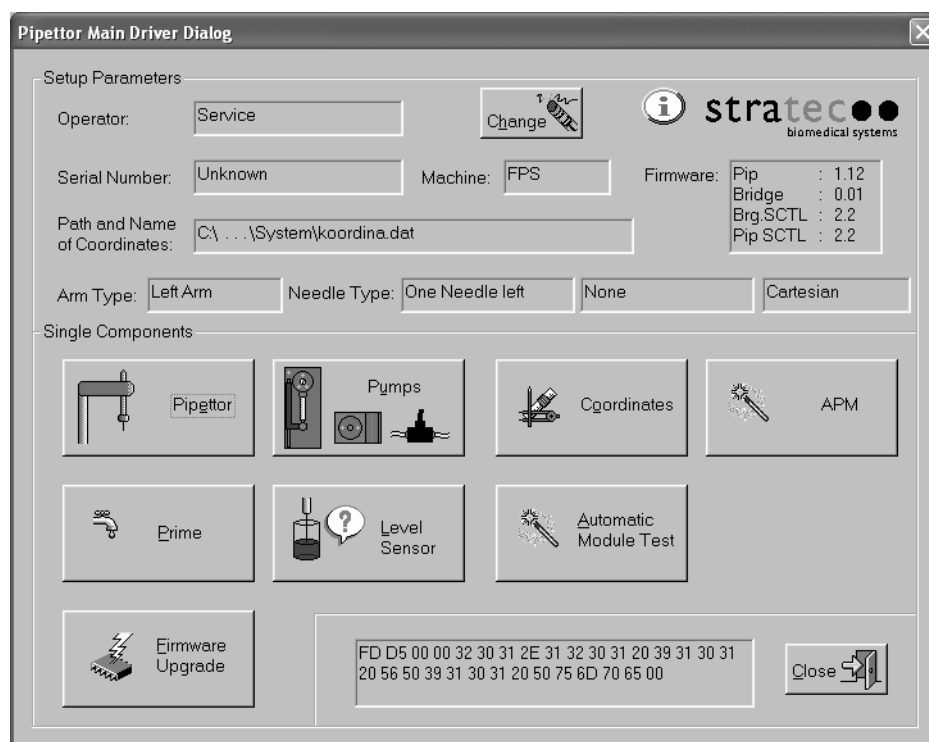


Figure 12-57: Pipettor Main Driver Dialog

SETUP PARAMETERS

Function	Description
Operator	Shows the user name.
Serial Number	Shows the serial number of the machine.
Machine	Type of the machine (FPS).
Path and Name of Coordinates	Path and name of the coordinate file.
Firmware	Shows the firmware version number, if connection is established with the module.
Arm Type	Arm type of the pipettor: <ul style="list-style-type: none"> • Default: Left arm
Needle Type	Number of needle adapters and used type of coordinate system: <ul style="list-style-type: none"> • Default: One needle left/Cartesian coordinates
Change	The parameters can be modified if necessary.
i	The version of the pipettor-DLL (service software) is shown.

Table 12-2: Functions of the Setup Parameters area

SINGLE COMPONENTS

Function	Description
Pipettor	see chapter 12.7.1 on page 12-66
Pumps	see chapter 12.7.2 on page 12-70
Coordinates	see chapter 12.7.3 on page 12-72
APM	see chapter 12.7.4 on page 12-75
Prime	see chapter 12.7.5 on page 12-76
Level Sensor	see chapter 12.7.6 on page 12-77
Automatic Module Test	see chapter 12.7.7 on page 12-80
Firmware Upgrade	Do not use this function! Instead of this function use the complete firmware update function (see chapter 21.1 on page 21-1).

Table 12-3: Functions of the **Single Components** area

GENERAL

Function	Description
Close	Closes application
Command Line Display	The line at the bottom of the screen displays the devices reply.

Table 12-4: Functions

12.7.1 PIPETTOR DIALOG

The Pipettor dialog looks as follows:

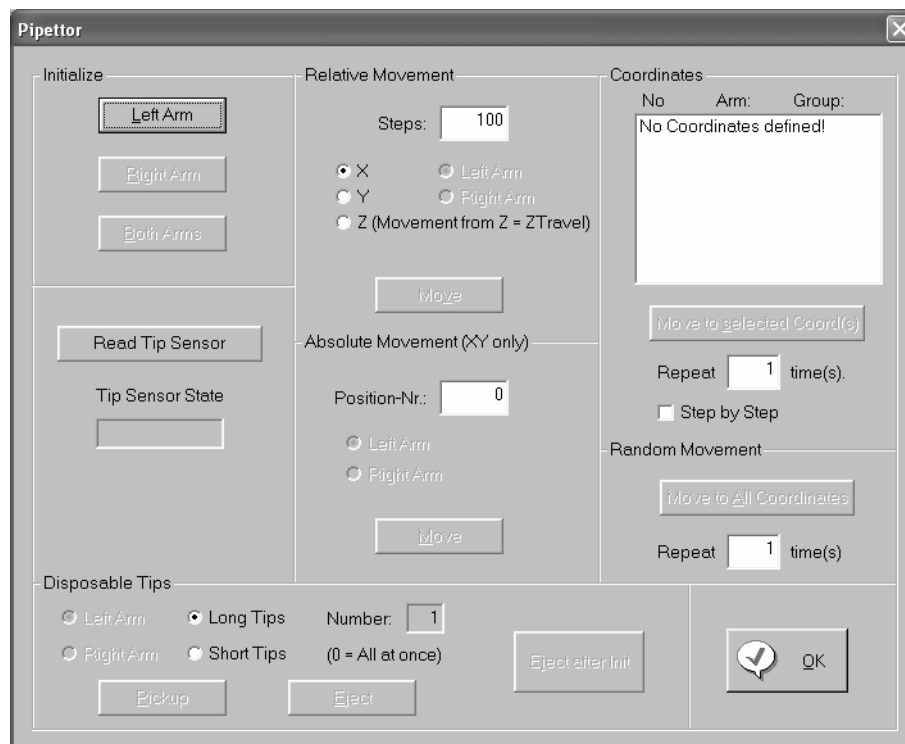


Figure 12-58: Pipettor dialog

⚠ CAUTION



Risk of injury!

In the following, functions to move the pipettor are described. Risk of injury: the pipettor will perform movements also if the cover is open. Please note also that the service software does not check if a movement can be performed safely. The pipettor will not move automatically at z travel. Therefore, the pipettor mechanics can be damaged, e. g. in case an X-/Y-movement is performed although the tip adapter was inserted in a well or a tube.

INITIALIZE

Function	Description
Left Arm	<p>First, the pipettor must be initialized.</p> <p>Initialization steps:</p> <ol style="list-style-type: none"> 1. Reset X-drive. 2. Reset command store. 3. Initialize Z-drive. 4. Initialize Y-drive. 5. Initialize X-drive.

Table 12-5: Functions of the **Initialize** area

During a movement the **Device is busy** dialog appears:

- **Cancel:**
Only the current sending of commands will be stopped.
- **Emergency Stop:**
An emergency stop command is sent to the pipettor. After this, the pipettor must be initialized again.

INFO

After the first initialization you automatically get to the **Coordinates** dialog (see chapter 12.7.3 on page 12-72).

RELATIVE MOVEMENT

Function	Description
Steps	Enter the number of steps for relative movement. The steps can be entered positive or negative depending on the desired direction of the movement.
X/Y/Z	Select the axis to move. The Z-axis moves to ZTravel before each movement, so it can be avoided that the Z-axis is too deep and possibly hangs during an XY-movement. That means that it also moves to ZTravel if the Z-axis itself is to move. The relative movement then starts from this height.
Move	By pressing the button, the selected arm moves with the selected axis the entered number of steps.

Table 12-6: Functions of the **Relative Movement** area

ABSOLUTE MOVEMENT

Function	Description
Position-Nr.	Enter the absolute position number. These numbers must correspond with those of the transmitted coordinates.
Move	By pressing the button, the selected arm moves to this position without moving the Z-axis. At the third position of the system (EJECT position) the Z-axis is moved to the top before the movement, so the arm doesn't get caught. This applies to each movement to the third position with the system.

Table 12-7: Functions of the **Absolute Movement** area

COORDINATES

In the area **Coordinates** appear the coordinates sent to the pipettor.

Function	Description
Move to selected Coord(s)	If you select some coordinates (marking with the mouse by pressing the key <i>Shift</i> or <i>Ctrl</i> while marking several coordinates that are not contiguous can be selected), the button Move to selected Coord(s) becomes active. By pressing this button the pipettor moves to the selected coordinates.
Repeat	Enter the number of repetitions of the movements.
Step by Step	The pipettor waits before each movement for the confirmation of the user.

Table 12-8: Functions of the **Coordinates** area

RANDOM MOVEMENT

Function	Description
Move to All Coordinates	By pressing the button, the pipettor moves to all coordinates in the same order as sent before. The pipettor will move alternately with the defined arm.
Repeat	Enter the number of repetitions of the movements.

Table 12-9: Functions of the **Random Movement** area

DISPOSABLE TIPS

Function	Description
Long Tips/Short Tips	Select the type of the used disposable tips.
Number	Not used (always 1).
Pickup	The pipettor will move down and pickup a tip.
Eject	To eject a tip, the pipettor must be moved to the eject position (FPS: No 3). Only there, the button Eject becomes active and can be pressed. The tip then is ejected.
Eject after Init	If there are a disposable tip attached to the needle after an initialization, they can be ejected immediately after the initialization by pressing the Eject after Init button.
Verify	The pipettor will move to the tip size detection position and checks the tip length.
Verify Result	Shows the result of the tip length test.

Table 12-10: Functions of the **Disposable Tips** area

After each picking up or ejecting of tips, the result is checked and a **No tip** message is reported on the screen if necessary.

GENERAL

Function	Description
Read Tip Sensor	To check for the presence of a tip. In case a tip is detected, the Tip Sensor State displays "presence" otherwise "absence" is shown.
Tip Sensor State	See Read Tip Sensor .
OK	Closes application
Command Line Display	The line at the bottom of the screen displays the devices reply.

Table 12-11: Functions

12.7.2 PUMPS DIALOG

If the pipettor was not initialized with the **Pipettor** dialog (see chapter 12.7.1 on page 12-66) or there were no coordinates sent, the question "Pipettor initialized and Coordinates sent?" is shown when calling the **Pumps** dialog. This question appears only once. By pressing **Yes**, the pipettor moves to the waste position and the **Pumps** dialog is shown.

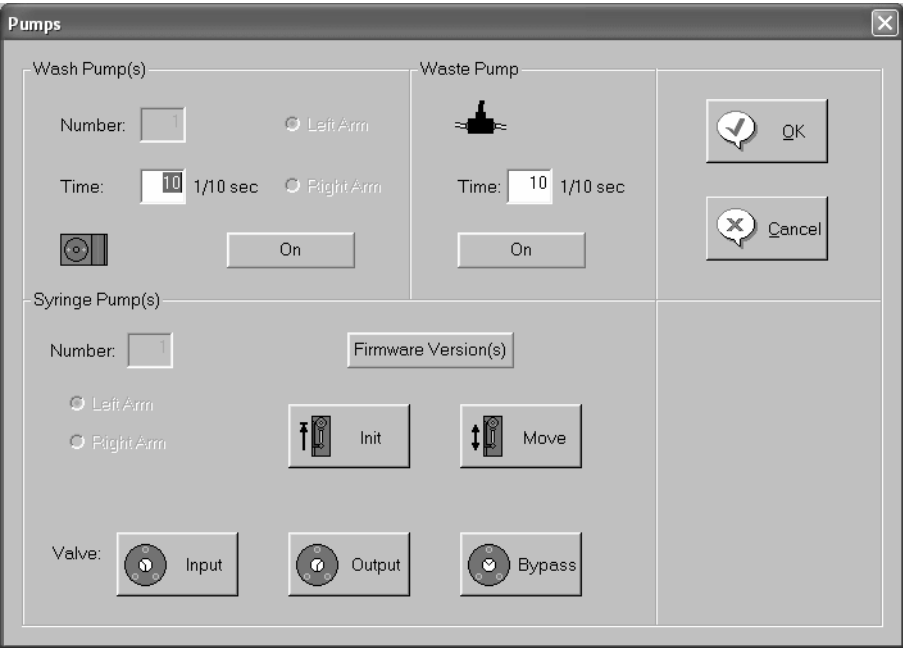


Figure 12-59: Pumps dialog

WASH PUMP(S)

Function	Description
Number	Not used
Time	Enter the time of switching on the wash pump.
On	Switches the wash pump on

Table 12-12: Functions of the Wash Pump(s) area

NOTICE

If the wash pumps are turned on, the waste pump is not switched on automatically! The wash position can overflow then.

WASTE PUMP

Function	Description
Time	Enter the time of switching on the waste pump.
On	Switches the waste pump on

Table 12-13: Functions of the Waste Pump area

SYRINGE PUMP(S)

Function	Description
Number	Not used
Firmware Version(s)	By pressing the button, the firmware version of the selected pump is shown.
Init/Input/Output/Bypass	By pressing the corresponding button, the movement of the plunger (initialization or normal movement) or of the valve (movement to input-, output- or bypass-position) can be tested.
Move	With the button, the pump moves 3000 steps, alternating downward or upwards. For the movement, the currently programmed speed parameters are used. That means that the pump moves quite slow after an initialization but faster after a prime cycle.

Table 12-14: Functions of the Syringe Pump(s) area

While a pump is working the dialog "Device is busy" appears (see chapter 12.7.1 on page 12-66).

GENERAL

Function	Description
OK	Closes the window and returns to main pipettor window. Parameters are stored.
Cancel	Closes the window and returns to main pipettor window. Parameters aren't stored.

Table 12-15: Functions

12.7.3 COORDINATES DIALOG

If the pipettor was not initialized with the **Pipettor** dialog (see chapter 12.7.1 on page 12-66), the question "Pipettor initialized?" is shown when calling the coordinates dialog. This question appears only once. By pressing the **Yes**, button the **Coordinates** dialog opens.

After the first initialization, the **Coordinates** dialog is shown automatically.

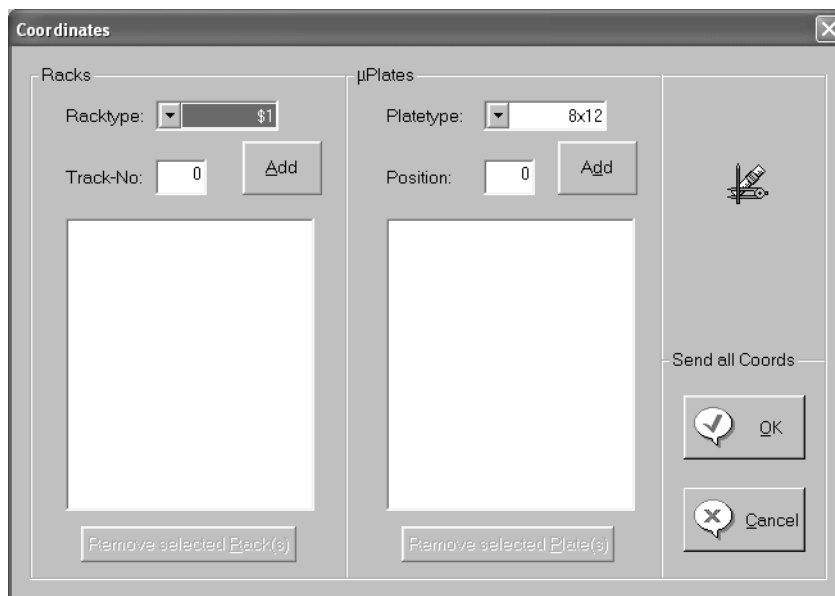


Figure 12-60: **Coordinates** dialog

RACKS

Function	Description
Racktype	Select the type of the rack (name of the rack file).
Track-No	Enter the number of the track where the rack is placed. The numbering of the tracks starts with zero (00 = left track; 11 = right track).
Add	Take over the racktype and the track-number and add the rack into the list.
Remove selected Rack(s)	By marking one or several racks and pressing Remove selected Rack(s) , these racks can be removed from the list.

Table 12-16: *Functions of the Racks area*

Defaults:

- Rack T at Track-No 00
- Rack T at Track-No 01
- Rack T at Track-No 02
- Rack T at Track-No 03
- Rack T at Track-No 04

- Rack T at Track-No 05
- Rack T at Track-No 06
- Rack T at Track-No 07
- Rack T at Track-No 08
- Rack T at Track-No 09
- Rack T at Track-No 10
- Rack T at Track-No 11

PLATES

Function	Description
Platetype	Select the type of the plate (name of the plate file).
Position	Enter the number of the plate position. The numbering of the plate positions starts with zero. Plate positions (pipetting station): <ul style="list-style-type: none"> • 00 = rear side • 03 = front side Disposable tip rack positions: <ul style="list-style-type: none"> • 04 = rear side • 08 = front side
Add	Take over the plate type and the position and add the plate into the list.
Remove selected Plate(s)	By marking one or several plates and pressing Remove selected Plate(s) , these plates can be removed from the list.

Table 12-17: Functions of the μ Plates area

Defaults:

- Plate 8x12 at Position 00
- Plate 8x12 at Position 01
- Plate 8x12 at Position 02
- Plate 8x12 at Position 03
- Plate Tips at Position 04
- Plate Tips at Position 05
- Plate Tips at Position 06
- Plate Tips at Position 07
- Plate Tips at Position 08

GENERAL

Function	Description
OK	<p>By pressing OK, the static coordinates (init position, wash- and waste position) are sent together with the just entered dynamic coordinates if they are defined in the coordinates-file.</p> <p>While the coordinates are sent the dialog "Device is busy" appears (see chapter 12.7.1 on page 12-66).</p> <p>After transmitting the coordinates, you get back to the pipettor main dialog (see chapter 12.7 on page 12-62), except after the first initialization. Then you get back to the pipettor dialog (see chapter 12.7.1 on page 12-66).</p> <p>If you want to change the dynamic coordinates you get, go again to the Coordinates dialog by pressing the Coordinates button in the main dialog. Have already coordinates been sent, the warning messages "Old Coordinates will be deleted!" appears.</p> <p>By pressing OK, the old coordinates in the service software are deleted and the coordinates dialog appears.</p>
Cancel	Drops all parameters, closes window and returns to main pipettor window.

Table 12-18: Functions

12.7.4 AUTOMATIC PRESSURE MEASUREMENT DIALOG (APM)

The screenshot shows the 'Automatic Pressure Measurement' dialog box. It features a title bar with a close button. The main area is divided into two columns: 'Values' and 'Ranges'. In the 'Values' column, there are input fields for 'P - Static', 'P - Delta', and 'Result' (which currently displays 'Unknown'). In the 'Ranges' column, there are labels for '[240 to 360]' and '[-5 to 40]'. Below these columns are three buttons: 'Check Tubing', 'Read Sensor', and 'Exit'. Additionally, there is a 'Sensor Value' field displaying '2148'.

Figure 12-61: Automatic Pressure Measurement (APM) dialog

GENERAL

Function	Description
P - Static	Shows the static pressure during the pipettor tubings check.
P - Delta	Shows pressure fluctuations during the pipettor tubings check.
Result	Shows the result of the pipettor tubings check.
Check Tubing	Starts the check of the pipettor tubings (see chapter 12.4.1 on page 12-19).
Sensor Value	Shows pressure sensor value.
Read Sensor	Reads the pressure sensor value.
Exit	Closes application

Table 12-19: Functions

12.7.5 PRIME DIALOG

If the pipettor was not initialized with the **Pipettor** dialog (see chapter 12.7.1 on page 12-66) or there were no coordinates sent, the question "Pipettor initialized and Coordinates sent?" is shown when calling the **Prime** dialog. This question appears only once. By pressing **Yes**, the pipettor moves to the waste position and the **Prime** dialog is shown.



Figure 12-62: Prime dialog

GENERAL

Function	Description
Number of Primecycles	Enter the number of prime cycles.
Time Bypasspump On	Enter the time of switching on the bypass pump.
OK	By pressing OK the priming starts. First, the valve of the pump is turned to the bypass position and the bypass pump is switched on for the specified time. After that the pump moves for the given number of cycles. In the meantime the "Device is busy" dialog is shown (see chapter 12.7.1 on page 12-66).
Cancel	Closes window and returns to main pipettor window.

Table 12-20: Functions

12.7.6 LEVEL SENSOR DIALOG

When calling the **Level Sensor** dialog, some buttons are active and some are inactive according to previous actions.

If there are no coordinates sent to the pipettor, no level sensor test can be started.

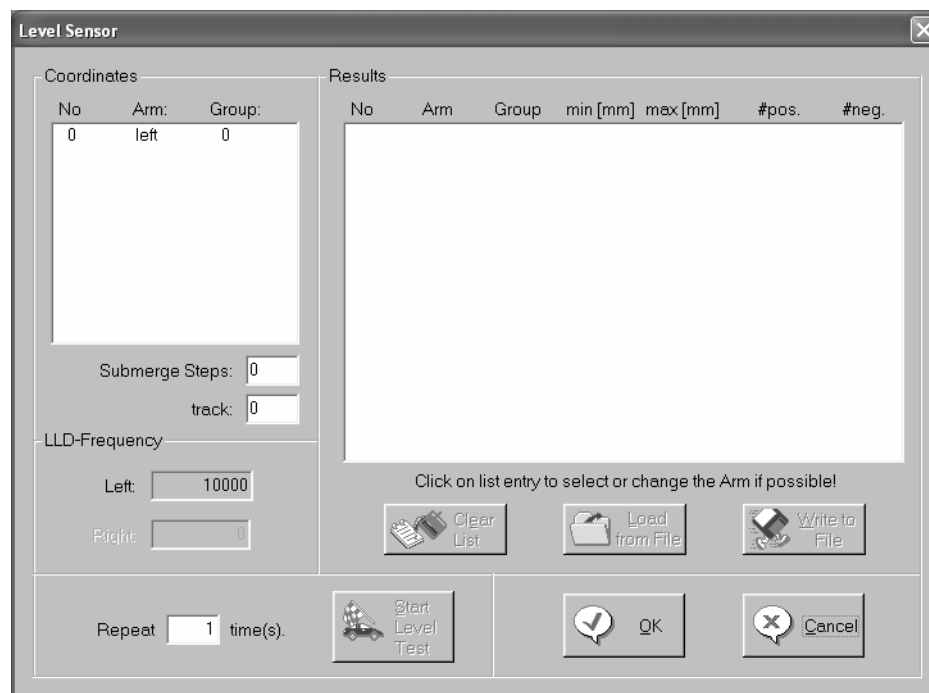


Figure 12-63: Level Sensor dialog

COORDINATES

The transmitted coordinates are shown in the area **Coordinates**.

Function	Description
Submerge Steps	Not used for service.
track	Not used for service.

Table 12-21: Functions of the **Coordinates** area

RESULTS

Function	Description
Clear List	With the Clear List button you can clear the result list in the display.
Load from File	If a file of target coordinates exists, it can be loaded now by pressing Load from File .
Write to File	After the test has finished the result list can be stored by pressing Write to File . At the same time a target data file is created.

Table 12-22: Functions of the Results area

LLD-FREQUENCY

Function	Description
Left	The actual LLD-Frequency is shown. The value is updated every half second if no level sensor test is running. When a test is started, the updating stops.

Table 12-23: Functions of the LLD-Frequency area

GENERAL

Function	Description
LLD Speed	Speed (in percent) at which the pipettor moves into the liquid. Set the speed normally used over the selected profiles or causing problems.
Repeat	In the field Repeat , the number of repetitions can be entered.
Start Level Test	<p>Before pressing Start Level Test load a target coordinates file (Load from File). Otherwise, the target coordinates for the test must now be selected (marking with the mouse by pressing the key <i>Shift</i> or <i>Ctrl</i> while marking several coordinates that are not contiguous can be selected). The marked coordinates are copied automatically into the Results area.</p> <p>After pressing Start Level Test, the test starts. The pipettor moves to the selected coordinates one after the other and searches for liquid at each position. At the same time the result list is continuously updated. The minimum and the maximum height are determined as well as the number of positive and negative results.</p> <p>During the test the "Device is busy" dialog is shown (see chapter 12.7.1 on page 12-66).</p>
OK	If you leave a dialog with the OK button the software remembers the entered values when reopening the dialog.
Cancel	With Cancel the entered values are not stored.

Table 12-24: Functions

12.7.7 AUTOMATIC MODULE TEST DIALOG

The automatic module test runs almost completely independently. Only at the beginning tips and a rack must be placed.

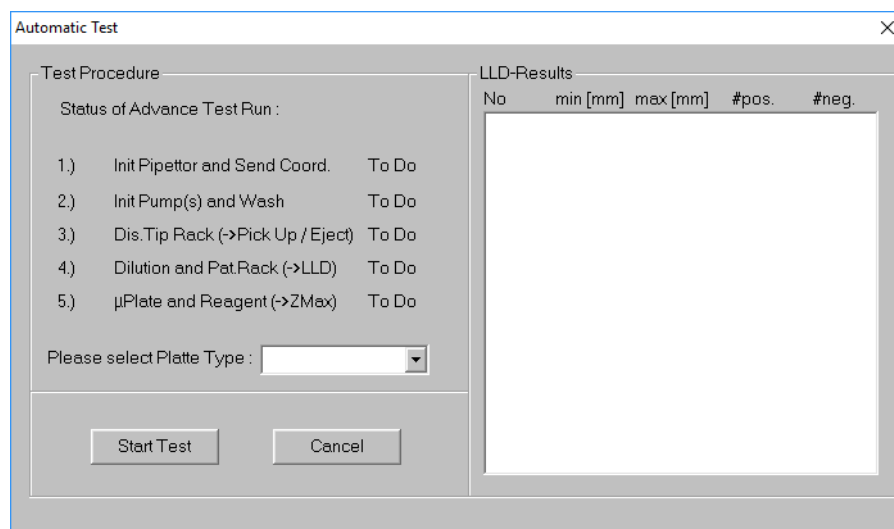


Figure 12-64: Automatic Test dialog

Procedure:

1. Choose the used plate type in the list **Plate Type**.
2. Press on the **Start Test** button to start the automatic module test.
3. First, short tips must be placed at the shown position.
4. Press on the **OK** button.
5. Long tips must be placed at the position that is shown now.
6. Press on the **OK** button.
7. A T-rack filled with tubes (with and without liquid) must be placed on the first track.
8. Press on the **OK** button.
The test runs itself with the selected parts. The result window for the level detection is constantly updated.

Criterion for passed: **#pos 2** and **#neg 0** (The pipettor found fluid in all positions twice.)

At the end a log file is created automatically.

13 PIPETTOR MODULE (VERSION 3)

This chapter describes this module in detail. In the first section "Safety" additionally to the general safety notes (see chapter 1.2 on page 1-6) safety notes are specified, which concern particularly this module. The section "Overview" gives a short overview about this module. The section "Tips and Information" gives tips and information for the handling. This section is followed by a larger part containing information about maintenance, repair and testing of this module (sections "Adjustment and Calibration", "Check and Verification", "Maintenance", "Troubleshooting and Repairs" and "Connections, Signals and Switches"). The last section "Service Software" describes only the service software module which only concerns this module.

13.1 OVERVIEW

INFO

For detailed liquid plan see chapter 17.2.3 on page 17-5.

13.1.1 PIPETTOR MODULE

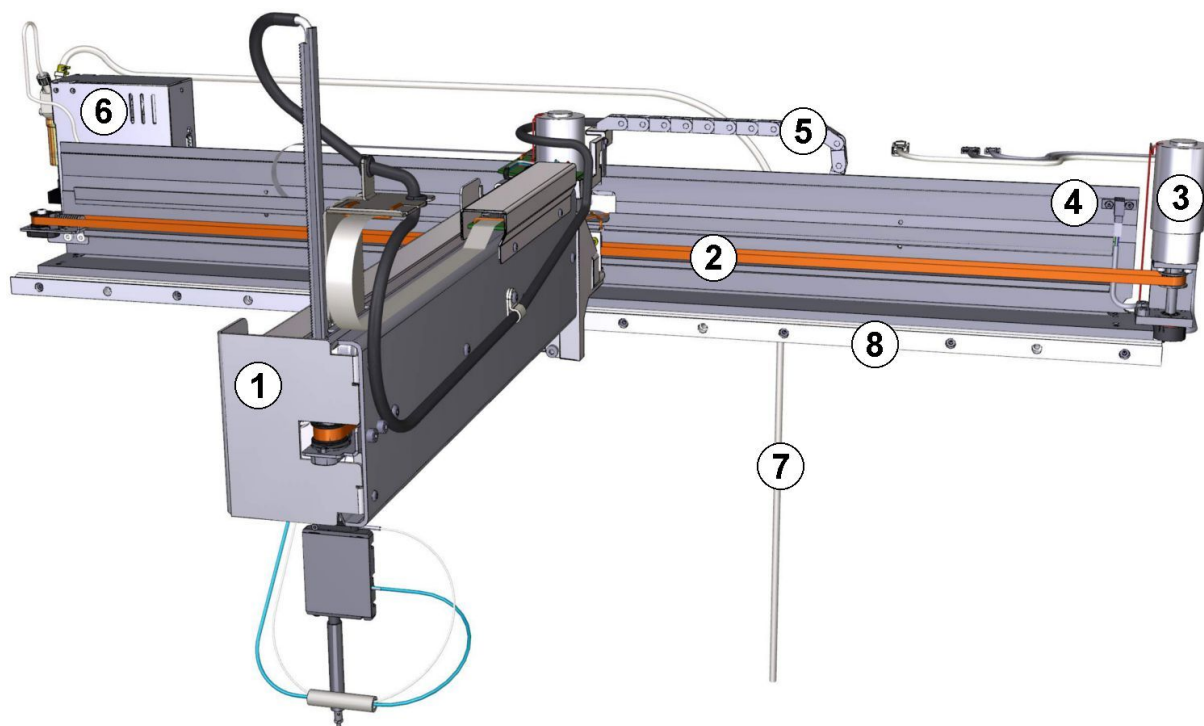


Figure 13-1: Pipettor module (version 3) with diluter pump

- | | |
|---|---|
| 1 | Pipettor arm with disposal tip adapter and Y-/Z-drive (see chapter 13.1.2 on page 13-3) |
| 2 | X-belt |
| 3 | X-motor and X-encoder - (connected to the instrument CU board, ST57 + ST58) |
| 4 | X-init light barrier (X-home position) - (connected to the instrument CU board, ST54) |
| 5 | Energy chain |
| 6 | Diluter pump with syringe and 3-way valve (connected to the instrument CU board, ST59) |
| 7 | System liquid tubing (between diluter pump and system liquid pump, see chapter 17.2.2 on page 17-3) |
| 8 | X-guiding |

13.1.2 PIPETTOR ARM

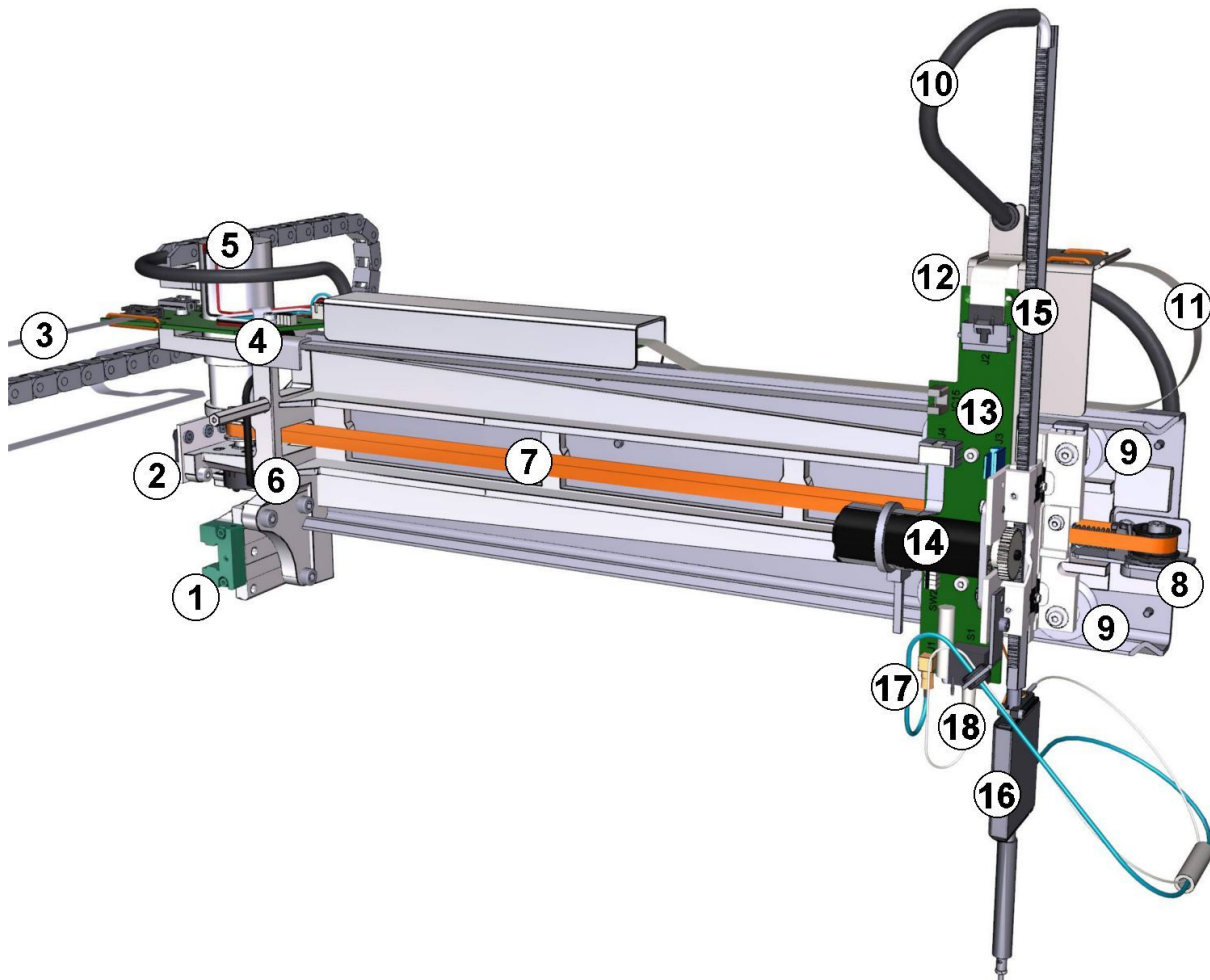


Figure 13-2: Pipettor arm without left cover

- | | |
|----|---|
| 1 | X-guiding unit |
| 2 | X-belt fixing plates |
| 3 | Pipettor ribbon cable to instrument CU board (ST60) |
| 4 | X-sledge CU board |
| 5 | Y-motor |
| 6 | Y-encoder |
| 7 | Y-belt |
| 8 | Y-belt tightener |
| 9 | 2 upper and 2 lower guiding rollers |
| 10 | Pipettor system liquid tubing (between disposal tip adapter and diluter pump) |

- | | |
|----|--|
| 11 | Arm ribbon cable between X-sledge CU board and Y-sledge CU board |
| 12 | Y-sledge |
| 13 | Y-sledge CU board with Y-init light barrier (Y-home position) |
| 14 | Z-motor |
| 15 | Toothed rack |
| 16 | Disposable tip adapter |
| 17 | Liquid level detection cable (LLD cable) |
| 18 | APM tubing |

13.2 TIPS AND INFORMATION

This section describes tips and tricks for the handling of the pipetting system.

13.2.1 PIPETTOR TOOLS

INFO

For pipettor module teach tools see chapter 20.2.1 on page 20-2.

INFO

For pipettor module adjustment tool see chapter 12.2.1 on page 12-5.

13.3 ADJUSTMENT AND CALIBRATION

In this section, the adjustment of the pipetting system is described.

13.3.1 ADJUSTMENT OF X-BELT AND X-MOVEMENT FORCE

See chapter 13.6.6 on page 13-22. It is not necessary to replace the X-belt.

13.3.2 ADJUSTMENT OF Y-BELT AND Y-MOVEMENT FORCE

See chapter 13.6.8 on page 13-25. It is not necessary to replace the Y-belt.

13.3.3 ADJUSTMENT OF Z-DRIVE

See chapter 13.6.10 on page 13-30. It is not necessary to replace the Z-motor.

13.3.4 ADJUSTMENT OF PIPETTOR MODULE

TOOLS

- Loading Bay Teach Tool (see chapter 20.2.1.3 on page 20-3)
- Toothed Rack Adjustment Tool (see chapter 12.2.1.1 on page 12-5)

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Remove the APM disposable tip adapter (see chapter 13.6.2 on page 13-13).
5. Remove the loading bay grid (see chapter 16.5.1 on page 16-9).

ADJUSTMENT

6. Insert the loading bay teach tool into the left position of the loading bay.
7. Insert the toothed rack adjustment tool into the loading bay teach tool.
8. Move the pipettor/toothed rack next to the toothed rack adjustment tool (touch with the toothed rack the left/right or front/rear side of the adjustment tool).
9. Check the parallelism of the toothed rack to the adjustment tool.

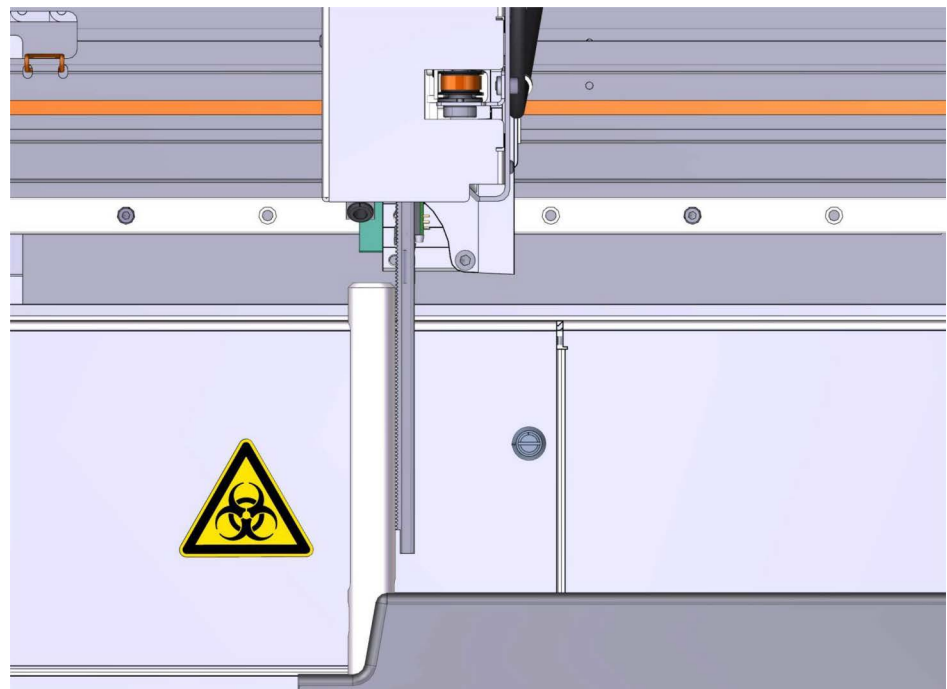


Figure 13-3: Adjustment with toothed rack adjustment tool

Left/right adjustment:

10. Loose the three screws (1) to adjust the left/right straightness.

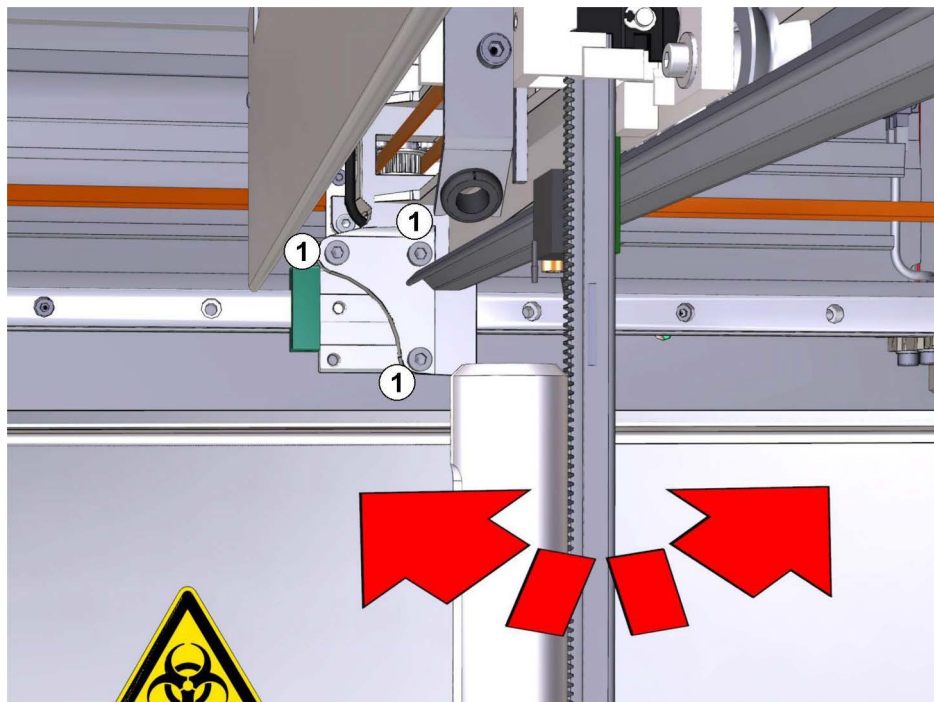


Figure 13-4: Left/right adjustment

11. Tighten the three screws (1).

Front/rear adjustment and left/right precise adjustment:

12. Loose the four retaining screws (2).

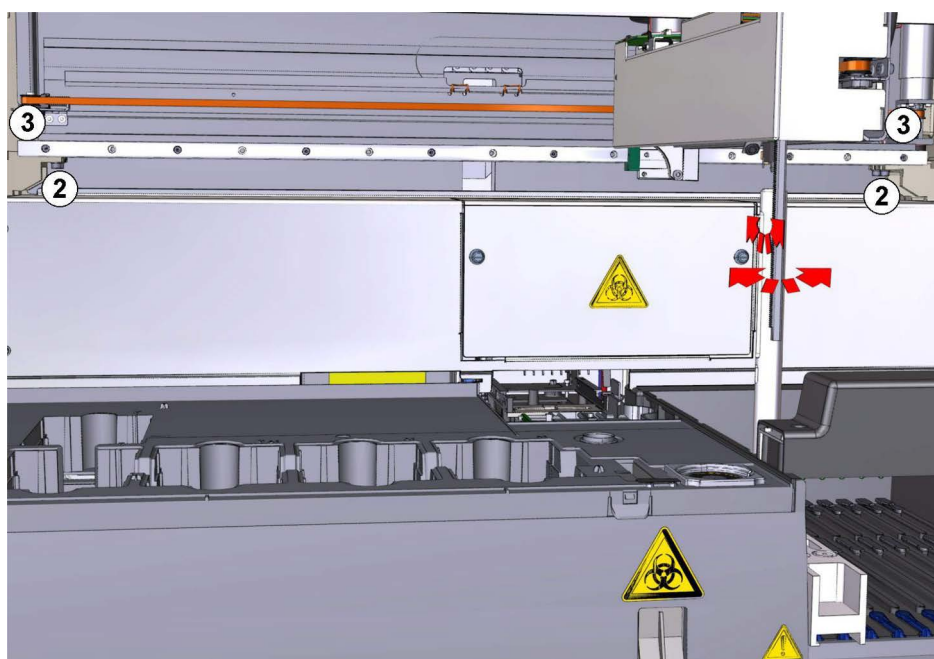


Figure 13-5: Front/rear and left/right adjustment

13. Use the four set screws (3) to adjust the front/rear and left/right straightness.

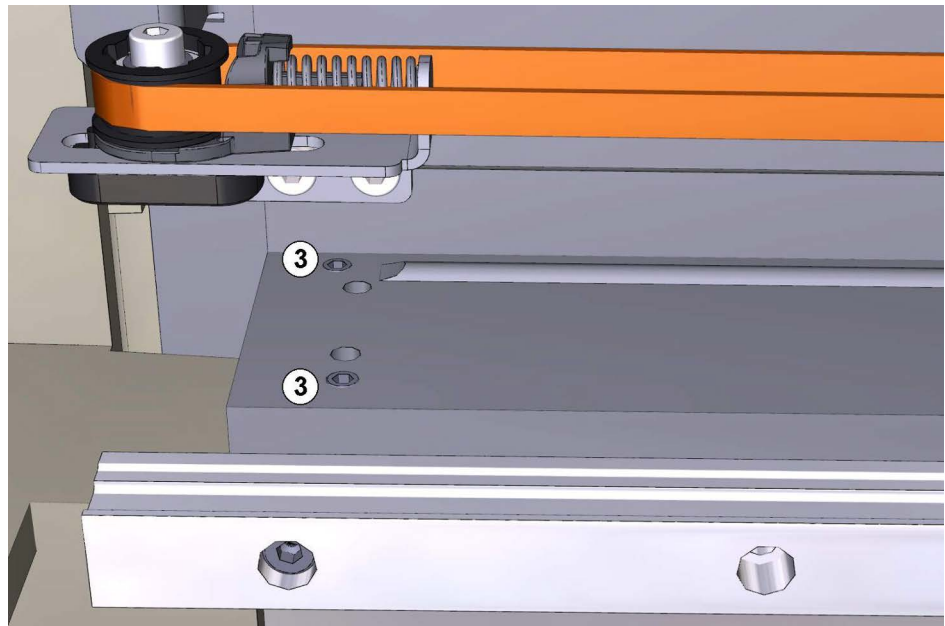


Figure 13-6: Left set screws

14. Tighten the four retaining screws (2).

INSTALLATION

15. Install the APM disposable tip adapter (see chapter 13.6.2 on page 13-13).
16. Install the loading bay grid (see chapter 16.5.1 on page 16-9).
17. Install the top cover (see chapter 8.3.4 on page 8-12).
18. Teach the pipettor module (see chapter 20.2 on page 20-2).

13.4 CHECK AND VERIFICATION

13.4.1 CHECK PIPETTOR TUBING (APM)

See chapter 12.4.1 on page 12-19

13.4.2 CHECK X-/Y-BELTS AND Z-DRIVE

To check tensions and movements see adjustment procedures:

- X-belt: chapter 13.6.6 on page 13-22
- Y-belt: chapter 13.6.8 on page 13-25
- Z-drive: chapter 13.6.10 on page 13-30

It is not necessary to replace the X-/Y-belts or the Z-motor.

13.4.3 CHECK FREE MOVEMENT OF Z-INIT PIN

See chapter 12.4.3 on page 12-20

13.4.4 PERFORM PIPETTOR MODULE TEST

See chapter 12.4.4 on page 12-21

13.5 MAINTENANCE

This section contains instructions for the maintenance of individual components of the pipetting system. Follow the instructions in the individual sections.

13.5.1 CLEANING OF X-GUIDING



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Wipe the X-guiding with a lint-free cloth.
4. Move the pipettor arm several times from the left to the right and back.

13.5.2 CLEANING OF Y-GUIDING RAILS AND ROLLERS



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Open the left pipetting arm cover (see chapter 13.6.1 on page 13-12).
4. Remove all dirt with a cleaning paper from both Y-guiding rails (1) and the four Y-guiding rollers (2).
5. Check for excessive friction force in all axes.

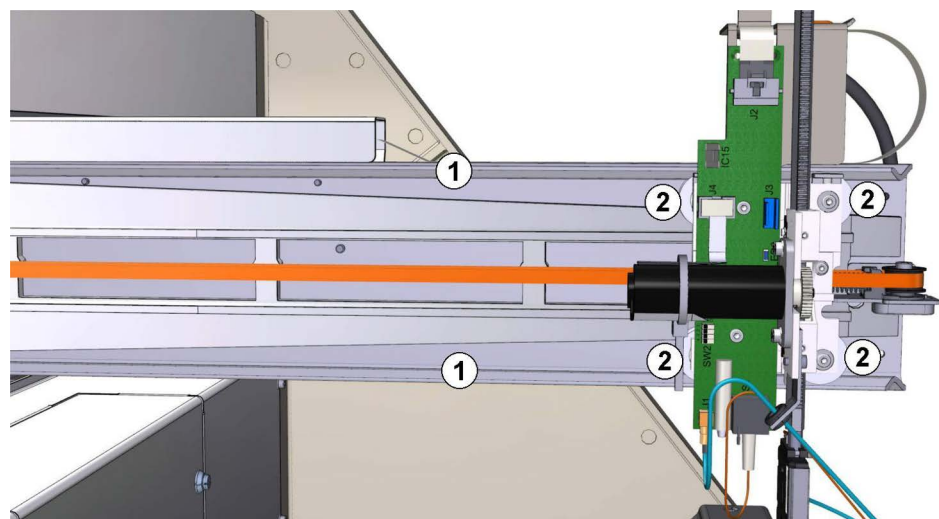


Figure 13-7: Pipettor arm without right cover

6. Close the left pipetting arm cover (see chapter 13.6.1 on page 13-12).

13.6 TROUBLESHOOTING AND REPAIRS

This section contains instructions for the repair of individual components of the pipetting system. After several repair works it is required that the individual components are readjusted. Follow the instructions in the individual sections.

13.6.1 OPEN/CLOSE LEFT PIPETTOR ARM COVER

OPEN



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Open the top cover.
4. Remove screw (1) and both screws (2).

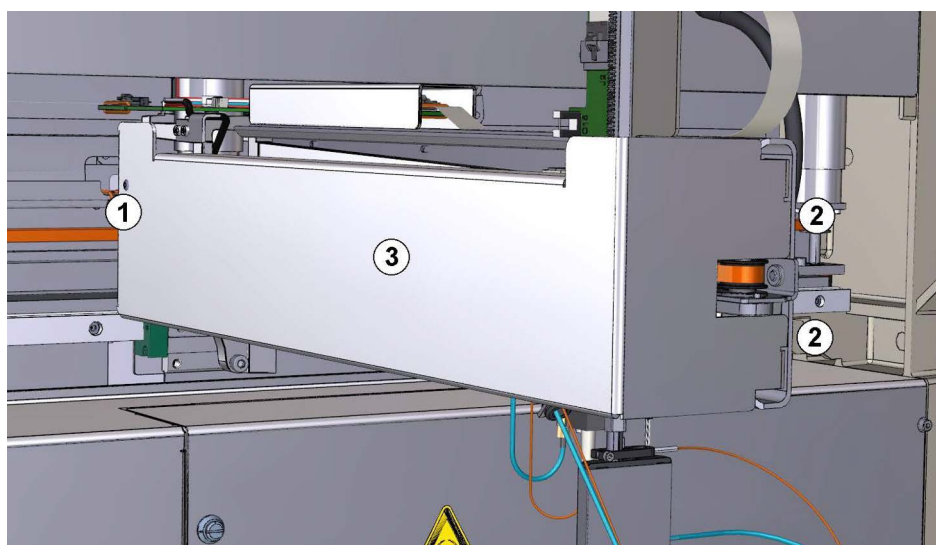


Figure 13-8: Pipettor arm

5. Remove the left cover (3).

CLOSE

6. Install the left cover (3) and tighten the screws (1 + 2).

13.6.2 REPLACEMENT OF APM DISPOSABLE TIP ADAPTER

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Move the pipettor/disposable tip adapter above the pipettor wash station, because the pipettor drops when the tubing is removed in the next step.
5. Screw the pipettor system liquid tubing (1) with the fitting (2) out of the diluter pump valve (5).

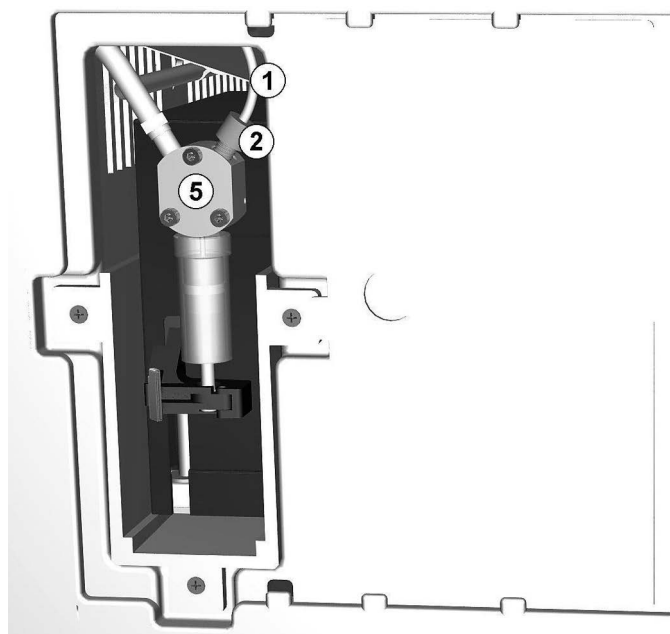


Figure 13-9: Installed diluter pump

6. Remove the complete fitting (2, 3, and 4) from the pipettor system liquid tubing (1).

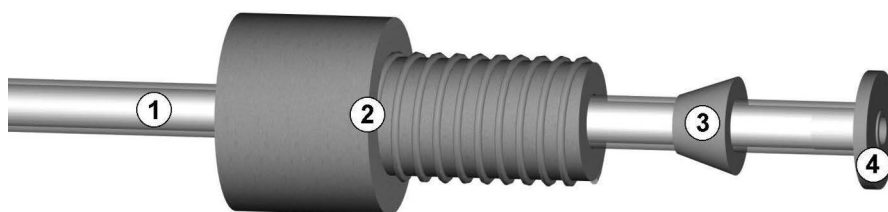


Figure 13-10: Fitting

7. Unhook the energy chain (6) on position (7).

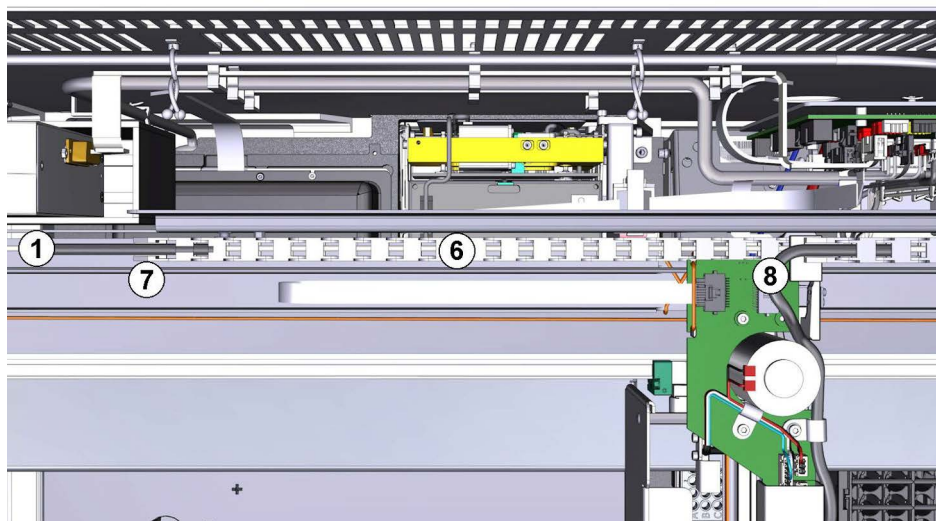


Figure 13-11: Energy chain (top view)

8. Pull the pipettor system liquid tubing (1) out of the energy chain (6).
9. Remove the protection tubing (8) from both cable clamps (9).

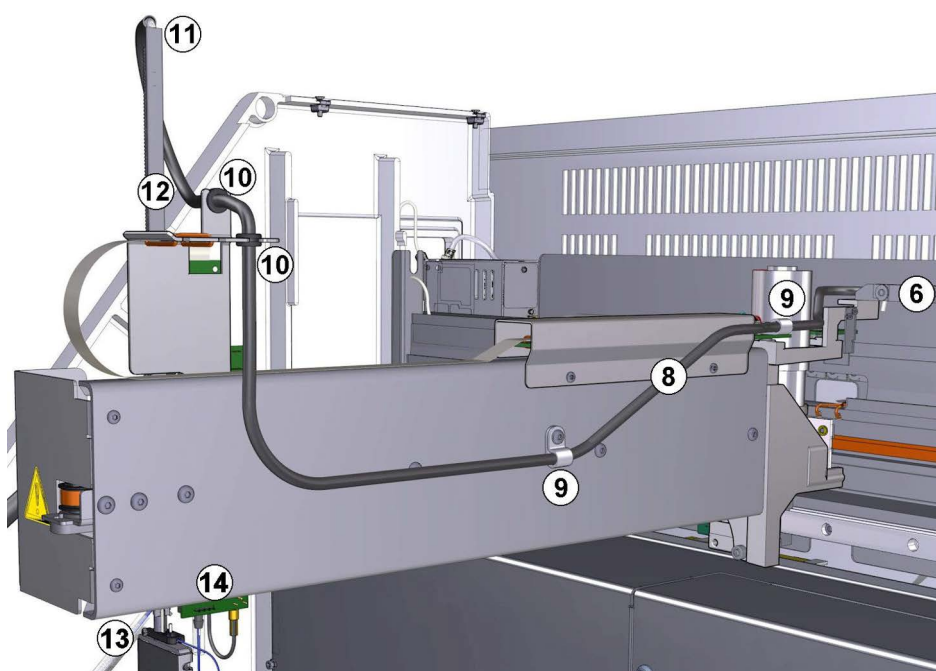


Figure 13-12: Pipettor arm

10. Pull off the protection tubing (8) from the metal tubing (11).
11. Pull the pipettor system liquid tubing (1) out of the protection tubing (8).
12. Pull the metal tubing (11) out of the toothed rack (12).
13. Pull the pipettor system liquid tubing (1) out of the metal tubing (11).
14. Pull the APM tubing (15) with adapter tubing (16) out of the sensor (S1) on the Y-sledge CU board (14) (see chapter 19.6.2 on page 19-23).

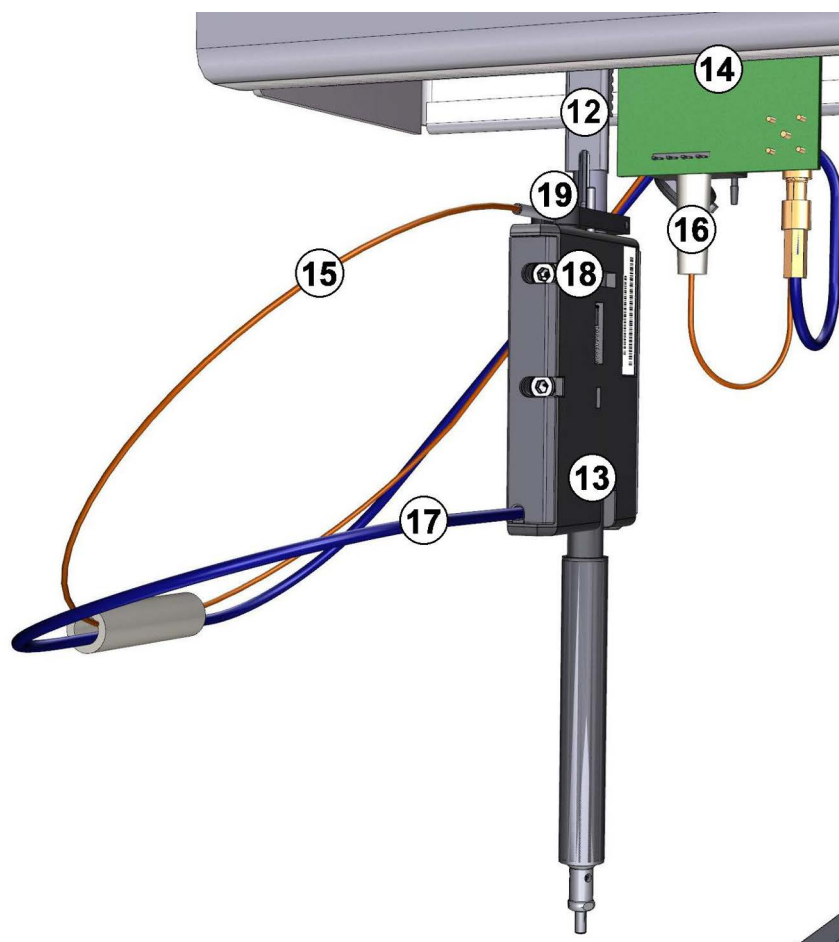


Figure 13-13: Installed disposable tip adapter

15. Pull the APM tubing (15) out of the adapter tubing (16).
16. Disconnect the LLD cable (17) from the connector (J1) on the Y-sledge CU board (17) (see chapter 19.6.2 on page 19-23).
17. Remove the APM tubing (15) and the LLD cable (17) from the duct next to the Y-sledge CU board (17).
18. Open the set screw (18).
19. Pull the disposal tip adapter (13) with both tubings (1 and 15) down from the toothed rack (12) and remove it.

INSTALLATION

NOTICE

Use of tubings:

- Avoid kinks in the tubings during the installation!
- Do not pull the pipettor system liquid tubing, because the adhesive bonding of the tubing inside the tip adapter can be damaged easily.

20. Insert the APM tubing (15) of the new disposal tip adapter (13) into the toothed rack (12) and lead it out through the elongated hole.
21. Push the pipettor system liquid tubing (1) through the toothed rack (12).

22. Put the new disposal tip adapter (13) up to the toothed rack (12) and tighten the set screw (18).
23. Push the APM tubing (15) through the air tube guiding (19).
24. Push the APM tubing (15) through the duct next to the Y-sledge CU board (17).
25. Put the adapter tubing (16) up to the APM tubing (15).
26. Put the adapter tubing (16) up to the sensor (S1) on the Y-sledge CU board (17) (see chapter 19.6.2 on page 19-23).
27. Push the LLD cable (15) through the duct next to the Y-sledge CU board (17).
28. Plug the LLD cable (15) into the connector (J1) on the Y-sledge CU board (17) (see chapter 19.6.2 on page 19-23).
29. Push the pipettor system liquid tubing (1) through the metal tubing (11) and the protection tubing (8). If necessary remove the protection tubing (8) from the ducts (10).
30. Push the metal tubing (11) into the toothed rack (12).
31. Push the protection tubing (8) onto the metal tubing (11).
32. Stick the protection tubing (8) throw both cable clamps (9).
33. Push the pipettor system liquid tubing (1) into the energy chain (6).
34. Hook the energy chain (6) on position (7).
35. Install the complete fitting (2, 3, and 4) on the pipettor system liquid tubing (1).

NOTICE

Do not use any tools to fit and tighten the fittings!

36. Screw the fitting (2) in the diluter pump valve (5).
37. Install the top cover (see chapter 8.3.4 on page 8-12).
38. Check free movement of Z-Init pin (see chapter 13.4.3 on page 13-10).
39. Move the pipettor arm and the toothed rack.

NOTICE

The APM tubing (15) and the LLD cable (17) must not touch the toothed rack during movement!

NOTICE

The protection tubing (8) between the metal tubing (11) and the upper duct (10) must not touch the front border of the pipettor housing during movement!

40. Teach the pipettor module (see chapter 20.2 on page 20-2).
41. Purge the pipettor with the service software (see chapter 12.7.2 on page 12-70).
42. Perform the pipettor module test (see chapter 12.4.4 on page 12-21).
43. Perform the pipettor tubing (APM) test (see chapter 12.4.1 on page 12-19)

13.6.3 REPLACEMENT OF LIQUID LEVEL DETECTION CABLE

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Disconnect the LLD cable from the connector (J1) on the Y-sledge CU board (see chapter 19.6.2 on page 19-23).
4. Open carefully the front cover of the disposable tip adapter (1) with a small screwdriver, see arrows:



Figure 13-14: Disposable tip adapter (backside)

5. Turn the cable a bit and push very carefully a little screw driver between the small disposable tip adapter board and the LLD cable connector (see arrows). Remove the connector by slow and gentle movements of the screw driver.

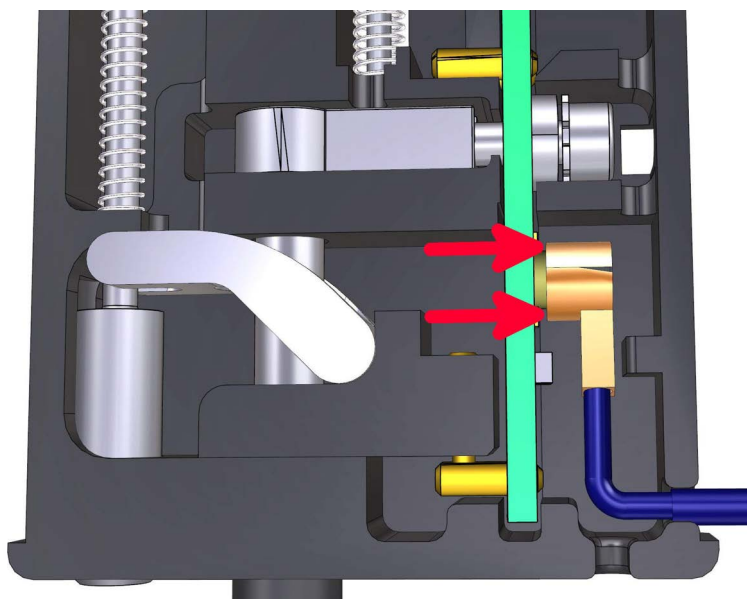


Figure 13-15: Liquid level detection cable connector

INSTALLATION

6. Push the cable connector slowly onto the small disposable tip adapter board connector.
7. Place the LLD cable into the gap.
8. Close carefully the front cover of the disposable tip adapter (1).
9. Plug the new LLD cable into the connector (J1) on the Y-sledge CU board (see chapter 19.6.2 on page 19-23).
10. Move the pipettor arm and the toothed rack.

NOTICE

The APM tubing and the LLD cable must not touch the toothed rack during movement!

13.6.4 REPLACEMENT OF APM SYRINGE- VALVE-SYSTEM (DILUTER PUMP)

See chapter 12.6.3 on page 12-31

13.6.5 REPLACEMENT OF DILUTER PUMP (VP9101)

REMOVAL



1. Remove the syringe-valve-system chapter 13.6.4 on page 13-19.
If possible, use the service software to remove the syringe-valve-system.
2. Shut down the computer and switch off the instrument.
3. Disconnect main power from the instrument.
4. Remove the top cover (see chapter 8.3.4 on page 8-12).
5. Remove the three retaining screws (4) of the pump holding device (3).

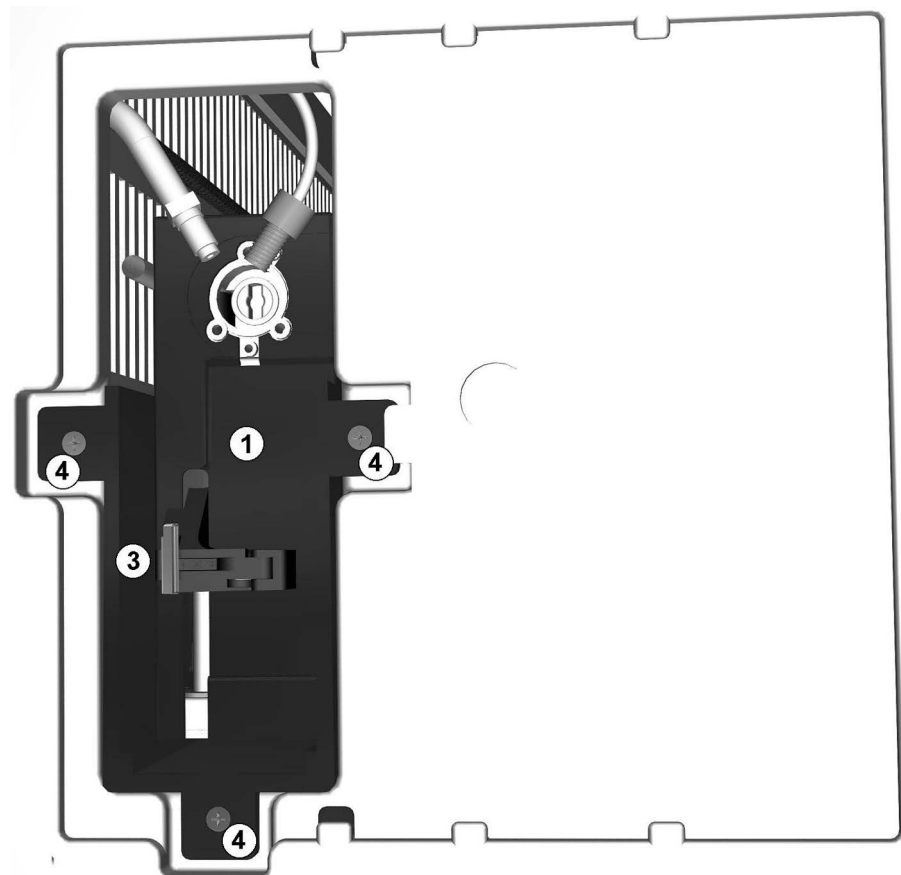


Figure 13-16: Installed diluter pump without syringe-valve-system (side view)

6. Pull the diluter pump (1) with pump holding device (3) out of the instrument.
7. Disconnect the connector (2) from the diluter pump (1).

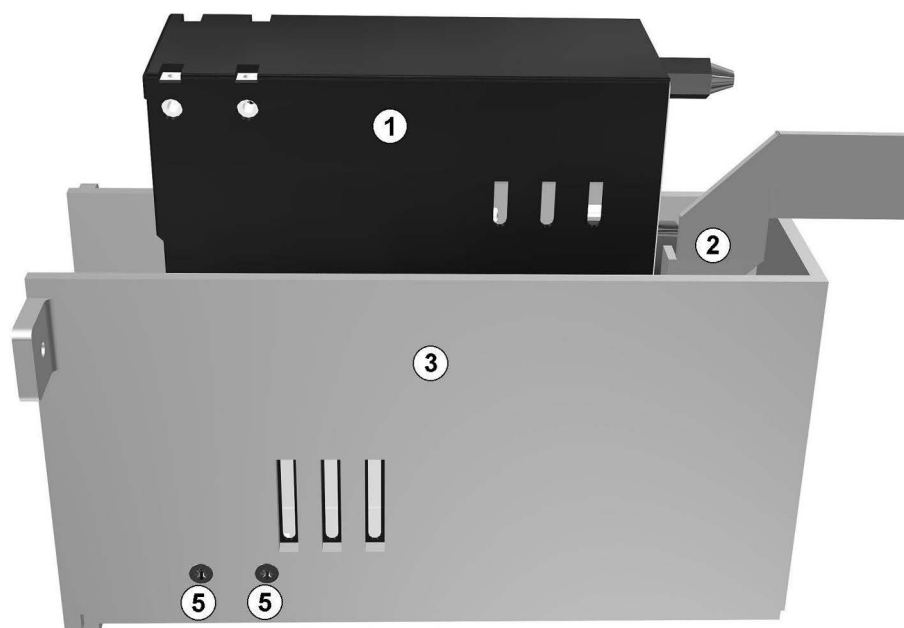


Figure 13-17: Diluter pump with pump holding device

8. Remove the four retaining screws (5) on both sides of the pump holding device (3).
9. Remove the diluter pump (1).

INSTALLATION

10. Set the arrowhead of the address switch (6) of the new diluter pump (1) to address 0.

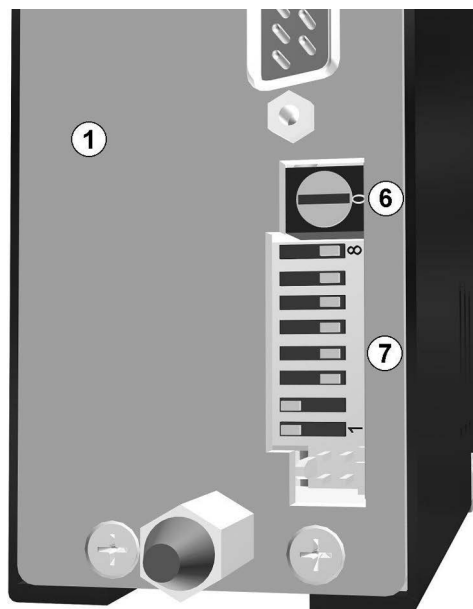


Figure 13-18: Diluter pump (back side)

11. Set the DIP switches (7):
 - 1 and 2: ON
 - 3 to 8: OFF

12. Insert the diluter pump (1) into the pump holding device (3) and tighten the four retaining screws (5) on both sides.
13. Plug the connector (2) into the diluter pump (1).
14. Push the diluter pump (1) with pump holding device (3) into the instrument.
15. Tighten the three retaining screws (4).
16. Install the top cover (see chapter 8.3.4 on page 8-12).
17. Connect main power to the instrument.
18. Switch on the instrument.
19. Install the syringe-valve-system chapter 13.6.4 on page 13-19.
If possible, use the service software to install the syringe-valve-system.

13.6.6 REPLACEMENT AND ADJUSTMENT OF X-BELT

ADDITIONAL TOOLS

- Spring balance (0 to 10 N)

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Loosen tension screw (2) of the X-belt tightening device. Press it against the right side/tension spring and tighten tension screw (2).

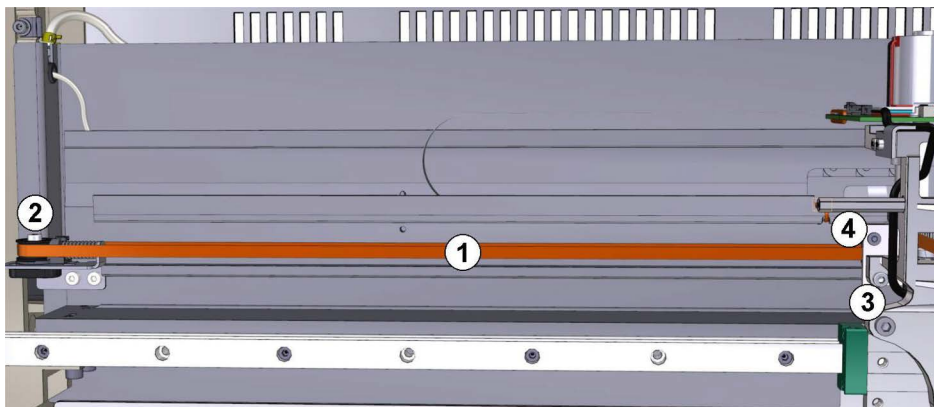


Figure 13-19: Left side of the X-drive

5. Remove screw (3) of the belt fixing plates holder (4).
6. Remove the belt fixing plates holder (4) from the pipettor arm and move it to a free place.
7. Remove the screws of both belt fixing plates (5).

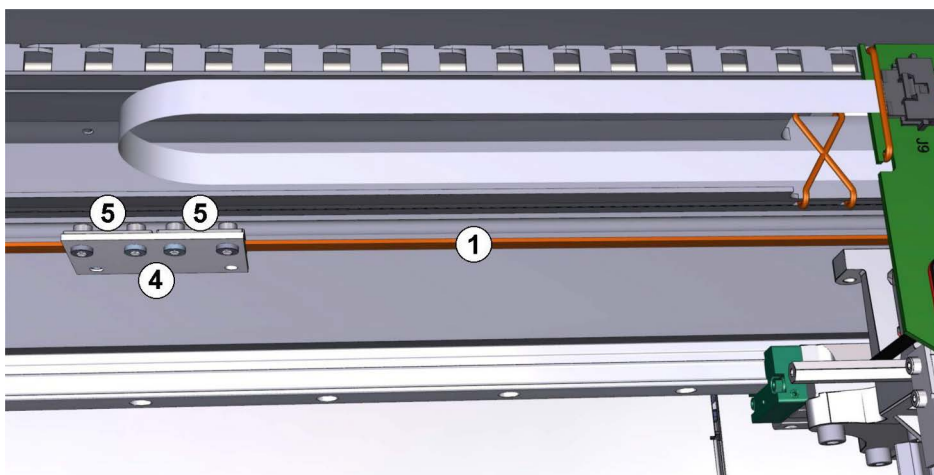


Figure 13-20: Belt fixing plates holder

8. Remove the fixing plates (5) with screws, the fixing plates holder (4) and the X-belt (1).

INSTALLATION I

9. Install the first fixing plate (5) to clamp one end of the X-belt (1) on the fixing plates holder (4).
The end of the belt must be laid centered and completely under the fixing plate.
10. Insert the X-belt (1) and lead it around the gear wheel (6) of the X-motor.

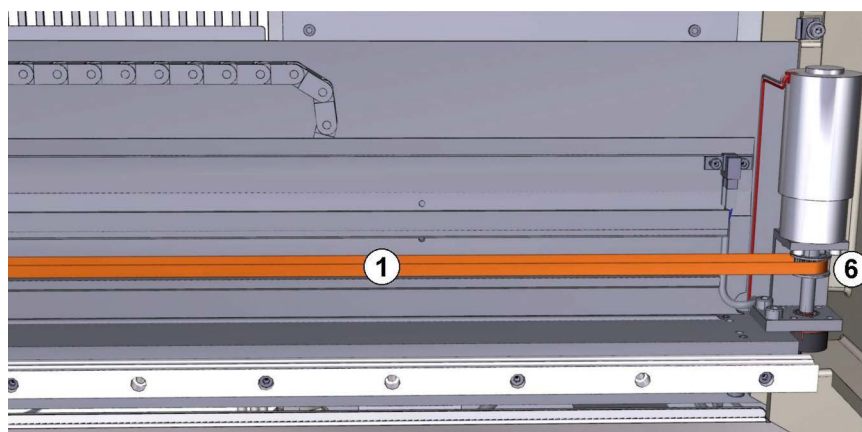


Figure 13-21: X-motor

11. Install the second fixing plate (5) to clamp the end of the X-belt (1) on the fixing plates holder (4).
The end of the belt must be laid centered and completely under the fixing plate.

ADJUSTMENT

12. Move the pipettor arm to the left or right side.
13. Loose tension screw (2) of the X-belt tightening device.
14. Move the fixing plates holder (4) several times from the left to the right and back. The tension spring will tense the X-drive belt (1).
15. Tighten tension screw (2).
16. Use the spring balance to pull the rear side against front side of the X-belt (1) in the center of the instrument.
17. Note the tension of the spring balance:
 - 1.5 to 2 N: The tension is correct.
 - < 1.5 N: The tension is too low. Open a fixing plate (5) and extend the X-belt (1) about one tooth. Repeat the adjustment.
 - > 2 N: The tension is too high. Open a fixing plate (5) and cut the X-belt (1) about one tooth. Repeat the adjustment.

INSTALLATION II

- Move the fixing plates holder (4) behind the pipettor arm.
- Stick the right borehole of the fixing plates holder (4) into the cylindrical pin and tighten the fixing plates holder (4) with screw (3).
- Install the top cover (see chapter 8.3.4 on page 8-12).
- Teach the pipettor module (see chapter 20.2 on page 20-2).

13.6.7 REPLACEMENT OF X-MOTOR/ENCODER MODULE

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Disconnect the X-motor connector (ST58) from the instrument CU board (see chapter 9.4.2 on page 9-17).
5. Remove X-belt (1) (see chapter 13.6.6 on page 13-22).

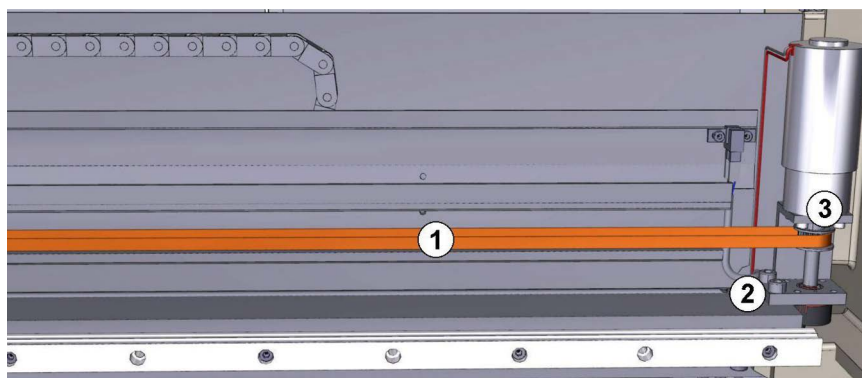


Figure 13-22: Installed X-motor/encoder

6. Remove both screws (2) from the X-motor/encoder bracket (3).
7. Remove the X-motor/encoder module (3).

INSTALLATION

8. Insert the X-motor/encoder module (3) and tighten both screws (2).
9. Plug the X-motor connector (ST58) into the instrument CU board (see chapter 9.4.2 on page 9-17).
10. Install the X-belt (1) (see chapter 13.6.6 on page 13-22).
11. Install the top cover (see chapter 8.3.4 on page 8-12).
12. Teach the pipettor module (see chapter 20.2 on page 20-2).

13.6.8 REPLACEMENT AND ADJUSTMENT OF Y-BELT

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Open the left pipettor arm cover (see chapter 13.6.1 on page 13-12).
4. Loosen tension screw (2) of the Y-belt tightening device. Press it against the right side/tension spring and tighten tension screw (2).

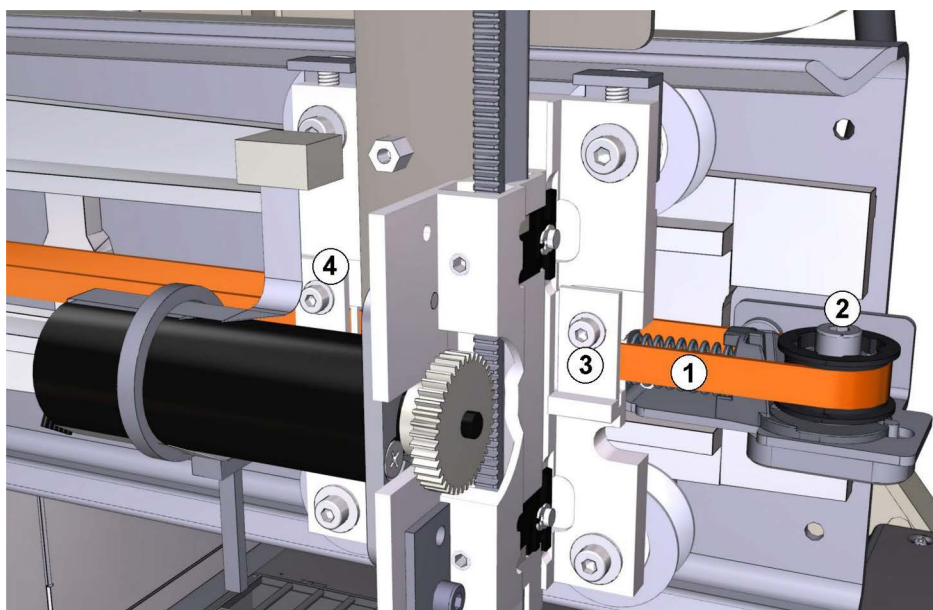


Figure 13-23: Y-belt fixing plates and tightening device

5. Remove the screws of the right belt fixing plate (3). Remove screw, washer and belt fixing plate.
6. Remove the screws of the left belt fixing plate (4). Remove screw, washer and belt fixing plate.
7. Remove the Y-belt (1).

INSTALLATION I

8. Install the left belt fixing plate (4) to clamp one end of the Y-belt (1) on the Y-sledge.
The end of the belt must be laid centered and completely under the fixing plate.
9. Lead the X-belt (1) around the gear wheel (5) of the X-motor.

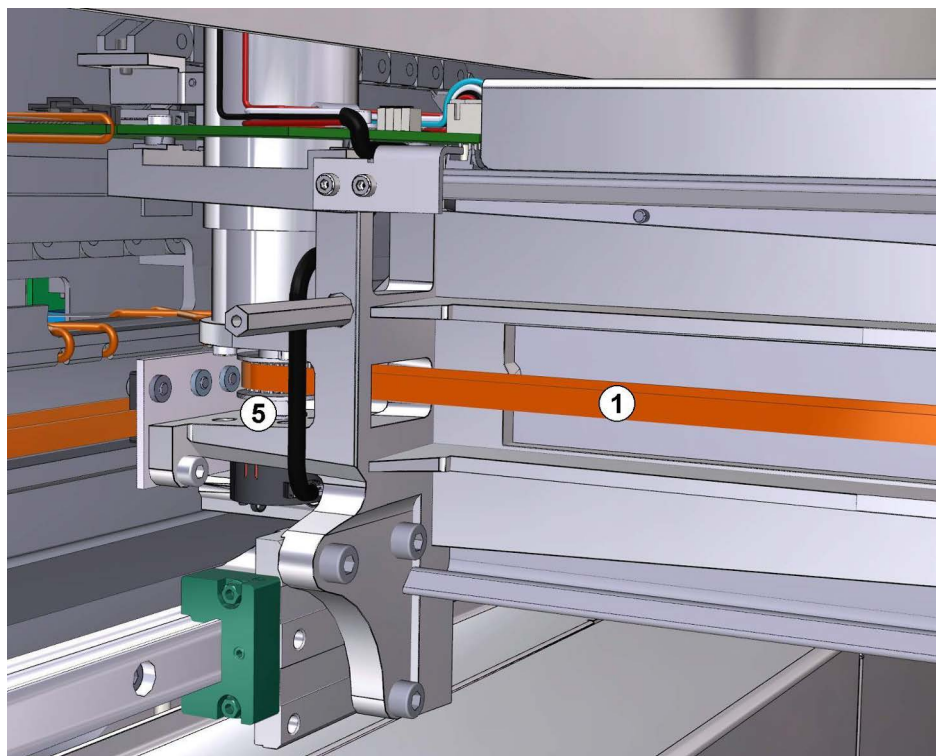


Figure 13-24: Y-motor

10. Lead the X-belt (1) around the Y-belt tightening device (2).
11. Install the right belt fixing plate (3) to clamp the end of the Y-belt (1) on the Y-sledge.
The end of the belt must be laid centered and completely under the fixing plate.

ADJUSTMENT

12. Loosen tension screw (2) of the Y-belt tightening device.
13. Move the X-sledge several times from the front to the rear and back. The tension spring will tense the Y-drive belt (1).
14. Tighten tension screw (2).
15. Move the X-sledge to the front side.
16. Use the spring balance to pull the rear side against front side of the Y-belt (1) in the center of the pipettor arm.
17. Note the tension of the spring balance:
 - 4 to 5 N: The tension is correct.
 - < 4 N: The tension is too low. Open a fixing plate and extend the Y-belt (1) about one tooth. Repeat the adjustment.
 - > 5 N: The tension is too high. Open a fixing plate and cut the Y-belt (1) about one tooth. Repeat the adjustment.

INSTALLATION II

18. Close the left pipettor arm cover (see chapter 13.6.1 on page 13-12).
19. Teach the pipettor module (see chapter 20.2 on page 20-2).

13.6.9 REPLACEMENT OF Y-MOTOR/ENCODER

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the pipettor arm (see chapter 13.6.16 on page 13-42).
4. Loose tension screw of the Y-belt tightening device (see figure 13-23: on page 13-25). Press it against the right side/tension spring and tighten tension screw.
5. Remove screw and cable clamp (1).

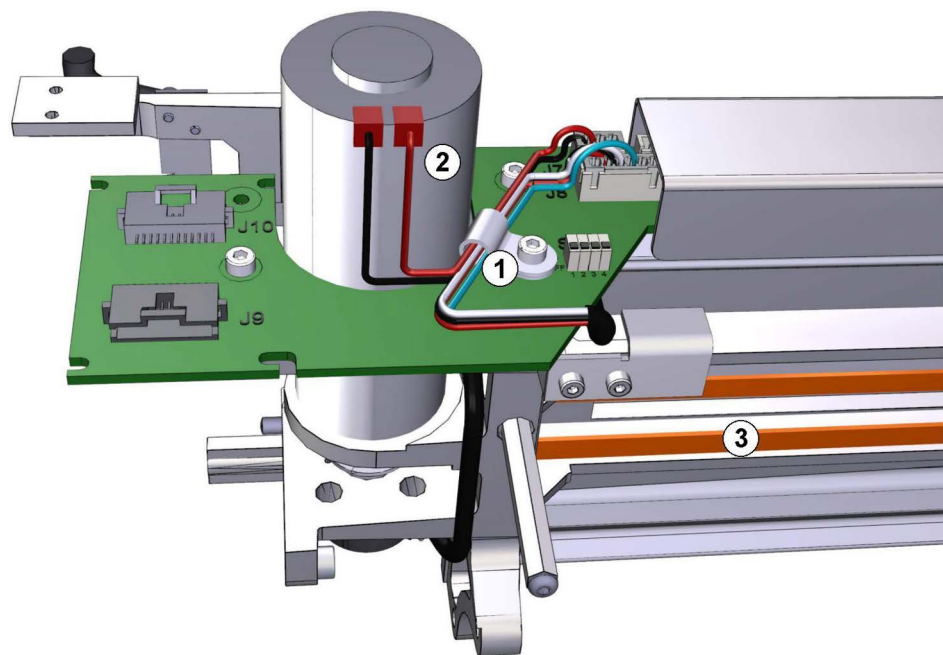


Figure 13-25: Y-motor

6. Disconnect the Y-motor connector (J7) from the X-sledge CU board (see chapter 19.6.1 on page 19-21).
7. Disconnect the Y-encoder connector (6) from the Y-encoder (7).

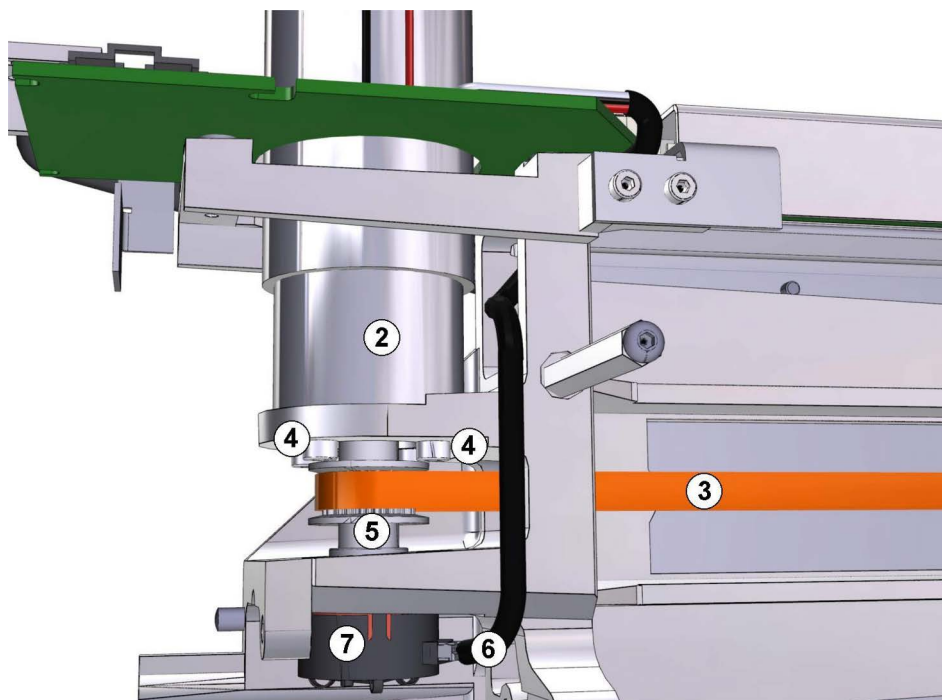


Figure 13-26: Y-motor fastening

8. Open the three fastening clamps with a small screwdriver and pull the Y-encoder (7) off.
9. Remove both screws (8) and the Y-encoder holder (9).

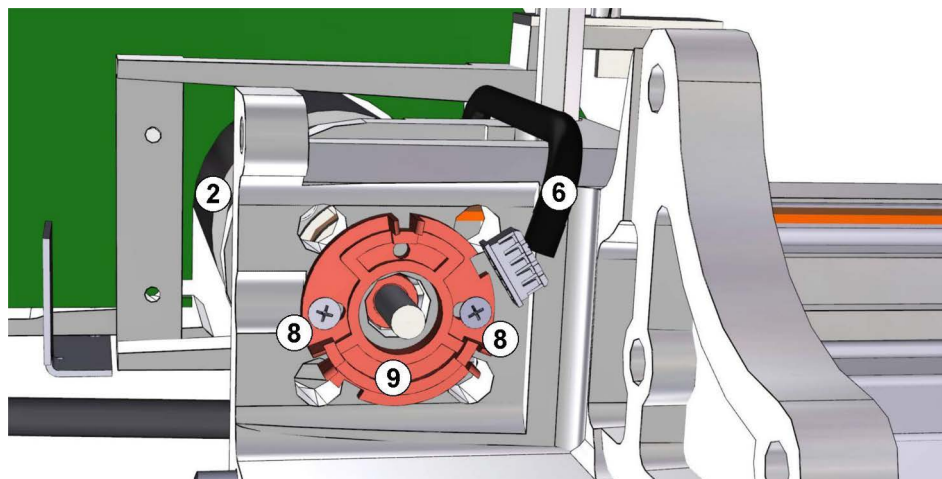


Figure 13-27: Y-encoder holder

10. Remove the four screws (4).
11. Remove the Y-motor.

INSTALLATION

NOTICE

Installation of a encoder

Incorrectly installed encoders may not be used again!

Already installed encoders may not be reused.

12. Insert the new Y-motor and lay the Y-belt (3) around the gear wheel (5).
13. Tighten the four screws (4).
14. Plug the Y-motor connector (J7) into the X-sledge CU board (see chapter 19.6.1 on page 19-21).
15. Install the cable clamp (1) and tighten the screw.
16. Install the new Y-encoder holder (9) and tighten both screws (8).
17. Put the Y-encoder (7) up to its holder (9).
18. Press with your finger onto the center of the Y-encoder (7).
19. Plug the Y-encoder connector (6) into the Y-encoder (7).
20. Install the pipettor arm (see chapter 13.6.16 on page 13-42).
21. Adjust the Y-belt (see chapter 13.6.8 on page 13-25). It is not necessary to replace the Y-belt.
22. Teach the pipettor module (see chapter 20.2 on page 20-2).

13.6.10 REPLACEMENT AND ADJUSTMENT OF Z-MOTOR

ADDITIONAL MATERIALS AND TOOLS

- Paper 80 g/m²
- Spring balance up to 10 N

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Open the left pipettor arm cover (see chapter 13.6.1 on page 13-12).
4. Disconnect the Z-motor connector (J4) from the Y-sledge CU board (see chapter 13.6.14 on page 13-38).
5. Remove both screws (1) with washers.

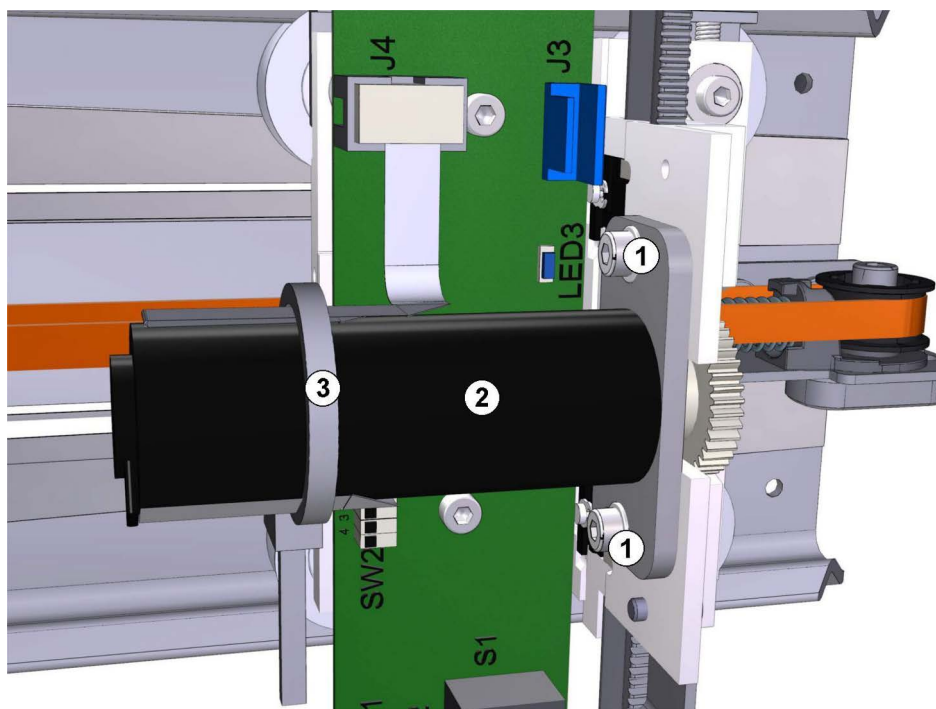


Figure 13-28: Installed Z-motor

6. Remove the Z-motor (2).

INSTALLATION I

7. Install the new Z-motor (2) and insert both screws (1) with washers. Do not tighten the screws.
8. Plug the Z-motor connector (J4) into the Y-sledge CU board (see chapter 13.6.14 on page 13-38).
9. Clamp the Z-motor cable with a cable strap onto the Z-motor (2).

ADJUSTMENT

10. Insert a small piece of paper (4) between the Z-motor gear wheel (5) and toothed rack (6).

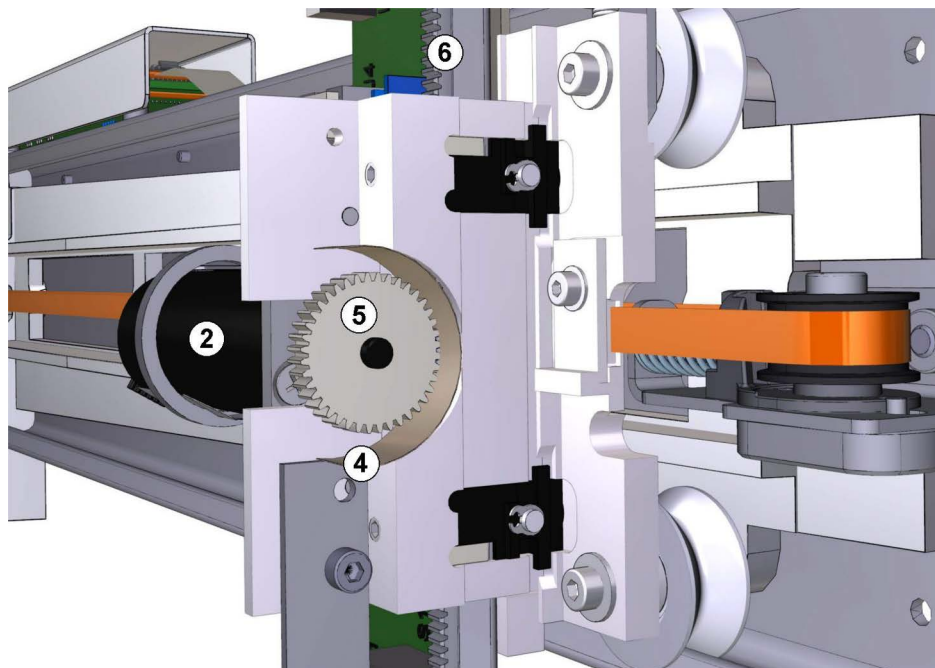


Figure 13-29: Adjust Z-motor

11. Press the Z-motor (2) on its holder forcefully against the toothed rack (6) and tighten both screws (1).
12. Remove the small piece of paper (4).
Note: The paper should have been strongly deformed and perforated through the gear.

INSTALLATION II

13. Close the left pipettor arm cover (see chapter 13.6.1 on page 13-12).
14. Teach the pipettor module (see chapter 20.2 on page 20-2).

CHECK

15. Hook the spring balance into the top of the disposable tip adapter and pull the spring balance down.
The holding force of the disposable tip adapter must be approximately 5 N.
 - Repeat the adjustment of the motor if the holding force is too high or too low.

13.6.11 REPLACEMENT OF PIPETTOR RIBBON CABLE

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Disconnect the pipettor ribbon cable connector (ST60) from the instrument CU board (see chapter 9.4.10 on page 9-36).
5. Remove the rubber band (1).

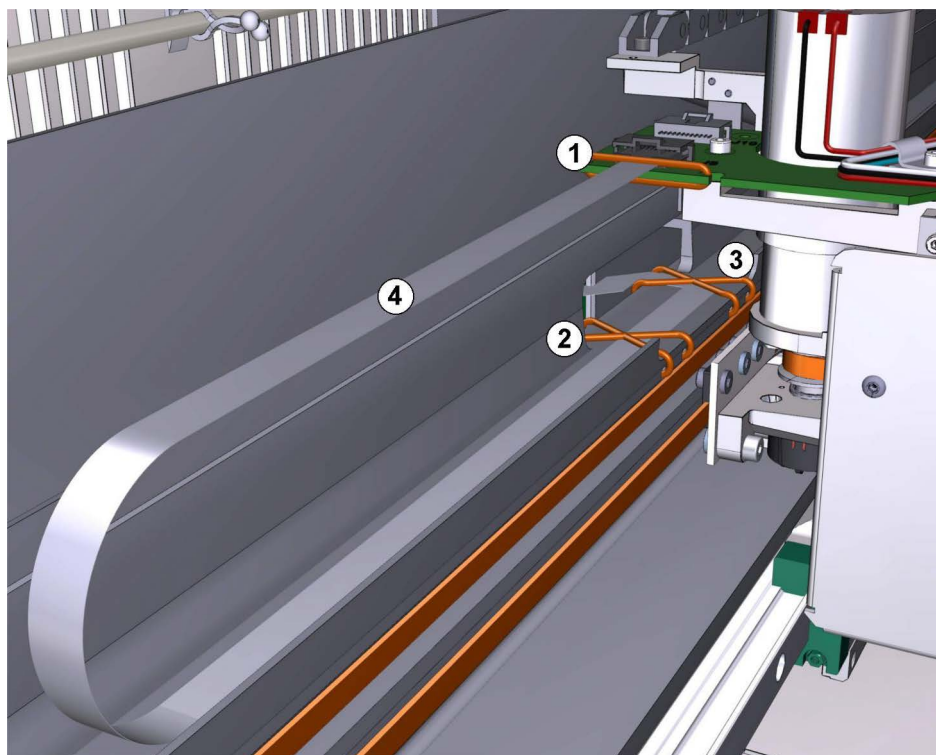


Figure 13-30: Installed pipettor ribbon cable

6. Remove the rubber band (2).
7. Remove the rubber band (3).
8. Disconnect the pipettor ribbon cable connector (J9) from the X-sledge CU board (see chapter 19.6.1 on page 19-21).
9. Remove the pipettor ribbon cable (4).

INSTALLATION

10. Put the new pipettor ribbon cable (4) through the rubber bands (1 + 3).
11. Plug the pipettor ribbon cable connector (J9) into the X-sledge CU board (see chapter 19.6.1 on page 19-21).
12. Install the rubber band (1).
13. Install the rubber band (3). The rubber band must be mounted crosswise.
14. Install the rubber band (2). The rubber band must be mounted crosswise.
15. Plug the pipettor ribbon cable connector (ST60) into the instrument CU board (see chapter 9.4.10 on page 9-36).
16. Install the top cover (see chapter 8.3.4 on page 8-12).

13.6.12 REPLACEMENT OF ARM RIBBON CABLE

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove both screws (1).

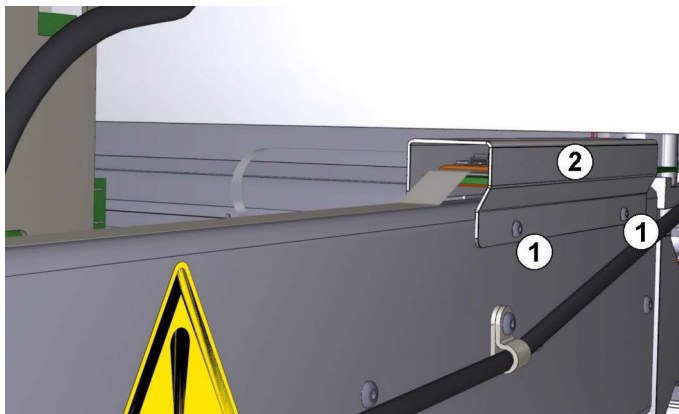


Figure 13-31: Installed X-sledge CU board cover

4. Remove the X-sledge CU board cover (2).
5. Remove the rubber band (3).

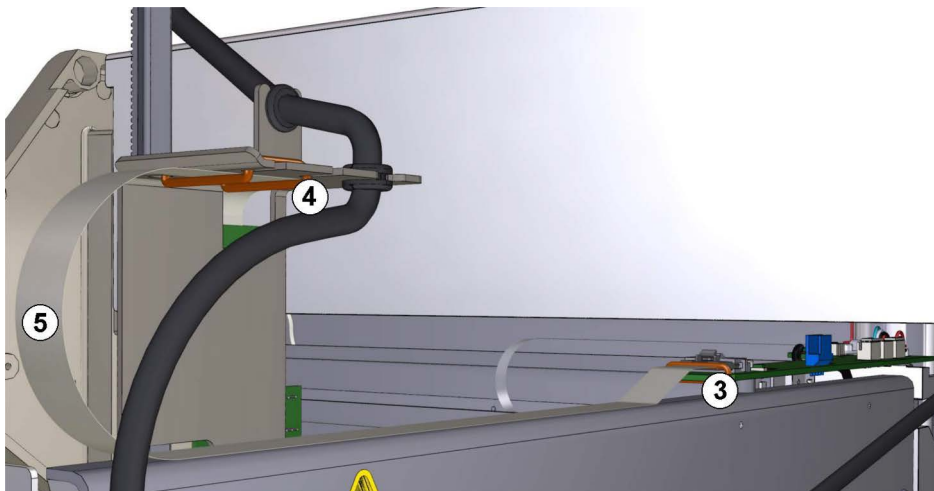


Figure 13-32: Installed arm ribbon cable

6. Remove the rubber band (4).
7. Disconnect the arm ribbon cable connector (J6) from the X-sledge CU board (see chapter 19.6.1 on page 19-21).
8. Disconnect the arm ribbon cable connector (J2) from the Y-sledge CU board (see chapter 19.6.2 on page 19-23).
9. Remove the arm ribbon cable (5).

INSTALLATION

10. Plug the new arm ribbon cable connector (J2) into the Y-sledge CU board (see chapter 19.6.2 on page 19-23).
11. Install the rubber band (4).
12. Put the new arm ribbon cable (5) through the rubber band (3).
13. Plug the arm ribbon cable connector (J6) into the X-sledge CU board (see chapter 19.6.1 on page 19-21).
14. Install the rubber band (3).
15. Install the X-sledge CU board cover (2) and tighten both screws (1).
16. Teach the pipettor module (see chapter 20.2 on page 20-2).

13.6.13 REPLACEMENT OF X-SLEDGE CU BOARD

TOOLS

- Low strength threadlocker

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Remove both screws (1).

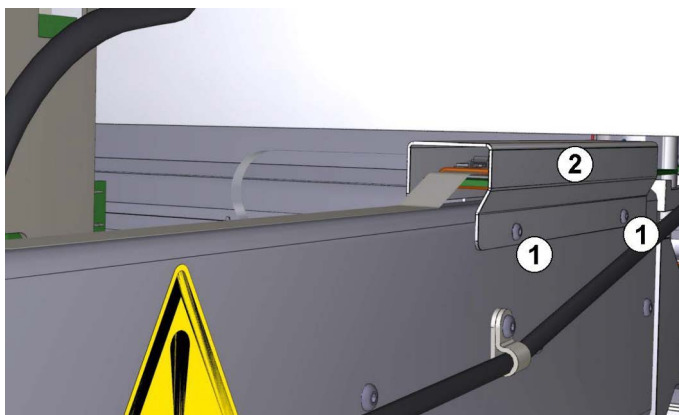


Figure 13-33: Installed X-sledge CU board cover

5. Remove the X-sledge CU board cover (2).
6. Remove the rubber band (3).

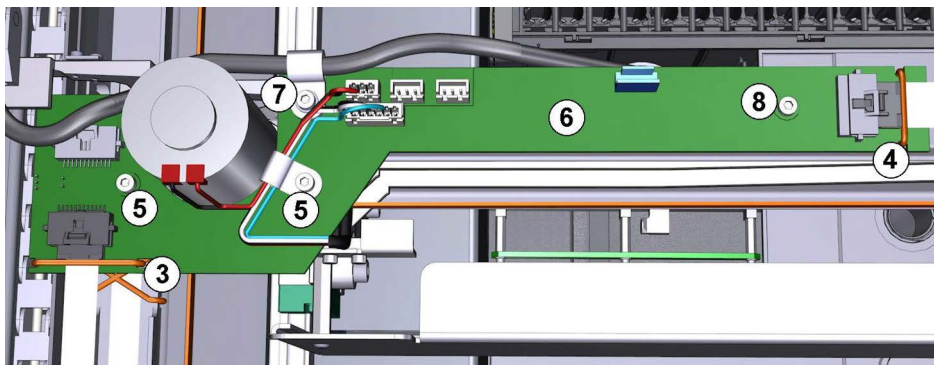


Figure 13-34: Installed X-sledge CU board

7. Disconnect the pipettor ribbon cable connector (J9) from the X-sledge CU board (see chapter 19.6.1 on page 19-21).
8. Remove the rubber band (4).
9. Disconnect the arm ribbon cable connector (J6) from the X-sledge CU board (see chapter 19.6.1 on page 19-21).
10. Remove the two screws (5).
11. Remove the screw (7) with washer.

12. Remove the screw (8).
13. Lift up the X-sledge CU board (6) carefully, because there are four spacers located under the board.
14. Remove the X-sledge CU board (6).

INSTALLATION

15. Check DIP-Switch SW1 (see chapter 19.6.1 on page 19-21). All switches must set to OFF.
16. Install the new X-sledge CU board (6) and tighten the three screws (5 + 8). Do not forget the cable strap.
Note the spacers located under the board.
17. Moisten the thread of the screw (7) with threadlocker.
18. Tighten the screw (7). Do not forget the cable strap and the washer.
19. Plug the arm ribbon cable connector (J6) into the X-sledge CU board (see chapter 19.6.1 on page 19-21).
20. Install the rubber band (4).
21. Plug the pipettor ribbon cable connector (J9) into the X-sledge CU board (see chapter 19.6.1 on page 19-21).
22. Install the rubber band (3).
23. Install the X-sledge CU board cover (2) and tighten both screws (1).
24. Install the top cover (see chapter 8.3.4 on page 8-12).
25. Start the instrument setup (see chapter 21.1 on page 21-1).
26. Teach the pipettor module (see chapter 20.2 on page 20-2).

13.6.14 REPLACEMENT OF Y-SLEDGE CU BOARD

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Open the left pipettor arm cover (see chapter 13.6.1 on page 13-12).
4. Disconnect the LLD cable from the connector (J1) on the Y-sledge CU board (see chapter 19.6.2 on page 19-23).

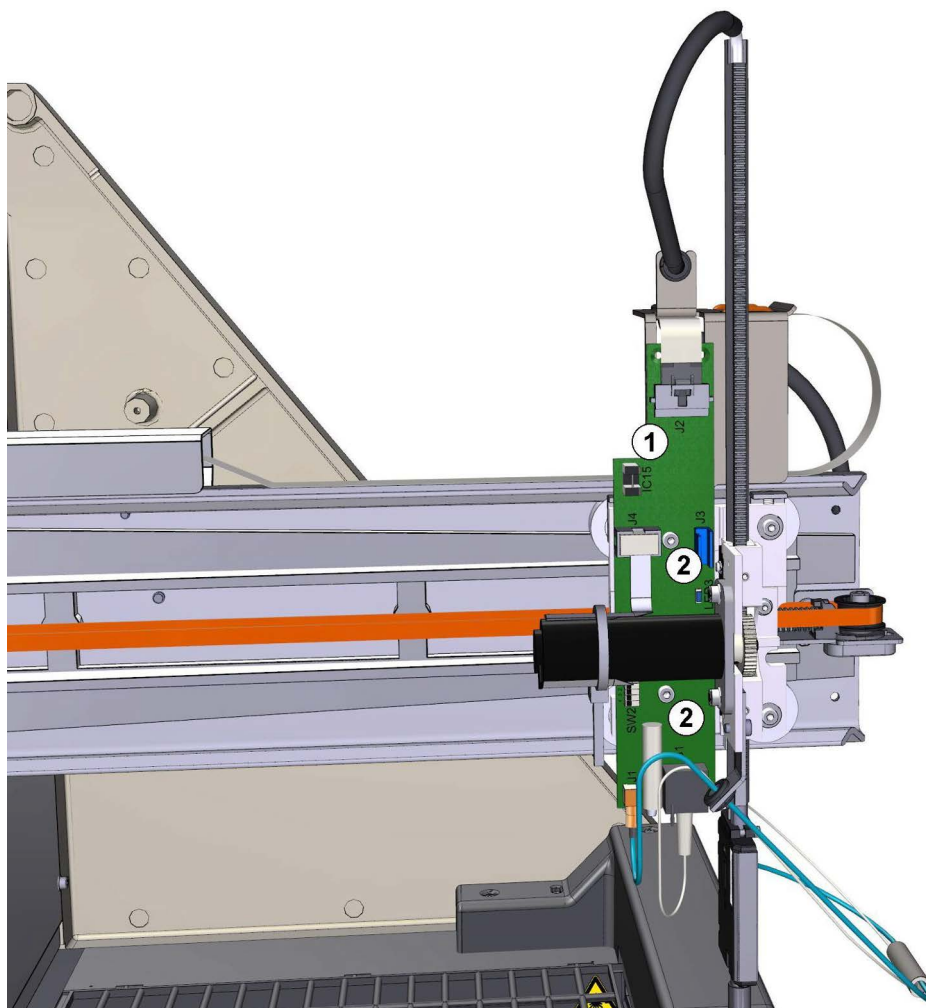


Figure 13-35: Installed Y-sledge

5. Pull the APM tubing with adapter tubing out of the sensor (S1) on the Y-sledge CU board (see chapter 19.6.2 on page 19-23).
6. Disconnect the connector J1 and J2 from the Y-sledge CU board (see chapter 19.6.2 on page 19-23).
7. Remove both screws (2).
8. Remove the Y-sledge CU board (1).

INSTALLATION

9. Check DIP-Switch SW1 (see chapter 19.6.2 on page 19-23). All switches must set to OFF.
10. Install the Y-sledge CU board (1) and tighten both screws (2).
11. Plug the connector J1 and J2 into the Y-sledge CU board (see chapter 19.6.2 on page 19-23).
12. Plug the LLD cable into the connector (J1) on the Y-sledge CU board (see chapter 19.6.2 on page 19-23).
13. Put the APM tubing with adapter tubing up to the sensor (S1) on the Y-sledge CU board (see chapter 19.6.2 on page 19-23).
14. Close the left pipettor arm cover (see chapter 13.6.1 on page 13-12).
15. Start the instrument setup (see chapter 21.1 on page 21-1).
16. Teach the pipettor module (see chapter 20.2 on page 20-2).

13.6.15 REPLACEMENT OF TOOTHED RACK

INFO

Install the new toothed rack immediately after removal of the old toothed rack.

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Remove the APM disposable tip adapter (see chapter 13.6.2 on page 13-13).
5. To remove toothed rack: Move the Y-sledge over one of the disposable tip rack positions on the front side.
6. Pull the toothed rack carefully downwards out of the Y-sledge.
7. Remove the toothed rack (1).

INSTALLATION

NOTICE

The slide bearings can collapse when you remove the Y-sledge. If they are collapsed push them carefully aside and slide the toothed rack up.

8. Push the new toothed rack (1) carefully from the bottom up to the top into the Y-sledge.
9. Use the set screws (2) to adjust the toothed rack (1). The toothed rack (1) must be located in the center and not rub against the aluminum.

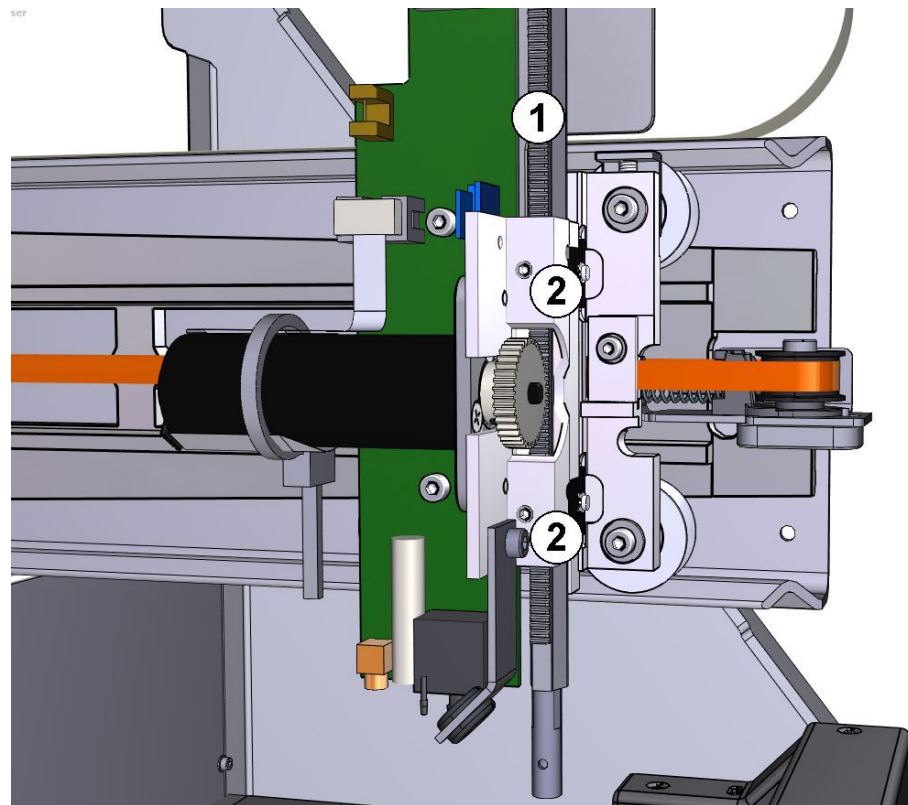


Figure 13-36: Inserted toothed rack

10. Install the APM disposable tip adapter (see chapter 13.6.2 on page 13-13).
11. Adjust the Z-motor (see chapter 13.6.10 on page 13-30). It is not necessary to replace the Z-motor.
12. Install the top cover (see chapter 8.3.4 on page 8-12).
13. Teach the pipettor module (see chapter 20.2 on page 20-2).

13.6.16 REPLACEMENT OF PIPETTOR ARM

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Open the left pipettor arm cover (see chapter 13.6.1 on page 13-12).
5. Remove the APM disposable tip adapter (see chapter 13.6.2 on page 13-13).
6. Remove the rubber band (1).

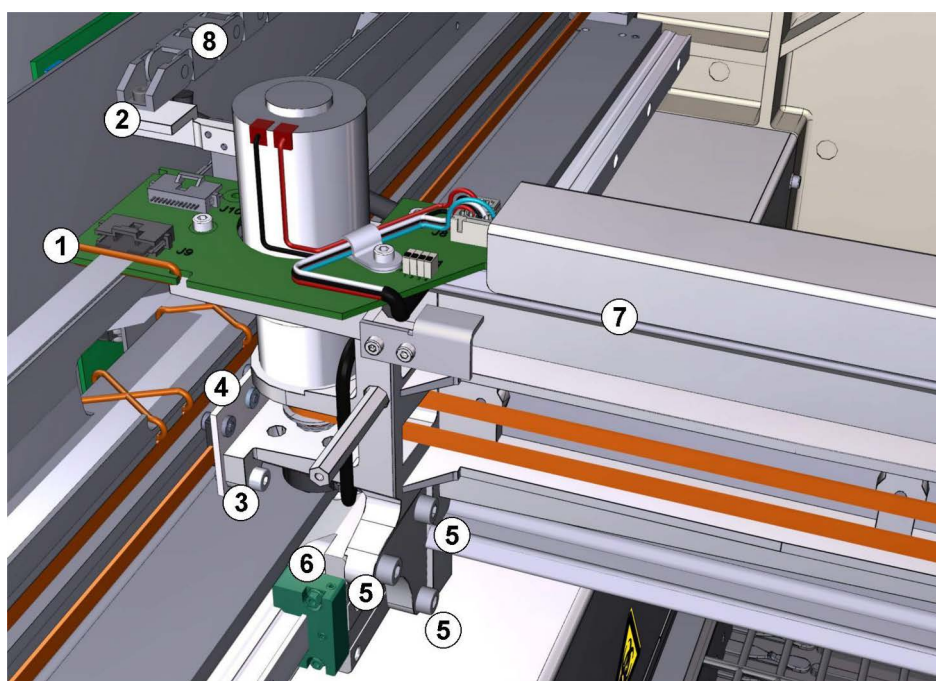


Figure 13-37: Y-belt motor and Y-sledge CU board

7. Disconnect the ribbon cable connector (J9) from the X-sledge CU board (see chapter 19.6.1 on page 19-21).
8. Remove the screw (2).
9. Remove screw (3) of the X-belt fixing plates holder (4).
10. Remove the X-belt fixing plates holder (4) from the pipettor arm (7).
11. Hold the pipettor arm (7) and remove the three screws (5).
12. Remove the pipettor arm (7).

INSTALLATION

13. Install the pipettor arm (7) and tighten the three screws (5).
14. Move the fixing plates holder (4) behind the pipettor arm.
15. Stick the right borehole of the fixing plates holder (4) into the cylindrical pin and tighten the fixing plates holder (4) with screw (3).
16. Adjust the X-belt (see chapter 13.3.1 on page 13-6).
17. Install the energy chain (8) and tighten the screw (2).

18. Plug the ribbon cable connector (J9) into the X-sledge CU board (see chapter 19.6.1 on page 19-21).
19. Install the rubber band (1).
20. Install the APM disposable tip adapter (see chapter 13.6.2 on page 13-13).
21. Close the left pipettor arm cover (see chapter 13.6.1 on page 13-12).
22. Install the top cover (see chapter 8.3.4 on page 8-12).
23. Start the instrument setup (see chapter 21.1 on page 21-1).
24. Teach the pipettor module (see chapter 20.2 on page 20-2).
25. Perform the pipettor module test (see chapter 12.4.4 on page 12-21).
26. Perform the pipettor tubing (APM) test (see chapter 12.4.1 on page 12-19).

13.6.17 REPLACEMENT OF PIPETTOR MODULE

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Remove the APM disposable tip adapter (see chapter 13.6.2 on page 13-13).
5. Remove the toothed rack (see chapter 13.6.15 on page 13-40)
6. Disconnect the connectors (ST54, ST57, ST58 and ST60) from the instrument CU board (see chapter 19.2.1 on page 19-11).
7. Remove the upper cover (see chapter 8.3.5.2 on page 8-16).

NOTICE

Pipettor module damage

After removing of the mounting screws the pipettor module will fall down immediately.

- Hold the pipettor module.
8. Hold the pipettor module and remove the four mounting screws (2) with washers on the left and the right side.

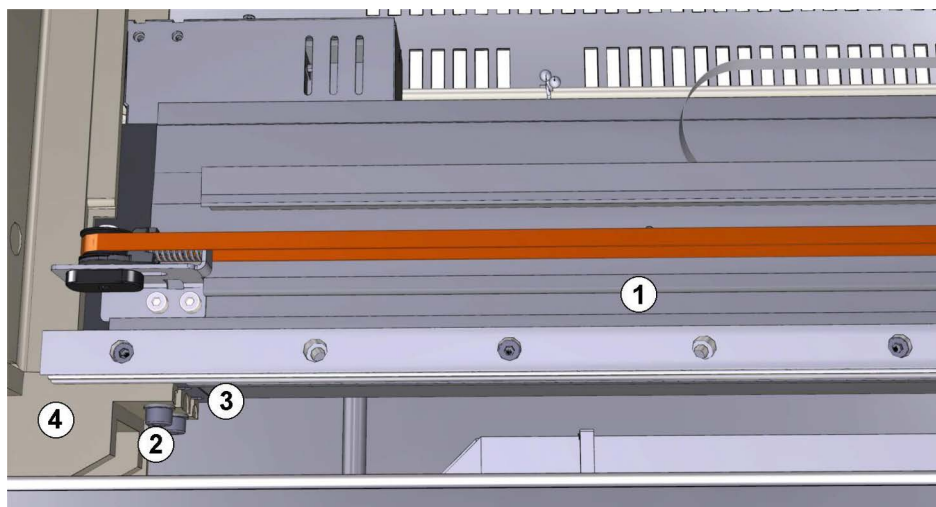


Figure 13-38: Pipettor mounting screws (left side)

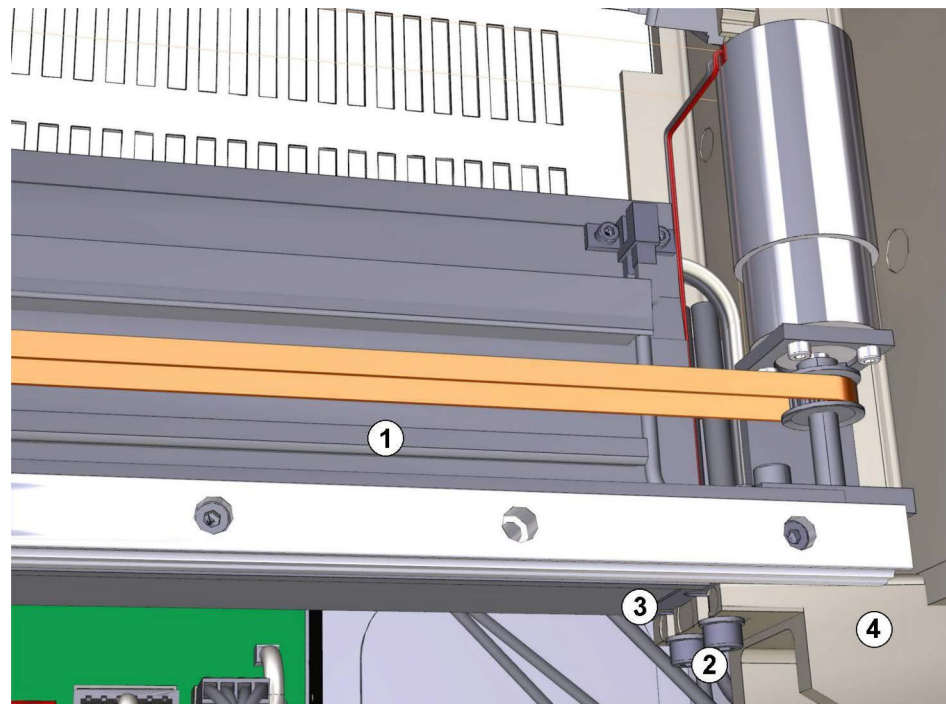


Figure 13-39: Pipettor mounting screws (right side)

9. Remove the pipettor module.

INSTALLATION

10. Place one pressure plate (3) on the left retaining bracket (4) and one on the right retaining bracket (4).

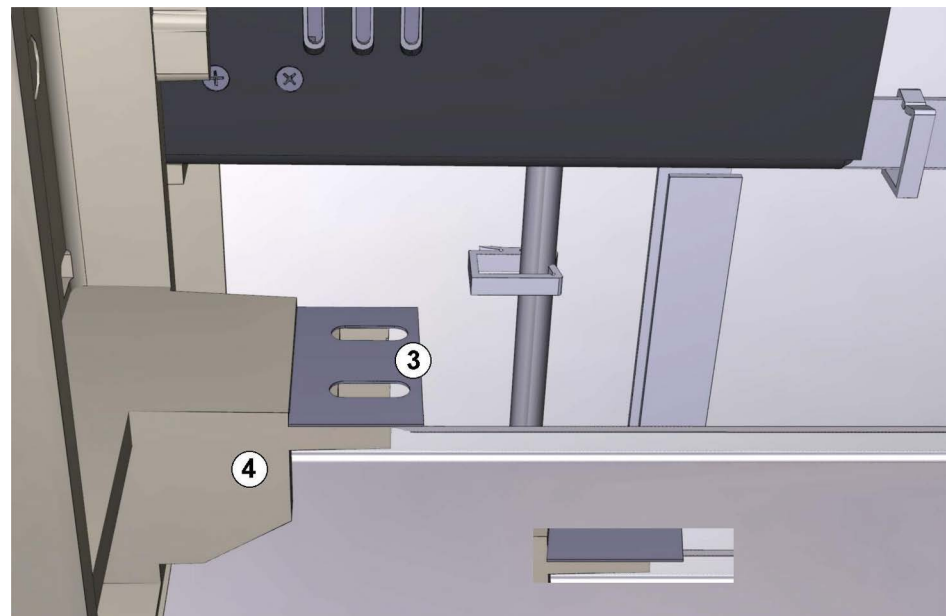


Figure 13-40: Pipettor retaining bracket (left side)

11. Set the new/repaired pipettor module onto the pressure plates and screw in the four mounting screws (2) with washers.
Do not tighten the screws!

12. Adjust the pipettor module (see chapter 13.3.4 on page 13-7).
13. Install the upper cover (see chapter 8.3.5.2 on page 8-16).
14. Plug the connectors (ST54, ST57, ST58 and ST60) into the instrument CU board (see chapter 19.2.1 on page 19-11).
15. Install the toothed rack (see chapter 13.6.15 on page 13-40)
16. Install the APM disposable tip adapter (see chapter 13.6.2 on page 13-13).
17. Install the top cover (see chapter 8.3.4 on page 8-12).
18. Start the instrument setup (see chapter 21.1 on page 21-1).
19. Teach the pipettor module (see chapter 20.2 on page 20-2).
20. Perform the pipettor module test (see chapter 12.4.4 on page 12-21).
21. Perform the pipettor tubing (APM) test (see chapter 12.4.1 on page 12-19).

13.7 SERVICE SOFTWARE

The following chapter describes only the pipettor version 3 service software functions. See chapter 12.7 on page 12-62 for all other functions.

13.7.1 LONG TERM RUN

The long term run checks the pipettor X-/Y-/Z-motors and encoders and the sensors (LLD, init).

Procedure:

1. Start the service software (see chapter 7.1.2 on page 7-2).
2. Initialize the pipettor with the service software (see chapter 12.7 on page 12-62).
3. Press on the **Long Term Run** button in the **Pipettor Main Driver Dialog**.

The service software shows the **Start Long term run** dialog.

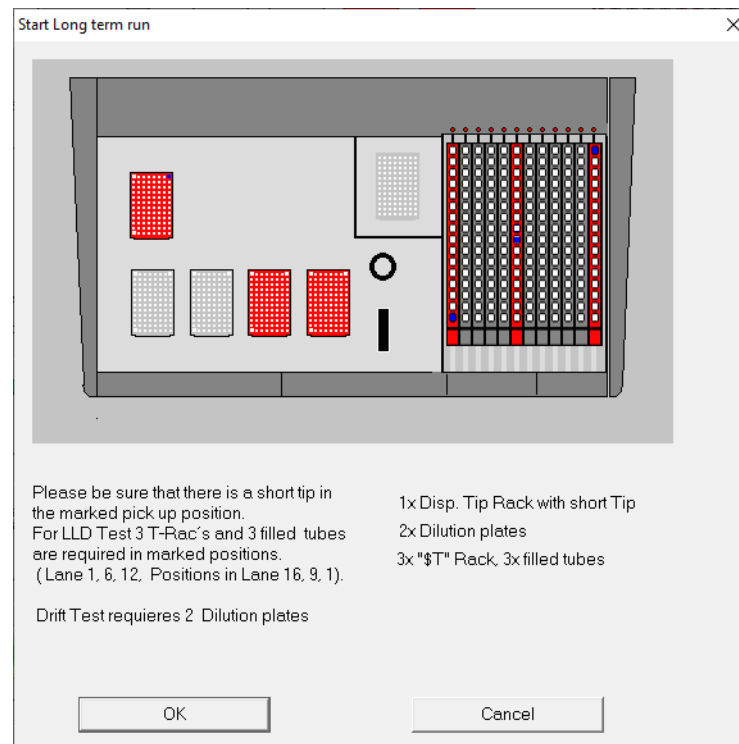
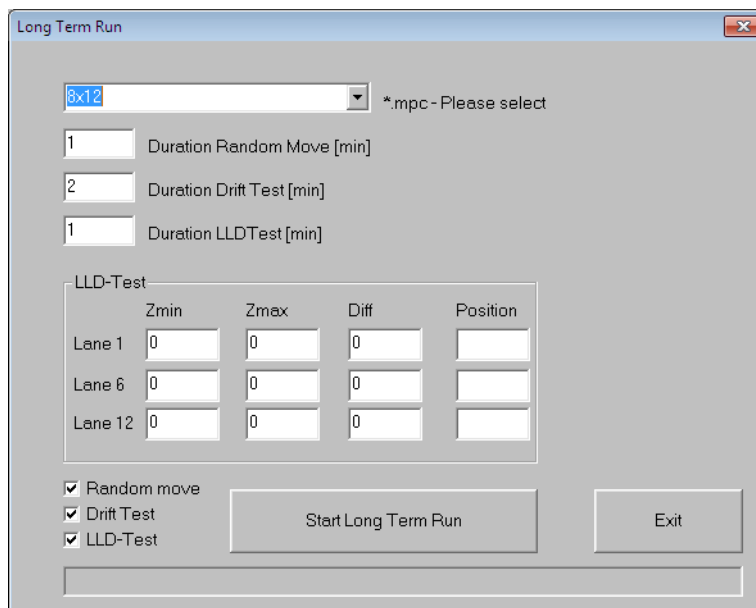


Figure 13-41: Start Long term run dialog

4. Fulfill the instructions on the dialog.
5. Press on the **OK** button.
6. Set the following durations in minutes:
 - **Duration random Move**

- **Duration Drift Test**
- **Duration LLD Test**



The 'Long Term Run' dialog box contains the following elements:

- A dropdown menu at the top showing '8x12' with a note '*.mpc - Please select'.
- Three input fields for durations:
 - '1' for Duration Random Move [min]
 - '2' for Duration Drift Test [min]
 - '1' for Duration LLDTest [min]
- An 'LLD-Test' section with a table:

	Zmin	Zmax	Diff	Position
Lane 1	0	0	0	
Lane 6	0	0	0	
Lane 12	0	0	0	
- Three checked checkboxes: 'Random move', 'Drift Test', and 'LLD-Test'.
- Two buttons: 'Start Long Term Run' and 'Exit'.
- A status bar at the bottom.

Figure 13-42: Long Term Run dialog

7. Press on the **Start Long Term Run** button to start the run.

14 IFA PIPETTOR MODULE (OPTIONAL)

NOTICE

Software version

Only usable from software version 2.0.7 or higher.

This chapter describes this module in detail. In the first section "Safety" additionally to the general safety notes (see chapter 1.2 on page 1-6) safety notes are specified, which concern particularly this module. The section "Overview" gives a short overview about this module. The section "Tips and Information" gives tips and information for the handling. This section is followed by a larger part containing information about maintenance, repair and testing of this module (sections "Adjustment and Calibration", "Check and Verification", "Maintenance", "Troubleshooting and Repairs" and "Connections, Signals and Switches"). The last section "Service Software" describes only the service software module which only concerns this module.

INFO

IFA pipettor module and pipettor module (version 3)

The IFA pipettor module based on version 3 of the normal pipettor module.

14.1 OVERVIEW

INFO

For detailed IFA liquid plan see chapter 18.2.2 on page 18-4.

14.1.1 IFA PIPETTOR MODULE

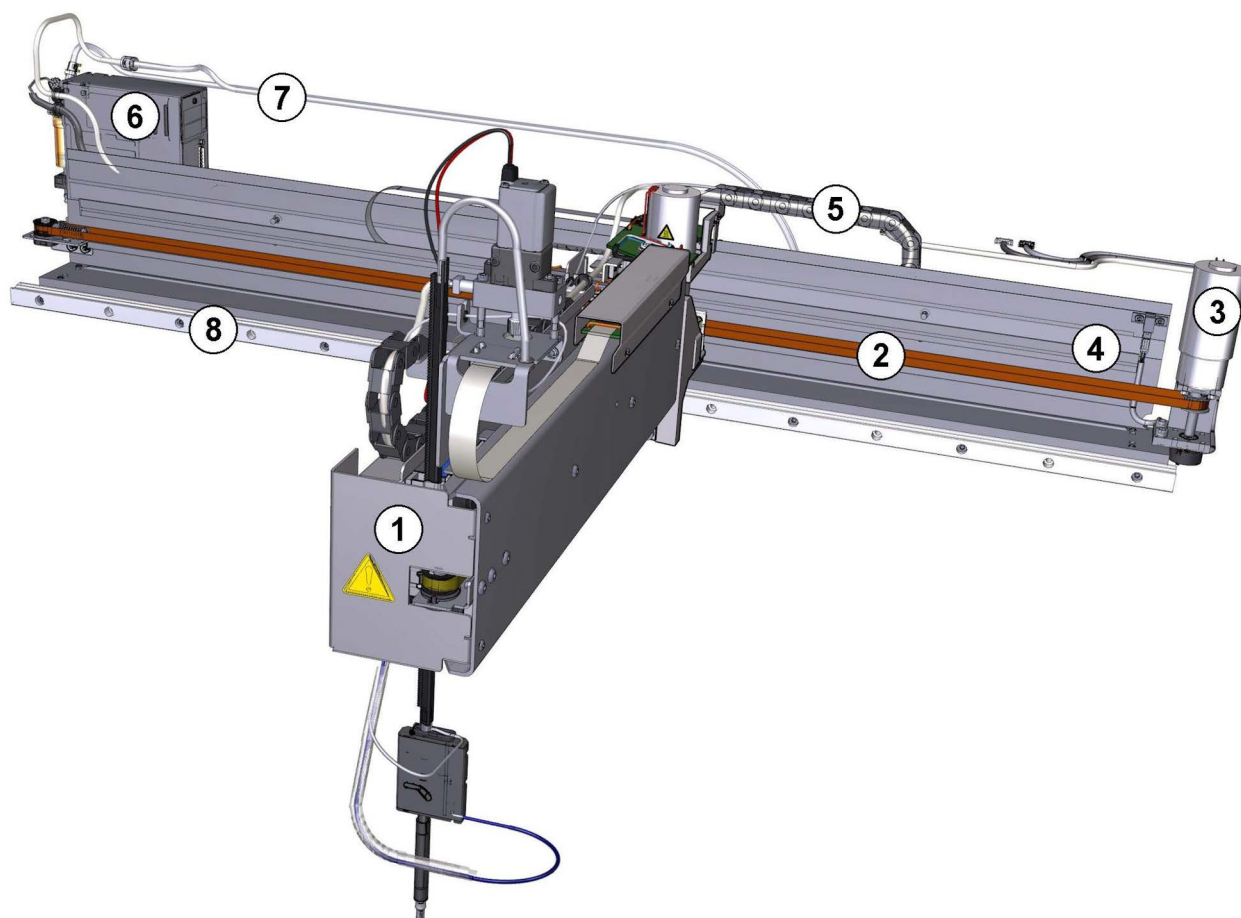


Figure 14-1: IFA Pipettor with diluter pump

- | | |
|---|---|
| 1 | Pipettor arm with disposal tip adapter and Y-/Z-drive (see chapter 14.1.2 on page 14-3) |
| 2 | X-belt |
| 3 | X-motor and X-encoder - (connected to the instrument CU board, ST57 + ST58) |
| 4 | X-init light barrier (X-home position) - (connected to the instrument CU board, ST54) |
| 5 | Energy chain |
| 6 | Diluter pump P9 with syringe and 3-way valve (connected to the instrument CU board, ST59) |
| 7 | System liquid tubing (between diluter pump and system liquid pump, see chapter 17.2.2 on page 17-3) |
| 8 | X-guiding |

14.1.2 IFA PIPETTOR ARM

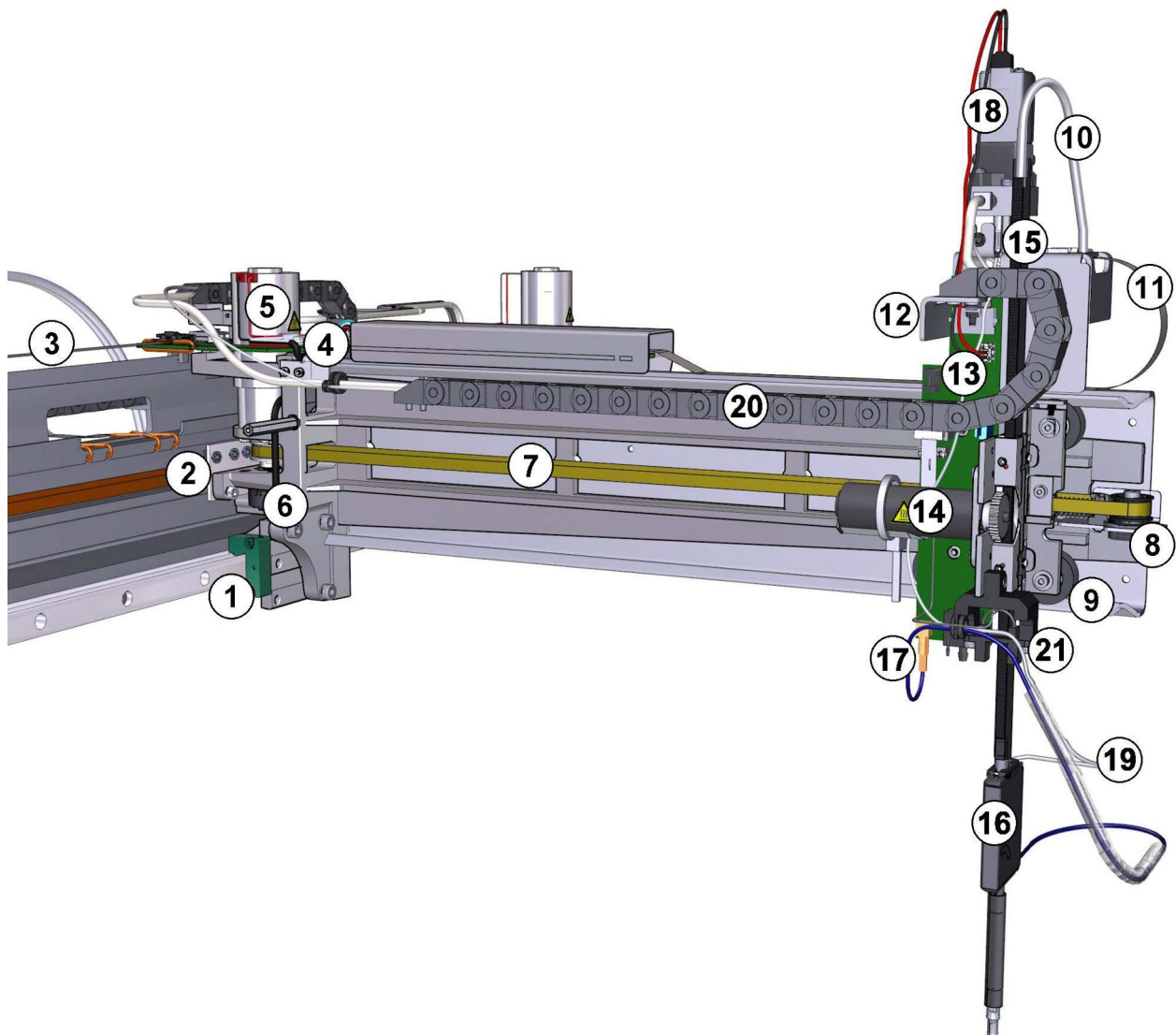


Figure 14-2: IFA pipettor arm without left cover

- | | |
|---|---|
| 1 | X-guiding unit |
| 2 | X-belt fixing plates |
| 3 | Pipettor ribbon cable to instrument CU board (ST60) |
| 4 | X-sledge CU board |
| 5 | Y-motor |
| 6 | Y-encoder |
| 7 | Y-belt |
| 8 | Y-belt tightener |
| 9 | 2 upper and 2 lower guiding rollers |

- | | |
|----|---|
| 10 | Pipettor system liquid/IFA wash buffer tubing (between disposal tip adapter and diluter pump) |
| 11 | Arm ribbon cable between X-sledge CU board and Y-sledge CU board |
| 12 | Y-sledge |
| 13 | Y-sledge CU board with Y-init light barrier (Y-home position) |
| 14 | Z-motor |
| 15 | Toothed rack |
| 16 | IFA disposable tip adapter |
| 17 | Liquid level detection cable (LLD cable) |
| 18 | Toggle valve between APM sensor and liquid waste extraction |
| 19 | Liquid waste tubing |
| 20 | Y-sledge energy chain |
| 21 | Z-init light barrier (Z-home position) |

14.2 TIPS AND INFORMATION

This section describes tips and tricks for the handling of the pipetting system.

14.2.1 PIPETTOR TOOLS

INFO

For pipettor module teach tools see chapter 20.2.1 on page 20-2.

INFO

For pipettor module adjustment tool see chapter 12.2.1 on page 12-5.

14.3 ADJUSTMENT AND CALIBRATION

In this section, the adjustment of the pipetting system is described.

14.3.1 ADJUSTMENT OF X-BELT AND X-MOVEMENT FORCE

See chapter 13.6.6 on page 13-22. It is not necessary to replace the X-belt.

14.3.2 ADJUSTMENT OF Y-BELT AND Y-MOVEMENT FORCE

See chapter 14.6.9 on page 14-20. It is not necessary to replace the Y-belt.

14.3.3 ADJUSTMENT OF Z-DRIVE

See chapter 14.6.11 on page 14-21. It is not necessary to replace the Z-motor.

14.3.4 ADJUSTMENT OF IFA PIPETTOR MODULE

TOOLS

- Loading Bay Teach Tool (see chapter 20.2.1.3 on page 20-3)
- Toothed Rack Adjustment Tool (see chapter 12.2.1.1 on page 12-5)

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Remove the IFA disposable tip adapter (see chapter 14.6.2 on page 14-11).
5. Remove the loading bay grid (see chapter 16.5.1 on page 16-9).

ADJUSTMENT

6. See chapter 13.3.4 on page 13-7

INSTALLATION

7. Install the IFA disposable tip adapter (see chapter 14.6.2 on page 14-11).
8. Install the top cover (see chapter 8.3.4 on page 8-12).

9. Install the loading bay grid (see chapter 16.5.1 on page 16-9).
10. Teach the pipettor module (see chapter 20.3 on page 20-30).
11. Perform the pipettor module test (see chapter 14.4.3 on page 14-8).

14.4 CHECK AND VERIFICATION

14.4.1 CHECK PIPETTOR TUBING

See chapter 12.4.1 on page 12-19

14.4.2 CHECK X-/Y-BELTS AND Z-DRIVE

To check tensions and movements see adjustment procedures:

- X-belt: see chapter 13.6.6 on page 13-22
- Y-belt: see chapter 14.6.9 on page 14-20
- Z-drive: see chapter 14.6.11 on page 14-21

It is not necessary to replace the X-/Y-belts or the Z-motor.

14.4.3 PERFORM IFA PIPETTOR MODULE TEST

See chapter 12.4.4 on page 12-21

14.5 MAINTENANCE

This section contains instructions for the maintenance of individual components of the IFA pipetting system. Follow the instructions in the individual sections.

14.5.1 CLEANING OF X-GUIDING

See chapter 13.5.1 on page 13-11

14.5.2 CLEANING OF Y-GUIDING RAILS AND ROLLERS

See chapter 13.5.2 on page 13-11

14.6 TROUBLESHOOTING AND REPAIRS

This section contains instructions for the repair of individual components of the IFA pipetting system. After several repair works it is required that the individual components are readjusted. Follow the instructions in the individual sections.

14.6.1 OPEN/CLOSE LEFT PIPETTOR ARM COVER

OPEN



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Open the top cover.
4. Hang out both tubings (1).

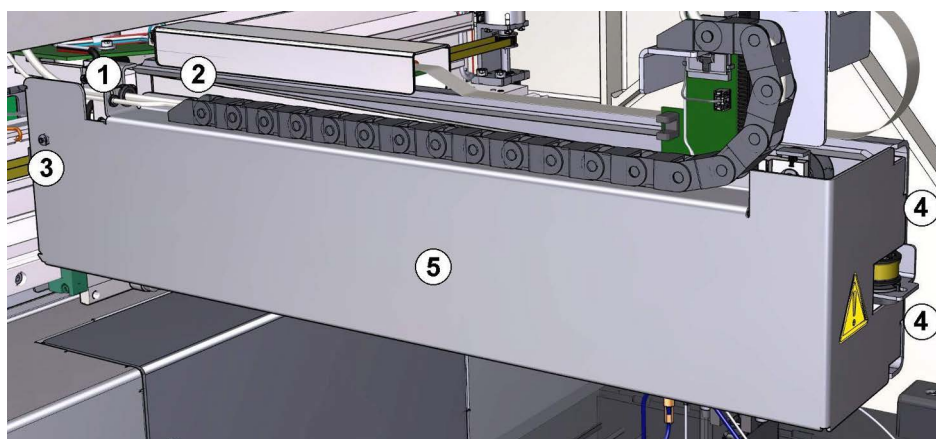


Figure 14-3: Pipettor arm

5. Remove both chain retaining screws (2).
 6. Remove screw (3) and both screws (4).
 7. Remove the left cover (5).
-
8. Install the left cover (3) and tighten the screws (1 + 2).
 9. Tighten both chain retaining screws (2).
 10. Hang up both tubings (1).

CLOSE

14.6.2 REPLACEMENT OF IFA DISPOSABLE TIP ADAPTER

DANGER



Risk of infection!

Parts of the pipettor must be treated as potentially infectious. Improper handling of infectious parts can cause skin irritations, illnesses and possible death.

- Note all safety notes!
- Pay attention to fluid leaking!
- Do not mix the waste tubing fitting (3) with the other fitting!

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Move the pipettor/disposable tip adapter above the pipettor wash station, because the pipettor drops when the tubing is removed in the next step.
5. Screw the pipettor system liquid tubing (1) with the fitting (2) out of the diluter pump valve (5).

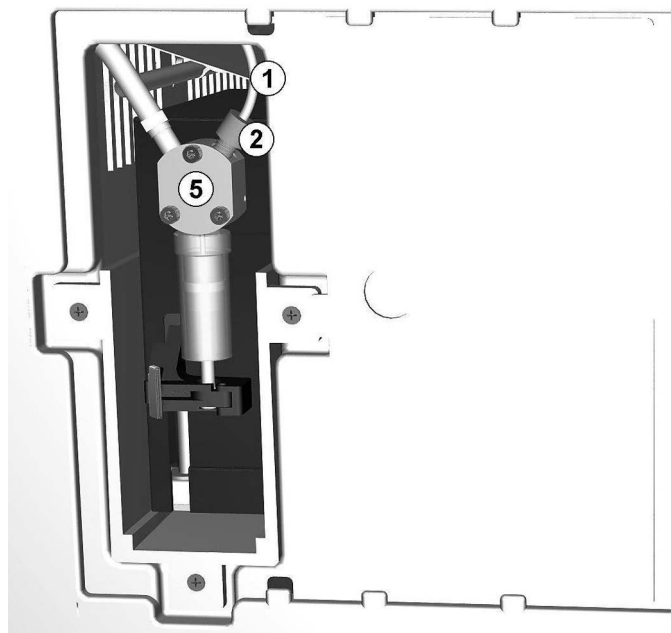


Figure 14-4: Installed diluter pump

6. Remove the complete fitting (2, 3, and 4) from the pipettor system liquid tubing (1).

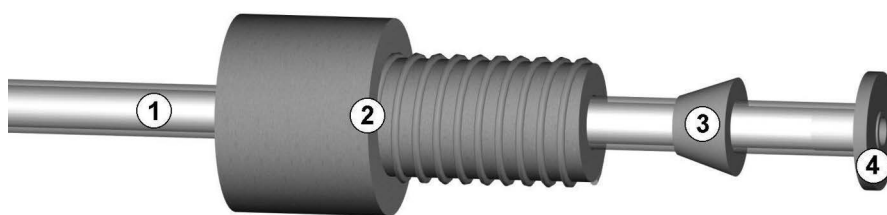


Figure 14-5: Fitting

7. Unhook the energy chain (6) on position (7).

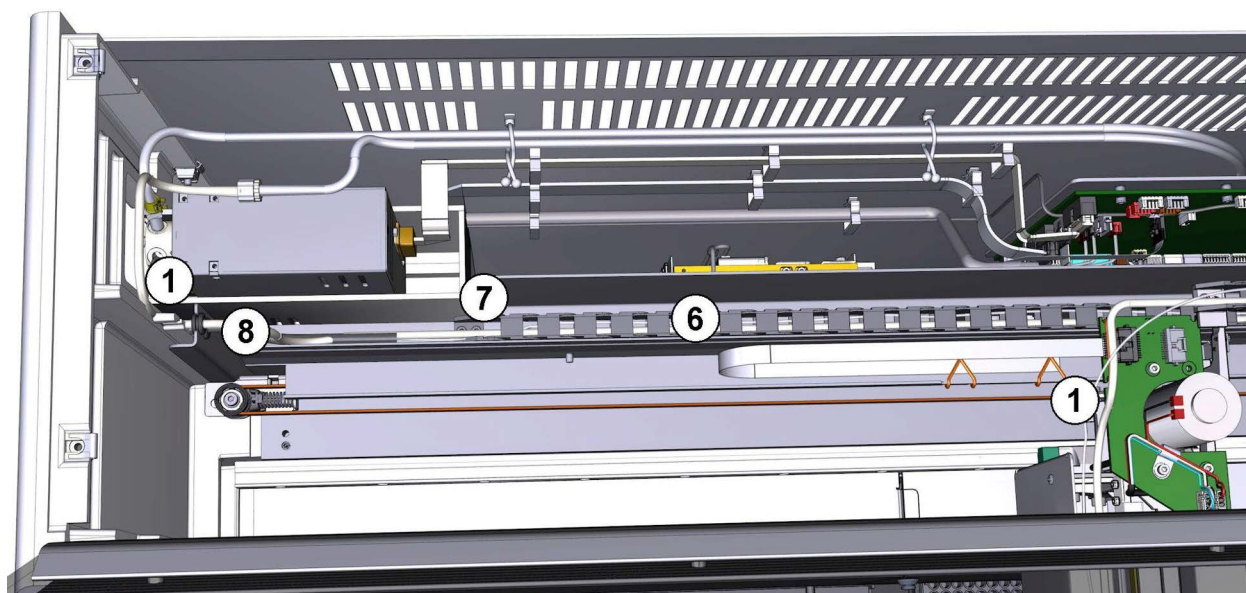


Figure 14-6: Energy chain (top view)

8. Pull the pipettor system liquid tubing (1) out of the protection tubing (8)
9. Pull the pipettor system liquid tubing (1) out of the energy chain (6).
10. Pull the pipettor system liquid tubing (1) out of the tubing bushing (9).

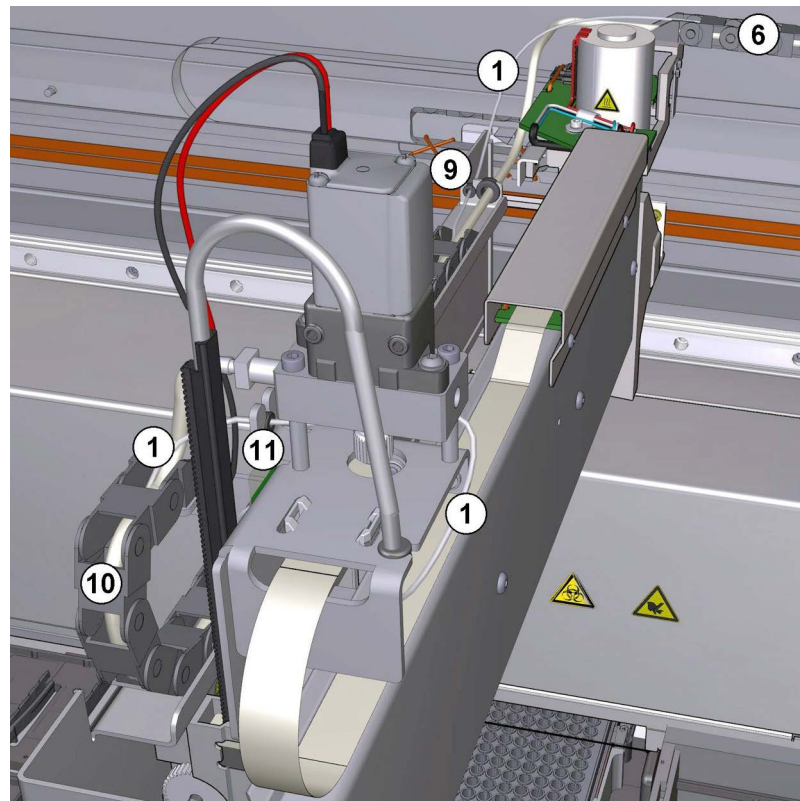


Figure 14-7: Energy chain on the Y-sledge

11. Pull the pipettor system liquid tubing (1) out of the energy chain (10).
12. Pull the pipettor system liquid tubing (1) out of the tubing bushing (11).
13. Pull the pipettor system liquid tubing (1) out of the spring tubing (19).

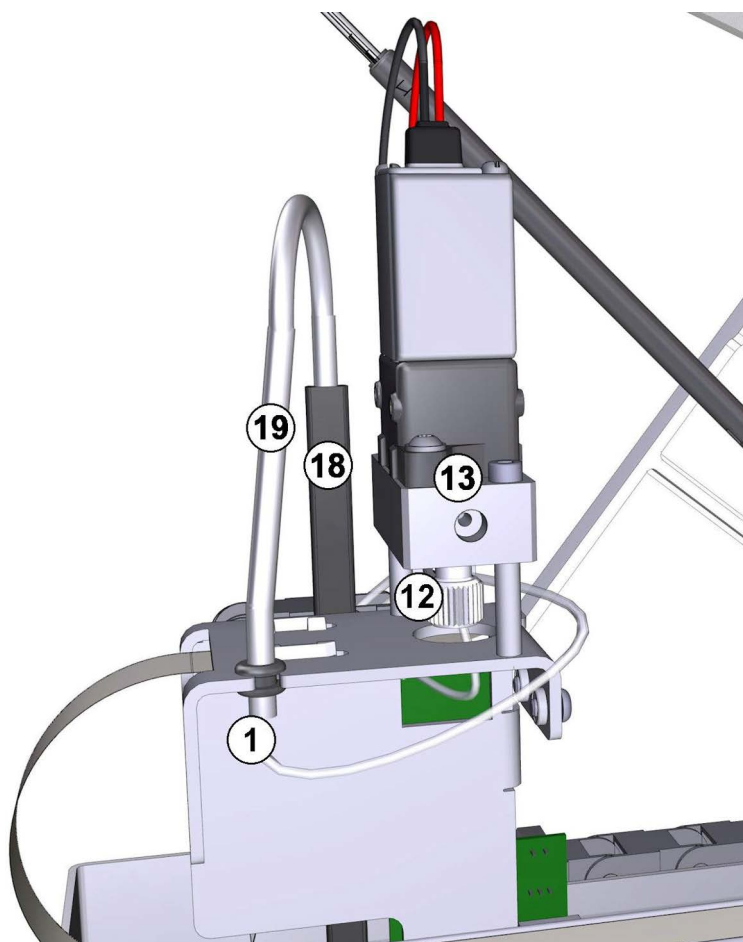


Figure 14-8: Valve on the Y-sledge

14. Pull the spring tubing (19) out of the toothed rack (18).
15. Screw the waste tubing (12) with fitting out of the valve (13).
16. Remove the complete fitting from the waste tubing (12).
Note the order of the fitting parts!
17. Disconnect the LLD cable (14) from the connector (J1) on the Y-sledge CU board (15) (see chapter 19.6.2 on page 19-23).

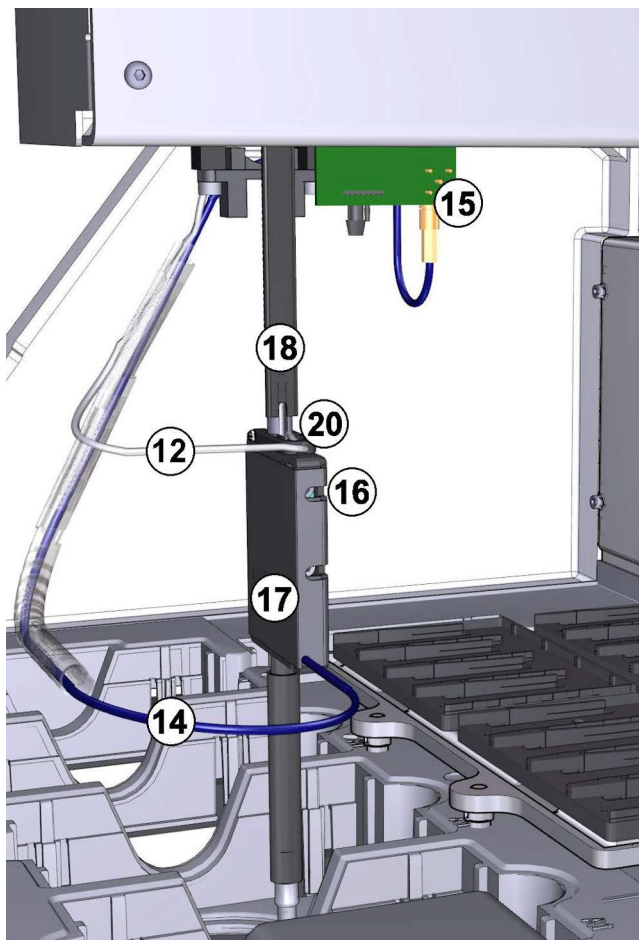


Figure 14-9: Installed disposable tip adapter

18. Remove the waste tubing (12) and the LLD cable (14) from the duct next to the Y-sledge CU board (15).
19. Pull the waste tubing (12) and the LLD cable (14) out of the spiral hose.
20. Open the set screw (16).
21. Pull the IFA disposal tip adapter (17) with both tubings (1 and 12) down from the toothed rack (18) and remove it.

INSTALLATION

NOTICE

Use of tubings:

- Avoid kinks in the tubings during the installation!
- Do not pull the pipettor system liquid tubing, because the adhesive bonding of the tubing inside the tip adapter can be damaged easily.

22. Insert the waste tubing (12) of the new disposal tip adapter (17) into the toothed rack (18) and lead it out through the elongated hole.
23. Push the liquid tubing (1) through the toothed rack (18).

24. Put the new disposal tip adapter (17) up to the toothed rack (18) and tighten the set screw (17).
Note, that the longer needle of the new disposal tip adapter (17) is on the left side.
25. Push the waste tubing (12) through the tube guiding (20).
26. Push the waste tubing (12) and the LLD cable (14) into the spiral hose.
27. Push the waste tubing (12) and the LLD cable (14) through the duct next to the Y-sledge CU board (15).
28. Plug the LLD cable (14) into the connector (J1) on the Y-sledge IFA CU board (15) (see chapter 19.6.2 on page 19-23).
29. Push the liquid tubing (1) through the spring tubing (19).
30. Push the spring tubing (19) into the toothed rack (18).
31. Put the waste tubing (12) along the Y-sledge CU board (15) to the top. The tubing must lie behind the Z-motor.

NOTICE

Do not use any tools to fit and tighten the fittings!

32. Install the complete fitting on the waste tubing (12).
33. Screw the fitting of the waste tubing (12) in the valve (13).
34. Guide the pipettor system liquid tubing (1) through the tubing bushing (11).
35. Guide the pipettor system liquid tubing (1) through the energy chain (10).
36. Guide the pipettor system liquid tubing (1) through the tubing bushing (9).
37. Guide the pipettor system liquid tubing (1) through the energy chain (6).
38. Guide the pipettor system liquid tubing (1) through the protection tubing (8).
39. Hook the energy chain (6) on position (7).
40. Install the complete fitting (2, 3, and 4) on the pipettor system liquid tubing (1).

NOTICE

Do not use any tools to fit and tighten the fittings!

41. Screw the fitting (2) in the diluter pump valve (5).
42. Install the top cover (see chapter 8.3.4 on page 8-12).
43. Check free movement of Z-Init pin (see chapter 13.4.3 on page 13-10).
44. Move pipettor carefully in all axis (X/Y/Z) to check if cables or tubes get bent.
45. Teach the pipettor module (see chapter 20.3 on page 20-30).
46. Perform the pipettor module test (see chapter 14.4.3 on page 14-8).

14.6.3 REPLACEMENT OF LIQUID LEVEL DETECTION CABLE

See chapter 13.6.3 on page 13-17

14.6.4 REPLACEMENT OF SYRINGE-VALVE- SYSTEM (DILUTER PUMP)

See chapter 12.6.3 on page 12-31

14.6.5 REPLACEMENT OF DILUTER PUMP (VP9101)

See chapter 13.6.5 on page 13-19

14.6.6 REPLACEMENT OF LIQUID WASTE VALVE

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Disconnect the valve cable (5) connector (J5) on the Y-sledge IFA CU board (see chapter 19.6.2 on page 19-23).

DANGER



Risk of infection!

Parts of the pipettor must be treated as potentially infectious. Improper handling of infectious parts can cause skin irritations, illnesses and possible death.

- Note all safety notes!
- Pay attention to fluid leaking!

4. Screw the waste tubing (1) with fitting out of the valve (2).

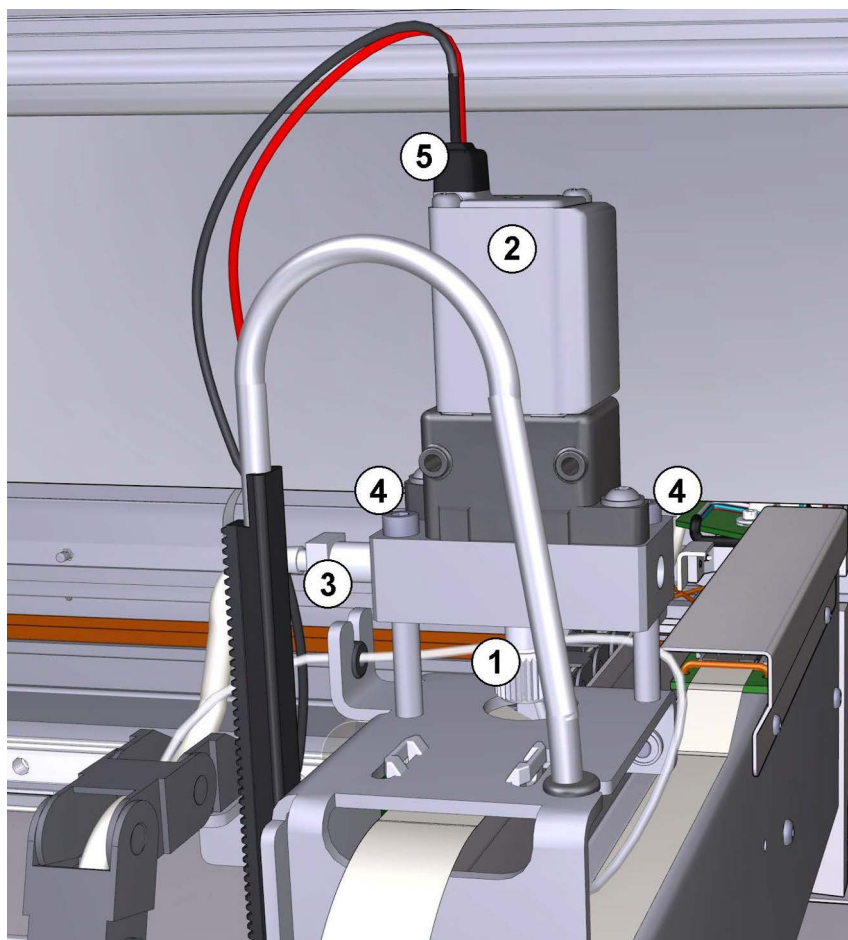


Figure 14-10: Installed liquid waste valve

5. Remove both screws (4).
6. Remove the liquid waste valve (2).

INSTALLATION

7. Screw the thick waste tubing (3) out of the valve (2).

8. Screw the thick waste tubing (3) in the valve (2).

9. Install the liquid waste valve (2) and tighten both screws (4).

Note the mounting direction of the valve. The cable outlet (5) must be on the left side.

NOTICE

Do not use any tools to fit and tighten the fittings!

10. Screw the waste tubing (1) in the valve (2).

11. Plug the valve cable (5) connector (J5) into the Y-sledge IFA CU board (see chapter 19.6.2 on page 19-23).

14.6.7 REPLACEMENT AND ADJUSTMENT OF X-BELT

See chapter 13.6.6 on page 13-22

14.6.8 REPLACEMENT OF X-MOTOR/ENCODER MODULE

See chapter 13.6.7 on page 13-24

14.6.9 REPLACEMENT AND ADJUSTMENT OF Y-BELT

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Open the left pipettor arm cover (see chapter 14.6.1 on page 14-10).
4. For replacement of the Y-belt see chapter 13.6.8 on page 13-25.

INSTALLATION AND ADJUSTMENT

5. For installation and adjustment of the Y-belt see chapter 13.6.8 on page 13-25.
6. Close the left pipettor arm cover (see chapter 14.6.1 on page 14-10).
7. Teach the pipettor module (see chapter 20.3 on page 20-30).

14.6.10 REPLACEMENT OF Y-MOTOR/ENCODER

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the pipettor arm (see chapter 14.6.17 on page 14-26).
4. For replacement of the Y-motor/encoder see chapter 13.6.9 on page 13-27.

INSTALLATION

5. For installation of the Y-motor/encoder see chapter 13.6.9 on page 13-27.
6. Install the pipettor arm (see chapter 14.6.17 on page 14-26).
7. Adjust the Y-belt (see chapter 14.6.9 on page 14-20). It is not necessary to replace the Y-belt.
8. Teach the pipettor module (see chapter 20.3 on page 20-30).

14.6.11 REPLACEMENT AND ADJUSTMENT OF Z-MOTOR

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Open the left pipettor arm cover (see chapter 14.6.1 on page 14-10).
4. For replacement of the Z-motor see chapter 13.6.10 on page 13-30.

INSTALLATION AND ADJUSTMENT

5. For installation and adjustment of the Z-motor see chapter 13.6.10 on page 13-30.
6. Close the left pipettor arm cover (see chapter 14.6.1 on page 14-10).
7. Teach the pipettor module (see chapter 20.3 on page 20-30).

14.6.12 REPLACEMENT OF PIPETTOR RIBBON CABLE

See chapter 13.6.11 on page 13-32

14.6.13 REPLACEMENT OF ARM RIBBON CABLE

See chapter 13.6.12 on page 13-34

14.6.14 REPLACEMENT OF X-SLEDGE CU BOARD

See chapter 13.6.13 on page 13-36

14.6.15 REPLACEMENT OF Y-SLEDGE IFA CU BOARD

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Open the left pipettor arm cover (see chapter 14.6.1 on page 14-10).
4. Disconnect the LLD cable (1) from the connector (J1) on the Y-sledge IFA CU board (see chapter 19.6.2 on page 19-23).

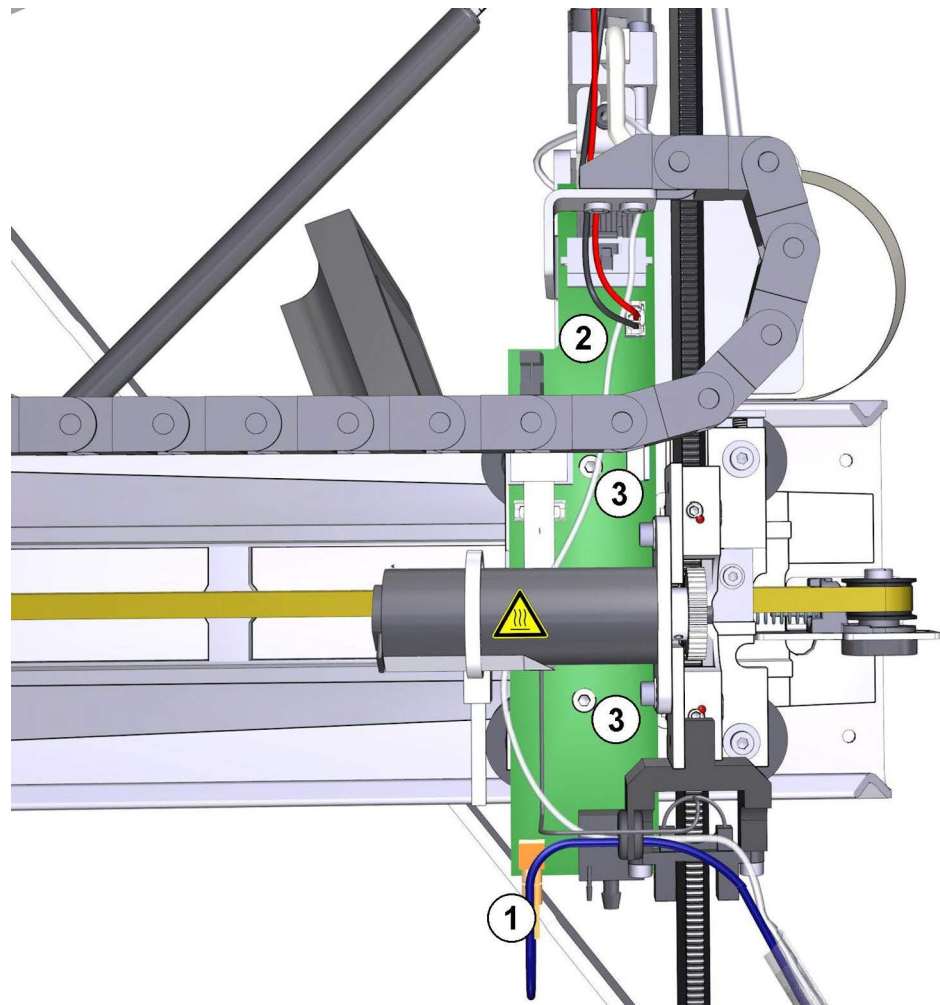


Figure 14-11: Installed IFA Y-sledge

5. Disconnect the connector J2 and J5 from the Y-sledge IFA CU board.
6. Remove both screws (3).
7. Remove the Y-sledge CU board (2).

INSTALLATION

8. Check DIP-Switch SW1 of the Y-sledge IFA CU board (see chapter 19.6.2 on page 19-23). All switches must set to OFF.
9. Install the Y-sledge CU board (2) and tighten both screws (3).
10. Plug the connector J2 and J5 into the Y-sledge IFA CU board.
11. Plug the LLD cable (1) into the connector (J1) on the Y-sledge IFA CU board.
12. Close the left pipettor arm cover (see chapter 14.6.1 on page 14-10).
13. Start the instrument setup (see chapter 21.1 on page 21-1).
14. Teach the pipettor module (see chapter 20.2 on page 20-2).
15. Perform the pipettor module test (see chapter 14.4.3 on page 14-8).

14.6.16 REPLACEMENT OF TOOTHED RACK

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the IFA disposable tip adapter (see chapter 14.6.2 on page 14-11).
4. For replacement of the toothed rack see chapter 13.6.15 on page 13-40.

INSTALLATION

5. For installation of the toothed rack see chapter 13.6.15 on page 13-40.
6. Install the IFA disposable tip adapter (see chapter 14.6.2 on page 14-11).
7. Teach the pipettor module (see chapter 20.3 on page 20-30).

14.6.17 REPLACEMENT OF IFA PIPETTOR ARM

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Remove the IFA disposable tip adapter (see chapter 14.6.2 on page 14-11).
5. Open the left pipettor arm cover (see chapter 14.6.1 on page 14-10).

DANGER



Risk of infection!

Parts of the pipettor must be treated as potentially infectious. Improper handling of infectious parts can cause skin irritations, illnesses and possible death.

- Note all safety notes!
- Pay attention to fluid leaking!

6. Screw the waste tubing (1) out of the valve (2).

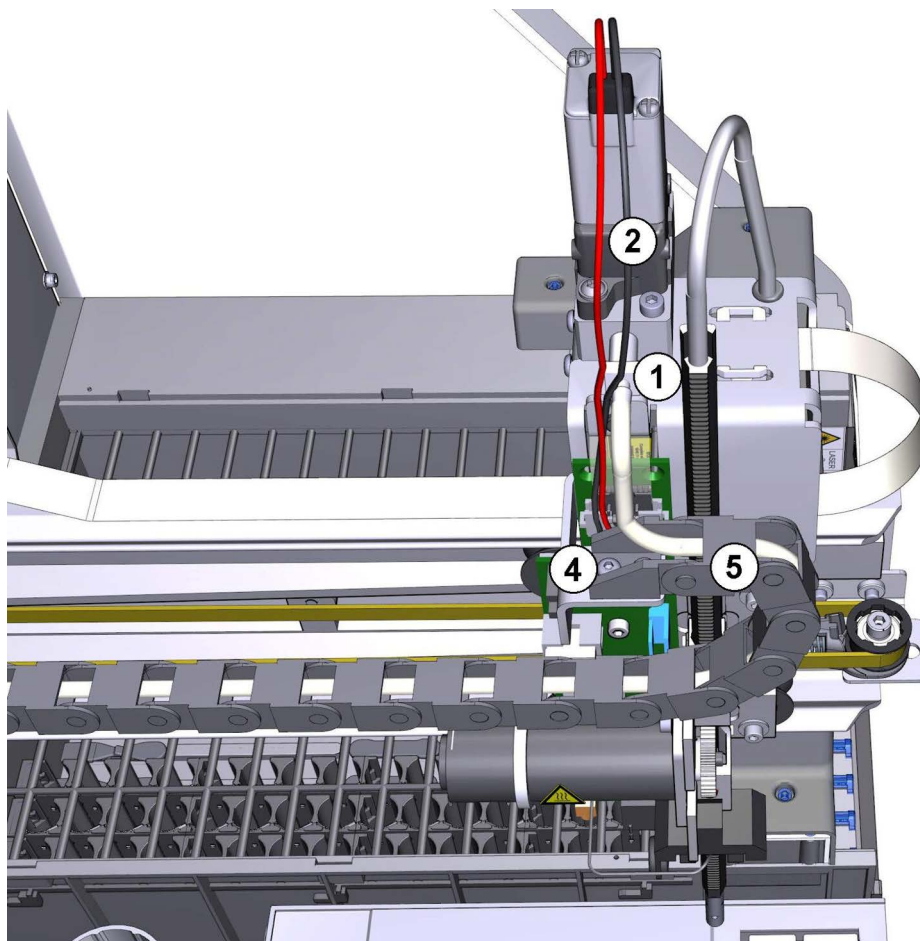


Figure 14-12: Y-sledge chain and tubings

7. Remove both chain retaining screws (4).

8. Put the chain with tubing (5) aside.
Note the liquid in the tubings.
9. Remove the energy chain retaining screw (6).

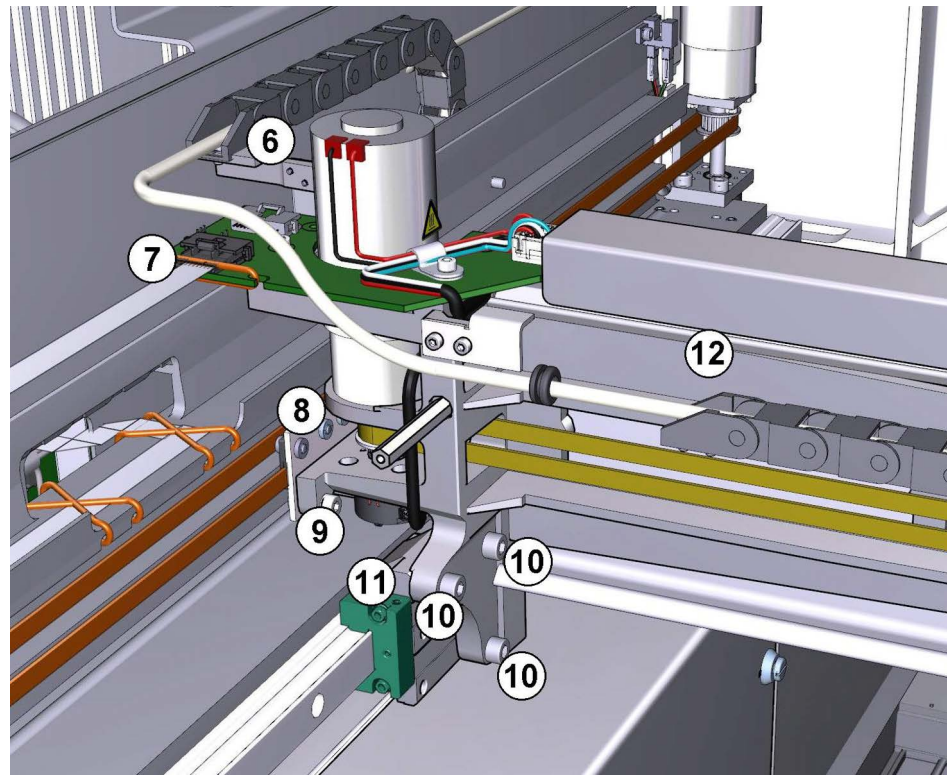


Figure 14-13: Y-belt motor and Y-sledge CU board

10. Put the energy chain aside.
11. Remove the rubber band (7).
12. Disconnect the ribbon cable connector (J9) from the X-sledge CU board (see chapter 19.6.1 on page 19-21).
13. Remove screw (9) of the X-belt fixing plates holder (8).
14. Remove the X-belt fixing plates holder (9) from the pipettor arm (12).
15. Hold the pipettor arm (12) and remove the three screws (10).
16. Remove the pipettor arm (12).

INSTALLATION

17. Install the pipettor arm (12) and tighten the three screws (10).
18. Move the fixing plates holder (8) behind the pipettor arm.
19. Stick the right borehole of the fixing plates holder (8) into the cylindrical pin and tighten the fixing plates holder (8) with screw (9).
20. Adjust the X-belt (see chapter 14.3.1 on page 14-6).
21. Plug the ribbon cable connector (J9) into the X-sledge CU board (see chapter 19.6.1 on page 19-21).
22. Install the rubber band (7).
23. Install the energy chain and tighten the screw (6).
24. Tighten both chain retaining screws (4).

NOTICE

Do not use any tools to fit and tighten the fittings!

25. Screw the waste tubing (1) into the valve (2).
26. Close the left pipettor arm cover (see chapter 14.6.1 on page 14-10).
27. Install the IFA disposable tip adapter (see chapter 14.6.2 on page 14-11).
28. Install the top cover (see chapter 8.3.4 on page 8-12).
29. Start the instrument setup (see chapter 21.1 on page 21-1).
30. Teach the pipettor module (see chapter 20.3 on page 20-30).
31. Perform the pipettor module test (see chapter 14.4.3 on page 14-8).

14.6.18 REPLACEMENT OF IFA PIPETTOR MODULE

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Screw the system liquid tubing (5) out of the valve.

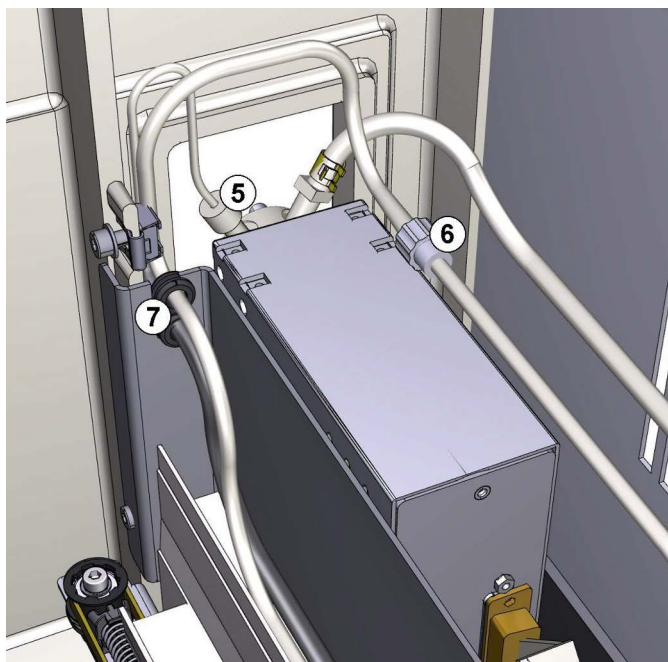


Figure 14-14: Installed diluter pump

DANGER



Risk of infection!

Parts of the pipettor must be treated as potentially infectious. Improper handling of infectious parts can cause skin irritations, illnesses and possible death.

- Note all safety notes!
- Pay attention to fluid leaking!

5. Disconnect the waste tubing (6).
6. Hang both tubings out of the bracket (7).
7. Disconnect the connectors (ST54, ST57, ST58 and ST60) from the instrument CU board (see chapter 19.2.1 on page 19-11).
8. Remove the upper cover (see chapter 8.3.5.2 on page 8-16).

NOTICE**Pipettor module damage**

After removing of the mounting screws the pipettor module will fall down immediately.

- Hold the pipettor module.

9. Hold the pipettor module and remove the four mounting screws (2) with washers on the left and the right side.

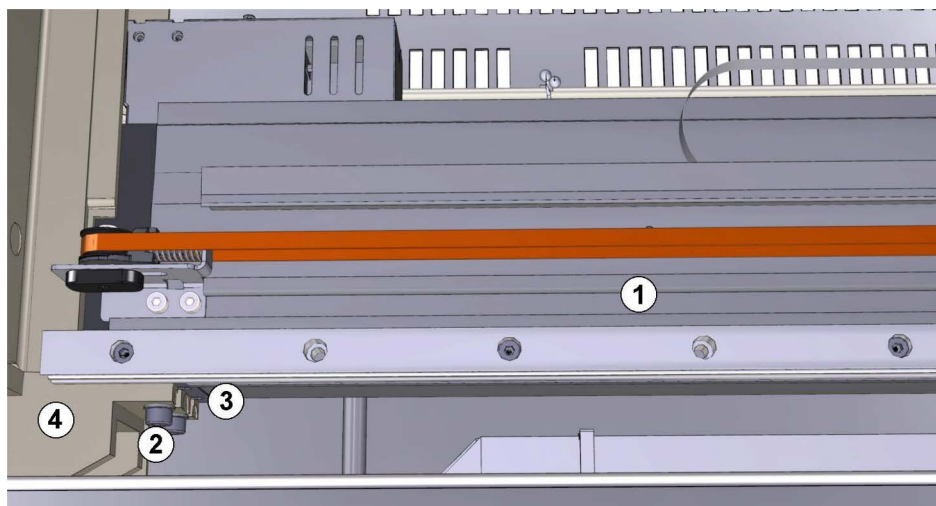


Figure 14-15: Pipettor mounting screws (left side)

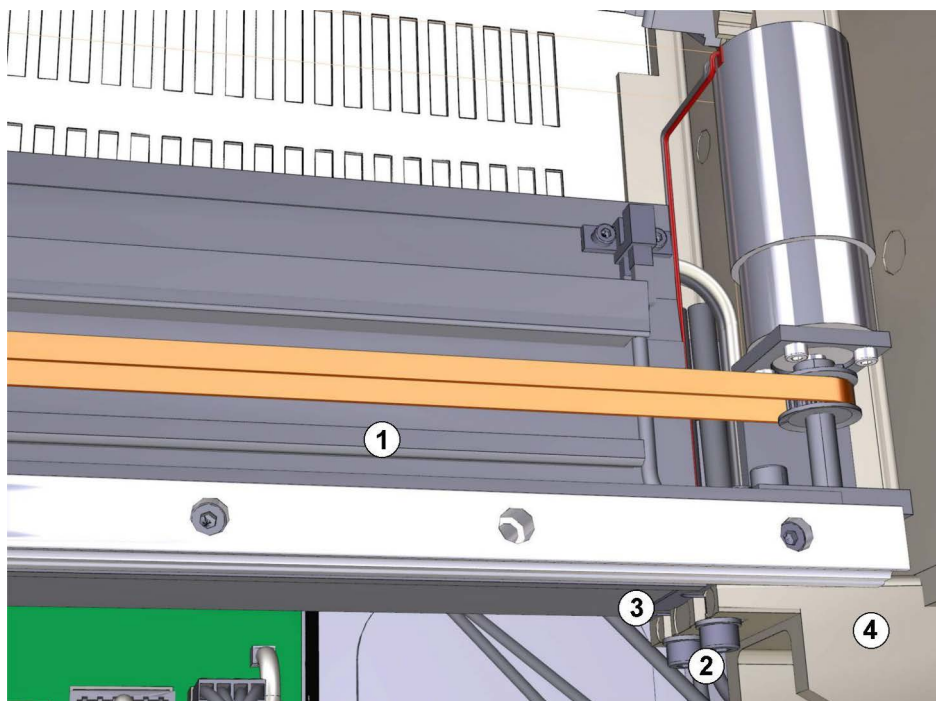


Figure 14-16: Pipettor mounting screws (right side)

10. Remove the pipettor module.

INSTALLATION

11. Place one pressure plate (3) on the left retaining bracket (4) and one on the right retaining bracket (4).

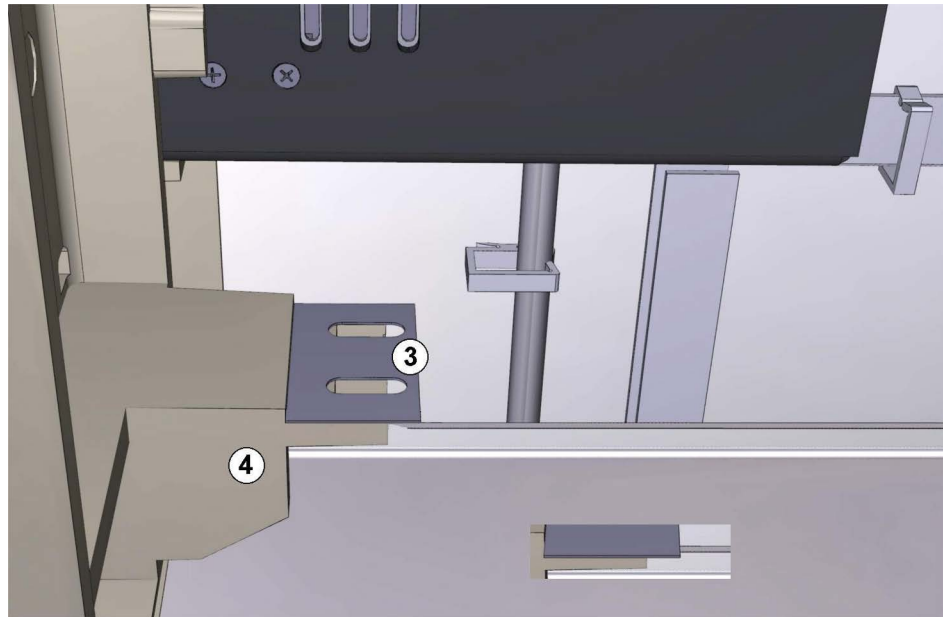


Figure 14-17: Pipettor retaining bracket (left side)

12. Set the new/repaired pipettor module onto the pressure plates and screw in the four mounting screws (2) with washers.
Do not tighten the screws!
13. Adjust the pipettor module (see chapter 14.3.4 on page 14-6).
14. Install the upper cover (see chapter 8.3.5.2 on page 8-16).
15. Plug the connectors (ST54, ST57, ST58 and ST60) into the instrument CU board (see chapter 19.2.1 on page 19-11).
16. Hang both tubings up into the bracket (7).

NOTICE

Do not use any tools to fit and tighten the fittings!

17. Screw the system liquid tubing (5) into the valve.
18. Connect the waste tubing (6).
19. Install the top cover (see chapter 8.3.4 on page 8-12).
20. Start the instrument setup (see chapter 21.1 on page 21-1).
21. Teach the pipettor module (see chapter 20.3 on page 20-30).
22. Perform the pipettor module test (see chapter 14.4.3 on page 14-8).

14.7 SERVICE SOFTWARE

The following chapter describes only the IFA pipettor service software functions. See chapter 12.7 on page 12-62 and chapter 13.7.1 on page 13-47 for all other functions.

14.7.1 IFA DIALOG

Function	Description
Coordinate file in gService.ini	Shows the path of the associated coordinate file.
Select Rac-file	Select the corresponding rac-file for the used slide.
Well no.	Number of the first used well.
Shape	Select the shape of the well (circle or rectangle)
Size X	Size of the selected well.
Size Y	Size of the selected well.
Sweep count	Number of sweep steps.
Z offset	Sweep Z offset (only positive and should be less than Z max.
Sweep direction	Moving direction (left to right, right to left, up to down, down to up)
Delay time	Delay time between dispense/aspirate. Aspirate is always first followed by dispense. This delay time is used before the start of the first sweep (where the aspirate pump is turned ON) and at the end of last sweep (where the aspirate pump is finally turned OFF).
Disp. pump speed	Speed of the dispense pump.
X-Position/Y-Position/Z-Position	Position of the pipettor tip.
White Bottle/ Green Bottle	Select the used IFA wash buffer.
Sequence	<ul style="list-style-type: none"> • First: First IFA wash sequence • Middle: IFA wash sequence • Last: Last IFA wash sequence • Single: IFA wash sequence which implies both First and Last sequences are done
Init IFA Sensor	Initializes the IFA Sensor.
Init Pipettor	Initializes the complete IFA pipettor module.
Ventilate	Ventilates the IFA system.
Get IFABay	Shows the status of the IFA bay sensor: <ul style="list-style-type: none"> • Present: IFA bay installed • Not present: No IFA bay available
Sweep speed	Sweep speed of the movement. (If any one of the values of Size X and Size Y is not equal to zero.)
Wash IFA Slide	Washes the complete slide.

Function	Description
Duration	Period of time for pump activity.
Rinse Wash buffer	Flushes the IFA wash buffer pump.
Z Stop height	Stop position.
Dispense IFA wash-buffer	Dispense IFA wash buffer on the specified well.
Wash IFA Needle	Flushes the pipettor tip.
OK	Closes the IFA dialog.

Table 14-1: Functions of the IFA dialog

15 PLATE TRANSPORT MODULE

This chapter describes this module in detail. In the first section "Safety" additionally to the general safety notes (see chapter 1.2 on page 1-6) safety notes are specified, which concern particularly this module. The section "Overview" gives a short overview about this module. This section is followed by a larger part containing information about maintenance, repair and testing of this module (sections "Adjustment and Calibration", "Check and Verification", "Maintenance", "Troubleshooting and Repairs" and "Connections, Signals and Switches"). The last section "Service Software" describes only the service software module which only concerns this module.

15.1 OVERVIEW

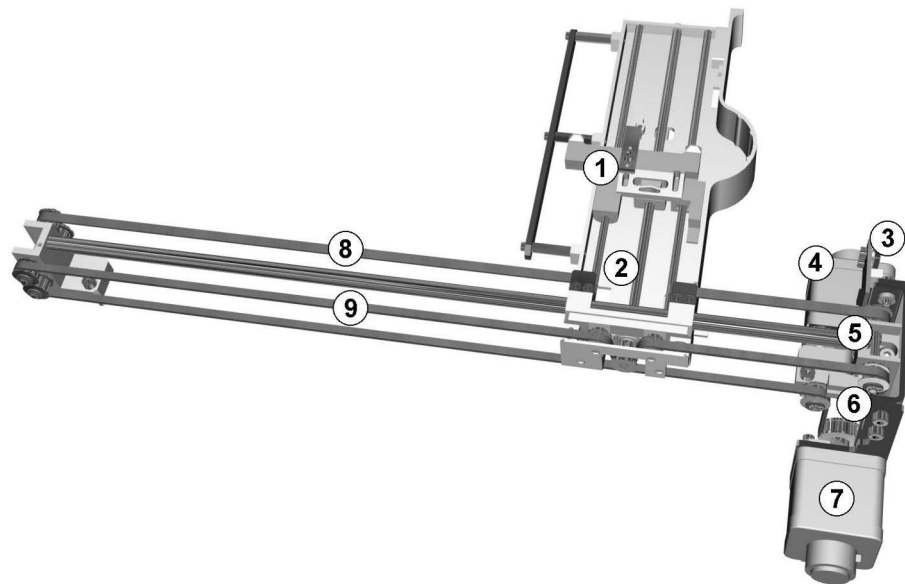


Figure 15-1: Plate transport module

- | | |
|---|---------------------------------|
| 1 | Y-sledge (plate carrier holder) |
| 2 | X-sledge |
| 3 | Plate carrier detection sensor |
| 4 | X-motor and X-encoder |

- | | |
|---|--|
| 5 | X-init light barrier (X-home position) |
| 6 | Y-init light barrier (Y-home position) |
| 7 | Y-motor and Y-encoder |
| 8 | X-belt (single-sided toothed belt) |
| 9 | Y-belt (double-sided toothed belt) |

15.2 ADJUSTMENT AND CALIBRATION

In this section, the adjustment of the plate transport module is described.

15.2.1 ADJUSTMENT OF X-/Y-TRANSPORT BELTS



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the deck top (see chapter 8.3.1 on page 8-9).
4. Move the X-sledge to the right side.
5. Push down the X- or Y-transport belt with **1 N** in the middle with a compression spring balance.
The elongation of the belts shall be about **6.5 mm**.

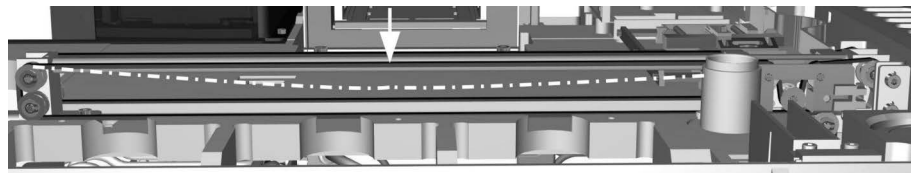


Figure 15-2: Tension of the Y-transport belt

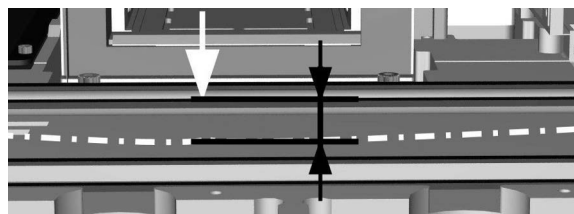


Figure 15-3: Tension of the Y-transport belt (detail)

6. It is possible to tighten or loosen the X- or Y-transport belt:
 - Open the retaining screws of the X- or Y-motor bracket.
 - Tighten or loosen the X- or Y-transport belt.
 - Tighten the retaining screws of the X- or Y-motor bracket.

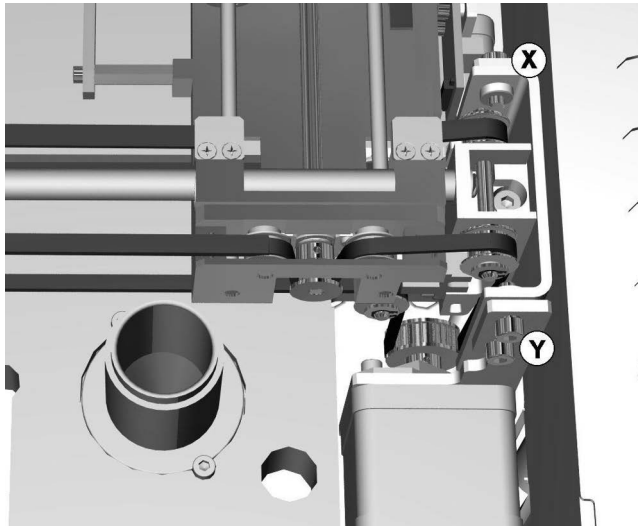


Figure 15-4: X- and Y-motors

15.3 CHECK AND VERIFICATION

In this section information about the testing of certain components can be found.

15.3.1 CHECK X-/Y-TRANSPORT BELTS

To check tensions see adjustment procedures:

- X-/Y-transport belts: chapter 15.2.1 on page 15-3

15.3.2 PERFORM PLATE TRANSPORT MODULE TEST

1. Switch on the instrument.
2. Start the service software (see chapter 7.1 on page 7-1).
3. Start the plate transport service software module (see chapter 15.6 on page 15-21).
4. Press on the **Selftest** button to initialize the module and start the selftest (see chapter 15.6.2 on page 15-29).
5. Press on the **Module Test** button and follow the instructions (see chapter 15.6.3 on page 15-30).

15.4 MAINTENANCE

This section contains instructions for the maintenance of individual components of the plate transport module. After several maintenance it is required that the individual components are readjusted. Follow the instructions in the individual sections.

15.4.1 LUBRICATION OF PLATE TRANSPORT MODULE

NOTICE

Use the **GEMINI** lubrication kit for this maintenance job.



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the deck top (see chapter 8.3.1 on page 8-9).
4. Remove all dirt and old grease with a cleaning paper from the Y-lead screw (1). Press the cleaning paper into the thread grounds of the Y-lead screw.

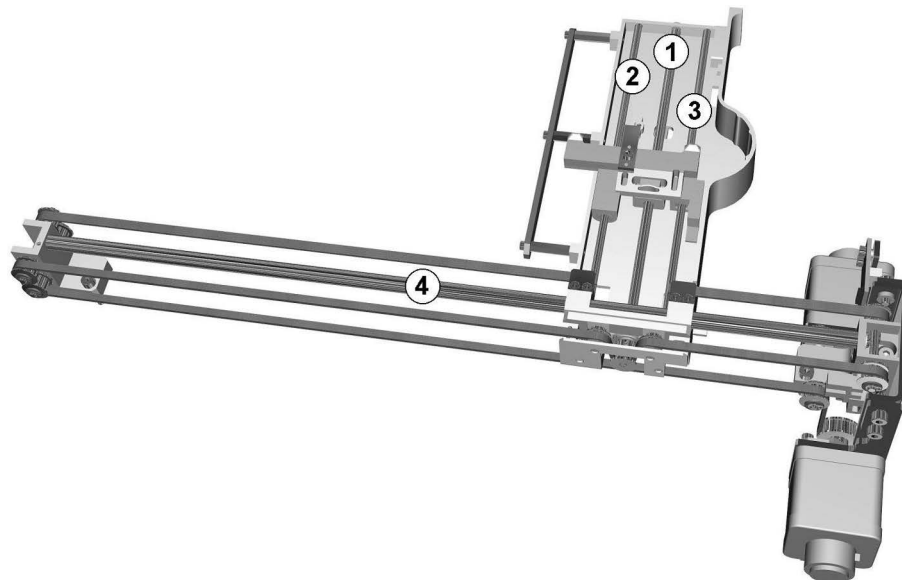


Figure 15-5: Plate transport

5. Remove all dirt and old oil with a cleaning paper from both Y-guiding rods (2 + 3) and the X-guiding rod (4).

6. Use in a second step a cleaning paper with alcohol (standard disinfection fluids of the laboratories).
7. Place some grease on the Y-lead screw (1) and wipe the grease with a brush into the Y-lead screw surface.

NOTICE

Do not place too much grease on the Y-lead screw! Do not grease other parts of the plate transport!

8. Place with the syringe oil on both Y-guiding rods (2 + 3) and the X-guiding rod (4).
Put the oil on the complete surface of the guiding rod.

NOTICE

Do not place too much oil on the guiding rods! Dropping oil is absolutely not allowed! Do not oil other parts of the plate transport!

9. Switch on the instrument.
10. Start the service software.
The service software displays its main menu.
11. Start the plate transport service software module.
12. Move the plate transport across the whole length of the X-guiding rod 10 times to build up a complete oiled surface on the X-guiding rod.
13. Move the plate transport across the whole length of the Y-guiding rods and Y-lead screw 10 times to build up a complete oiled surface on the guiding rods and a closed and homogeneous film of grease on the Y-lead screw.
14. If an oil or grease bubble accumulates on the sides of the sledges, it must be removed.
15. Install the deck top (see chapter 8.3.1 on page 8-9).

15.5 TROUBLESHOOTING AND REPAIRS

This section contains instructions for the repair of individual components of the plate transport module. After several repair works it is required that the individual components are readjusted. Follow the instructions in the individual sections.

15.5.1 REPLACEMENT OF PLATE TRANSPORT MODULE

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the top cover (see chapter 8.3.4 on page 8-12).
4. Remove the upper cover (see chapter 8.3.5 on page 8-14).
5. Remove the deck top (see chapter 8.3.1 on page 8-9).
6. Remove the module cover (see chapter 8.3.3 on page 8-11).
7. Remove the loading bay module and turn it on its left side (see chapter 16.5.2 on page 16-11).
It is not necessary to remove the loading bay module completely!
8. Disconnect the five connectors ST9, ST10, ST16, ST17, and ST26 from the instrument CU board (see chapter 19.2.1 on page 19-11).
9. Remove the cables from the cable clamps.
10. Remove the four retaining screws (2).

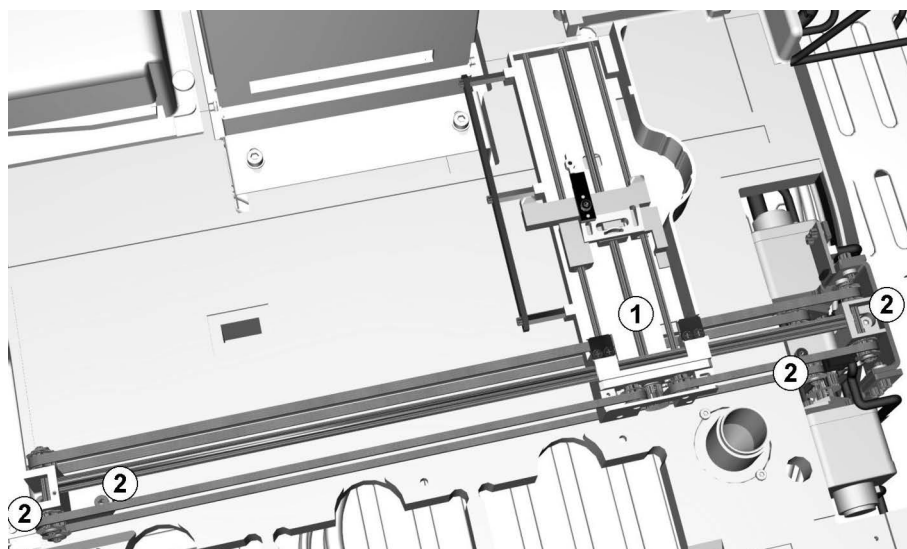


Figure 15-6: Installed plate transport module

11. Move the plate transport (1) to the right and remove the complete module.

INSTALLATION

12. Insert the complete module and move plate transport (1) to the left.
13. Move the complete module as far to the right as possible and tighten the four retaining screws (2).
14. Plug the five connectors ST9, ST10, ST16, ST17, and ST26 into the instrument CU board (see chapter 19.2.1 on page 19-11).
15. Insert the cables into the cable clamps.
16. Adjust the X- and Y-transport belts (see chapter 15.2.1 on page 15-3).
17. Install the loading bay module (see chapter 16.5.2 on page 16-11).
18. Install the module cover (see chapter 8.3.3 on page 8-11).
19. Install the upper cover (see chapter 8.3.5 on page 8-14).
20. Install the top cover (see chapter 8.3.4 on page 8-12).
21. Teach the plate transport module (see chapter 20.4 on page 20-44).
Teach the washer position first!
If this position is not reached, then loosen the screws (2) again, move the complete module to the right and tighten the screws (1) again.
22. Install the deck top (see chapter 8.3.1 on page 8-9).
23. Teach the pipetting position of the pipettor module (see chapter 20.2.5 on page 20-14).
24. Perform Plate Transport Module Test (see chapter 15.3.2 on page 15-5).

15.5.2 REPLACEMENT OF X-TRANSPORT BELT

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the deck top (see chapter 8.3.1 on page 8-9).
4. Remove the four screws and both brackets (2).

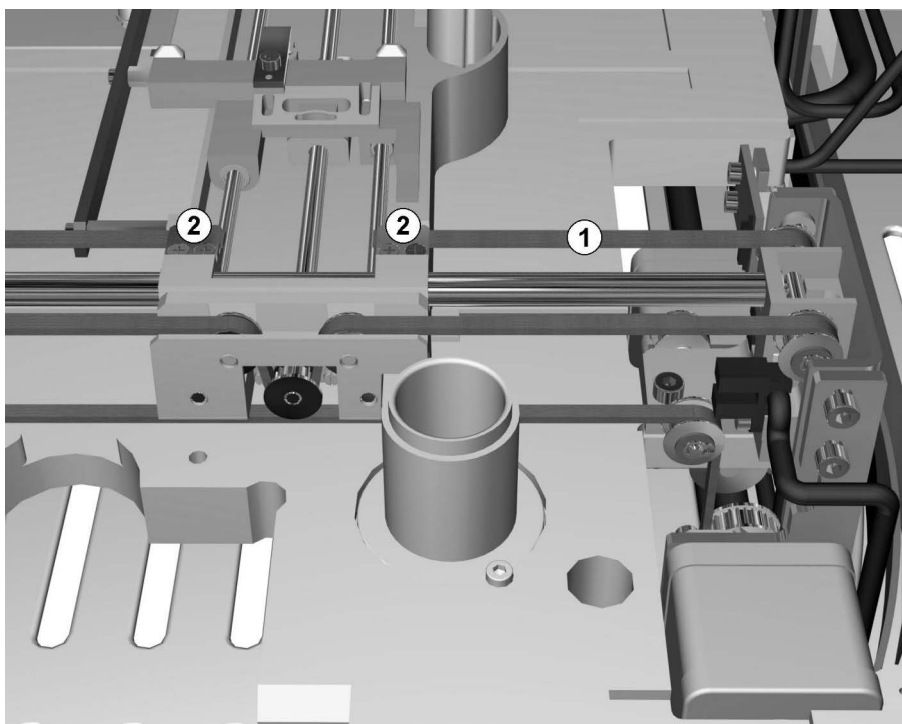


Figure 15-7: Transport belts

5. Remove the X-transport belt (1).

INSTALLATION

6. Loosen both screws (3).

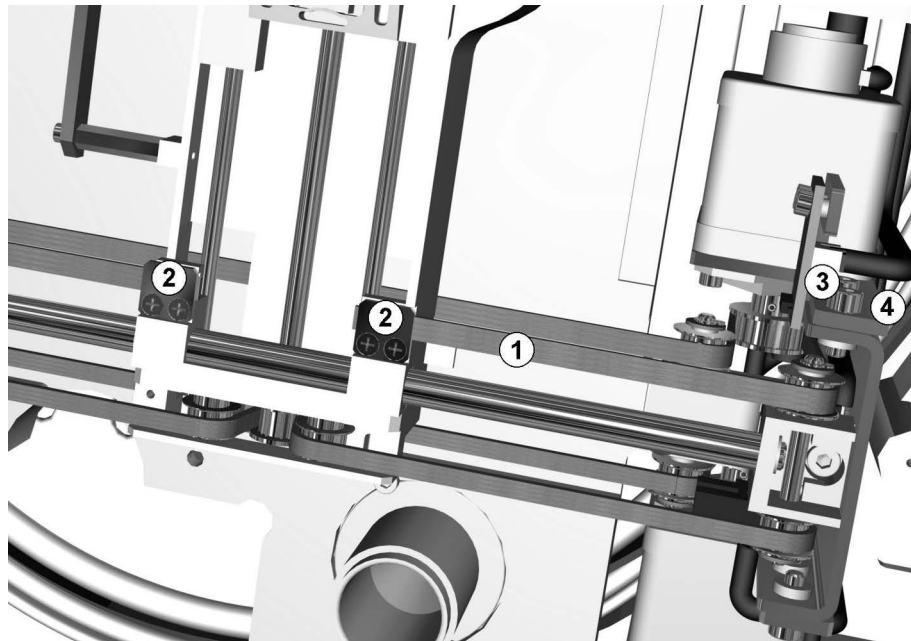


Figure 15-8: Transport belts (top view)

7. Insert the new X-transport belt (1).
8. Install both brackets (2) and tighten the four screws.
The belt has to get out two teeth on each side!
9. Move the X-motor bracket (4) down and tighten both screws (3).
10. Adjust the X-transport belt (see chapter 15.2.1 on page 15-3).
11. Teach the plate transport module (see chapter 20.4 on page 20-44).
12. Install the deck top (see chapter 8.3.1 on page 8-9).
13. Check the reader, incubator and washer positions (see chapter 15.6.1 on page 15-25).
14. Teach the pipetting position of the pipettor module (see chapter 20.2.5 on page 20-14).
15. Perform Plate Transport Module Test (see chapter 15.3.2 on page 15-5).

15.5.3 REPLACEMENT OF Y-TRANSPORT BELT

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the deck top (see chapter 8.3.1 on page 8-9).
4. Remove the screw and Y-init light barrier (2).

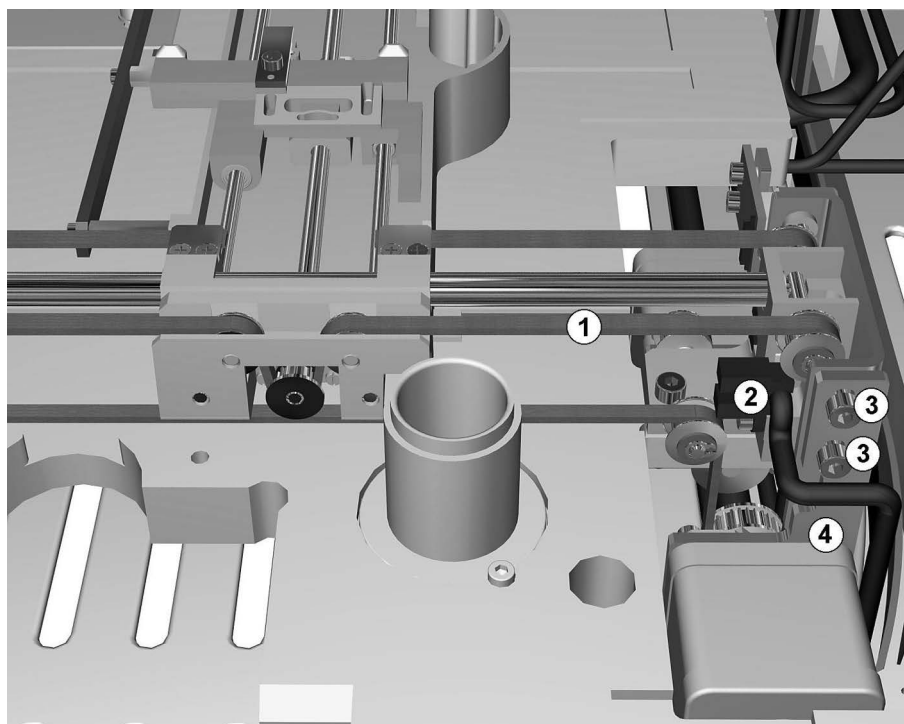


Figure 15-9: Transport belts

5. Loosen both screws (3) and the Y-motor bracket (4).
Do not remove it!
6. Hang out the Y-transport belt (1) and remove it.

INSTALLATION

7. Insert the new Y-transport belt.
8. Move the Y-motor bracket (4) down and tighten both screws (3).
9. Adjust the Y-transport belt (see chapter 15.2.1 on page 15-3).
10. Install the Y-init light barrier (2) upright and tighten the screw.
11. Teach the plate transport module (see chapter 20.4 on page 20-44).
12. Install the deck top (see chapter 8.3.1 on page 8-9).
13. Check the reader, incubator and washer positions (see chapter 15.6.1 on page 15-25).
14. Teach the pipetting position of the pipettor module (see chapter 20.2.5 on page 20-14).
15. Perform Plate Transport Module Test (see chapter 15.3.2 on page 15-5).

15.5.4 REPLACEMENT OF X-MOTOR WITH ENCODER

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the deck top (see chapter 8.3.1 on page 8-9).
4. Remove the plate carrier detection sensor (see chapter 15.5.8 on page 15-20).
5. Remove both screws (2) and put down the X-motor with bracket (1).

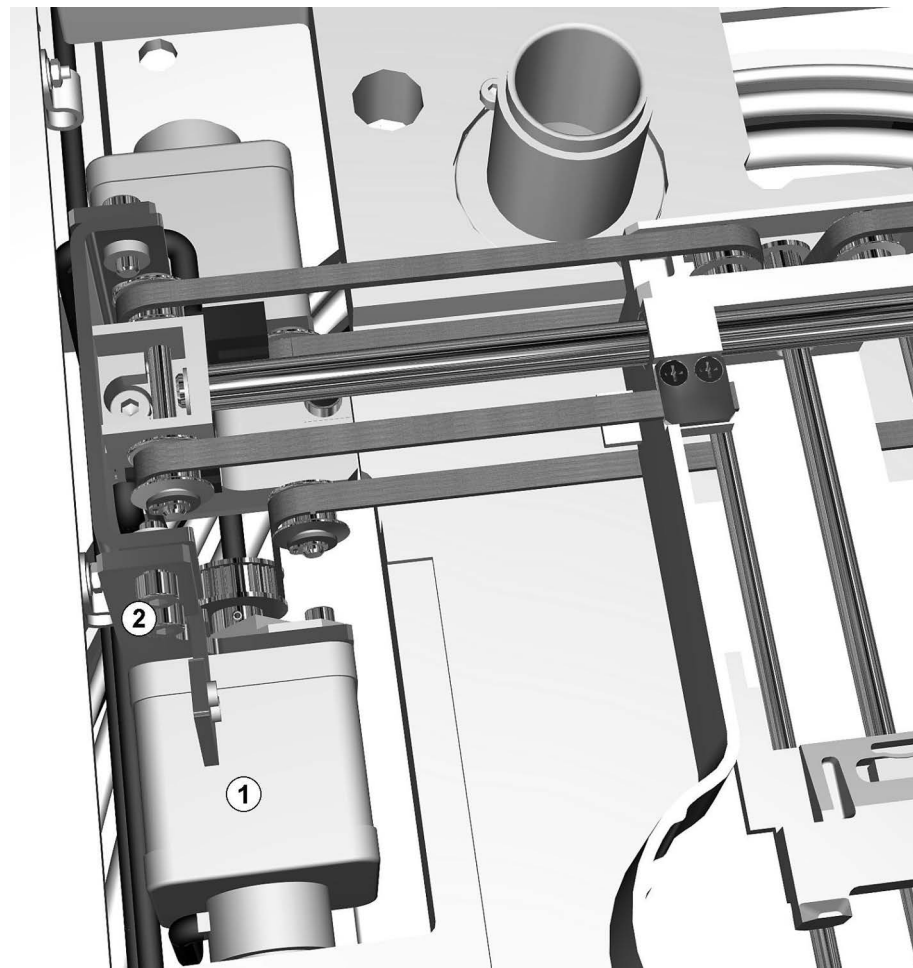


Figure 15-10: X-motor with encoder (back view without plate carrier detection sensor)

6. Disconnect the connectors from the X-motor and the encoder.
7. Remove the X-motor with bracket (1).

INSTALLATION

8. Insert the new the X-motor with bracket (1).
9. Plug the connectors into the X-motor and the encoder.
10. Hang up the X-motor with bracket (1) into the X-transport belt.
11. Move the X-motor bracket (1) down and tighten both screws (2).
12. Adjust the X-transport belt (see chapter 15.2.1 on page 15-3).
13. Install the plate carrier detection sensor (see chapter 15.5.8 on page 15-20).
14. Teach the plate transport module (see chapter 20.4 on page 20-44).
15. Install the deck top (see chapter 8.3.1 on page 8-9).
16. Check the reader, incubator and washer positions (see chapter 15.6.1 on page 15-25).
17. Teach the pipetting position of the pipettor module (see chapter 20.2.5 on page 20-14).
18. Perform Plate Transport Module Test (see chapter 15.3.2 on page 15-5).

15.5.5 REPLACEMENT OF Y-MOTOR WITH ENCODER

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the deck top (see chapter 8.3.1 on page 8-9).
4. Remove both screws (2) and put down the Y-motor with bracket (1).

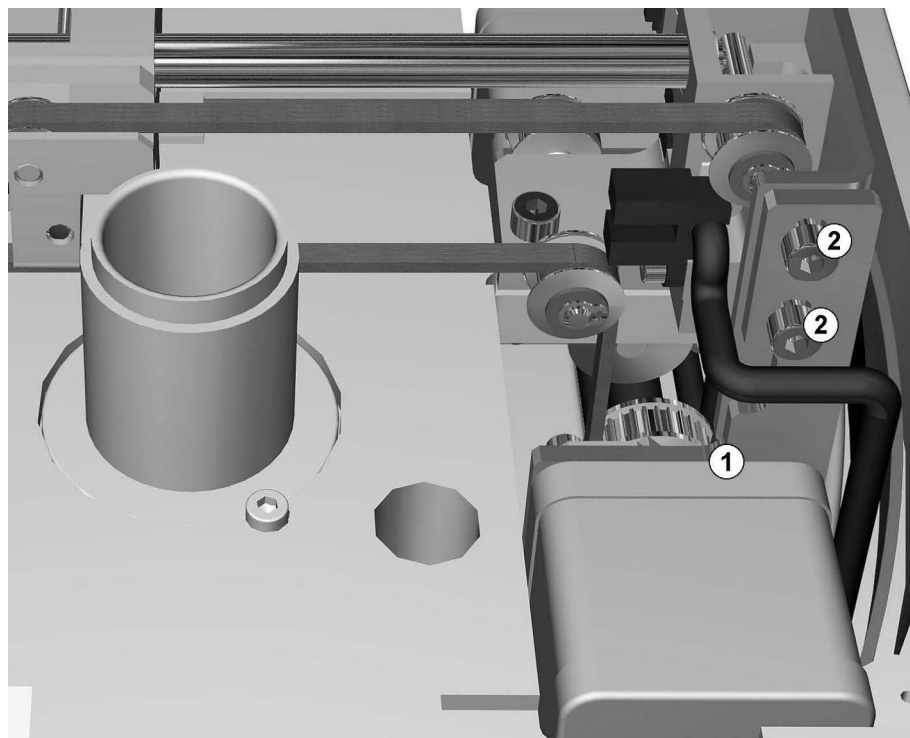


Figure 15-11: Y-motor with encoder

5. Disconnect the connectors from the Y-motor and the encoder.
6. Remove the Y-motor with bracket (1).

INSTALLATION

7. Insert the new the Y-motor with bracket (1).
8. Plug the connectors into the Y-motor and the encoder.
9. Hang up the Y-motor with bracket (1) into the Y-transport belt.
10. Move the Y-motor bracket (1) down and tighten both screws (2).
11. Adjust the Y-transport belt (see chapter 15.2.1 on page 15-3).
12. Teach the plate transport module (see chapter 20.4 on page 20-44).
13. Install the deck top (see chapter 8.3.1 on page 8-9).
14. Check the reader, incubator and washer positions (see chapter 15.6.1 on page 15-25).
15. Teach the pipetting position of the pipettor module (see chapter 20.2.5 on page 20-14).

16. Perform Plate Transport Module Test (see chapter 15.3.2 on page 15-5).

15.5.6 REPLACEMENT OF X-INIT LIGHT BARRIER

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the upper cover (see chapter 8.3.5 on page 8-14).
4. Remove the deck top (see chapter 8.3.1 on page 8-9).
5. Remove the loading bay module and turn it on its left side (see chapter 16.5.2 on page 16-11).
It is not necessary to remove the loading bay module completely!
6. Remove the retaining screw (2).

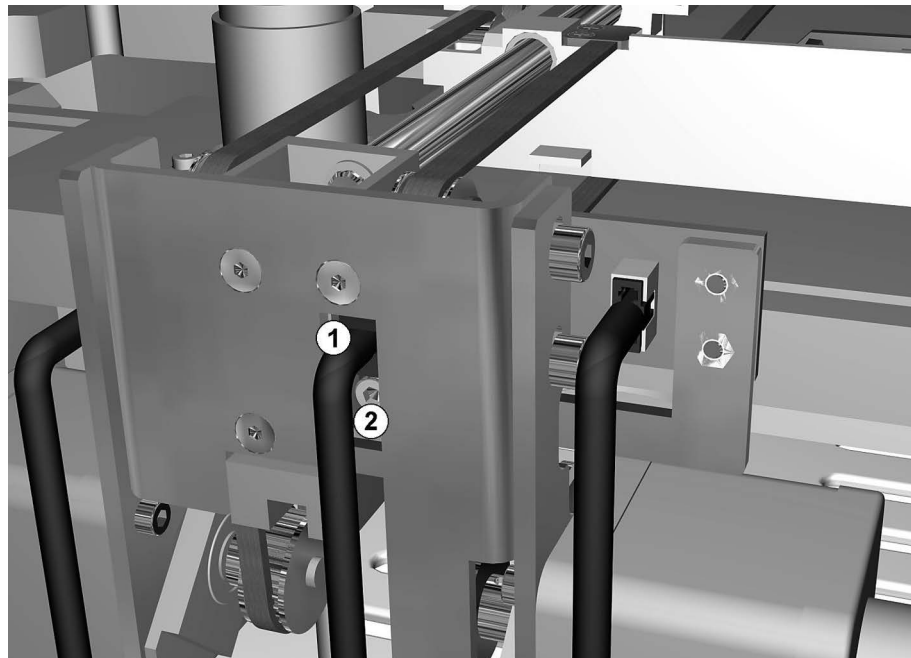


Figure 15-12: X-init light barrier (right side view)

7. Push the X-init light barrier (1) through the notch.
8. Disconnect connector ST16 from the instrument CU board (see chapter 19.2.1 on page 19-11).
9. Remove the cable from the cable clamps.
10. Remove the X-init light barrier (1).

INSTALLATION

11. Push the new X-init light barrier (1) through the notch.
12. Install the new X-init light barrier (1) upright and tighten the screw (2).
13. Plug connector ST16 into the instrument CU board (see chapter 19.2.1 on page 19-11).
14. Insert the cable into the cable clamps.
15. Install the loading bay module (see chapter 16.5.2 on page 16-11).
16. Install the upper cover (see chapter 8.3.5 on page 8-14).
17. Install the deck top (see chapter 8.3.1 on page 8-9).
18. Check the teaching of the plate transport (see chapter 20.4 on page 20-44).
19. Check the reader, incubator and washer positions (see chapter 15.6.1 on page 15-25).
20. Teach the pipetting position of the pipettor module (see chapter 20.2.5 on page 20-14).
21. Perform Plate Transport Module Test (see chapter 15.3.2 on page 15-5).

15.5.7 REPLACEMENT OF Y-INIT LIGHT BARRIER

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the upper cover (see chapter 8.3.5 on page 8-14).
4. Remove the deck top (see chapter 8.3.1 on page 8-9).
5. Remove the retaining screw (2).

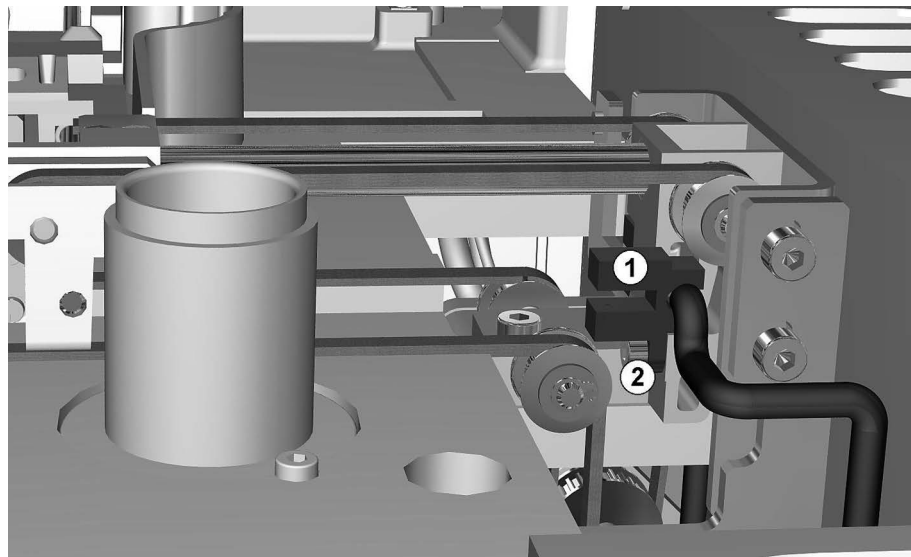


Figure 15-13: Y-init light barrier

6. Disconnect connector ST17 from the instrument CU board (see chapter 19.2.1 on page 19-11).
7. Remove the cable from the cable clamps.
8. Remove the Y-init light barrier (1).

INSTALLATION

9. Install the new Y-init light barrier (1) upright and tighten the screw (2).
10. Plug connector ST17 into the instrument CU board (see chapter 19.2.1 on page 19-11).
11. Insert the cable into the cable clamps.
12. Install the deck top (see chapter 8.3.1 on page 8-9).
13. Install the upper cover (see chapter 8.3.5 on page 8-14).
14. Check the teaching of the plate transport (see chapter 20.4 on page 20-44).
15. Check the reader, incubator and washer positions (see chapter 15.6.1 on page 15-25).
16. Teach the pipetting position of the pipettor module (see chapter 20.2.5 on page 20-14).
17. Perform Plate Transport Module Test (see chapter 15.3.2 on page 15-5).

15.5.8 REPLACEMENT OF PLATE CARRIER DETECTION SENSOR

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove both retaining screws (2).

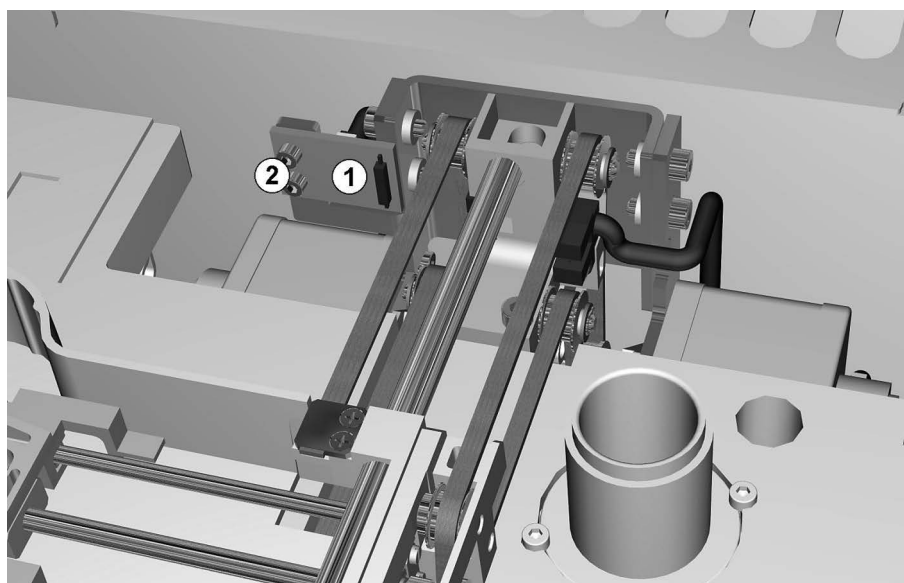


Figure 15-14: Plate carrier detection sensor (side view)

4. Disconnect the connector from the back side of the plate carrier detection sensor (1).
5. Remove the plate carrier detection sensor (1).

INSTALLATION

6. Plug the connector into the back side of the new plate carrier detection sensor (1).
7. Insert the new plate carrier detection sensor (1) and tighten both retaining screws (2).
8. Install the deck top (see chapter 8.3.1 on page 8-9).
9. Insert a plate carrier and check with the service software whether the new sensor recognizes the plate carrier.

15.6 SERVICE SOFTWARE

When the plate transport software is started, the application attempts to communicate to the instrument and plate transport module. When successful, the following dialog will be displayed with the firmware version number, and serial number displayed. Defaults such as instrument offsets will be read from the module EEPROM and shown. If no module is detected, ??? will be shown.

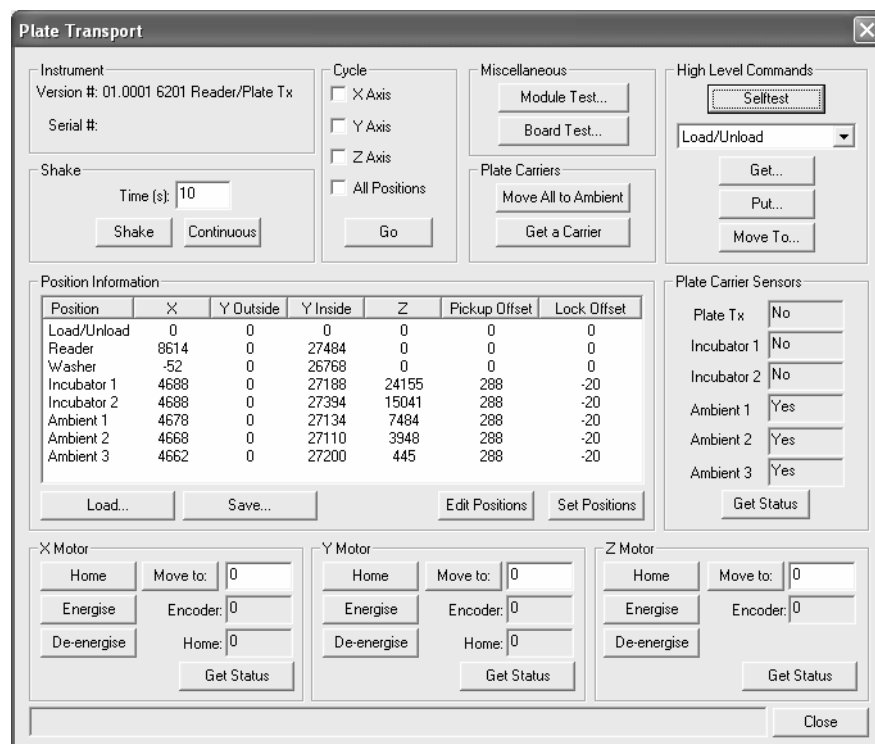


Figure 15-15: Plate Transport main dialog

INSTRUMENT

Function	Description
Version	Shows the firmware version number, if connection is established with the module.
Serial	Shows the serial number, if connection is established with the module.

Table 15-1: Functions of the Instrument area

SHAKE

Function	Description
Time	Time in seconds can be selected for individual test of shaking options of the plate transport.
Shake	Starts shaking of plate transport with set time.
Continuous	Starts continuous shaking.

Table 15-2: Functions of the Shake area

CYCLE

INFO

Notes about the cycle test:

- The user is not prompted to load a plate carrier.
- It is unwise to run X- and P-cycles together.
- 3 plate carriers are necessary to perform the cycle test.

Function	Description
X Axis/Y Axis/ Z Axis/All Positions	Each axis, X, Y, Z can be enabled for continuous cycling.
Go	Continuously cycles enable axis.

Table 15-3: Functions of the Cycle area

MISCELLANEOUS

Function	Description
Module Test	see chapter 15.6.3 on page 15-30
Board Test	see chapter 15.6.4 on page 15-31

Table 15-4: Functions of the Miscellaneous area

PLATE CARRIERS

Function	Description
Move All to Ambient	Gets all plate carriers one-by-one out of the instrument.
Get a Carrier	Gets one plate carrier out of the instrument.

Table 15-5: Functions of the Plate Carriers area

POSITION INFORMATION

There are several positions stored within the module. Each position must be taught. Double clicking the display will automatically show the **Adjust Positions** dialog (see chapter 15.6.1 on page 15-25).

Function	Description
Load	Reads positions stored in a global parameter file.
Save	Writes positions to a global parameter file.
Edit Position	see chapter 15.6.1 on page 15-25
Set Position	The coordinates will be stored into the EEPROM of the plate transport.

Table 15-6: Functions of the **Position Information** area

HIGH LEVEL COMMANDS

Function	Description
Selftest	see chapter 15.6.2 on page 15-29
Get	Using the position displayed in the drop down list box, pressing this button will get a plate carrier using the current coordinates.
Put	Using the position displayed in the drop down list box, pressing this button will put a plate carrier using the current coordinates.
Move To	Using the position displayed in the drop down list box, pressing this button will move to that position using the current coordinates.

Table 15-7: Functions of the **High Level Commands** area

PLATE CARRIER SENSORS

Function	Description
Plate Tx	Displays status of the plate in sensor of the plate transport. No displayed if empty. Yes if plate carrier detected.
Incubator 1/ Incubator 2	Displays status of the plate in sensor of the incubator boxes 1 and 2. No displayed if empty. Yes if plate carrier detected.
Ambient 1/ Ambient 2/ Ambient 3	Displays status of the plate in sensor of the ambient boxes 1 to 3. No displayed if empty. Yes if plate carrier detected.
Get Status	Updates the sensors.

Table 15-8: Functions of the **Plate Carrier Sensors** area

X/Y/Z MOTOR

Same for all drives. Each axis can be individually controlled.

Function	Description
Home	Moves to drive's home position.
Energise	Leaves coils of motor energized, therefore locking the motor.
De-energise	Leaves coils of motor de-energized, therefore unlocking the motor.
Move to	Moves to the position in the edit box. Position set in tenths of mm, i.e. 10 will move the drive 1.0 mm away from home.
Encoder	Field displays the current decoder state of the corresponding motor.
Home	Only X/Y Motor area: The value indicates the state of the drive's init/home sensor output.
Get Status	Actualizes the home position and the encode position fields.

Table 15-9: Functions of the X/Y/Z Motor areas

GENERAL

Function	Description
Close	Closes application
Command Line Display	The line at the bottom of the screen displays the devices reply.

Table 15-10: Functions

15.6.1 ADJUST POSITIONS DIALOG

Allows the user to edit and test every position. Pressing the **Edit Position** button invokes the adjust positions dialog.

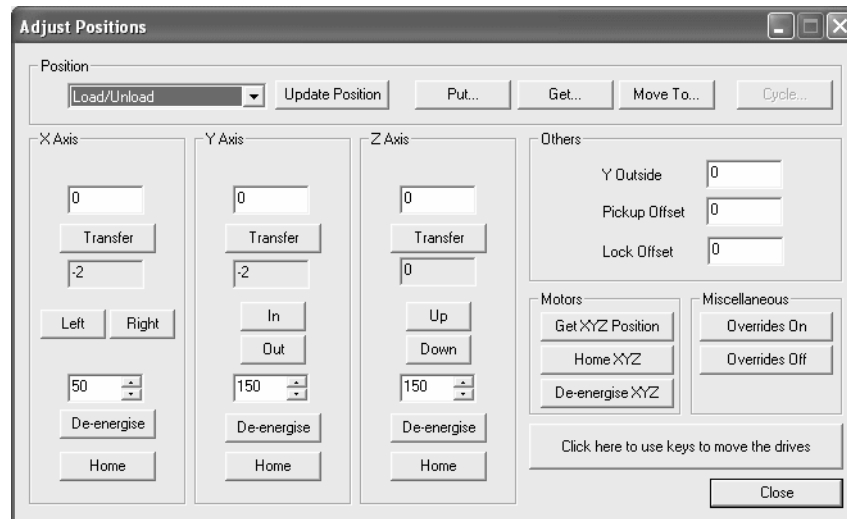


Figure 15-16: Adjust Positions dialog

INFO

Teaching procedure

See also Teaching the Plate Transport Module (see chapter 20.4 on page 20-44)

POSITION

Function	Description
Update Position	Transfers the data in the X, Y, Z, and door mechanism edit boxes to the data table and stores them in the EEPROM.
Put	Puts plate carrier into position displayed in drop down list box using the current values in the data table.
Get	Gets plate carrier from position displayed in drop down list box.
Move To	Moves to position displayed in drop down list box.
Cycle	Repeats the put and get function again and again. The cycle function can be stopped manually.

Table 15-11: Functions of the **Position** area

INFO

Activate "shake override" before loading/unloading a plate in the incubator (see **Miscellaneous** area)!

X AXIS

The first field displays the current coordinate for the position. New coordinates can be written into this field.

Function	Description
Transfer	Transfer button will update the window above the button with the contents of the gray background window.
Left	Moves left by the value in the spin box. The value is the number of steps moved relative from the current position. The new position is shown in the gray box.
Right	Moves right by the value in the spin box. The value is the number of steps moved relative from the current position. The new position is shown in the gray box.
De-energise	De-energizes or unlocks the motor. Allows the mechanism to be moved by hand.
Home	Moves to the drive's home position.

Table 15-12: Functions of the X Axis area

Y AXIS

The first field displays the current coordinate for the position. New coordinates can be written into this field.

Function	Description
Transfer	Transfer button will update the window above the button with the contents of the gray background window.
In	Moves out by the value in the spin box. The value is the number of steps moved relative from the current position. The new position is shown in the gray box.
Out	Moves in by the value in the spin box. The value is the number of steps moved relative from the current position. The new position is shown in the gray box.
De-energise	De-energizes or unlocks the motor. Allows the mechanism to be moved by hand.
Home	Moves to the drive's home position.

Table 15-13: Functions of the Y Axis area

Z AXIS

Function	Description
Transfer	Transfer button will update the widow above the button with the contents of the gray background window.
Up	Moves up by the value in the spin box. The value is the number of steps moved relative from the current position. The new position is shown in the gray box.
Down	Moves down by the value in the spin box. The value is the number of steps moved relative from the current position. The new position is shown in the gray box.
De-energise	De-energizes or unlocks the drive. Allows the Z-axis to be moved manually. A screwdriver can be used to turn the lead screw.
Home	Moves to the drive's home position.

Table 15-14: Functions of the **Z Axis** area

OTHERS

Function	Description
Y Outside	The y coordinate where plate carriers are moved outside the incubator, washer or reader. "0" in all instruments, needs not be changed.
Pickup Offset	For the incubator positions, this offset defines the X movement the plate transport sledge performs to load or unload a plate carrier. Needs not be changed.
Lock Offset	This is a small extra movement (off center) to the right performed during picking up a plate carrier. It is used to compensate for tolerances in the plate carrier guiding inside an incubator or ambient temperature slot and ensure that the plate carrier engages with an audible "click" in the plate transport sledge (spring loaded ball snaps into the sledge). The lock offset might need to be adjusted in rare cases, when the insertion of a plate carrier into a slot is correct, but the plate carrier does not fully snap into the sledge during unloading.

Table 15-15: Functions of the **Others** area

MOTORS

Function	Description
Get XYZ Position	Reports the current encoder values in the gray boxes.
Home XYZ	Drives home all axes.
De-energise XYZ	De-energizes all the drives.

Table 15-16: Functions of the **Motors** area

MISCELLANEOUS

Function	Description
Overrides On	Incubator shaking solenoids will be deactivated.
Overrides Off	Incubator shaking will stop and solenoids will be activated to allow load/unload of plates by plate transport mechanism.

Table 15-17: Functions of the Miscellaneous area

GENERAL

Function	Description
Click here to use keys to move the drivers	After activating this function, the arrow keys can be used to move the plate transport sledge for teaching. Note: The x and y coordinates can be taught by moving the belts manually. The incubator z drive must be driven by the motor, because the drive is not equipped with an encoder.
Close	Closes application

Table 15-18: Functions

15.6.2 INITIALIZATION AND SELFTEST

When **Selftest** button clicked, initialization and selftest commands are processed.

INITIALIZATION STEPS

1. Checks for EEPROM error
2. Initializes the Z-axis (if X home sensor is active - plate maybe in washer)
3. Initializes the Y-axis
4. Initializes the X-axis
5. Initializes the Y-axis again to remove tension in mechanics
6. Initializes the X-axis again to remove tension in mechanics
7. Initializes the Z-axis

If an error occurs during any test, the appropriate error response is given and the test stops (see chapter 6.2.4 on page 6-25).

Otherwise command responds with **OK**, successful command execution.

15.6.3 TEST PROCEDURE FOR MODULE TESTS

Runs the sequence of tests that verify correct operation of the plate transport module. When the **Module test** button is pressed, the following sequence is performed. The user must update the user field. This data is stored in the results file. Test modes allow for automatic sequencing through all the tests or allows the user to select and skip tests manually.

Procedure	Explanation:
Unique Identifications	The data report produced will display the user ID, input from the above dialog box, as well as the test software version.
Serial Number	The serial number to be read from the module EEPROM. If this test fails, please contact the manufacturer.
Parameters	Verifies default values stored within the EEPROM.
Plate In Sensor	Verifies the plate in sensor. Pass, if set and clear states detected.
X Motor	Pass, if 5 cycles completed without error.
Y Motor	Pass, if 5 cycles completed without error.
Z Motor	Pass, if 5 cycles completed without error.
Shake	Shakes plate carrier drive. Pass, if shake completed without error.
Selftest	Performs selftest. Pass, if selftest completes without error.
Position	Cycles the mechanism to all the positions. Positions are: Load/Unload, Washer, Reader, Incubator 1, Incubator 2, Pipette position, Ambient 1, Ambient 2, Ambient 3. Pass if 5 cycles completed without error.

Table 15-19: Module test procedures

15.6.4 TEST PROCEDURE FOR BOARD TESTS

Runs the sequence of tests that verify correct board operation. When the **Board Test** button is pressed, the following sequence is performed. The user must update the user field. This data is stored in the results file.

Test modes allow for automatic sequencing through all the tests or allows the user to select and skip tests manually.

Procedure	Explanation:
Unique Identifications	The data report produced will display the user ID, input from the above dialog box, as well as the test software version.
Serial Number	The serial number to be read from the module EEPROM. If this test fails, please contact the manufacturer.
Parameters	Verifies default values stored within the EEPROM.
Plate In Sensor	Verifies the plate in sensor. Pass, if set and clear states detected.
X Motor	Pass, if 5 cycles completed without error.
Y Motor	Pass, if 5 cycles completed without error.
Z Motor	Pass, if 5 cycles completed without error.
Shake	Shakes plate carrier drive. Pass, if shake completed without error.
Selftest	Performs selftest. Pass, if selftest completes without error.

Table 15-20: Board test procedures

Intentionally left blank.

16 LOADING BAY MODULE (RACK SYSTEM) AND COP

This chapter describes this module in detail. In the first section "Safety" additionally to the general safety notes (see chapter 1.2 on page 1-6) safety notes are specified, which concern particularly this module. The section "Overview" gives a short overview about this module. This section is followed by a larger part containing information about repair and testing of this module (sections "Check and Verification", "Troubleshooting and Repairs" and "Connections, Signals and Switches"). The last section "Service Software" describes only the service software module which only concerns this module and the COP.

16.1 SAFETY

NOTICE

Do not lean on the loading bay barcode scanner unit!

NOTICE

Handling and cleaning of optical surfaces

Improper optical surfaces (e. g. scanners, lenses, sensors) could generally degrade the quality of images, data, etc.

- Do not touch any optical surfaces.
 - Only clean the optical surfaces with a soft and lint-free cloth.
 - Do not use any aggressive detergents or solutions (e.g. acetone).
-

16.2 OVERVIEW

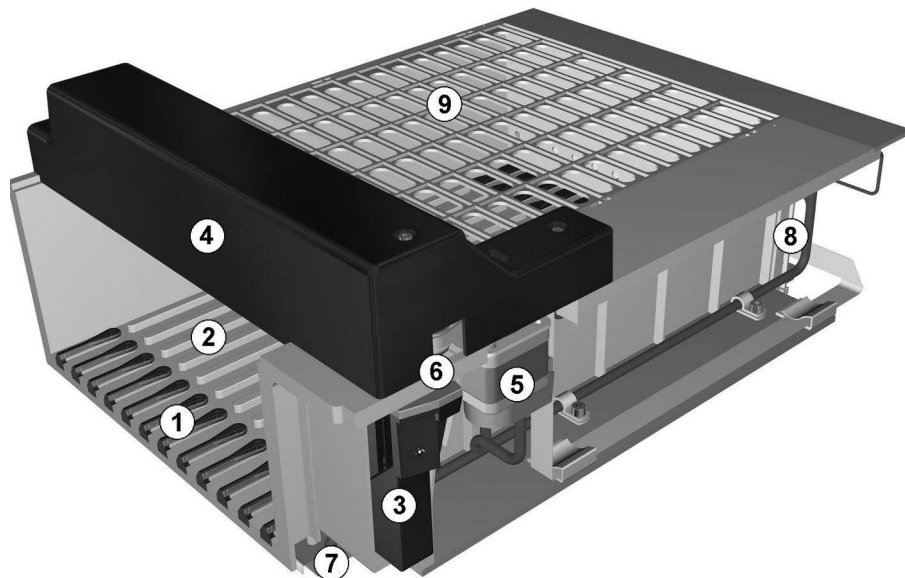


Figure 16-1: Loading bay

- | | |
|---|---|
| 1 | Rack position/status LED |
| 2 | Rack guiding rails |
| 3 | Barcode scanner |
| 4 | Barcode scanner guidance with cover |
| 5 | Barcode scanner motor with encoder |
| 6 | Barcode scanner init position light barrier |
| 7 | LED board |
| 8 | COP board |
| 9 | Loading bay grid |

16.3 ADJUSTMENT AND CALIBRATION

In this section, the adjustment of the loading bay module is described.

16.3.1 ADJUSTMENT OF BARCODE SCANNER BELT

ADDITIONAL TOOLS

- Spring balance (0 to 20 N)

CHECK



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Move the barcode scanner to its rightmost position.
4. Use the spring balance to pull the front side against rear side of the barcode scanner belt (1) in the center loading bay.

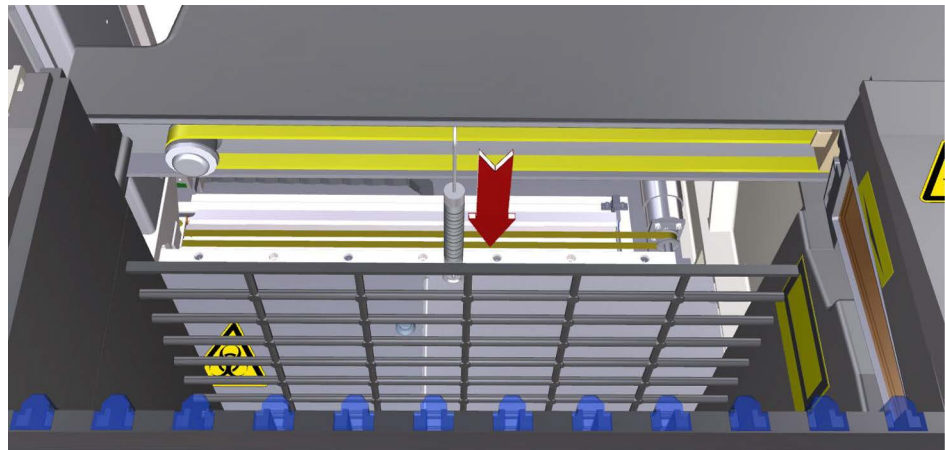


Figure 16-2: Adjustment of barcode scanner belt with spring balance

5. Note the tension of the spring balance:
 - 10 to 13 N: The tension is correct.
 - < 10 N: The tension is too low. Adjust the belt/motor (see below). Repeat the check.
 - > 13 N: The tension is too high. Adjust the belt/motor (see below). Repeat the check.

ADJUSTMENT

1. Remove the barcode scanner guidance cover (see chapter 16.5.6 on page 16-17).

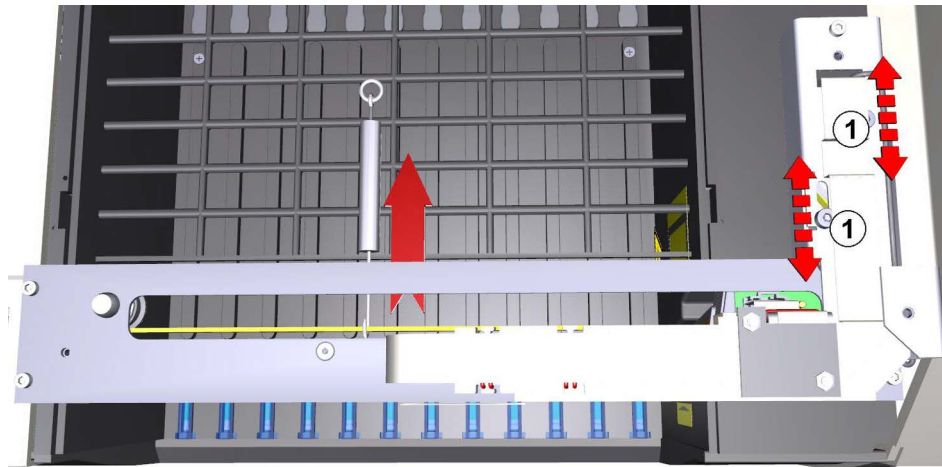


Figure 16-3: Adjustment of barcode scanner belt - motor screws

2. Loose both motor screws (1).
3. Move the motor:
 - The tension is too low. Move the motor to the rear.
 - The tension is too high. Move the motor to the front.
4. Tighten both motor screws (1).
5. Repeat the check (see above):
 - If the tension correct, install the barcode scanner guidance cover (see chapter 16.5.6 on page 16-17)
 - If the tension too low/high, repeat the adjustment.

16.4 CHECK AND VERIFICATION

In this section information about the testing of certain components can be found.

16.4.1 CHECK LOADING BAY GRID (LLD CHECK)

In order to confirm that the pipettor will never touch the loading bay grid during pipetting, it is recommended to perform the following short test run using the service software.

NOTICE

Requirements:

- The instrument must be correctly taught (see chapter 20 on page 20-1).
- The loading bay grid must be installed (see chapter 16.5.1 on page 16-9).

1. Unload all racks from the loading bay.
2. Put a tip rack containing a short tip in the rear right position into the rear tip rack position.
3. Switch on the instrument.
4. Start the service software.
The service software displays its main menu.
5. Start the pipettor service software module (see chapter 12.7 on page 12-62).
6. Press on the **Pipettor** button to open the **Pipettor** dialog (see chapter 12.7.1 on page 12-66).
7. Press on the **Left Arm** button to initialize the pipettor.
8. Press on the **Close** button to close the dialog.
9. Press on the **Coordinates** button to open the **Coordinates** dialog (see chapter 12.7.3 on page 12-72).
10. **Racks** area:
 - Select in the **Racktype** list **\$T**.
 - Enter 12 into the **Track-No** field for Track-No 00 to 11.
 - Press on the **Add** button.
11. **μPlates** area:
 - Select in the **Platetype** list **8x12** or **Tips**.
 - Enter 3 into the **Position** field for Position 00 to 02.
 - Press on the **Add** button.
12. Press on the **OK** button to close the dialog.
13. Press on the **Pipettor** button to open the **Pipettor** dialog (see chapter 12.7.1 on page 12-66).
14. Enter 775 in the **Position-Nr.** field in the **Absolute Movement (XY only)** area.
15. Press on the **Move** button in order to move the pipettor to the tip position.
16. Select **Short Tips** in the **Disposable Tips** area.

17. Press on the **Pickup** button.
18. Press on the **OK** button to close the dialog.
19. Press on the **Level Sensor** button to open the **Level Sensor** dialog (see chapter 12.7.6 on page 12-77).
20. As coordinates select in the **Coordinates** area all entries from Group 6 (No. 391-758). They will appear in the **Results** field on the right.
21. Load sample racks with tubes filled with water.
22. Press on the **Start Level Test** button. The instrument will now start to search for LLD in all loading bay positions.

RESULT

23. This test run must finish without errors. After the test run is finished, scroll down the whole **Results** field and check if all LLD results are negative (all line show a 0 in the **#pos** column and a 1 in the **#neg** column).
In case the run did not pass without errors, or the results show a positive LLD signal somewhere in the loading bay, the straightness of the loading bay and the grid must be checked. The loading bay must be replaced.

SAVE RESULTS

24. Press on the **Write to File** button to save the results into a file (e. g. file name: LLD000000.txt).

CLOSE SERVICE SOFTWARE

25. Press on the **OK** button to close the dialog.
26. Press on the **Close** button to close the pipettor service software module.
27. Press on the **Terminate Program** button to close the service software.

16.4.2 PERFORM LOADING BAY MODULE TEST

1. Switch on the instrument.
2. Start the service software (see chapter 7.1 on page 7-1).
3. Start the loading bay service software module (see chapter 16.6 on page 16-23).
4. Press on the **Selftest** button to initialize the module and start the selftest (see chapter 16.6.1 on page 16-27).
5. Press on the **Module Test** button and follow the instructions (see chapter 16.6.2 on page 16-28).

16.4.3 PERFORM COP MODULE TEST

1. Switch on the instrument.
2. Start the service software (see chapter 7.1 on page 7-1).
3. Start the COP service software module (see chapter 16.7 on page 16-29).
4. Press on the **Selftest** button to initialize the module and start the selftest (see chapter 16.7.1 on page 16-32).
5. Press on the **Module Test** button and follow the instructions (see chapter 16.7.2 on page 16-33).

16.4.4 CHECK BARCODE SCANNER

WARNING



Eye injuries due to laser radiation

Laser radiation cause eye injuries when you look into the laser beam.

- Never look directly into the laser beam!
- Do not use optical devices (e.g. mirror).
- Take off watches and mirroring jewelry before operating the laser.
- Be careful during operation and testing the laser of the barcode scanner. A class 2 laser is used.
- Note that the wrong usage of operating elements or of adjustments or the non-observance of processes can cause a dangerous emission of laser radiation.

1. Switch on the instrument.
2. Start the service software (see chapter 7.1 on page 7-1).
3. Start the loading bay service software module (see chapter 16.6 on page 16-23).
4. Press on the **Selftest** button to initialize the module and start the selftest (see chapter 16.6.1 on page 16-27).
5. Select lane 1 in the **Rack Position** field.
6. Press on the **Auto Load** button (see chapter 16.6 on page 16-23).
7. Insert a rack with barcoded tubes.
8. Press on the **Read Barcodes** button.
9. Check the displayed barcodes.
If there are problems:
 - Check tube barcodes
 - Check barcode scanner configuration
10. Remove the rack.
11. Repeat the steps for lane 6 and lane 12.

16.5 TROUBLESHOOTING AND REPAIRS

This section contains instructions for the repair of individual components of the loading bay module. After several repair works it is required that the individual components are readjusted. Follow the instructions in the individual sections.

16.5.1 REPLACEMENT OF LOADING BAY GRID

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Move the loading bay grid (1) to the front side.



Figure 16-4: Loading bay grid of the loading bay

4. Lift the loading bay grid (1) off.

INSTALLATION

5. Insert the loading bay grid (1) in the notches.
6. Push the loading bay grid (1) to the rear side.
7. Check loading bay grid (LLD check) after teaching (see chapter 16.4.1 on page 16-5).

16.5.2 REPLACEMENT OF LOADING BAY

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the deck top (see chapter 8.3.1 on page 8-9).
4. Remove the loading bay grid (see chapter 16.5.1 on page 16-9).
5. Disconnect connector ST23 (ambient temperature sensor) from the COP board (see chapter 19.9.1 on page 19-27).
6. Open both retaining screws (2).
Do not remove the screws completely!

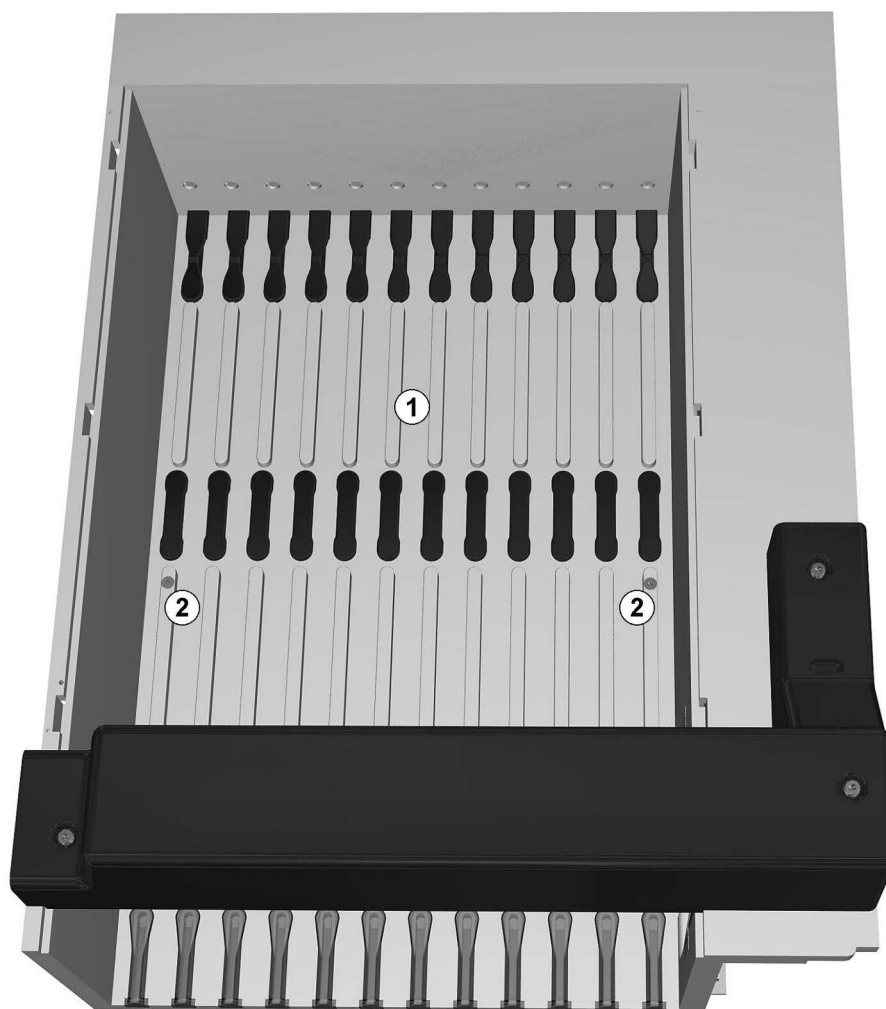


Figure 16-5: Loading bay

7. Move the barcode scanner a little to the left.
8. Lift the loading bay (it is held by two additional adjustment pins), then push the loading bay (1) to the back and lift it off.

INFO

Connection of the door locking magnet: Use ST9 only for COP firmware 01.0101 and above, otherwise use ST12 (see chapter 19.9.1 on page 19-27).

9. Disconnect the connectors ST2, ST4, ST9 (or ST12), ST17, and ST25 from the COP board (see chapter 19.9.1 on page 19-27).
10. Remove the loading bay (1).

INSTALLATION

11. Move the barcode scanner to the left.
12. Insert the loading bay (1).

INFO

Connection of the door locking magnet: Use ST9 only for COP firmware 01.0101 and above, otherwise use ST12 (see chapter 19.9.1 on page 19-27).

13. Plug the connectors ST2, ST4, ST9 (or ST12), ST17, and ST25 into the COP board (see chapter 19.9.1 on page 19-27).
14. Insert the loading bay (1) into the screws (2) and push it to the front.
15. Make sure that it is inserted correctly in the adjustment pins, so that it is parallel to the pipettor arm and the deck top.
16. Tighten both retaining screws (2).
17. Plug connector ST23 (ambient temperature sensor) into the COP board (see chapter 19.9.1 on page 19-27).
18. Check the barcode scanner belt (see chapter 16.3.1 on page 16-3).
19. Install the loading bay grid (see chapter 16.5.1 on page 16-9).
20. Install the deck top (see chapter 8.3.1 on page 8-9).
21. If you have changed the COP board, it is necessary to check/change the COM-port configuration (see chapter 16.5.4 on page 16-14).
22. Perform Complete Firmware Update with Instrument Setup (Pipettor Version 3) (see chapter 21.1 on page 21-1).
23. Teach the complete pipetting system (see chapter 20.2 on page 20-2).
24. Check loading bay grid (LLD check) after teaching (see chapter 16.4.1 on page 16-5).
25. Perform COP Module Test (see chapter 16.4.3 on page 16-7).

16.5.3 REPLACEMENT OF COP BOARD

REMOVAL

1. Remove the loading bay (see chapter 16.5.2 on page 16-11).
2. Disconnect all connectors from the COP board (see chapter 19.9.1 on page 19-27).

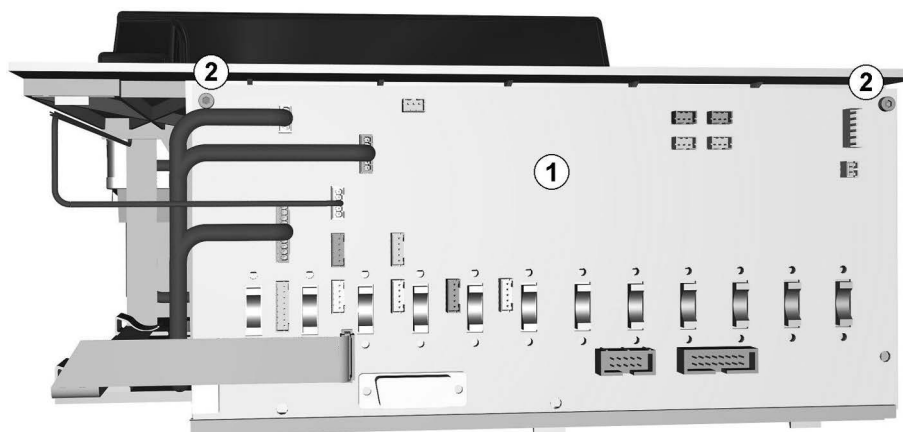


Figure 16-6: Backside of the loading bay

3. Remove the two retaining nuts (2) and the grounding cable on the right side.
4. Replace the COP board (1).

INSTALLATION

INFO

Check the COM-port configuration! If necessary, change the COM-port configuration (see chapter 16.5.4 on page 16-14).

5. Install the new COP board (1). Push the lower side into the notch.
6. Tighten the two retaining nuts (2). Do not forget to install the grounding cable on the right side.
7. Plug all connectors into the COP board (see chapter 19.9.1 on page 19-27).
8. Install the loading bay (see chapter 16.5.2 on page 16-11).
9. Perform Complete Firmware Update with Instrument Setup (Pipettor Version 3) (see chapter 21.1 on page 21-1).
10. Check the complete module with the service software (see chapter 16.6 on page 16-23 and chapter 16.7 on page 16-29).

16.5.4 CONFIGURATION OF USED COM-PORT

DRIVER INSTALLATION

1. Switch on the instrument.
The operation system detects new hardware and starts the **New Hardware Wizard** dialog to install the new driver.



Figure 16-7: New Hardware Wizard dialog

2. Select the **No, not this time** option.
3. Press on the **Next** button.
The operation system shows the next wizard dialog.
4. Select the **Install the software automatically** option.
5. Press on the **Next** button.
The operation system shows a warning message.
6. Press on the **Continue Anyway** button.
The operation system shows the last wizard dialog.
7. Press on the **Finish** button.
The operation system detects new hardware again.
8. Repeat the described steps for the new hardware for all drivers.
9. After the message **Found New Hardware: Your new hardware is installed and ready to use** in the right corner, you must check/change the COM-port configuration.

COM-PORT CONFIGURATION

1. Start the device manager:
 - Press on the Windows **Start** button.
 - Select the menu entry **Control Panel**.
 - Press on the **System** icon.
2. If the **Device Manager** is shown, press on the **+** sign next to the **Ports (COM & LPT)** entry.

The following procedure is only necessary, if the COM-port (x) is not COM3:

3. Double-click on the **GEMINI (COMx)** entry.
4. Select the **Port Settings** tab in the **Properties** dialog.

5. Press on the **Advanced** button.

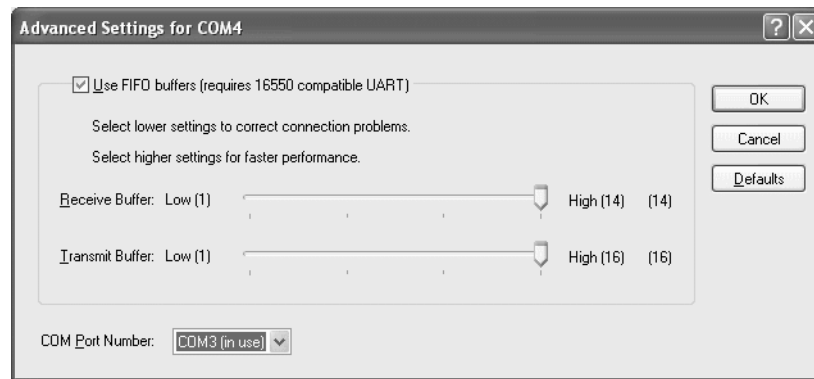


Figure 16-8: Advanced Settings dialog

6. Select in the **COM Port Number** list the entry **COM3** or **COM3 (in use)**.
7. If you select **COM3 (in use)**, the operating systems shows a information message. Press on the **Yes** button.
8. Press in the **Advanced Settings** dialog on the **OK** button.
9. Press in the **Properties** dialog on the **OK** button.
10. Close the **Device Manager**.

16.5.5 REPLACEMENT OF LED BOARD

REMOVAL

1. Remove the loading bay (see chapter 16.5.2 on page 16-11).
2. Remove the three retaining nuts (2).
3. Disconnect the connector ST1 from the LED board (see chapter 19.9.2 on page 19-30).

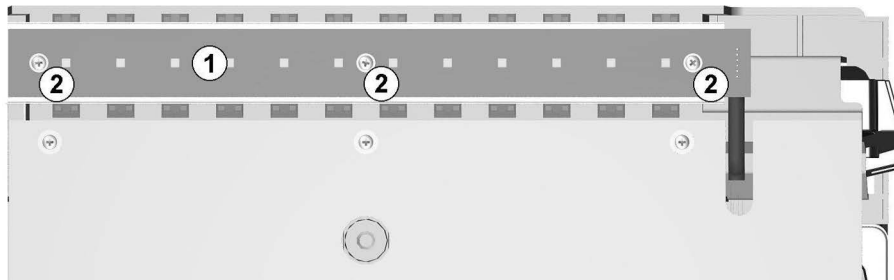


Figure 16-9: Bottom side of the loading bay

4. Replace the LED board (1).

INSTALLATION

5. Install the new LED board (1).
6. Plug the connector ST1 into the LED board (see chapter 19.9.2 on page 19-30).
7. Tighten the three retaining nuts (2).
8. Install the loading bay (see chapter 16.5.2 on page 16-11).

16.5.6 REPLACEMENT OF BARCODE SCANNER GUIDANCE COVER

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the three retaining screws (1).
4. Remove the barcode scanner guidance cover (2).

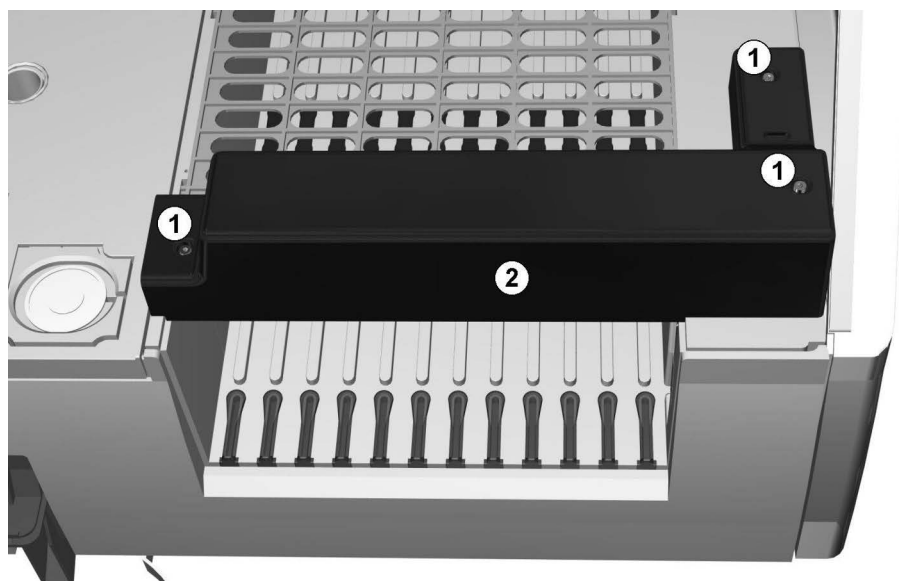


Figure 16-10: Installed loading bay

INSTALLATION

5. Install the barcode scanner guidance cover (2).
6. Tighten the three retaining screws (1).

16.5.7 REPLACEMENT OF BARCODE SCANNER

REMOVAL

1. Remove the barcode scanner guidance cover (see chapter 16.5.6 on page 16-17).
2. Move the barcode scanner (3) into the middle of the loading bay.
3. Disconnect the high flex cable (4) from the barcode scanner (3).

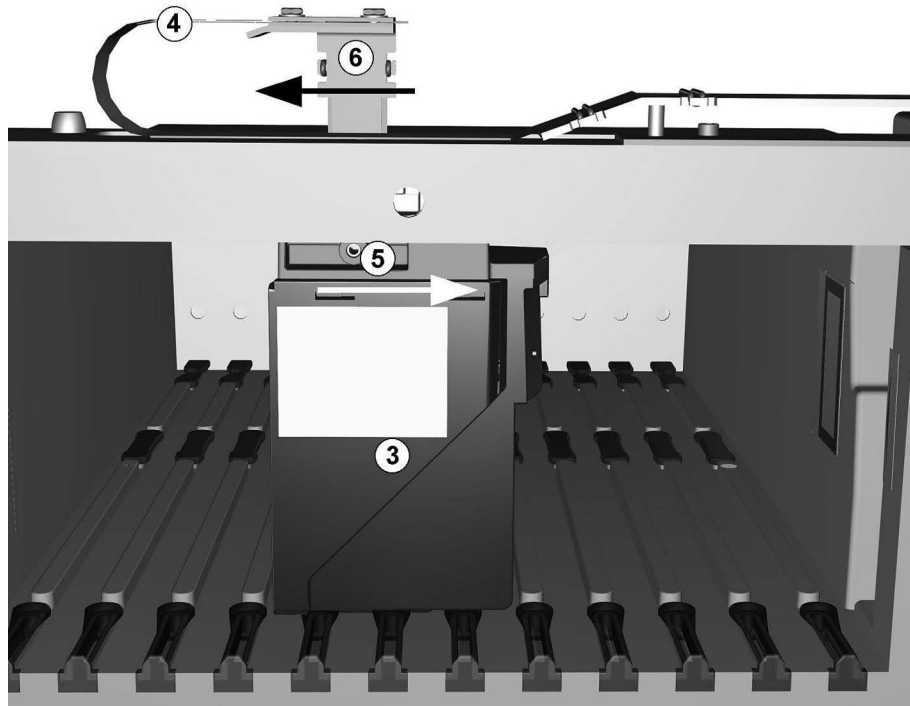


Figure 16-11: Moved barcode scanner

4. Drive one of the retaining screws into the bolt (5).
5. Pull the bolt (5) with screw out of the holder (6).
6. Push the barcode scanner (3) and the holder (6) towards each other (see arrows).
7. Remove the barcode scanner (3).

INSTALLATION

8. Install the new barcode scanner (3) on the holder (6).
9. Press the bolt (5) with screw into the holder (6).
10. Remove the retaining screw from the bolt (5).
11. Plug the high flex cable (4) into the barcode scanner (3).
12. Install the barcode scanner guidance cover (see chapter 16.5.6 on page 16-17).
13. Check the barcode scanner (see chapter 16.4.4 on page 16-8).

16.5.8 REPLACEMENT OF BARCODE SCANNER MOTOR WITH ENCODER

REMOVAL

1. Remove the loading bay (see chapter 16.5.2 on page 16-11).
2. Remove the barcode scanner guidance cover (see chapter 16.5.6 on page 16-17).
3. Disconnect both cables from the motor (1) and the encoder (2).

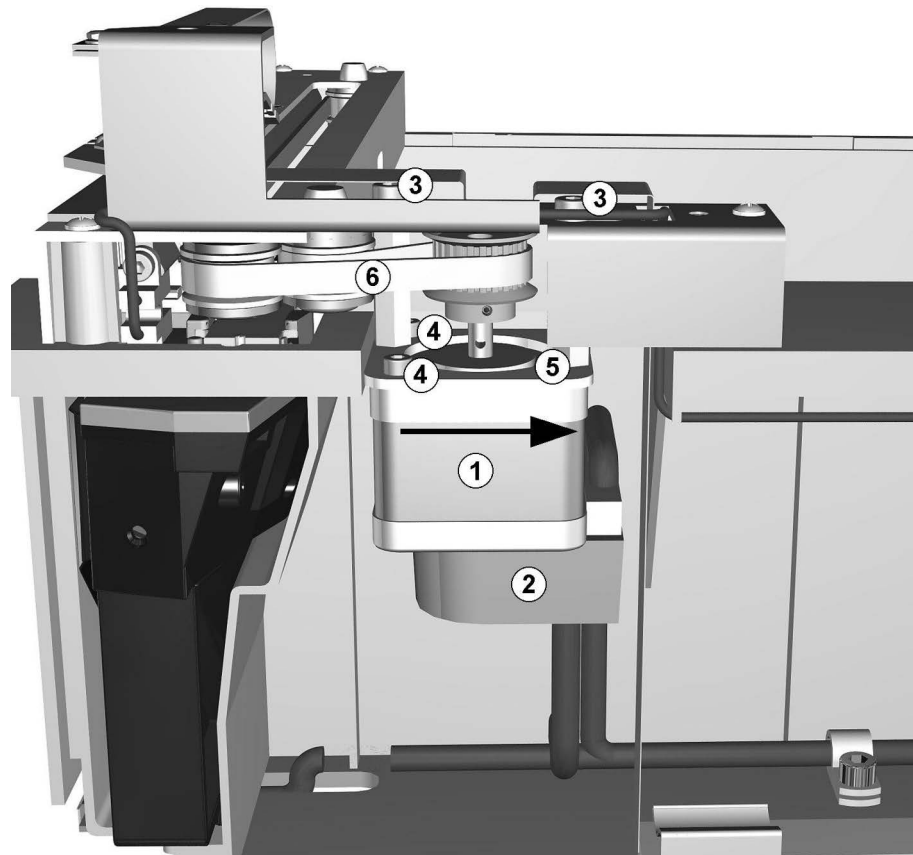


Figure 16-12: Installed motor

4. Remove both retaining screws (3).
5. Remove the motor (1) with encoder (2) and bracket (5).
6. Remove the screws (4).
7. Remove the motor (1) with encoder (2).

INSTALLATION

8. Install the new motor (1) with encoder (2) on the bracket (5).
9. Tighten the screws (4).
10. Install the motor (1) with encoder (2) and bracket (5).
11. Push the bracket (5) to the rear side of the loading bay (see arrow) and tighten both retaining screws (3).
12. Install the barcode scanner guidance cover (see chapter 16.5.6 on page 16-17).
13. Adjust the barcode scanner belt (see chapter 16.3.1 on page 16-3).
14. Check the barcode scanner (see chapter 16.4.4 on page 16-8).

16.5.9 REPLACEMENT OF BARCODE SCANNER BELT

REMOVAL

1. Remove the loading bay (see chapter 16.5.2 on page 16-11).
2. Remove the barcode scanner guidance cover (see chapter 16.5.6 on page 16-17).
3. Lose both motor (1) retaining screws (2).

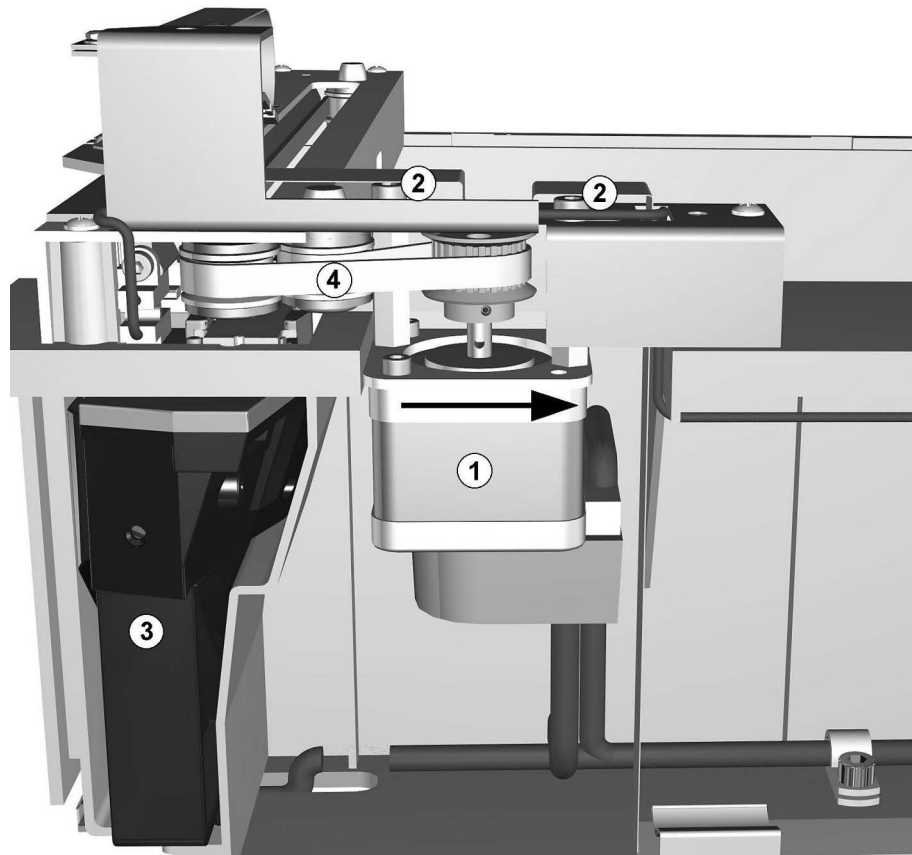


Figure 16-13: Installed belt

4. Move the barcode scanner (3) into the middle of the loading bay.
5. Pull both ends of the belt (4) out of the holder (5).

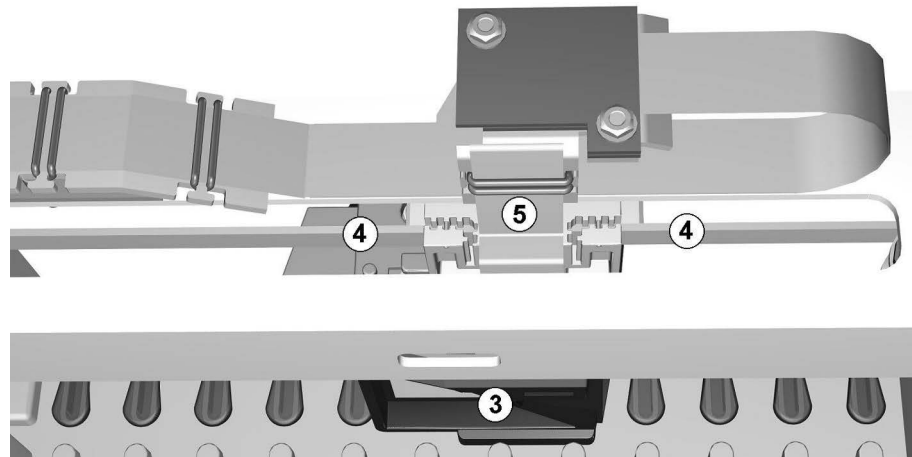


Figure 16-14: Belt on the barcode scanner holder

6. Remove the belt (4).
7. Insert the new belt (4).

INSTALLATION

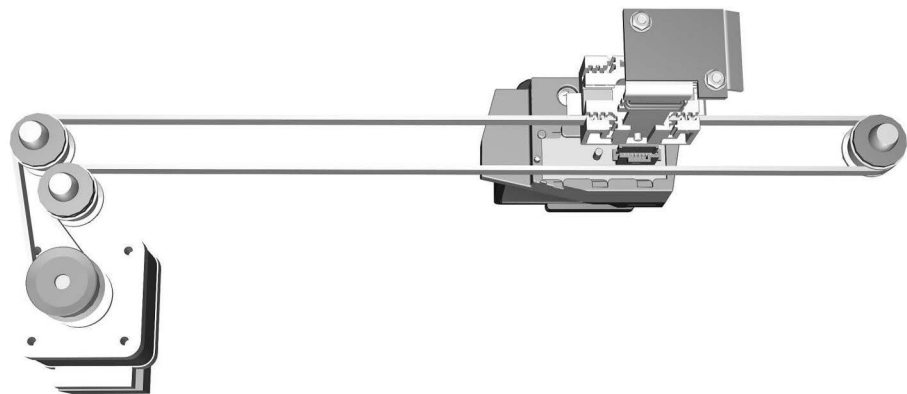


Figure 16-15: Belt guidance

8. Push the both ends of the belt (4) into the holder (5).
9. Push the bracket of the motor (1) to the rear side of the loading bay (see arrow) and tighten both retaining screws (2).
10. Install the barcode scanner guidance cover (see chapter 16.5.6 on page 16-17).
11. Install the loading bay (see chapter 16.5.2 on page 16-11).
12. Adjust the barcode scanner belt (see chapter 16.3.1 on page 16-3).
13. Check the barcode scanner (see chapter 16.4.4 on page 16-8).

16.5.10 REPLACEMENT OF INIT POSITION LIGHT BARRIER

REMOVAL

1. Remove the loading bay (see chapter 16.5.2 on page 16-11).
2. Remove the barcode scanner guidance cover (see chapter 16.5.6 on page 16-17).
3. Disconnect the connector ST11 from the COP board (see chapter 19.9.1 on page 19-27).
4. Remove the retaining screw (1).

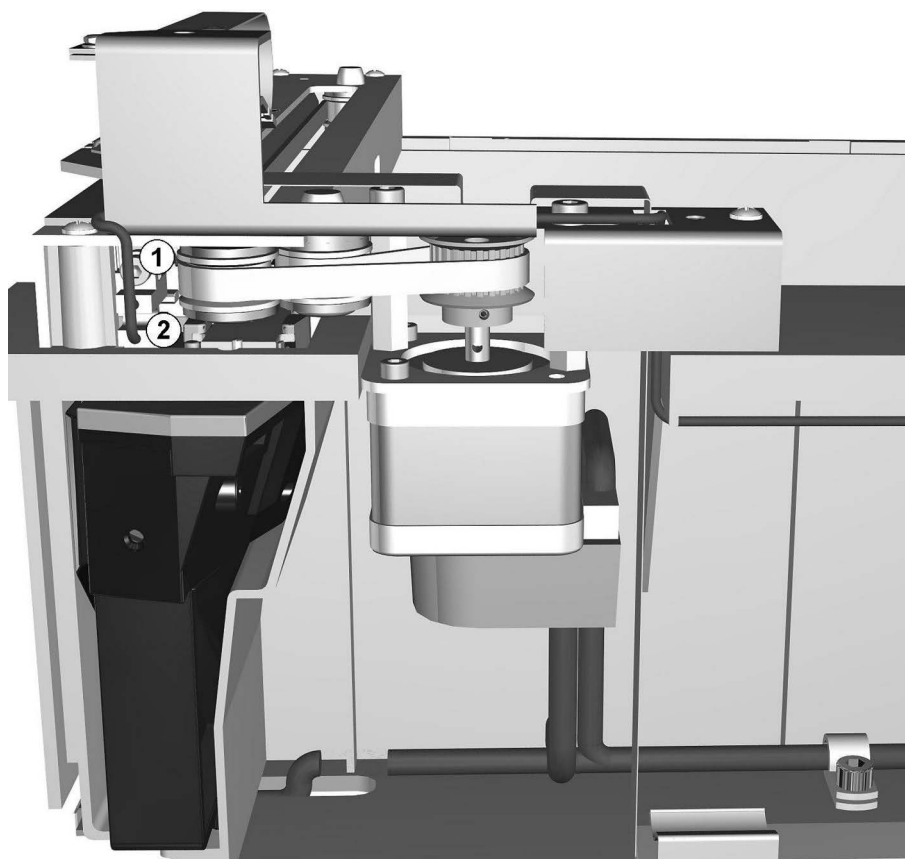


Figure 16-16: Installed light barrier

5. Remove the light barrier (2).

INSTALLATION

6. Install the new light barrier (2).
7. Tighten the retaining screw (1).
8. Plug the connector ST11 into the COP board (see chapter 19.9.1 on page 19-27).
9. Install the barcode scanner guidance cover (see chapter 16.5.6 on page 16-17).
10. Install the loading bay (see chapter 16.5.2 on page 16-11).
11. Check the barcode scanner (see chapter 16.4.4 on page 16-8).

16.6 SERVICE SOFTWARE

When the loading bay software is started, the application attempts to communicate to the instrument and loading bay module. When successful the following dialog will be displayed with the firmware version number, and serial number displayed. Barcode options will be read from the module EEPROM and shown. If no module is detected, nothing will be shown for the firmware version number.

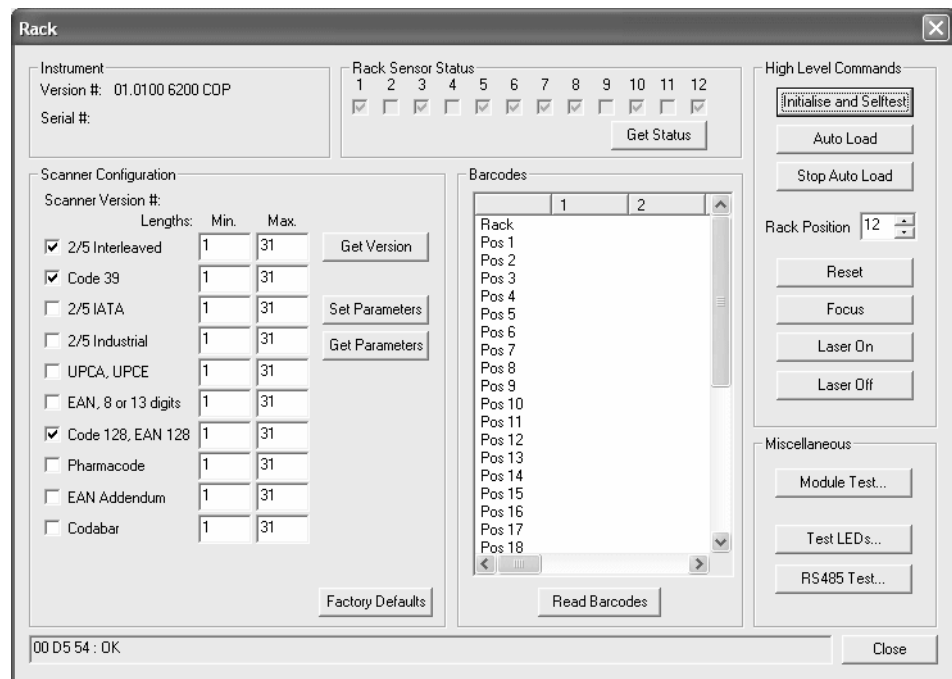


Figure 16-17: Rack main dialog

INSTRUMENT

Function	Description
Version	Shows the firmware version number, if connection is established with the module.
Serial	Shows the serial number, if connection is established with the module.

Table 16-1: Functions of the Instrument area

RACK SENSOR STATUS

Function	Description
1 - 12	Each of the twelve check boxes indicate the status of the corresponding rack position. Checked means occupied.
Get Status	Updates the status for the rack sensors, door sensor and trigger.

Table 16-2: Functions of the Rack Sensor Status area

SCANNER CONFIGURATION

Function	Description
Scanner Version	Shows the scanner version number.
Barcodes	To enable specific barcode types (e. g. 2/5 Interleaved, Code 39 etc.) check the appropriate boxes (see note). For the most reliable operation only enable barcodes actually used.
Get Version	Retrieves and displays the firmware version of the barcode scanner.
Set Parameters	Sends the enabled barcode types to the scanner.
Get Parameters	Returns scanner configuration, barcode types enabled and default horizontal rack settings.
Factory Defaults	Resets the barcode scanner to the factory defaults. This function is normally not needed.

Table 16-3: Functions of the Scanner Configuration area

INFO

A maximum of 8 barcode types can be enabled. This configuration does effect the configuration when using the PC software to run the instrument.

Default barcodes:

Barcode	Length (Min. to Max.)
2/5 Interleaved	1 to 31
Code 39	1 to 31
Code 128, EAN 128	1 to 31
Codabar	1 to 31

Table 16-4: Default barcodes

BARCODES

Displays the barcodes read for all the rack positions.

Function	Description
Read Barcodes	Reads the barcodes currently read within the instrument.

Table 16-5: Functions of the **Barcodes** area

HIGH LEVEL
COMMANDS

Function	Description
Initialize and Selftest	see chapter 16.6.1 on page 16-27
Auto Load	Starts the auto load sequence. The value in the Rack Position field sets the starting rack position. Auto load mode is used, so that the user can quickly load a selection of sample racks without the need for control from the PC. This allows racks to be loaded. The barcodes can be read later using the read barcodes button. Note that auto load mode should be stopped before trying to send other commands to the rack by pressing the Stop Auto Load button.
Stop Auto Load	Stops the auto load sequence. The rack will be returned to the idle state.
Rack Position	The value sets the starting rack position.
Reset	The scanner will be initialized.
Focus	Sets laser focus to current rack position.
Laser On	Turns on the laser of the scanner.
Laser Off	Turns off the laser of the scanner.

Table 16-6: Functions of the **High Level Commands** area

MISCELLANEOUS

Function	Description
Module Test	see chapter 16.6.2 on page 16-28
Test LEDs	Performs the LED test. This will illuminate each LED for a short period of time starting at position 1 on the left of the rack.
RS485 Test	Performs the RS485 test. Performs a loop back test on the RS485 communications link. This does not check that the scanner is functioning!

Table 16-7: Functions of the **Miscellaneous** area

GENERAL

Function	Description
Close	Closes application
Command Line Display	The line at the bottom of the screen displays the devices reply.

Table 16-8: Functions

16.6.1 INITIALIZATION AND SELFTEST

Sends the commands to the rack scanner to initialize and execute its selftest. Resets the laser scanner barcode. The rack barcode scanner is initialized ready for use during rack loading. This command can take over 30 seconds to complete.

INITIALIZATION STEPS

1. Initialize barcode scanner
2. Scanner focused at position 0.
3. Scanner focused at position 11.
4. Laser turned on.
5. Laser turned off.

The response will contain any error messages.

This command must be sent before the scanner can be used for any rack loading operations.

16.6.2 TEST PROCEDURE FOR MODULE TESTS

Performs a sequence of tests to verify the rack module. When the **Module Test** button is pressed, the following sequence is performed. The user must update the user field, this data is stored in the results file.

Test modes allow for automatic sequencing through all the tests or allows the user to select and skip tests manually.

Procedure	Explanation:
Unique Identifications	The data report produced will display the user ID, input from the above dialog box, as well as the test software version.
Serial Number	The serial number to be read from the module EEPROM. If this test fails, please contact the manufacturer.
Rack LEDs	Tests each LED is working correctly.
Rack Sensors	Checks that each rack sensor is working.
Rack RS485	Performs a loop back test on the barcode scanner RS485 link. No external connection is required for this test.
Rack Scanner Communications	Checks the BCL148 is communicating by obtaining it's firmware version.
Scanner Configuration	Not available
Selftest	Performs the selftest.

Table 16-9: Module test procedures

16.7 SERVICE SOFTWARE OF THE COP MODULE

When the COP module software is started, the application attempts to communicate to the instrument and COP module. When successful the **COP** dialog will be displayed with the firmware version number and serial number. If no module is detected, nothing will be shown for the firmware version number and serial number.

INSTRUMENT

Function	Description
Version	Shows the firmware version number, if connection is established with the module.
Serial	Shows the serial number, if connection is established with the module.

Table 16-10: Functions of the **Instrument** area

HIGH LEVEL COMMANDS

Function	Description
Selftest	see chapter 16.7.1 on page 16-32

Table 16-11: Functions of the **High Level Commands** area

MISCELLANEOUS

Function	Description
Module Test	See chapter 16.7.2 on page 16-33
Board Test	See chapter 16.7.3 on page 16-34
Load Parameters	Not used for service.
Save Parameters	Not used for service.

Table 16-12: Functions of the **Miscellaneous** area

INSTRUMENT COVER

Function	Description
Open	The check box indicates the status of the cover sensor, checked means cover open. The check box is only updated after pressing Lock or Unlock .
Lock	Locks the cover, the open status is updated. The cover lock can only be activated when the cover sensor detects that the cover is closed. If the instrument cover opened, the error message Instrument Cover Error: 01 is shown in the command line.
Unlock	Unlocks the instrument cover, the open status is updated.

Table 16-13: Functions of the Instrument Cover area

AMBIENT TEMPERATURE

Function	Description
Thermistor	Temperature of the ambient temperature sensor. The user software controls the instrument temperature with this sensor.
Get Status	Updates the temperature value in the fields Rack and Thermistor .

Table 16-14: Functions of the Ambient Temperature area

RACK

Function	Description
1 - 12	Each of the twelve check boxes indicate the status of the corresponding rack position. Checked means occupied.
Scanner Version	Shows the scanner firmware version number.
Get Status	Updates the status for the rack and door sensors.
Get Version	Retrieves and displays the scanner firmware version number.
Test LED	Tests operation of the rack indicator LEDs.

Table 16-15: Functions of the Rack area

IFA SENSORS

Function	Description
Bay Sensor	The check box indicates the status of the bay sensor, checked means the IFA bay is available. The check box is only updated after pressing Get Status .
Wash Buffer White	The check box indicates the status of the wash buffer sensor of the white channel, checked means the bottle sensor is connected. The check box is only updated after pressing Get Status .
Wash Buffer Green	The check box indicates the status of the wash buffer sensor of the green channel, checked means the bottle sensor is connected. The check box is only updated after pressing Get Status .
Get Status	Updates the status for the IFA sensors.

Table 16-16: Functions of the IFA Sensors area

GENERAL

Function	Description
Close	Closes application
Command Line Display	The line at the bottom of the screen displays the devices reply.

Table 16-17: Functions

16.7.1 INITIALIZATION AND SELFTEST

Initialize and perform the selftest.

INITIALIZATION STEPS

1. Checks for EEPROM error
2. Check ambient sensor in range

If an error occurs during any test, the appropriate error response is given and the test stops.

16.7.2 TEST PROCEDURE FOR MODULE TEST

Runs the sequence of tests that verify correct operation of the COP module. When the **Module Test** button is pressed, the following sequence is performed. The user must update the user field, this data is stored in the results file.

Test modes allow for automatic sequencing through all the tests or allows the user to select and skip tests manually.

Procedure	Explanation:
Unique Identification	The data report produced will display the user ID, input from the above dialog, as well as the test software version.
Serial Number	The serial number to be read from the module EEPROM. If this test fails, please contact the manufacturer.
Parameter	Verifies default values stored within the EEPROM.
Selftest	Performs selftest.
Instrument Cover Sensor	Tests the instrument cover sensor.
Instrument Cover Lock	Tests the instrument cover lock mechanism.
Rack RS485	Loop back test on RS485 communication link.
Rack Scanner Communications	Reads scanner firmware version.
Rack LEDs	Flashes each rack LED.
Rack Sensors	Tests each rack sensor.
Ambient Sensor	Tests the ambient sensor.
Buzzer	Tests instrument buzzer.

Table 16-18: Module test procedures

16.7.3 TEST PROCEDURE FOR BOARD TEST

Runs the sequence of tests that verify correct operation of the COP board. When the **Board Test** button is pressed, the following sequence is performed. The user must update the user field, this data is stored in the results file.

Test modes allow for automatic sequencing through all the tests or allows the user to select and skip tests manually.

Procedure	Explanation:
Unique Identification	The data report produced will display the user ID, input from the above dialog, as well as the test software version.
Serial Number	The serial number to be read from the module EEPROM. If this test fails, please contact the manufacturer.
Parameter	Verifies default values stored within the EEPROM.
Selftest	Performs selftest.
Instrument Cover Sensor	Tests the instrument cover sensor.
Instrument Cover Lock	Tests the instrument cover lock mechanism.
Rack RS485	Loop back test on RS485 communication link.
Rack Scanner Communications	Reads scanner firmware version.
Rack LEDs	Flashes each rack LED.
Rack Sensors	Tests each rack sensor.
Ambient Sensor	Tests the ambient sensor.
Buzzer	Tests instrument buzzer.

Table 16-19: Board test procedures

17 WASHER AND PUMPS MODULE

This chapter describes this module in detail. In the first section "Safety" additionally to the general safety notes (see chapter 1.2 on page 1-6) safety notes are specified, which concern particularly this module. The section "Overview" gives a short overview about this module. The section "Tips and Information" gives tips and information for the handling. This section is followed by a larger part containing information about maintenance, repair and testing of this module (sections "Adjustment and Calibration", "Check and Verification", "Maintenance", "Troubleshooting and Repairs" and "Connections, Signals and Switches"). The last section "Service Software" describes only the service software module which only concerns this module.

17.1 SAFETY

NOTICE

Avoid kinks in the tubings during the installation!

17.2 OVERVIEW

17.2.1 WASHER MODULE

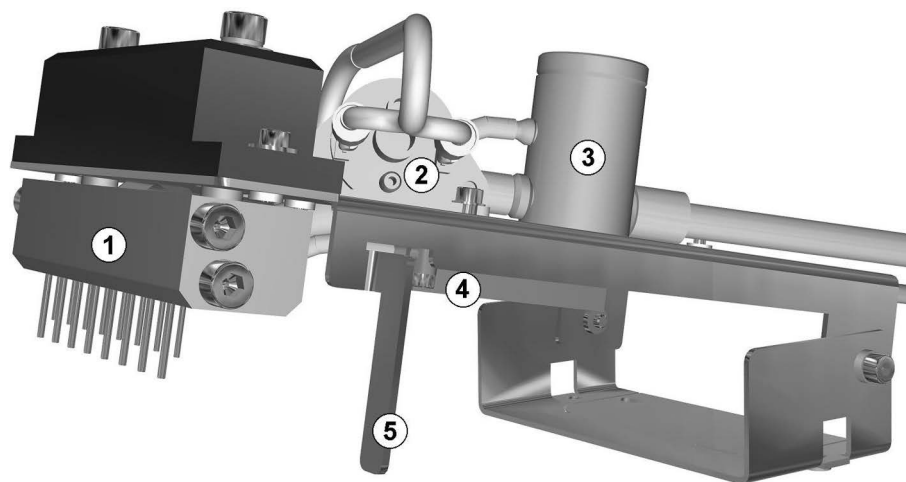


Figure 17-1: Washer module overview

1	Wash head
2	Vacuum sensor
3	Water trap
4	Dispense valve
5	Flag for upper position sensor

INFO

The up and down movement of the washer module will be done by the incubator module (see chapter 10.2.1 on page 10-2).

17.2.2 PUMPS MODULE OVERVIEW AND
LIQUID PLAN

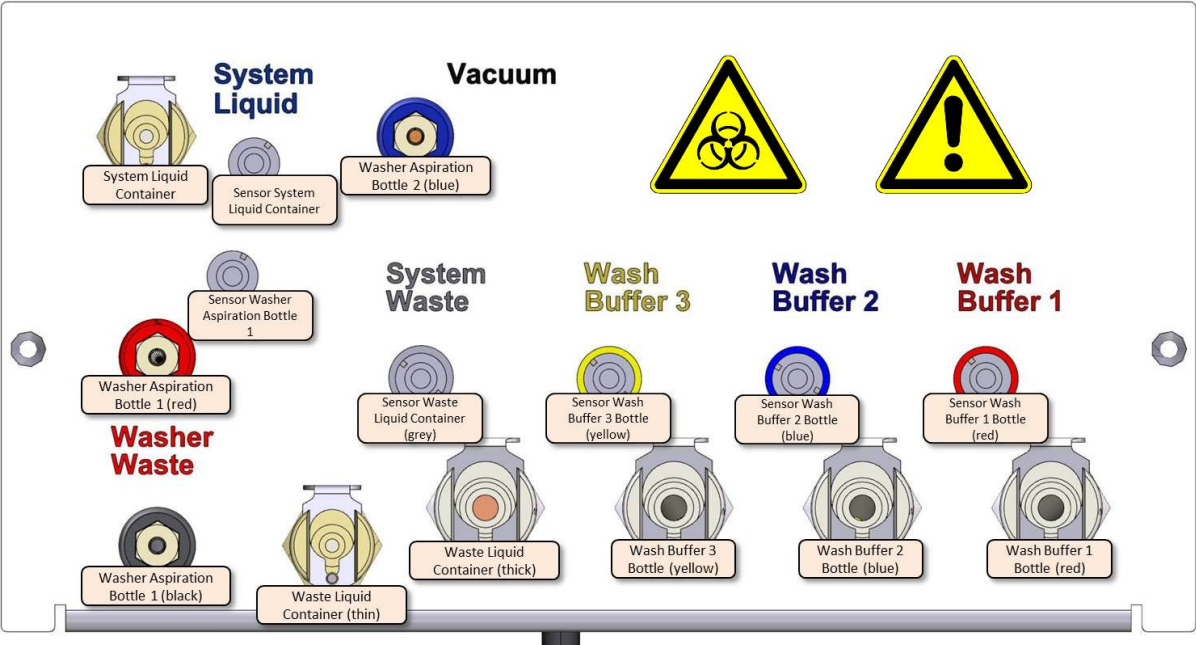


Figure 17-2: Pumps module overview (front view)

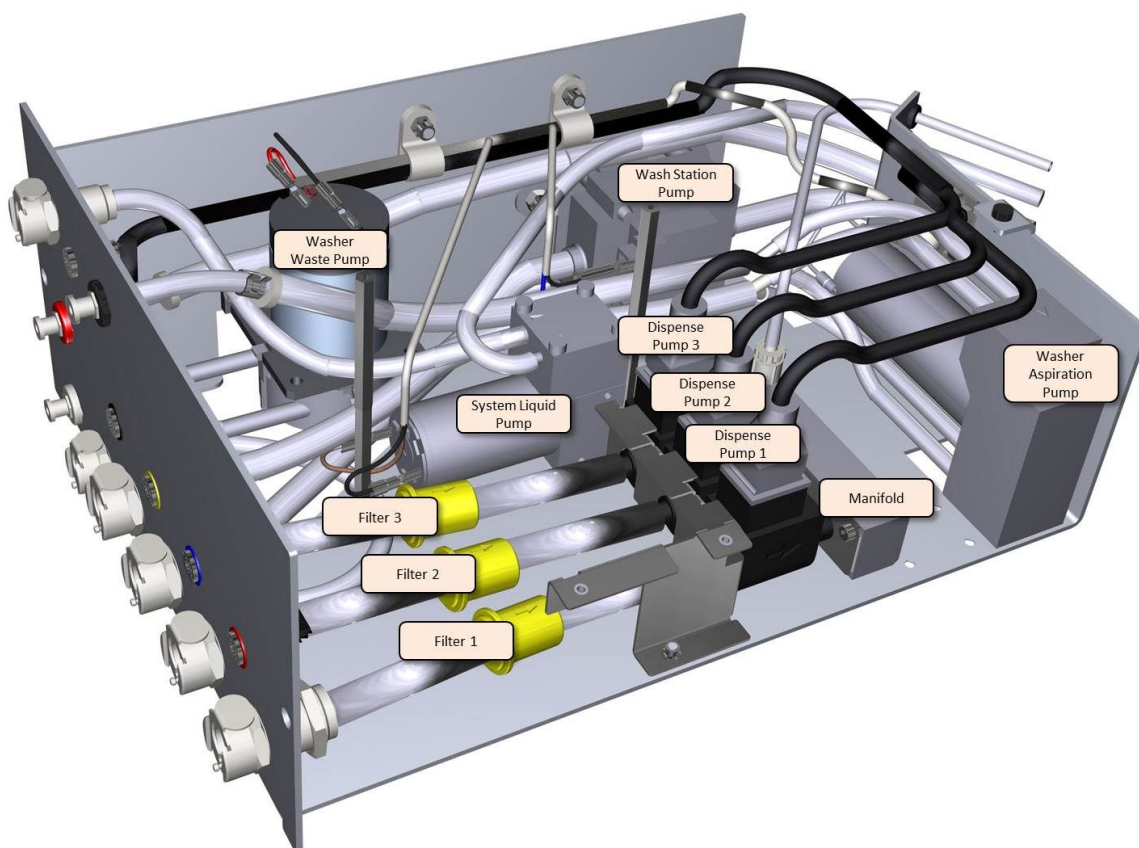


Figure 17-3: Pumps module overview (inside view - without liquid protection)

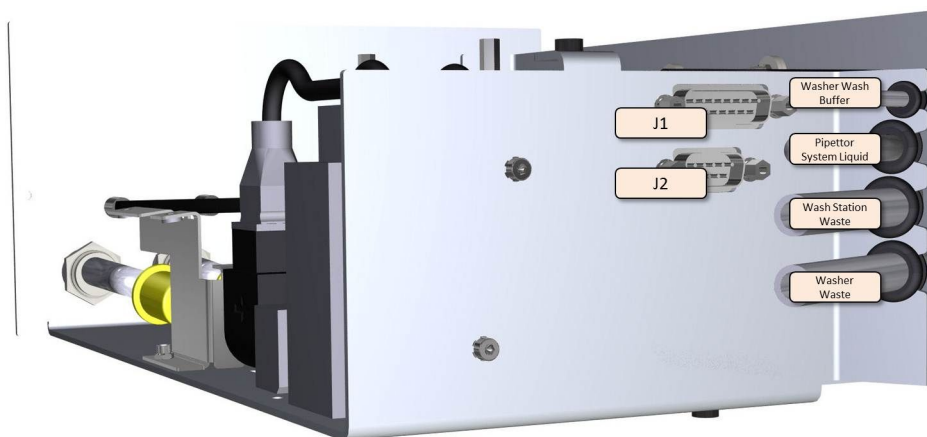


Figure 17-4: Pumps module overview (rear view)

17.2.3 LIQUID PLAN

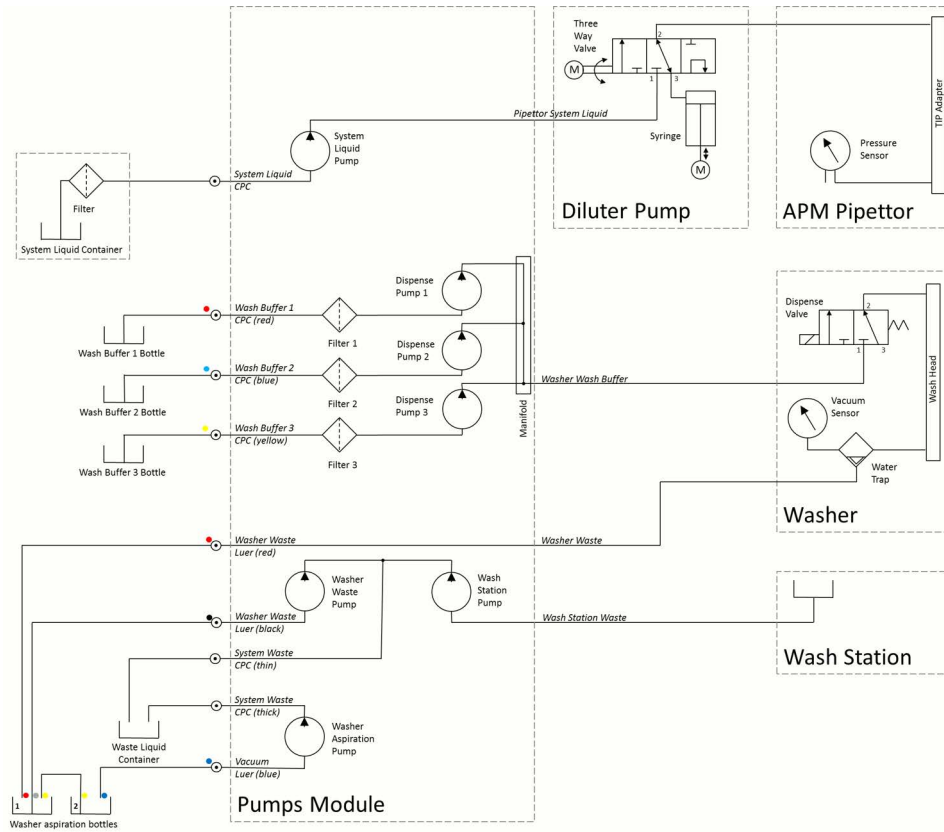


Figure 17-5: Liquid plan - instrument with APM pipettor

17.3 TIPS AND INFORMATION

This section describes tips and tricks for the handling of the washer and pumps module.

17.3.1 WASHER AND PUMPS MODULE TOOLS

17.3.1.1 CLEANING NEEDLES

Cleaning needles to clean the dispense and aspirate needles of the wash head.

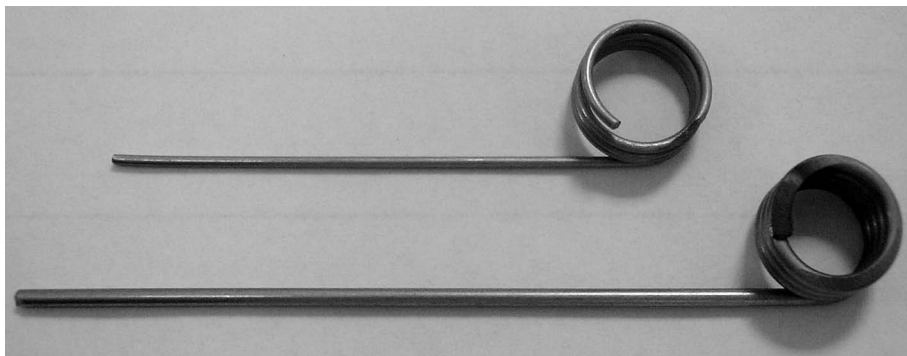


Figure 17-6: Cleaning needles

17.3.1.2 WASHER ADJUSTMENT TOOL

Washer adjustment tool to adjust the washer module.



Figure 17-7: Washer adjustment tool

17.3.1.3 WASHER CALIBRATION TOOL (JIG)

The washer calibration tool (jig) is used to calibrate the dispense pumps volume.

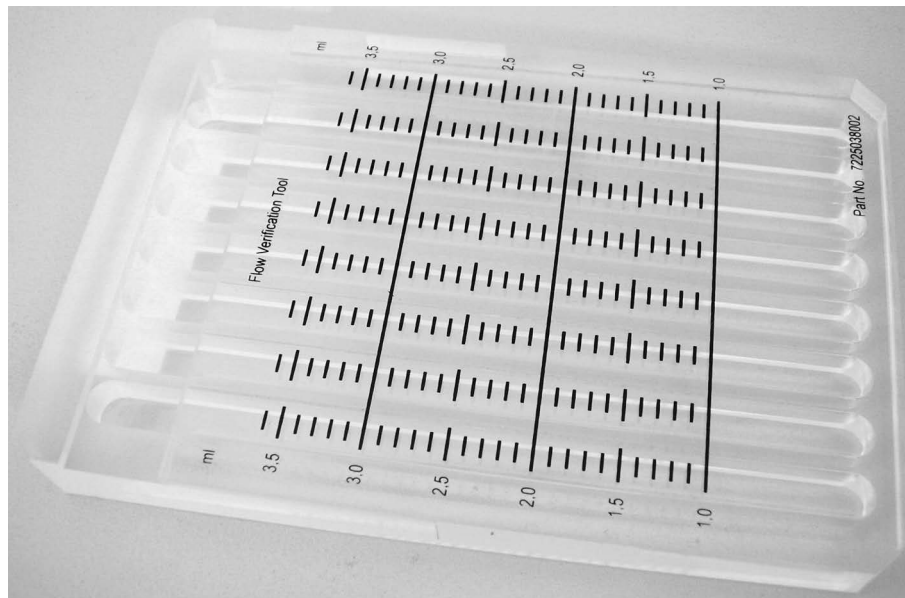


Figure 17-8: Washer calibration tool (jig)

17.3.1.4 WASHER DISPENSE PUMP REVIVAL TOOL

With the washer dispense pump revival tool, dry-run dispense pumps can be re-activated. For easier handling, the tool is provided with a connector.

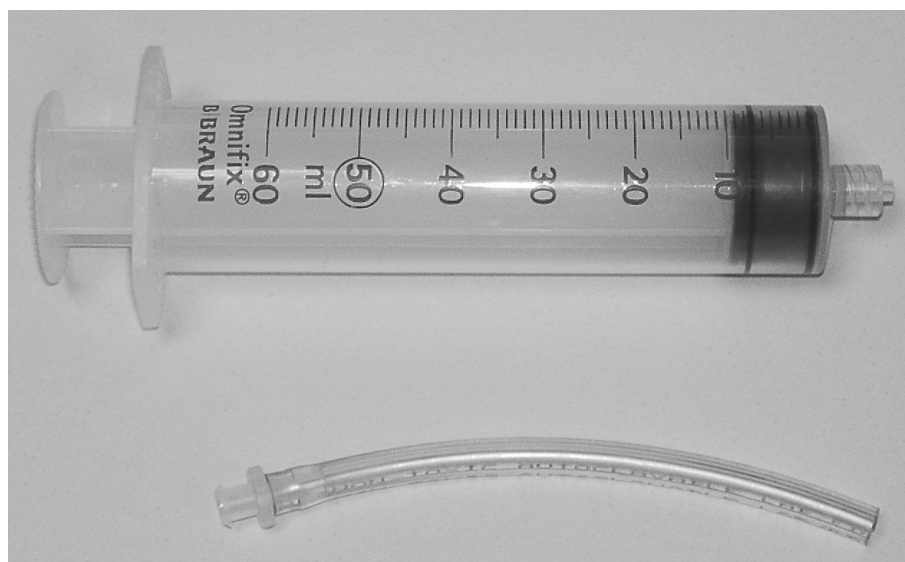


Figure 17-9: Washer dispense pump revival tool

17.4 ADJUSTMENT AND CALIBRATION

In this section, the adjustment of the washer and pumps module is described.

17.4.1 ADJUSTMENT OF WASH HEAD

Adjustment of Washer Module



1. Remove the module cover (see chapter 8.3.3 on page 8-11).
2. Start the service software.
The service software displays its main menu.
3. Start the washer service software module (see chapter 17.8 on page 17-38).
4. Press on the **Alignment** button in the **Miscellaneous** area.
5. Put the washer adjustment plate (see chapter 17.3.1.2 on page 17-6) into a plate carrier of the plate transport.
6. Load the plate transport carrier with the washer adjustment plate.
7. Press on the **Yes** button to confirm the message.
8. Follow the instructions on the **Y Alignment** dialog.

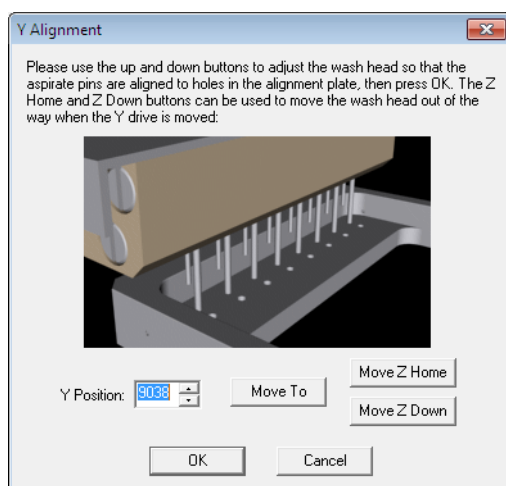


Figure 17-10: Y Alignment dialog

9. After Y-alignment, press on the **OK** button.
10. Follow the instructions on the **Y Alignment** dialog.

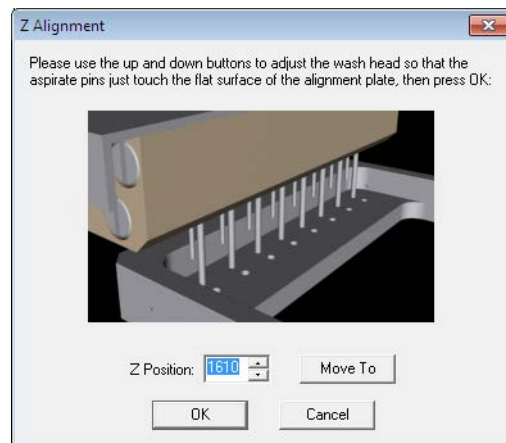


Figure 17-11: Z Alignment dialog

11. After Z-alignment, press on the **OK** button.
12. Press on the **Yes** button to save the alignment values.
13. Remove the washer adjustment tool.
14. Press on the **Yes** button to confirm the message.

X-ALIGNMENT

1. Only if necessary, loose the wash head to adjust it.
2. Repeat the X- and Z-alignment!

17.4.2 VOLUME/PUMPS CALIBRATION OF THE WASHER

TOOLS

- Empty plates and precision scales
or
- Washer calibration tool (jig), see chapter 17.3.1.3 on page 17-7

PROCEDURE

1. Start the service software.
The service software displays its main menu.
2. Start the washer service software module (see chapter 17.8 on page 17-38).
3. Press on the **Calibrate** button in the **Miscellaneous** area.
4. Press on the **No** button to confirm the “gravimetric calibrate” message.
5. Press on the **Yes** button to confirm the “Calibrate channel 0” message.
6. Put the washer calibration tool (jig) into a plate carrier of the plate transport.
7. Load the plate transport carrier with the washer calibration tool (jig).
8. Press on the **OK** button to confirm the “load” message.
9. After dispensing, remove the washer calibration tool (jig).
10. Enter the volume in microliter divided by 8 that can be read from the washer calibration tool (jig).
(1 ml = 1000 µl)

17.4.3 ADJUSTMENT OF VACUUM SENSOR

1. Start the service software.
The service software displays its main menu.
2. Start the washer service software module (see chapter 17.8 on page 17-38).
3. Press on the **Aspirate on** button in the **Miscellaneous** area to start the aspirate pump.
4. Press on the **Waste on** button in the **Miscellaneous** area to start the waste pump.
5. Press on the **Continuous** button.
6. If the **Aspirate Flow** value is 0, then turn the adjustment screw to the right until it changes to 1.
7. If the **Aspirate Flow** value is 1, then turn the adjustment screw to the left until it changes to 0.
8. Turn the adjustment screw 45° to the left. The **Aspirate Flow** value must remain on 0.
9. Test performance of the sensor:
 - open slightly the waste bottle 2 - the value must change to 1.
 - tighten the waste bottle again - the value must change back to 0.
10. When the sensor is not switching reliable between 0 and 1 during the test above you have to fine adjust the screw and repeat the test.
11. Press on the **Selftest** button to check the adjustment.
If the selftest fails, then repeat the adjustment.

17.5 CHECK AND VERIFICATION

In this section information about the testing of certain components can be found.

17.5.1 PERFORM WASHER AND PUMPS MODULE TEST

1. Switch on the instrument.
2. Start the service software (see chapter 7.1 on page 7-1).
3. Start the washer and pumps service software module (see chapter 17.8 on page 17-38).
4. Press on the **Selftest** button to initialize the module and start the selftest (see chapter 17.8.1 on page 17-45).
5. Press on the **Module Test** button and follow the instructions.

17.5.2 CHECK LEVEL OF WASH BUFFER FLOAT SWITCHES

1. Switch on the instrument.
2. Start the service software.
The service software displays its main menu.
3. Start the washer service software module (see chapter 17.8 on page 17-38).
4. Press on the **Get Status** button in the **Aspirate** area to get the status of the aspirate bottles float switches.
5. Press on the **Get Levels** button in the **Dispense** area to get the status of the dispense bottles float switches.
 - 0 = Bottle empty or unplugged
 - 4 = Bottle filled with liquid

INFO

If the display order "empty/full" is not correct, then the bottles have probably been changed over, this must be reversed via the service software. (see chapter 17.8 on page 17-38).

17.6 MAINTENANCE

This section contains instructions for the maintenance of individual components of the washer and pumps module. After several maintenance it is required that the individual components are readjusted. Follow the instructions in the individual sections.

17.6.1 CLEANING A CLOGGED WASH HEAD



If the wash function is not longer adequate, you have to clean the needles of the wash head.

1. Remove the washer service cover (see chapter 8.3.2 on page 8-10).
2. Using the supplied cleaning needle (see chapter 17.3.1.1 on page 17-6), clean the 8 dispense and the 8 aspirate needles of the wash head.

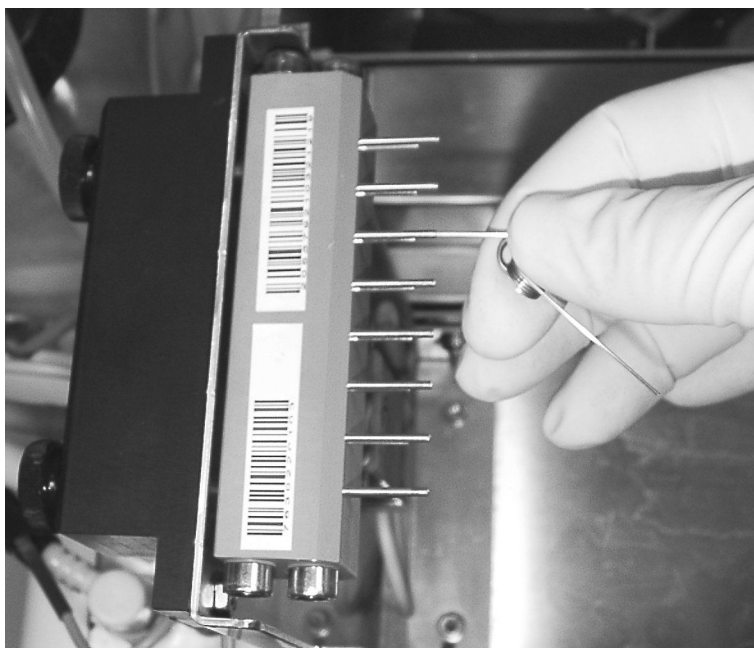


Figure 17-12: Wash head

3. Install the washer service cover (see chapter 8.3.2 on page 8-10).

17.6.2 ACTIVATE DRY-RUN DISPENSE PUMPS

1. Switch on the instrument.
2. Start the service software.
The service software displays its main menu.
3. Start the washer service software module (see chapter 17.8 on page 17-38).
4. Press the **Selftest** button.
5. Disconnect the wash buffer tubing connector (5a, 6a, or 7a, see chapter 17.2.2 on page 17-3) of the dry-run pump.
6. Fill the washer dispense pump revival tool (see chapter 17.3.1.4 on page 17-7) with wash buffer or water (> 30 ml).
7. Connect the washer dispense pump revival tool at the corresponding wash buffer tubing connector.
8. Press the **Waste On** button in the **Aspirate** area to activate the waste pump.
9. Select the dry-run pump in the field **Pump #** in the **Dispense** area.
 - 0 = RED channel
 - 1 = BLUE channel
 - 2 = YELLOW channel
10. Press the **Pump On** button in the **Dispense** area to activate the dry-run pump.

NOTICE

Risk of Flooding

Do not start any of the pumps without running the waste pump at the same time, or you may risk an overflow!

11. Push at least 30 ml of liquid carefully into the dispense pump.
12. Press the **Pump Off** button in the **Dispense** area to deactivate the (dry-run) pump.
13. Disconnect the washer dispense pump revival tool.
14. Reconnect the wash buffer tubing connector
15. Press the **Pump On** button in the **Dispense** area to activate the (dry-run) pump again.
16. Check if wash buffer is aspirated and runs out of the wash head.
17. If the dry-run pump does not work properly, check:
 - if the tubing is clogged (clean or replace clogged tubing).
 - If the pump is defective (replace defective dispense pump, see chapter 17.7.13 on page 17-33).
18. Press the **Pump Off** button in the **Dispense** area to deactivate the (dry-run) pump.
19. If necessary, repeat the steps for the remaining two dispense pumps.
20. Press the **Waste Off** button in the **Aspirate** area to deactivate the waste pump.
21. Close the washer service software module and the service software.

17.7 TROUBLESHOOTING AND REPAIRS

This section contains instructions for the repair of individual components of the washer and pumps module. After several repair works it is required that the individual components are readjusted. Follow the instructions in the individual sections.

17.7.1 REPLACEMENT OF WASHER MODULE

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the module cover (see chapter 8.3.3 on page 8-11).
4. Disconnect the connectors ST34, and ST51 from the instrument CU board (see chapter 19.2.1 on page 19-11).
5. Remove the cables from the cable duct.
6. Remove the tubing (1) from the water trap.

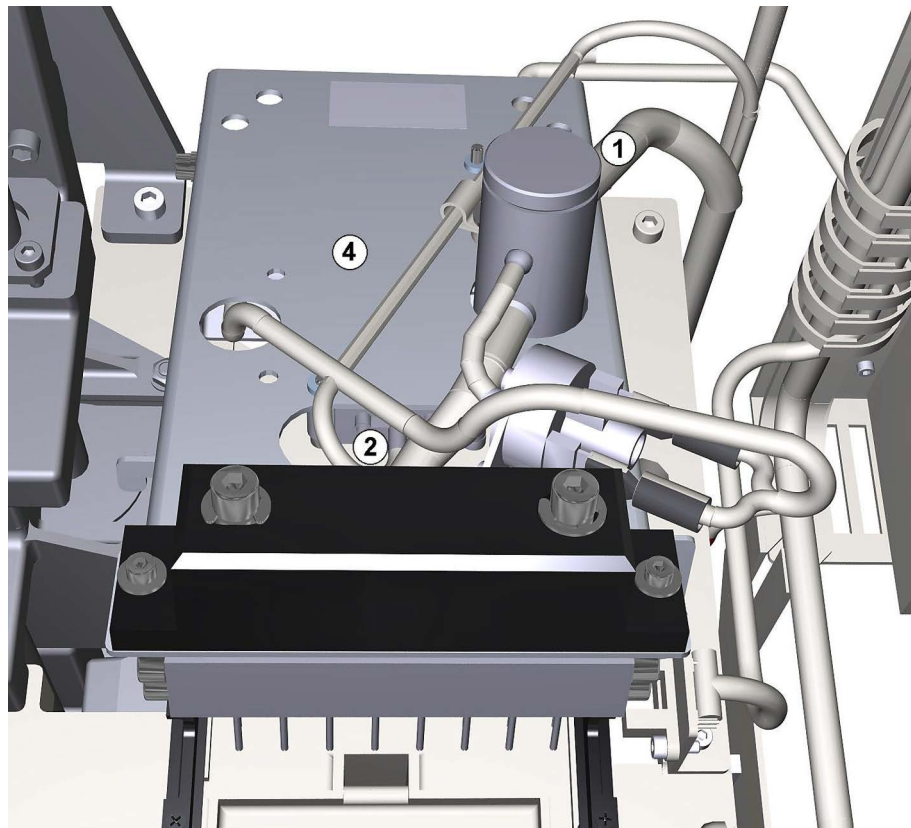


Figure 17-13: Installed washer module

7. Remove the tubing (2) from the dispense valve.
8. Remove both retaining screws (3). You reach the screws through the holes in the top part.

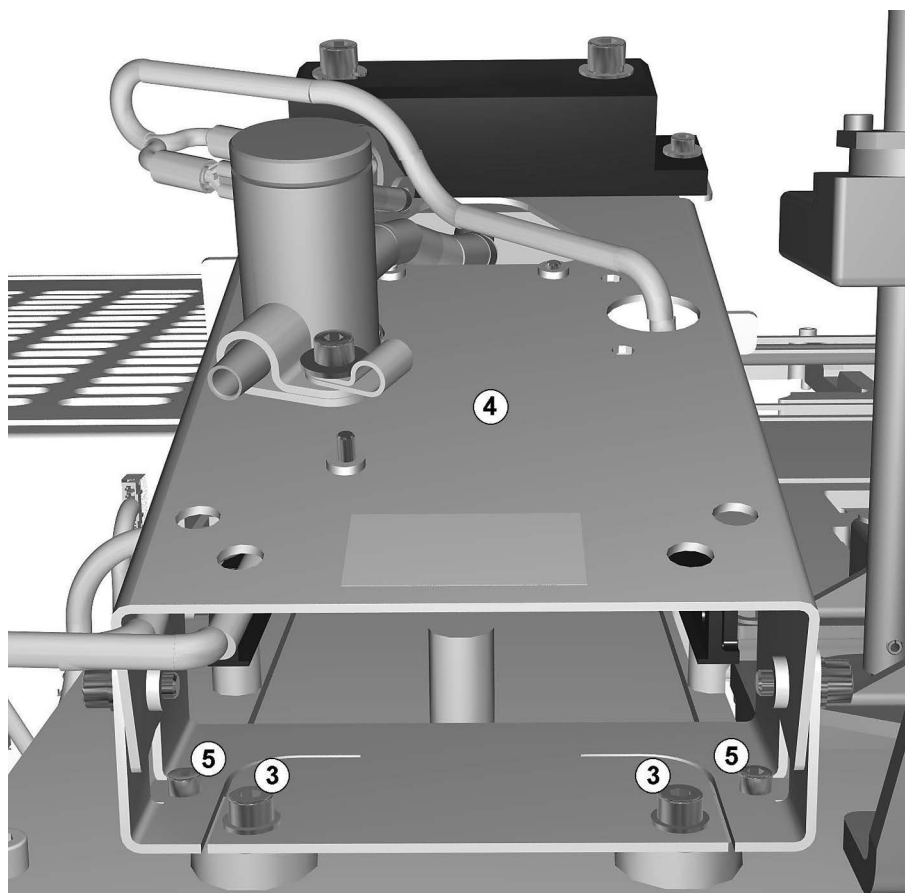


Figure 17-14: Washer back side

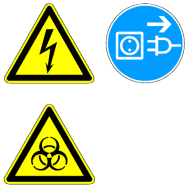
9. Remove the washer module (4).

INSTALLATION

10. Install the new washer module (4) and screw it on with both retaining screws (3). It is not necessary to tighten the screws now.
11. Put the tubing (2) up to the dispense valve.
12. Put the tubing (1) up to the water trap.
13. Plug the connectors ST34, and ST51 into the instrument CU board (see chapter 19.2.1 on page 19-11).
14. Insert the cables into the cable duct.
15. Adjust the washer module (see chapter 17.4.1 on page 17-8).
16. Adjust the vacuum sensor (see chapter 17.4.3 on page 17-10).
17. Adjust the wash head (see chapter 17.4.1 on page 17-8).
18. Calibrate the volume (see chapter 17.4.2 on page 17-10).
19. Install the module cover (see chapter 8.3.3 on page 8-11).

17.7.2 REPLACEMENT OF WASH HEAD

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the washer service cover (see chapter 8.3.2 on page 8-10).
4. Lift the washer up.
5. Remove both tubings (2) from the wash head (1).

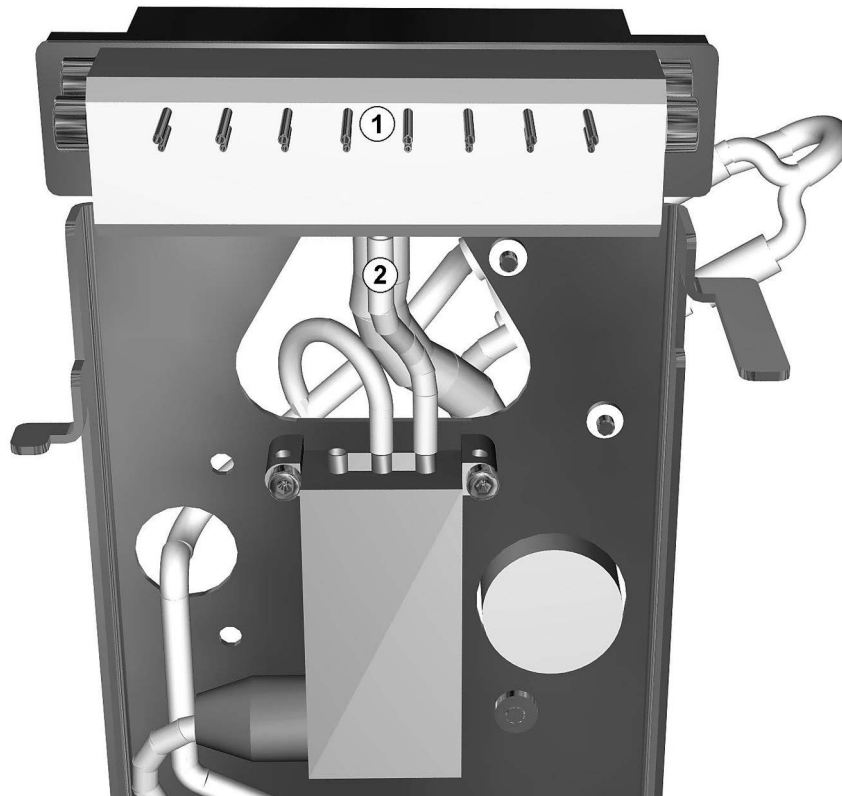


Figure 17-15: Washer (bottom side)

6. Turn the washer down.
7. Hold the wash head (1) and screw on both retaining screws (3).

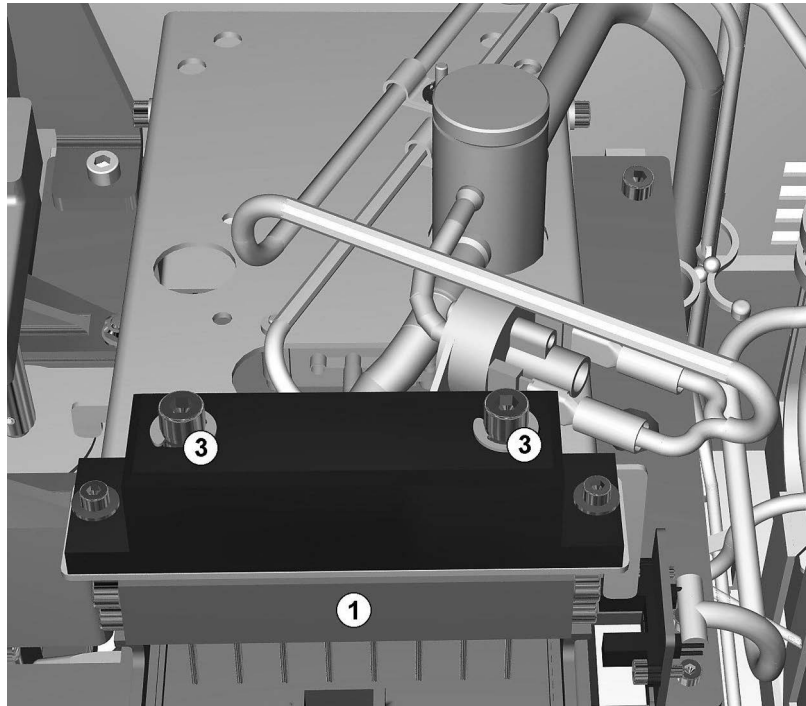


Figure 17-16: Washer

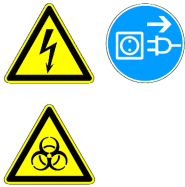
8. Remove the wash head (1).

INSTALLATION

9. Install the new/cleaned wash head (1) and tighten both retaining screws (3).
10. Put both tubings (2) up to the wash head (1).
11. Adjust the wash head (see chapter 17.4.1 on page 17-8).
12. Calibrate the volume (see chapter 17.4.2 on page 17-10).
13. Install the washer service cover (see chapter 8.3.2 on page 8-10).

17.7.3 REPLACEMENT OF VACUUM SENSOR

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the washer service cover (see chapter 8.3.2 on page 8-10).
4. Disconnect the connectors (2 + 3) from the vacuum sensor (1).

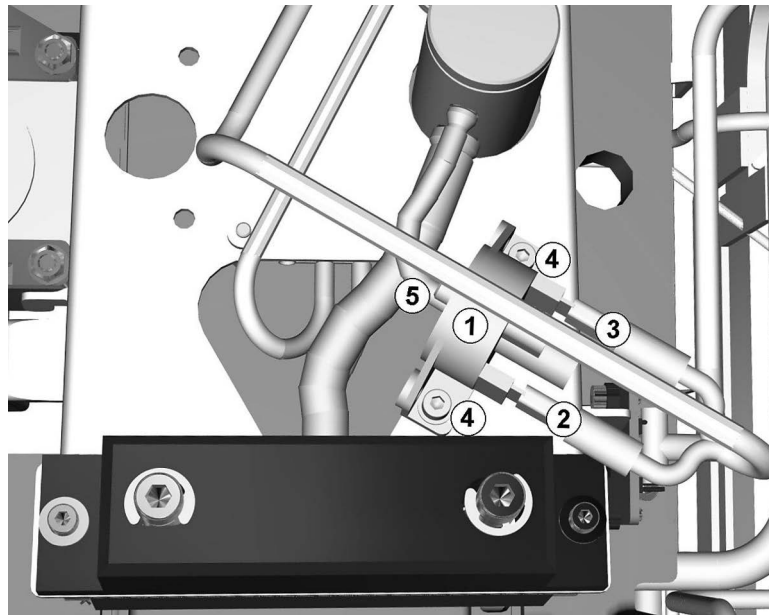


Figure 17-17: Installed washer (top view)

5. Remove both retaining screws (4).
6. Remove the tubing (5) from the vacuum sensor (1).
7. Remove the vacuum sensor (1).

INSTALLATION

8. Put the tubing (5) up to the new vacuum sensor (1).
9. Install the vacuum sensor (1) and tighten both retaining screws (4).
10. Plug the connectors onto the vacuum sensor (1). Note the cable color:
 - Connector (2): black cable
 - Connector (3): brown cable
11. Adjust the vacuum sensor (see chapter 17.4.3 on page 17-10).
12. Install the washer service cover (see chapter 8.3.2 on page 8-10).

17.7.4 REPLACEMENT OF WATER TRAP

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the washer service cover (see chapter 8.3.2 on page 8-10).
4. Remove the cable clamp (2).

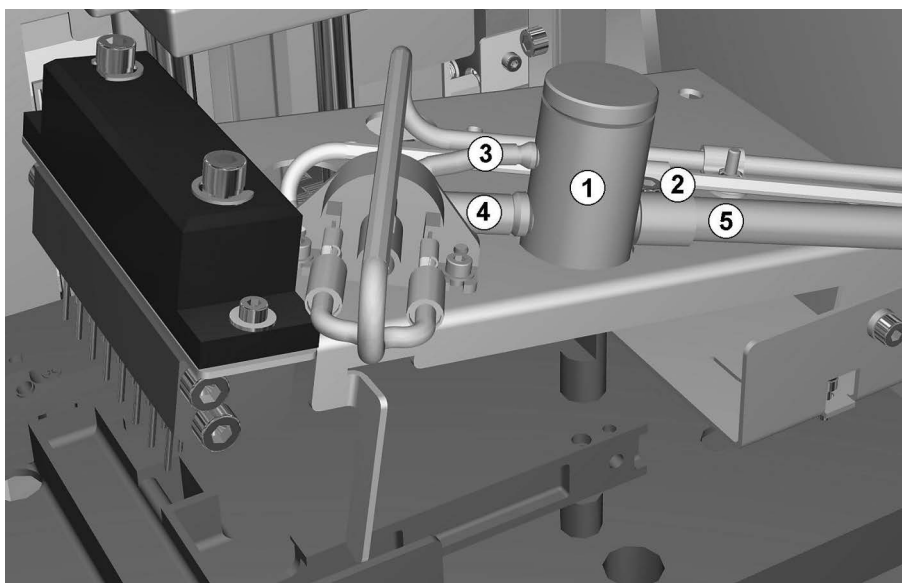


Figure 17-18: Washer (side view)

5. Remove the tubings (3, 4, and 5) from the water trap (1).
6. Remove the water trap (1).

INSTALLATION

7. Put the tubings (3, 4, and 5) up to the new water trap (1).
8. Install the cable clamp (2).
9. Install the washer service cover (see chapter 8.3.2 on page 8-10).

17.7.5 REPLACEMENT OF DISPENSE VALVE

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the module cover (see chapter 8.3.3 on page 8-11).
4. Disconnect the connector ST34 from the instrument CU board (see chapter 19.2.1 on page 19-11).
5. Remove the cable from the cable duct.
6. Remove the cable clamp (2).

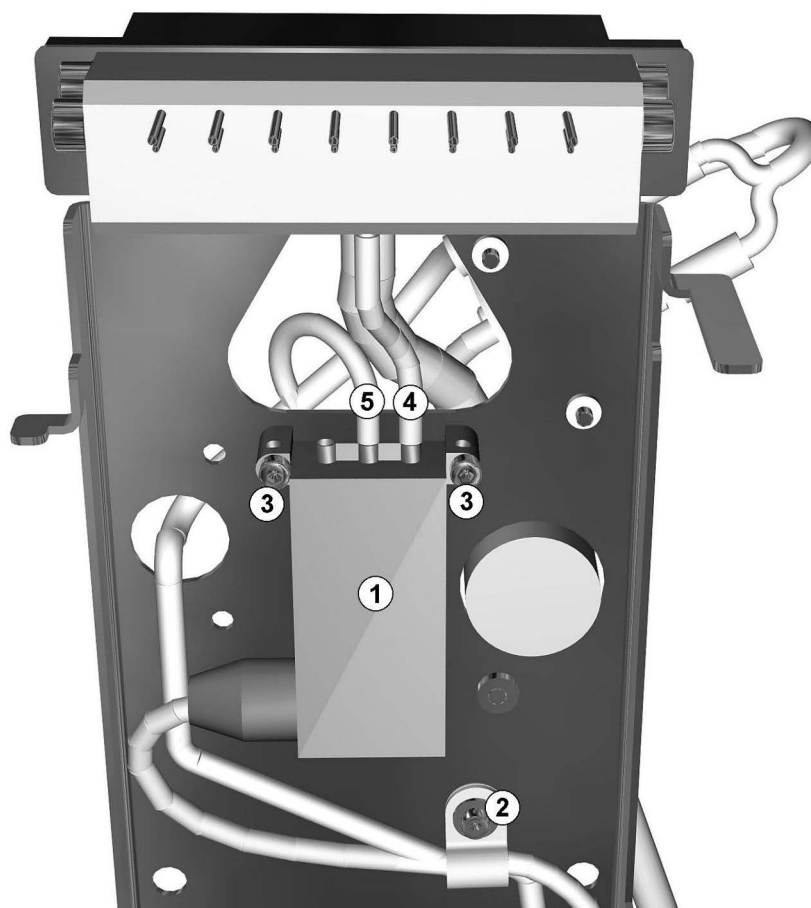


Figure 17-19: Washer (bottom side)

7. Remove both retaining screws (3).
8. Remove the tubings (4 + 5) from the dispense valve (1).
9. Remove the dispense valve (1).

INSTALLATION

10. Put the tubings (4 + 5) up to the new dispense valve (1).
11. Install the dispense valve (1) and tighten both retaining screws (3).
12. Install the cable clamp (2).
13. Insert the cable into the cable duct.
14. Plug the connector ST34 into the instrument CU board (see chapter 19.2.1 on page 19-11).
15. Install the module cover (see chapter 8.3.3 on page 8-11).

17.7.6 REPLACEMENT OF PUMPS MODULE

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the deck top (see chapter 8.3.1 on page 8-9).
4. Remove both retaining screws (2).

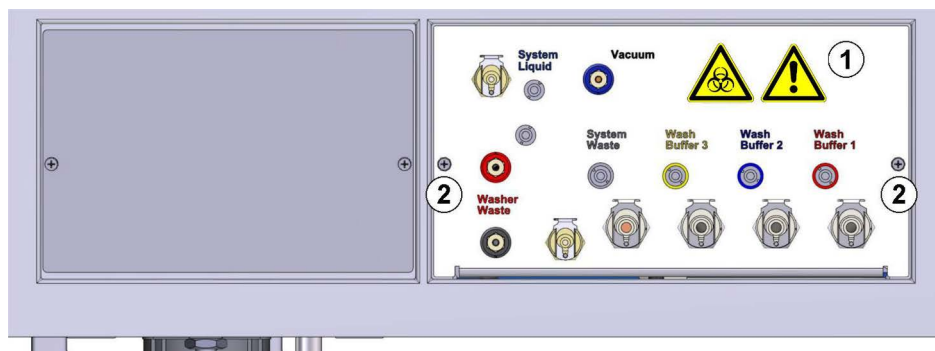


Figure 17-20: Pumps module

5. Pull out the pumps module (1). Take care about the cables and tubings.

Disconnect tubings and connectors:

6. Disconnect the connectors J1 and J2 (see chapter 17.2.2 on page 17-3).
7. Open the fitting of the tubing (8b) on the wash buffer manifold (8a) and remove the tubing.

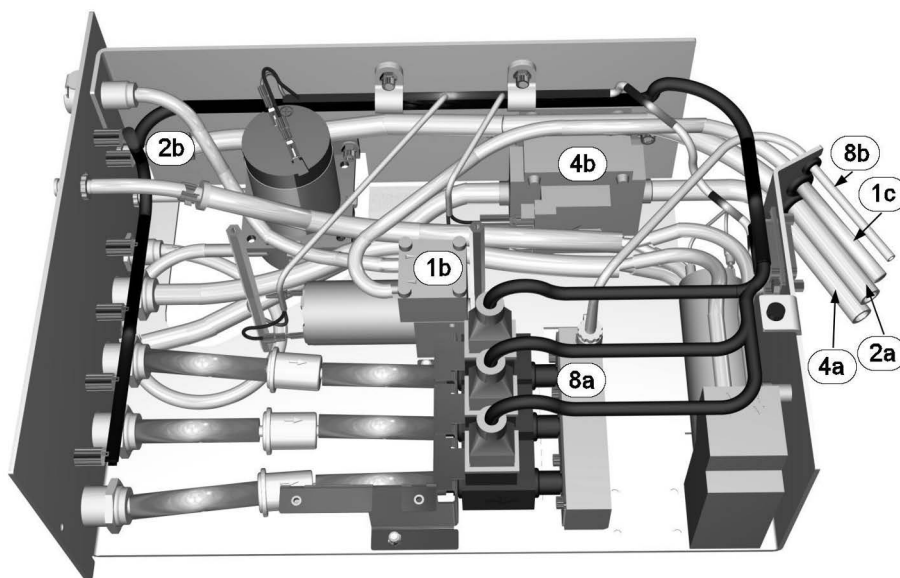


Figure 17-21: Pumps module overview (inside view - without liquid protection)

8. Remove tubing (1c) from the system liquid pump (1b) and remove the tubing.
9. Remove tubing (2a) from the wash foam bottle connector (2b) and remove the tubing.
10. Remove tubing (4a) from the wash station pump (4b) and remove the tubing.

INSTALLATION

11. Put the tubing (4a) up to the wash station pump (4b) inlet.
12. Put the tubing (2a) up to the wash foam bottle connector (2b).
13. Put the tubing (1c) up to the system liquid pump (1b) outlet.
14. Tighten the fitting of the tubing (8b) on the wash buffer manifold (8a).
15. Insert the hose nozzle of the tubings into the bracket.
16. Plug in the connectors J1 and J2 (see chapter 17.2.2 on page 17-3).
17. Put in the pumps module (1). Take care about the cables and tubings. You can see and sort the tubings through the frame under the desk top.
18. Tighten both retaining screws (2).
19. Install the deck top (see chapter 8.3.1 on page 8-9).

17.7.7 REPLACEMENT OF LIQUID PROTECTION

REMOVAL



1. Remove the pumps module (see chapter 17.7.6 on page 17-23).
2. Remove the four retaining screws (2).

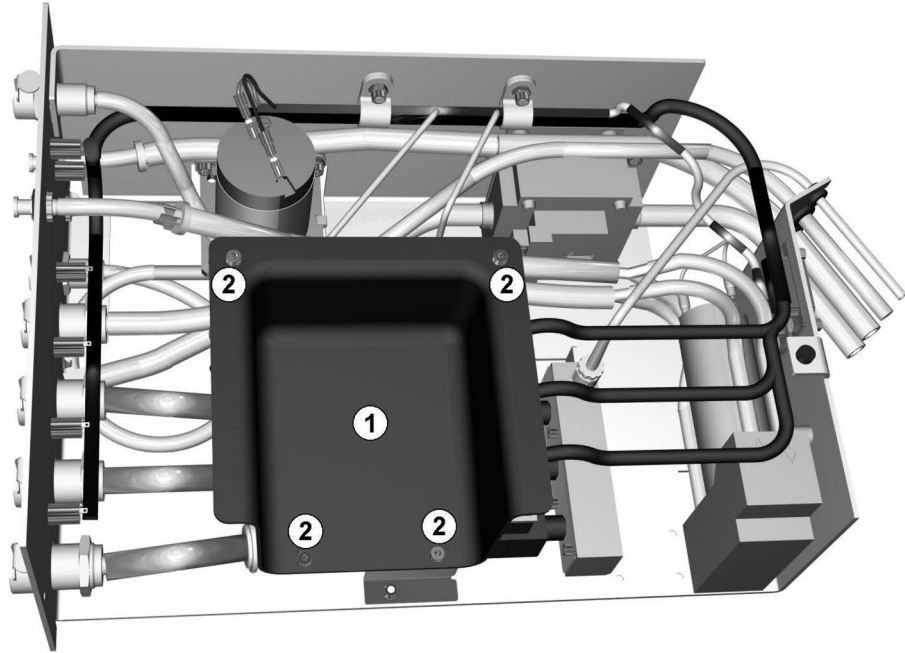


Figure 17-22: Pumps module

3. Remove the liquid protection (1).

INSTALLATION

4. Install the liquid protection (1).
5. Tighten the four retaining screws (2).
6. Install the pumps module (see chapter 17.7.6 on page 17-23).

17.7.8 REPLACEMENT OF SYSTEM LIQUID PUMP

REMOVAL



1. Remove the pumps module (see chapter 17.7.6 on page 17-23).
2. Remove the liquid protection (see chapter 17.7.7 on page 17-25).
3. Disconnect the two connectors (1 and 2) of the system liquid pump (1b).

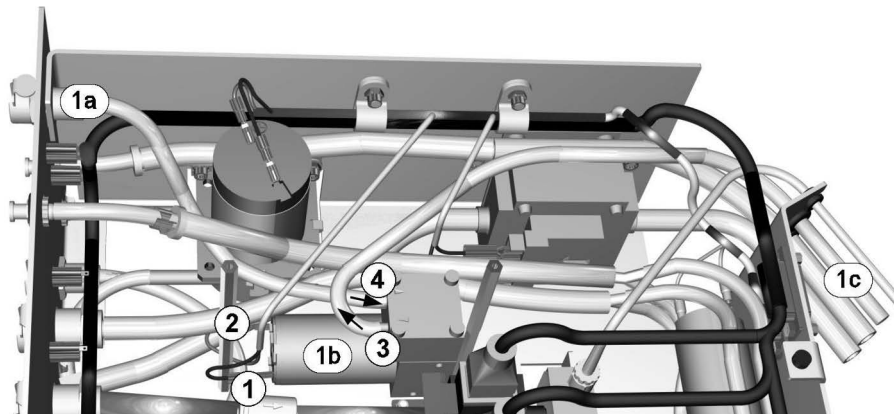


Figure 17-23: System liquid pump

4. Pull the tubing (3) down from the system liquid pump (1b).
5. Pull the tubing (4) down from the system liquid pump (1b).
6. Remove the four retaining screws on the underside of the pumps module.
7. Remove the system liquid pump (1b).

INSTALLATION

8. Install the system liquid pump (1b).
9. Tighten the four retaining screws on the underside of the pumps module.

NOTICE

Take notice of the flow direction!

10. Put the tubing (3) up to the system liquid pump (1b).
11. Put the tubing (4) up to the system liquid pump (1b).
12. Plug the two connectors to the system liquid pump (1b).
 - Plus: brown cable (2)
 - Minus: black cable (1)
13. Install the liquid protection (see chapter 17.7.7 on page 17-25).
14. Install the pumps module (see chapter 17.7.6 on page 17-23).

17.7.9 REPLACEMENT OF TUBING CASSETTE OF THE WASHER WASTE PUMP

REMOVAL



1. Remove the pumps module (see chapter 17.7.6 on page 17-23).
2. Open the tube clamp (1) next to the T-fitting (3).

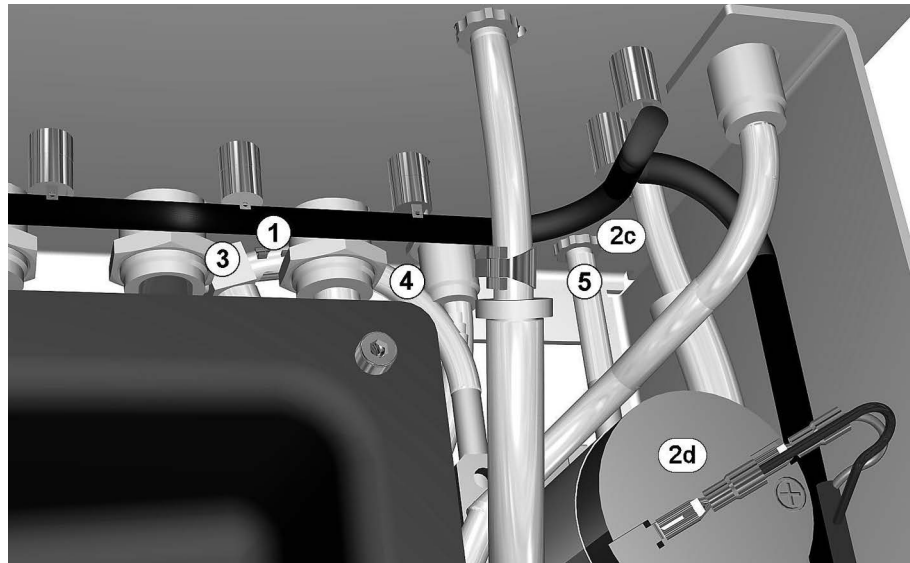


Figure 17-24: Tube clamp next to the T-fitting

3. Pull the tubing (4) down from the T-fitting (3).
4. Pull the tubing (5) down from the washer foam bottle connector (2c).
5. Remove the tubing cassette (6) by pressing the clips (7) at top and bottom of the cassette and pulling down the tubing cassette.

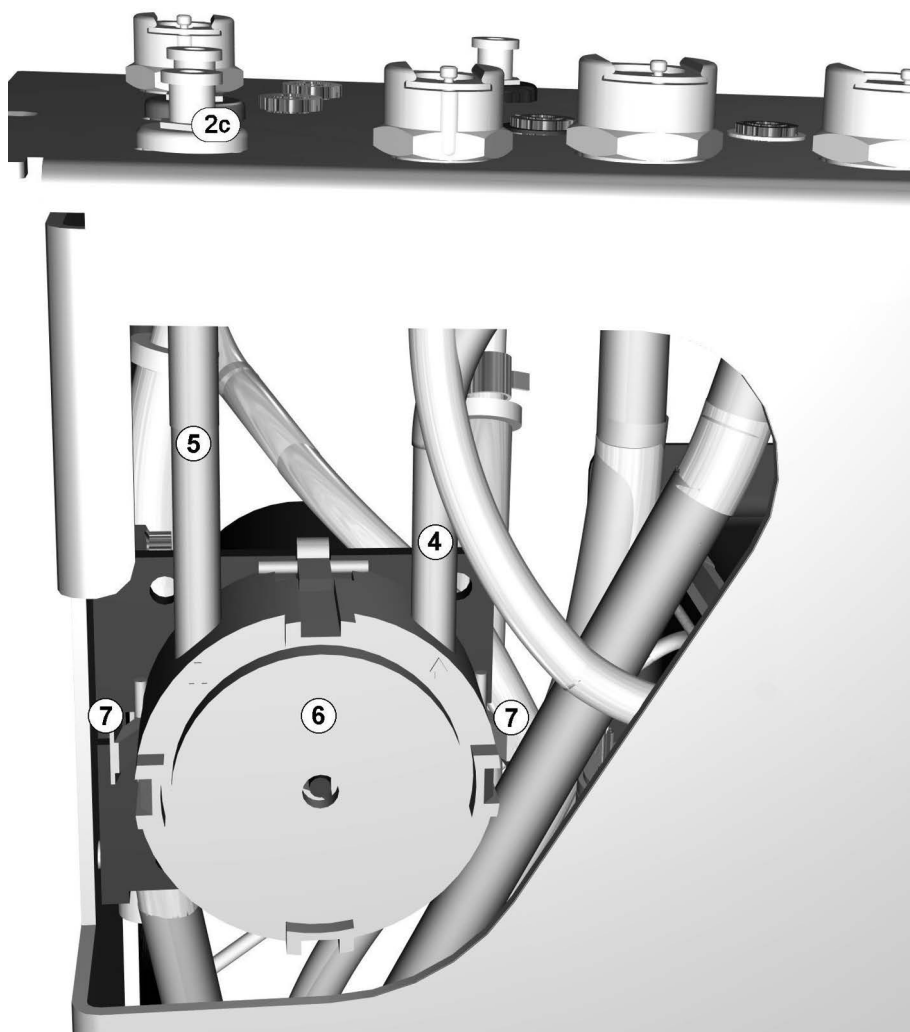


Figure 17-25: Tubing cassette

INSTALLATION

6. Push the new tubing cassette (6) onto the motor axle until the clips snap in.

NOTICE

Take notice of the flow direction!

7. Put the tubing (5) up to the fitting (2c).
8. Put the tubing (4) up to the T-fitting (3).
9. Install the tube clamp (1) next to the T-fitting (3).
10. Install the pumps module (see chapter 17.7.6 on page 17-23).

17.7.10 REPLACEMENT OF WASHER WASTE PUMP MOTOR

REMOVAL



1. Remove the pumps module (see chapter 17.7.6 on page 17-23).
2. Remove the tubing cassette (see chapter 17.7.9 on page 17-27).
It is not necessary to pull down the tubings!
3. Disconnect the two connectors (1 and 3) of the washer waste pump motor (2d).

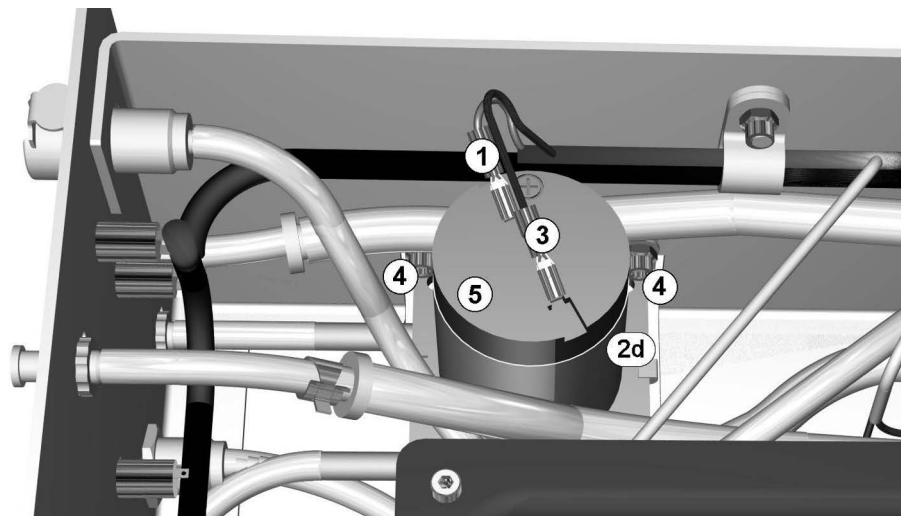


Figure 17-26: Washer waste pump motor

4. Remove the both retaining screws (4).
5. Remove the washer waste pump motor (5).

INSTALLATION

6. Install the new washer waste pump motor (5) and tighten the both retaining screws (4).
7. Plug the two connectors to the washer waste pump motor (5).
 - Plus: red cable (1) - there is a plus sign on the motor
 - Minus: black cable (3)
8. Push the tubing cassette onto the motor axle until the clips snap in (see chapter 17.7.9 on page 17-27).
9. Install the pumps module (see chapter 17.7.6 on page 17-23).

17.7.11 REPLACEMENT OF WASHER ASPIRATION PUMP

REMOVAL



1. Remove the pumps module (see chapter 17.7.6 on page 17-23).
2. Disconnect the two connectors (1 and 2) of the washer aspiration pump (3b).

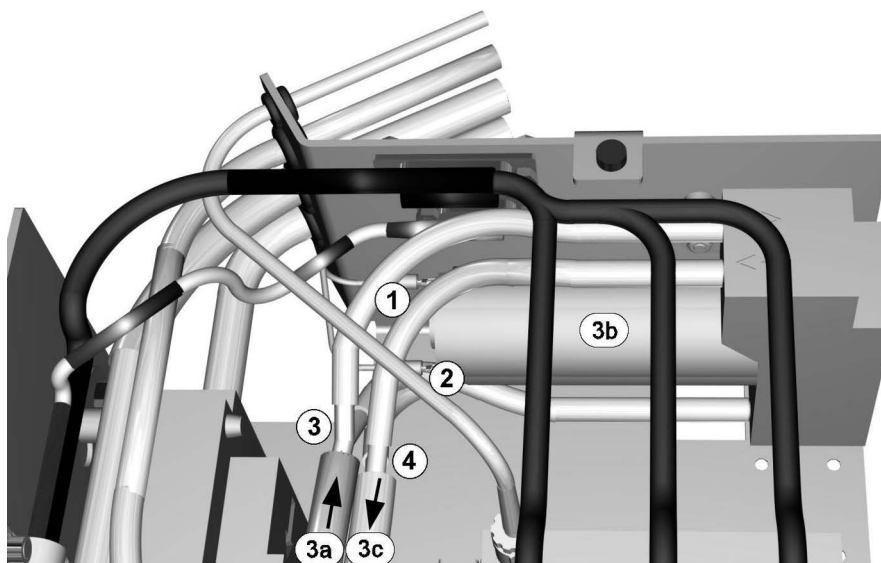


Figure 17-27: Installed washer aspiration pump

3. Pull the Y-fitting (3) down from the tubing to fitting (3a).
4. Pull the Y-fitting (4) down from the tubing to fitting (3c).
5. Remove both retaining screws on the rear side of the pumps module.
6. Remove the washer aspiration pump (3b).

INSTALLATION

7. Pull down both Y-fittings (3 and 4) from the tubings of the new washer aspiration pump (3b).

NOTICE

Take notice of the flow direction!

8. Put the tubings up to both Y-fittings (3 and 4).

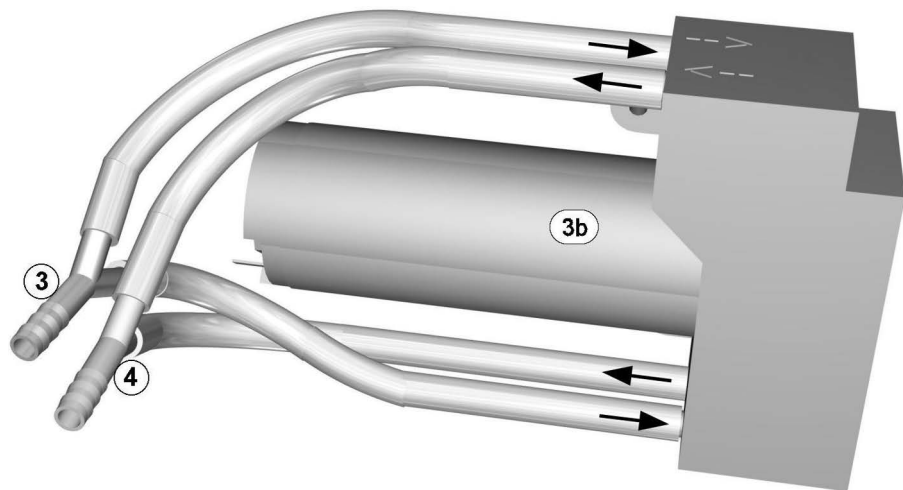


Figure 17-28: Aspiration pump

9. Insert the new washer aspiration pump (3b) into the pumps module.
10. Insert both nuts (6), spacers (7) and retaining screws (5) and tighten the screws.

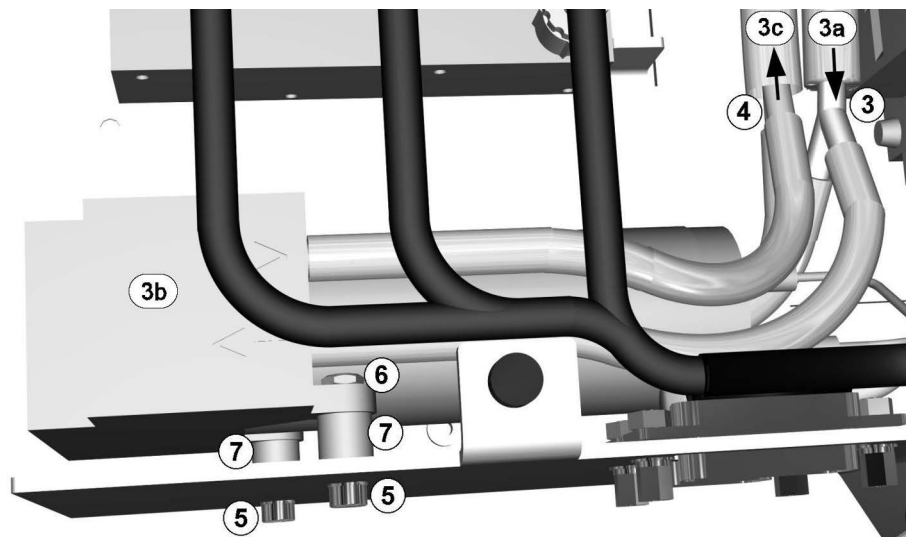


Figure 17-29: Aspiration pump (top view)

NOTICE

Take notice of the flow direction!

11. Put the Y-fitting (3) up to the tubing to fitting (3a).
12. Put the Y-fitting (4) up to the tubing to fitting (3c).
13. Plug the two connectors (1 and 2) to the washer aspiration pump (3b).
 - Plus: green cable
 - Minus: black cable
14. Install the pumps module (see chapter 17.7.6 on page 17-23).

17.7.12 REPLACEMENT OF WASH STATION PUMP

REMOVAL



1. Remove the pumps module (see chapter 17.7.6 on page 17-23).
2. Disconnect the two connectors (1 and 2) of the wash station pump (4b).

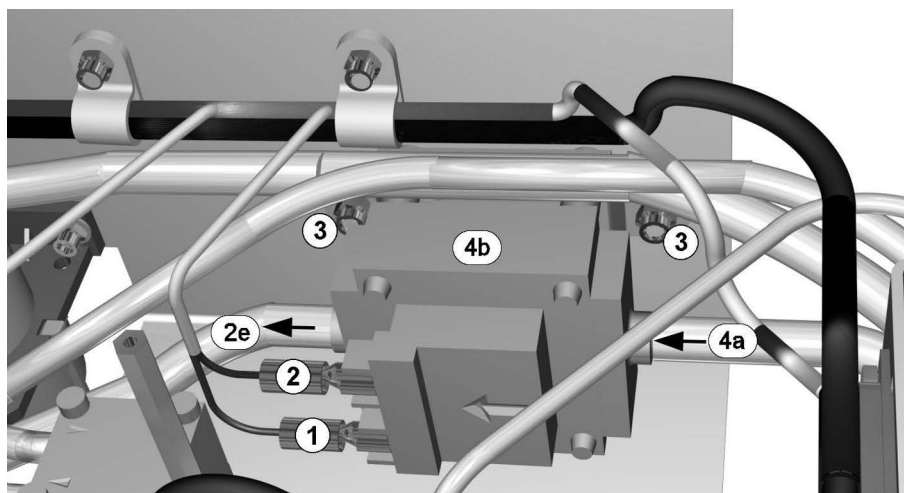


Figure 17-30: Installed wash station pump

3. Pull the tubing to the fitting (2e) down from the wash station pump (4b).
4. Pull the tubing to the fitting (4a) down from the wash station pump (4b).
5. Remove both nuts (3).
6. Remove the wash station pump (4b).

INSTALLATION

7. Install the new wash station pump (4b).
8. Tighten both nuts (3).

NOTICE

Take notice of the flow direction!

9. Put the tubing to the fitting (2e) up to the wash station pump (4b).
10. Put the tubing to the fitting (4a) up to the wash station pump (4b).
11. Plug the two connectors to the wash station pump (3b).
 - Plus: blue cable (1)
 - Minus: black cable (2)
12. Install the pumps module (see chapter 17.7.6 on page 17-23).

17.7.13 REPLACEMENT OF DISPENSE PUMP (WASH BUFFER PUMP)

REMOVAL



1. Remove the pumps module (see chapter 17.7.6 on page 17-23).
2. Remove the liquid protection (see chapter 17.7.7 on page 17-25).
3. Remove both retaining screws (1).

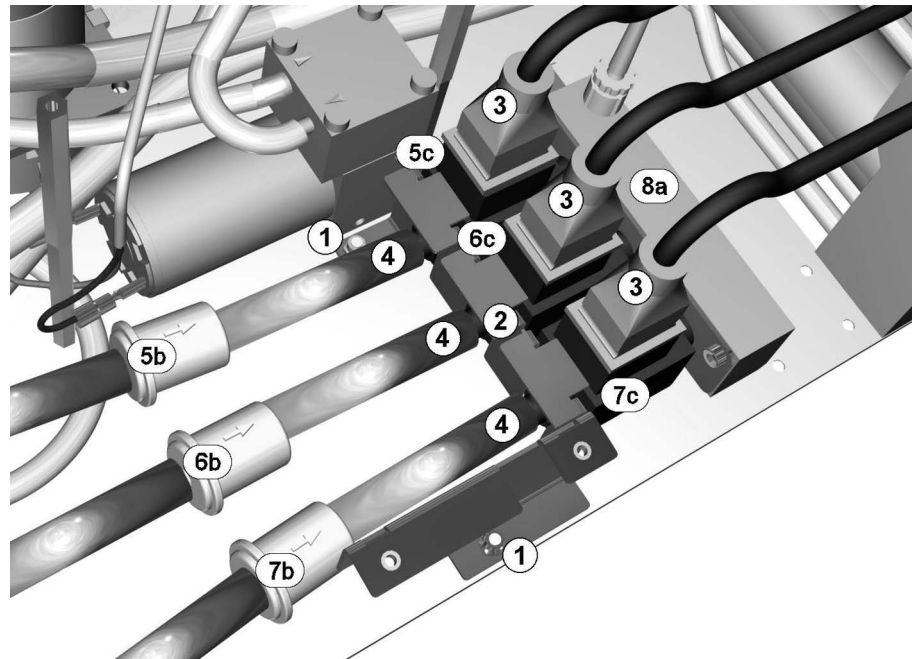


Figure 17-31: Installed dispense pumps

4. Remove the bracket (2).
5. Disconnect the connector (3) of the damaged dispense pump (5c, 6c, or 7c).
6. Pull the damaged dispense pump (5c, 6c, or 7c) out of the wash buffer manifold (8a).
7. Pull the tubing (4) down from the damaged dispense pump (5c, 6c, or 7c).
8. Remove the damaged dispense pump (5c, 6c, or 7c).

INSTALLATION

NOTICE

9. Insert the new dispense pump (5c, 6c, or 7c).

Take notice of the flow direction (arrows on the pumps and filters)!

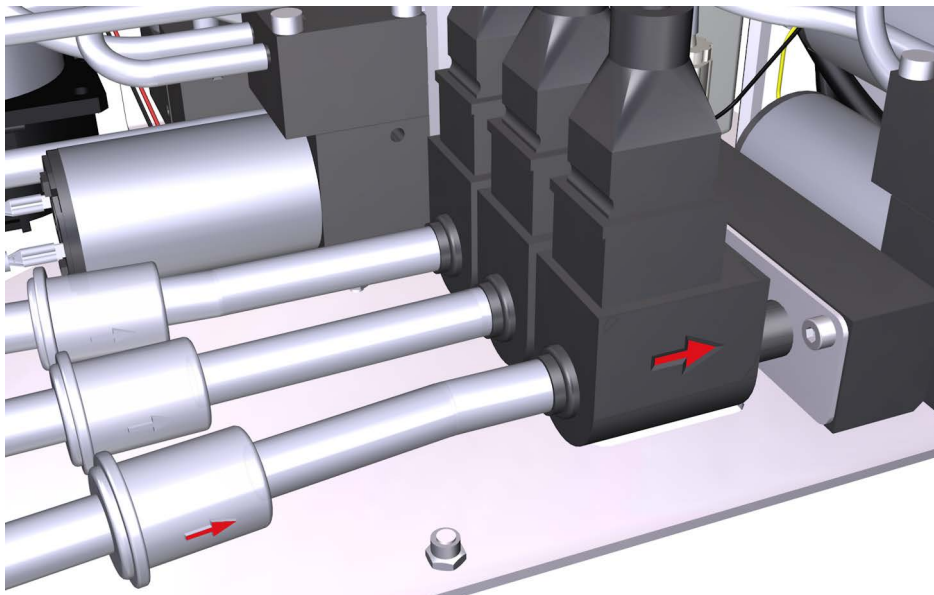


Figure 17-32: Flow direction

10. Put the tubing (4) up to the new dispense pump (5c, 6c, or 7c).
11. Push the dispense pump (5c, 6c, or 7c) into the wash buffer manifold (8a).
12. Plug the connector (3) into the new dispense pump (5c, 6c, or 7c).
13. Insert the bracket (2).
14. Tighten both retaining screws (1).
15. Install the liquid protection (see chapter 17.7.7 on page 17-25).
16. Install the pumps module (see chapter 17.7.6 on page 17-23).
17. Calibrate the pumps (see chapter 17.4.2 on page 17-10)

17.7.14 REPLACEMENT OF LIQUID FILTER

REMOVAL



1. Remove the pumps module (see chapter 17.7.6 on page 17-23).
2. Remove the liquid protection (see chapter 17.7.7 on page 17-25).
3. Pull the tubing between damaged filter (5b, 6b, or 7b) and dispense pump down from the filter.

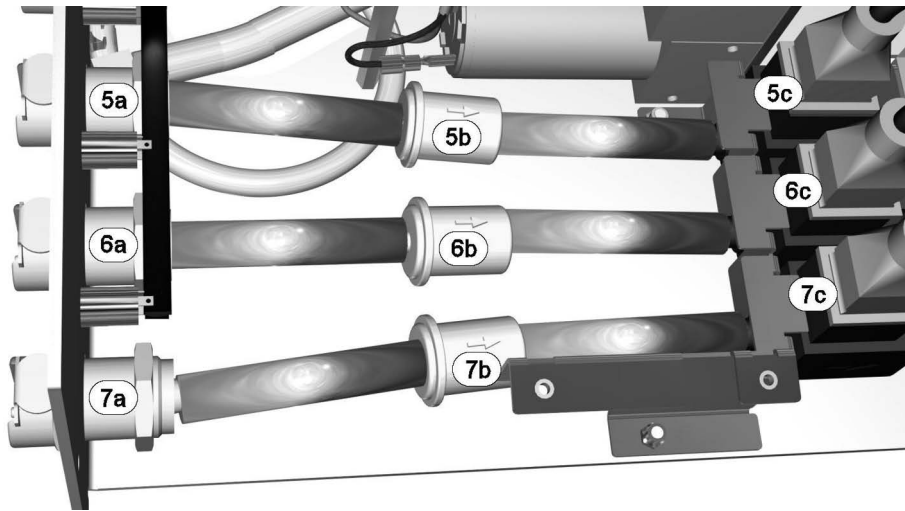


Figure 17-33: Installed liquid filters

4. Pull the tubing between damaged filter (5b, 6b, or 7b) and fitting down from the filter.

INSTALLATION

5. Insert the new liquid filter (5b, 6b, or 7b).

NOTICE

Take notice of the flow direction (arrows on the filters)!

6. Put the tubing between filter (5b, 6b, or 7b) and fitting up to the filter.
7. Put the tubing between filter (5b, 6b, or 7b) and dispense pump up to the filter.
8. Install the liquid protection (see chapter 17.7.7 on page 17-25).
9. Install the pumps module (see chapter 17.7.6 on page 17-23).
10. Calibrate the pumps (see chapter 17.4.2 on page 17-10)

17.7.15 REPLACEMENT OF WASH BUFFER MANIFOLD

REMOVAL



1. Remove the pumps module (see chapter 17.7.6 on page 17-23).
2. Remove the liquid protection (see chapter 17.7.7 on page 17-25).
3. Remove both retaining screws (1).

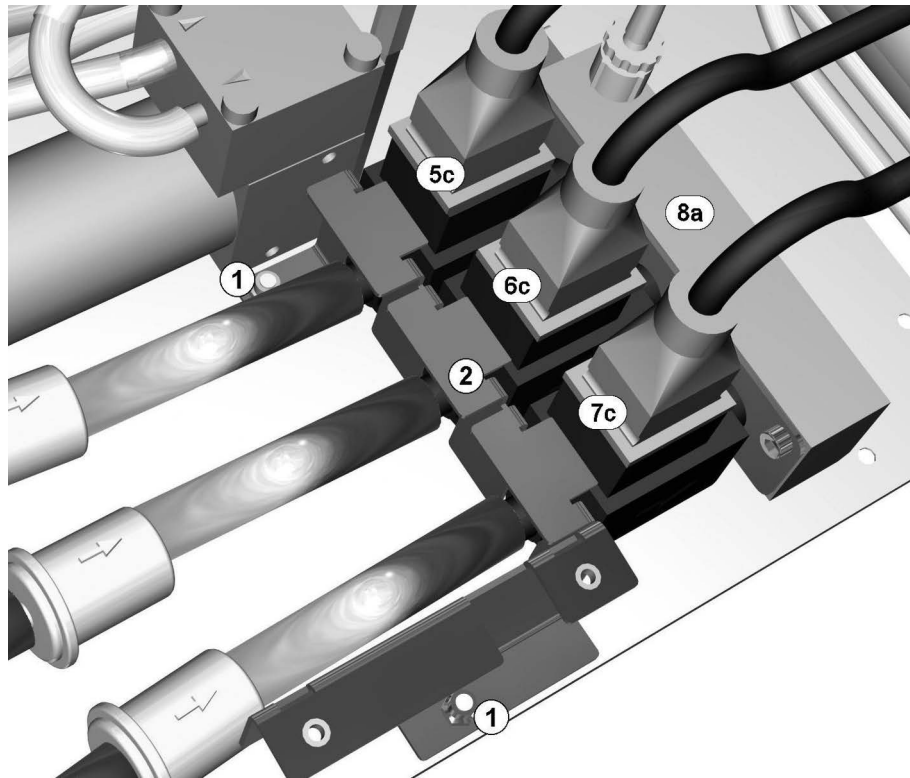


Figure 17-34: Installed dispense pumps

4. Remove the bracket (2).
5. Pull all dispense pumps (5c, 6c, and 7c) out of the wash buffer manifold (8a).
6. Remove the fitting (3).

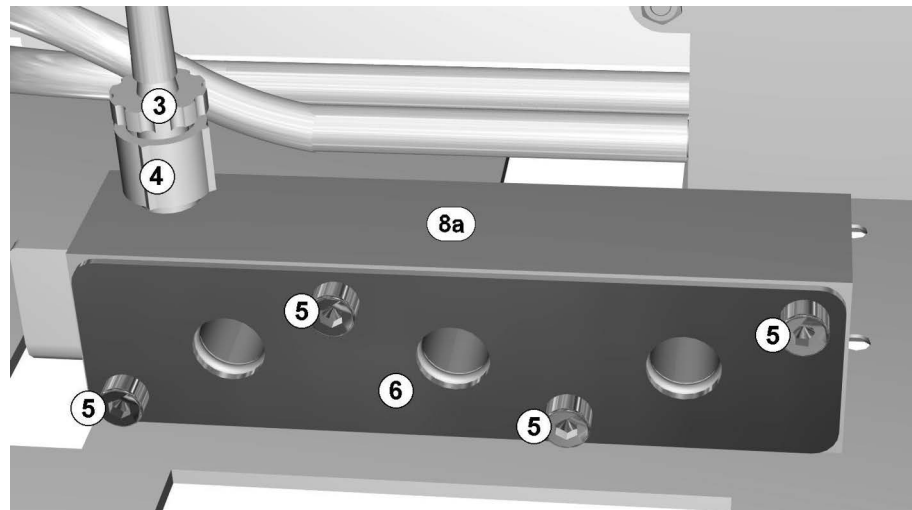


Figure 17-35: Wash buffer manifold

7. Remove both retaining screws on the underside of the pumps module.
8. Remove the four screws (5).
9. Remove the drop protection (6).
10. Remove the wash buffer manifold (8a).

INSTALLATION

11. Install the drop protection (6) on the new wash buffer manifold (8a) and tighten the four screws (5).
12. Install the wash buffer manifold (8a) in the pumps module and tighten both retaining screws.
13. Tighten the fitting (3) only by hand.
14. Push all dispense pumps (5c, 6c, and 7c) into the wash buffer manifold (8a).
15. Insert the bracket (2).
16. Tighten both retaining screws (1).
17. Install the liquid protection (see chapter 17.7.7 on page 17-25).
18. Install the pumps module (see chapter 17.7.6 on page 17-23).

17.8 SERVICE SOFTWARE

When the washer software is started, the application attempts to communicate to the instrument and washer module. When successful, the following dialog will be displayed with the version and serial number displayed. Defaults, such as instrument offsets will be read from the module EEPROM and shown. If no module is detected, ??? will be shown for the version.

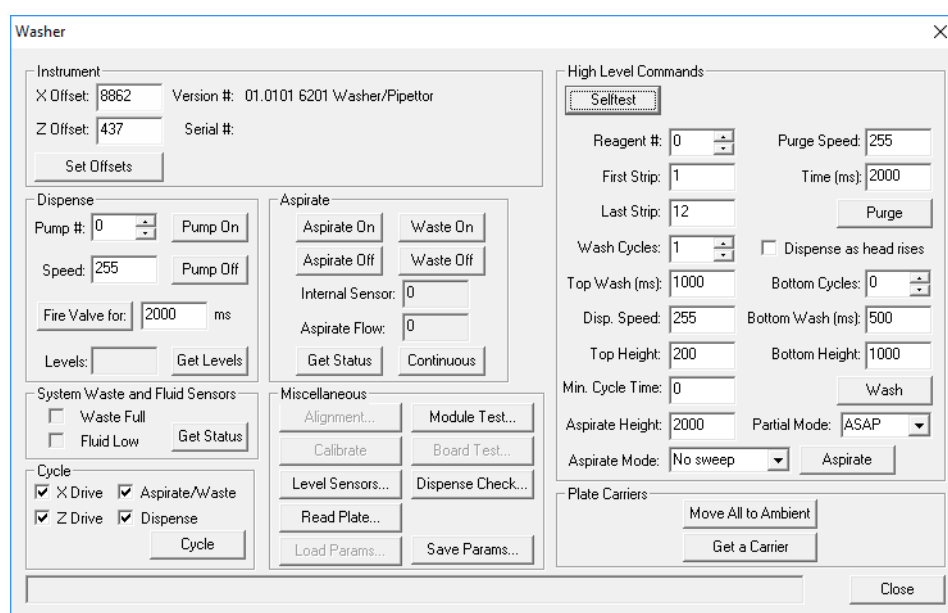


Figure 17-36: Washer main dialog

INSTRUMENT

Function	Description
X Offset	X-offset of the wash head. Automatically set by the adjustment function. The X-offset value is determined/fixed when teaching the plate transport.
Z Offset	Z-offset of the wash head. Automatically set by the adjustment function.
Set Offsets	X-offset and Z-offset edit boxes provided; Pressing set offsets sends offsets to module.
Version	Shows the firmware version number, if connection is established with the module.
Serial	Shows the serial number, if connection is established with the module.

Table 17-1: Functions of the **Instrument** area

DISPENSE

Allows user control of dispense pumps.

NOTICE

Risk of flooding

Running the pump with full reagent bottles connected will result in flooding.

Function	Description
Pump	Allows to enter the pump number (0 - 2) <ul style="list-style-type: none"> 0 = RED channel 1 = BLUE channel 2 = YELLOW channel
Speed	Dispense speed.
Pump On	Turns on the pump selected from list, pump #, pump speed determined by contents of edit box for speed. Do not use this function with GEMINI Washer Pipettor Firmware version 01.0101. Instead of the "dispense" functions, please use the "high level commands" to check the functioning of individual pumps.
Pump Off	Turns pump off. Do not use this function with GEMINI Washer Pipettor Firmware version 01.0101. Instead of the "dispense" functions, please use the "high level commands" to check the functioning of individual pumps.
Fire Value for	Edit box to enter time in ms, pressing 'Fire Valve for' button will activate the valve for the period of time given.
Levels	Shows the level of the bottle sensors in the following channel order: <ul style="list-style-type: none"> 0 = RED channel 1 = BLUE channel 2 = YELLOW channel <p>The letter or number shows the level of every channel.</p> <ul style="list-style-type: none"> 0 = Bottle empty or unplugged 4 = Bottle filled with liquid <p>Example: 404</p> <ul style="list-style-type: none"> RED channel: Bottle filled with liquid BLUE channel: Bottle empty or unplugged YELLOW channel: Bottle filled with liquid <p>Info: If the display order "empty/full" is not correct, then the bottles have probably been changed over, this must be reversed via the service software.</p> <p>See also chapter 17.5.2 on page 17-11.</p>
Get Levels	Updates the level sensors status of the Levels field.

Table 17-2: Functions of the **Dispense** area

ASPIRATE

Function	Description
Aspirate On	Turns on the aspirate pump.
Aspirate Off	Turns off the aspirate pump.
Waste On	Turns on the waste pump (peristaltic pump).
Waste Off	Turns off the waste pump.
Internal Sensor	Displays internal float switch (full) sensor status. 0 = Okay, 1 = Fluid Low or low vacuum.
Aspirate Flow	Displays aspirate flow sensor. 0 = Okay, 1 = Fluid Low or low vacuum.
Get Status	Updates the sensor float status of the Internal Sensor and Aspirate Flow fields.
Continuous	Continuous aspirate sensor check that updates dialog until Abort pressed.

Table 17-3: Functions of the **Aspirate** area

SYSTEM WASTE AND FLUID SENSORS

Function	Description
Waste Full	Check boxes will be checked, if sensor active.
Fluid Low	Check boxes will be checked, if sensor active.
Get Status	Updates the status in status display boxes.

Table 17-4: Functions of the **System Waste and Fluid Sensors** area

CYCLE

Function	Description
X Drive	Enable the X-drive for cycle test.
Z Drive	Enable the Z-drive for cycle test (12 movements to simulate a full plate per cycle).
Aspirate/waste	Enable aspirate/waste function for cycle test.
Dispense	Enable dispense function for cycle test.
Cycle	Starts the cycle test.

Table 17-5: Functions of the **Cycle** area

MISCELLANEOUS

Function	Description
Alignment	see chapter 17.4.1 on page 17-8
Board Test	see chapter 17.8.2 on page 17-46
Calibrate	Runs the calibration process. Follow the instructions in each dialog. Requires empty plates and precision scales or the washer calibration tool (jig).
Dispense Check	The check dispense 300 µl of each reagent into 4 rows of a microplate. The test also checks the aspiration of the liquid.
Load Params	Loads the module adjustment parameters from a file.
Module Test	Function not for service!
Read Plate	Allows a plate dispensed from the washer using a dyed solution to be read in the reader module. This allows the C.V. across the plate to be calculated from each OD reading.
Save Params	Saves the current module adjustment parameters to file. It uses the standard file dialog.

Table 17-6: Functions of the **Miscellaneous** area

INFO

Use the **Save Params** and **Load Params** functions before/after replacement of the instrument CU board to save/load the adjustment values.

HIGH LEVEL COMMANDS

Function	Description
Selftest	see chapter 17.8.1 on page 17-45
Reagent	Numbers 0 to 3. <ul style="list-style-type: none"> 0 = RED channel 1 = BLUE channel 2 = YELLOW channel
First Strip	First strip number defaults to 1
Last Strip	Last strip number defaults to 12, therefore default is for whole plate.
Wash Cycles	Number of cycles to wash defaults to 1, range 0 to 100.
Top Wash	Top wash duration defaults to 1000 ms.
Disp. Speed	Dispense speed, 255 is equivalent to 100 %. (See note)
Top Height	Defaults to 20.
Min. Cycle Time	Sets the minimum cycle time defaults to 0, no delay.
Aspirate Height	Defaults to 170.
Aspirate Mode	Always ensure the correct sweep mode is selected for the plate used: No sweep for U plates, Sweep for flat and C type plates.
Purge Speed	Default is 255. Purging is most effective at the fastest speed.
Time	Purge time defaults to 2000 ms.
Purge	Purges reagent channel. Edit boxes for purge speed and time (ms) provided. Purging is most effective when the highest speed (255) is used.
Dispense as head rises	If this item is selected, the wash heads dispenses wash fluid already while moving upward.
Bottom Cycles	Number of bottom cycles defaults to 0, range 0 to 100.
Bottom Wash	Duration of bottom wash defaults to 500 ms.
Bottom Height	Height of head during bottom wash operation defaults to 100.
Wash	Washes plate using the parameters assigned.
Partial Mode	Defaults to ASAP, other option Constant. (See note)
Aspirate	Aspirates plate using the parameters assigned.

Table 17-7: Functions of the High Level Commands area

INFO

If you pause the wash process, do not immediately click on **Abort** or **Continue**, wait until the washer has paused, before selecting either **Abort** or **Continue**. If you press abort too early, flooding may occur! Pressing **Selftest** will reset the module.

INFO

If you pause the aspirate process, do not immediately click on **Abort** or **Continue**, wait until the washer has paused, before selecting either **Abort** or **Continue**. If you press abort too early, the aspiration cycle will not move home correctly. Pressing **Selftest** will reset the module.

INFO

Dispense speed ranges from 0 to 255. This equates to a frequency drive to the dispense pump. 255 is equivalent to 50 Hz and 0 is equivalent to 10 Hz. However, the 100 % used in the user software can be adjusted by the rate 100 parameter (in the registry of the application software) to lower frequencies than 50 Hz. Typically this parameter is 75 %, i.e. 191.

INFO

Partial mode is used to alter the method of washing when less than 12 strips are being washed. Asap means the plate will be washed as soon as possible. Constant means that the wash time will be the same as for a full plate.

PLATE CARRIERS

Function	Description
Move All to Ambient	Gets all plate carriers one-by-one into the ambient positions.
Get a Carrier	Gets one plate carrier to the load/unload position.

Table 17-8: Functions of the Plate Carriers area

GENERAL

Function	Description
Close	Closes application
Command Line Display	The line at the bottom of the screen displays the devices reply.

Table 17-9: Functions

17.8.1 INITIALIZATION AND SELFTEST

When **Selftest** button clicked, initialization and selftest commands processed.

INITIALIZATION STEPS

- Checks for EEPROM error
- Initialize Z
- Aspirate pump off, check flow sensor
- Aspirate pump on, check flow sensor
- Waste pump connected
- Check waste bottle sensor
- Turn off all dispense pumps, check connected
- Check valve connected
- Check fan speed

If an error occurs during any test, the appropriate error response is given and the test stops (see chapter 6.2.6 on page 6-31).

Otherwise command responds with **OK**, successful command execution.

17.8.2 TEST PROCEDURE FOR BOARD TEST

Runs the sequence of tests that verify correct board operation. When the **Board Test** button is pressed, the following sequence is performed. The user must update the **user** field. This data is stored in the results file.

Test modes allow for automatic sequencing through all the tests or allows the user to select and skip tests manually.

Procedure	Explanation:
Unique Identifications	The data report produced will display the user ID input from the above dialog as well as the test software version.
Serial number	The serial number to be read from the module EEPROM. If this test fails, please contact the manufacturer.
Parameters	Verifies default values stored within the EEPROM.
Fan	Checks if the incubator fan is running.
Z Drive	Verifies the Z-drive.
Pump Control	Verifies the pumps. Note: The dispense pumps will function in this test. If reagent bottles are connected, reagent will be dispensed!
Level Sensors	Verifies the level sensors by detecting a change on each input.
Waste Sensor	Tests waste sensor.
System Fluid Sensor	Tests system fluid sensor.
Selftest	Performs the selftest.

Table 17-10: Board test procedures

18 IFA PUMPS MODULE (OPTIONAL)

This chapter describes this module in detail. In the first section "Safety" additionally to the general safety notes (see chapter 1.2 on page 1-6) safety notes are specified, which concern particularly this module. The section "Overview" gives a short overview about this module. The section "Tips and Information" gives tips and information for the handling. This section is followed by a larger part containing information about maintenance, repair and testing of this module (sections "Adjustment and Calibration", "Check and Verification", "Maintenance", "Troubleshooting and Repairs" and "Connections, Signals and Switches"). The last section "Service Software" describes only the service software module which only concerns this module.

18.1 SAFETY

NOTICE

Avoid kinks in the tubings during the installation!

18.2 OVERVIEW

18.2.1 IFA PUMPS MODULE OVERVIEW AND LIQUID PLAN

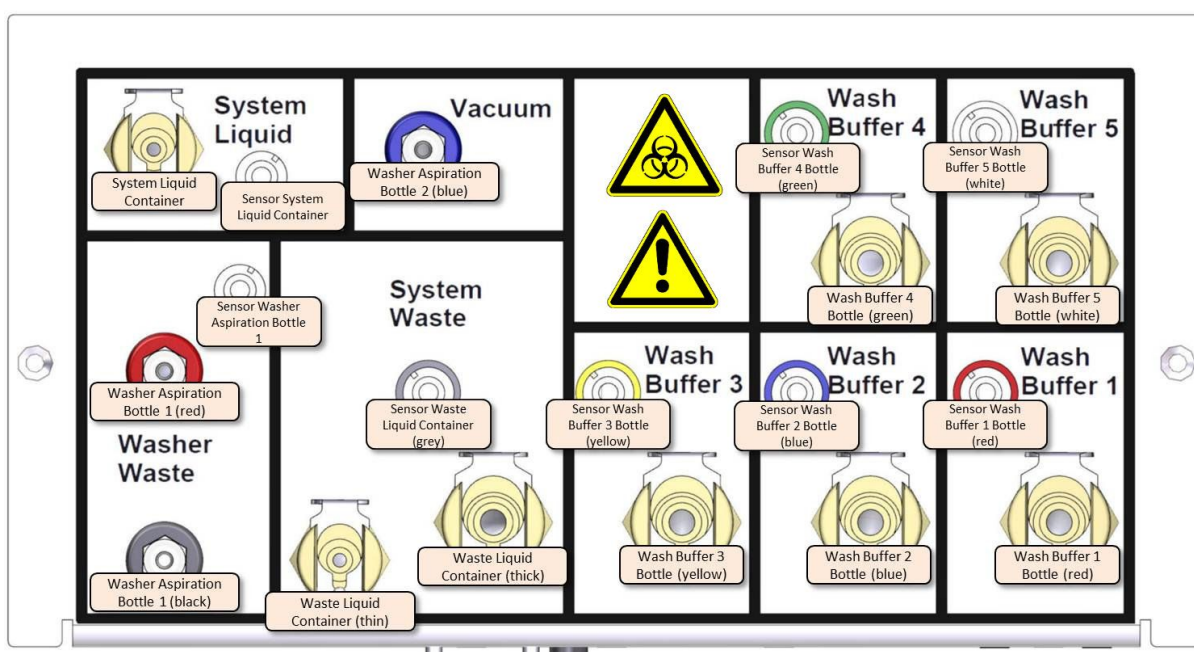


Figure 18-1: IFA pumps module overview (front view)

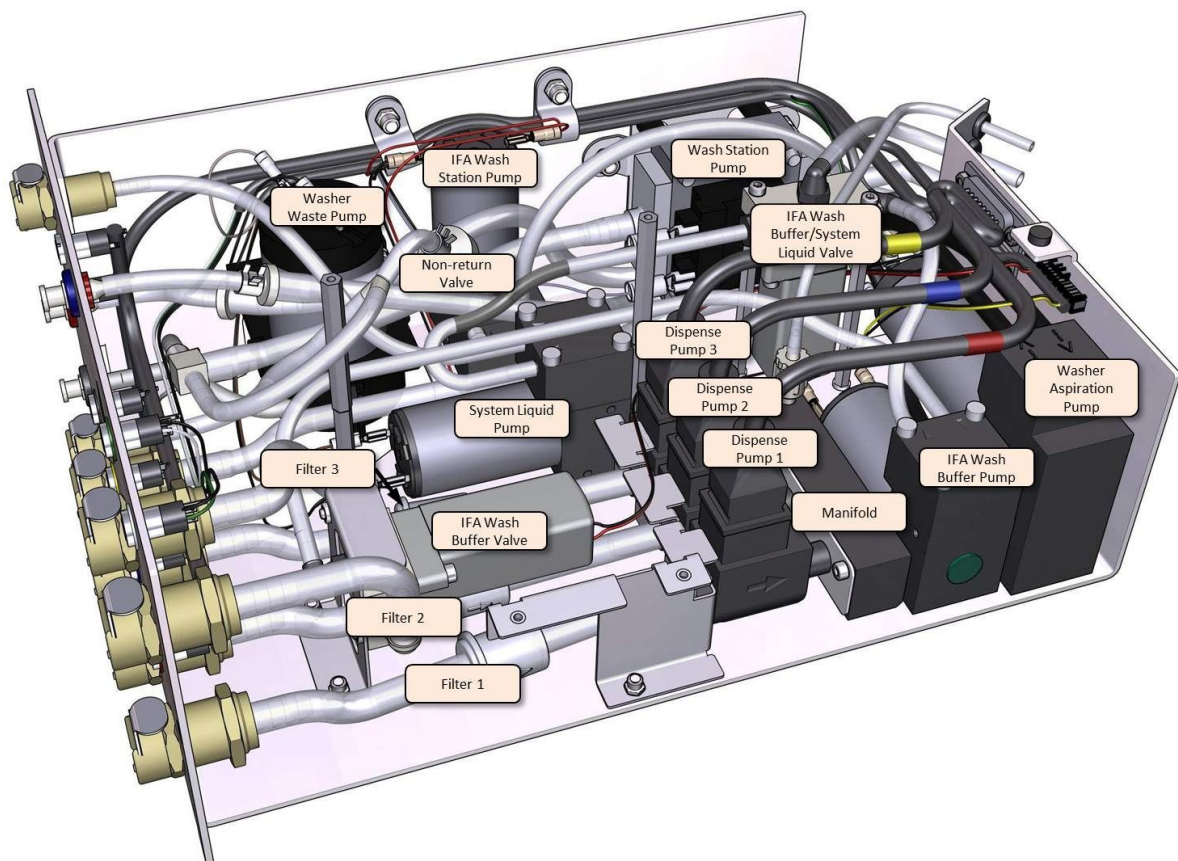


Figure 18-2: IFA pumps module overview (inside view - without liquid protection)

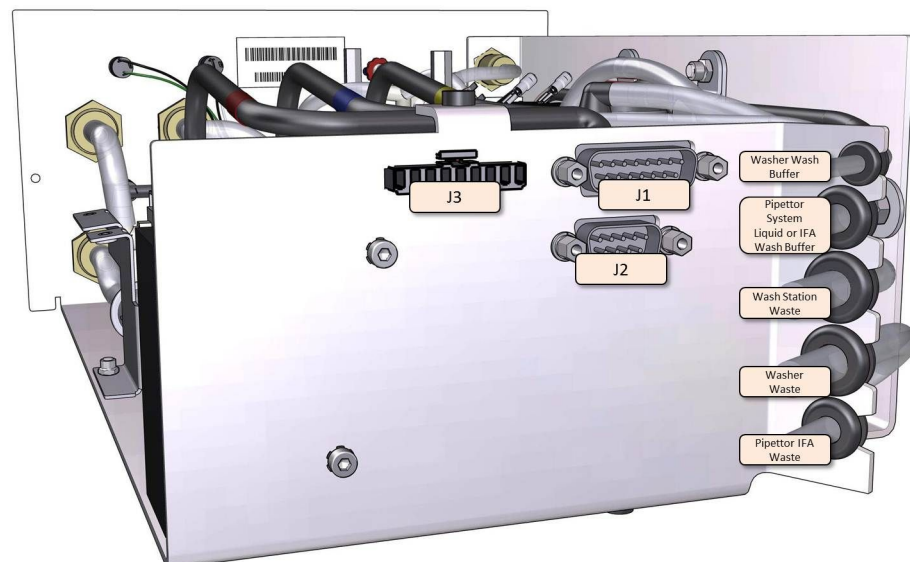


Figure 18-3: IFA pumps module overview (rear view)

18.2.2 IFA LIQUID PLAN

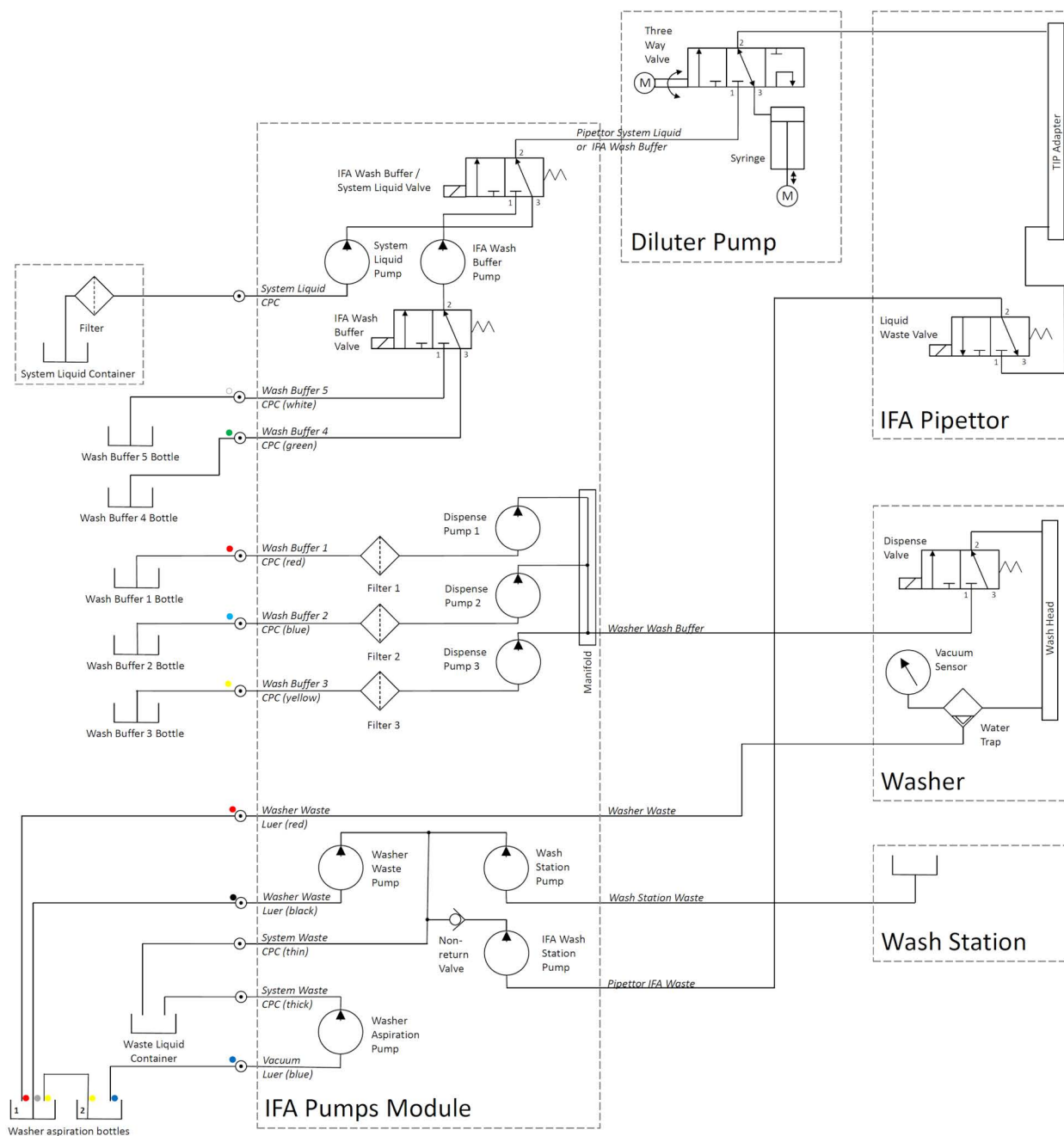


Figure 18-4: Liquid plan - instrument with IFA pipettor

18.3 TIPS AND INFORMATION

This section describes tips and tricks for the handling of the IFA pumps module.

18.3.1 IFA PUMPS MODULE TOOLS

See chapter 17.3.1 on page 17-6

18.4 ADJUSTMENT AND CALIBRATION

In this section, the adjustment of the IFA pumps module is described.

18.4.1 VOLUME CALIBRATION OF THE WASHER

See chapter 17.4.2 on page 17-10

18.5 CHECK AND VERIFICATION

In this section information about the testing of certain components can be found.

18.5.1 PERFORM WASHER AND PUMPS MODULE TEST

See chapter 17.5.1 on page 17-11

18.5.2 CHECK LEVEL OF WASH BUFFER FLOAT SWITCHES

See chapter 17.5.2 on page 17-11

18.6 MAINTENANCE

18.6.1 ACTIVATE DRY-RUN DISPENSE PUMPS

See chapter 18.6.1 on page 18-6

18.7 TROUBLESHOOTING AND REPAIRS

18.7.1 REPLACEMENT OF IFA PUMPS MODULE

REMOVAL



1. Shut down the computer and switch off the instrument.
2. Disconnect main power from the instrument.
3. Remove the deck top (see chapter 8.3.1 on page 8-9).
4. Remove both retaining screws (2).

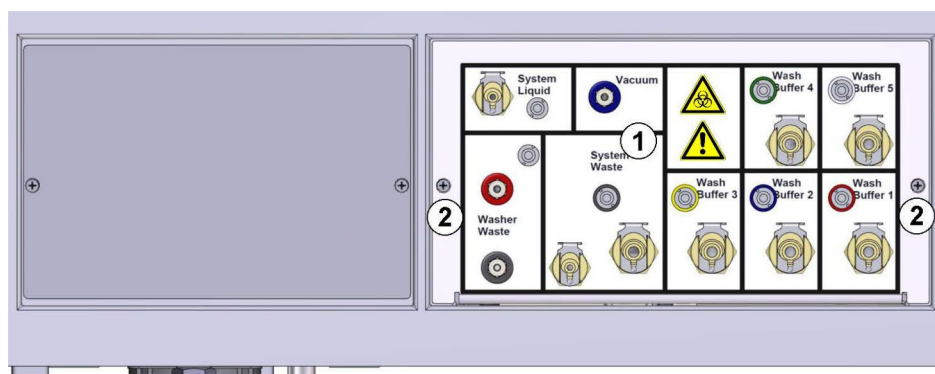


Figure 18-5: IFA pumps module

5. Pull out the IFA pumps module (1). Take care about the cables and tubings.

Disconnect tubings and connectors:

6. Disconnect the connectors J1, J2, and J3 (see chapter 18.2.1 on page 18-2).
7. Open the fitting of the tubing *Washer Wash Buffer* on the wash buffer manifold (1) and remove the tubing.

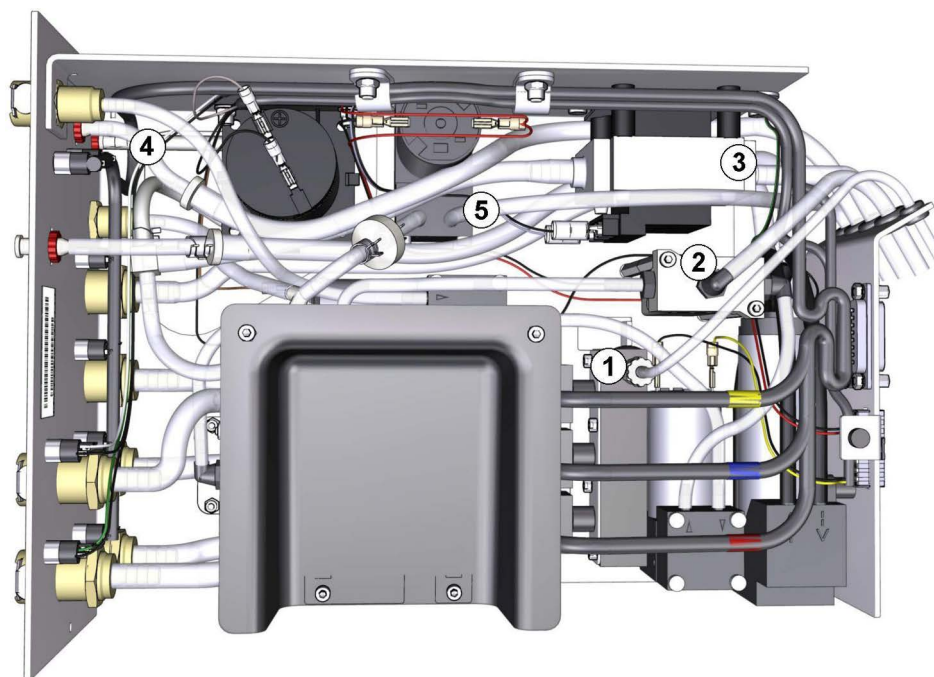


Figure 18-6: IFA pumps module overview (inside view)

8. Remove tubing *Pipettor System Liquid or Wash Buffer* from the system liquid/ wash buffer valve (2) and remove the tubing.
9. Remove tubing *Washer Waste* from the wash station pump (3) and remove the tubing.
10. Remove tubing *Wash Station Waste* from the washer aspiration bottle 1 connector (4) and remove the tubing.
11. Remove tubing *Pipettor IFA Waste* from the IFA wash station pump (5) and remove the tubing.

INSTALLATION

12. Put the tubing *Wash Station Waste* up to the IFA wash station pump (5) inlet.
13. Put the tubing *Wash Station Waste* up to the washer aspiration bottle 1 connector (4).
14. Put the tubing *Washer Waste* up to the wash station pump (3) inlet.
15. Put the tubing *Pipettor System Liquid or Wash Buffer* up to the system liquid/ wash buffer valve (2) outlet.
16. Tighten the fitting of the tubing *Washer Wash Buffer* on the wash buffer manifold (1).
17. Insert the hose nozzle of the tubings into the bracket.
18. Plug in the connectors J1, J2 and J3 (see chapter 18.2.1 on page 18-2).
19. Put in the pumps module (1). Take care about the cables and tubings. You can see and sort the tubings through the frame under the desk top.
20. Tighten both retaining screws (2).
21. Install the deck top (see chapter 8.3.1 on page 8-9).

18.7.2 REPLACEMENT OF LIQUID PROTECTION

See chapter 17.7.7 on page 17-25

18.7.3 REPLACEMENT OF SYSTEM LIQUID PUMP

REMOVAL



1. Remove the pumps module (see chapter 18.7.1 on page 18-7).
2. Remove the liquid protection (see chapter 17.7.7 on page 17-25).
3. Disconnect the two connectors (2 and 3) of the system liquid pump (1).

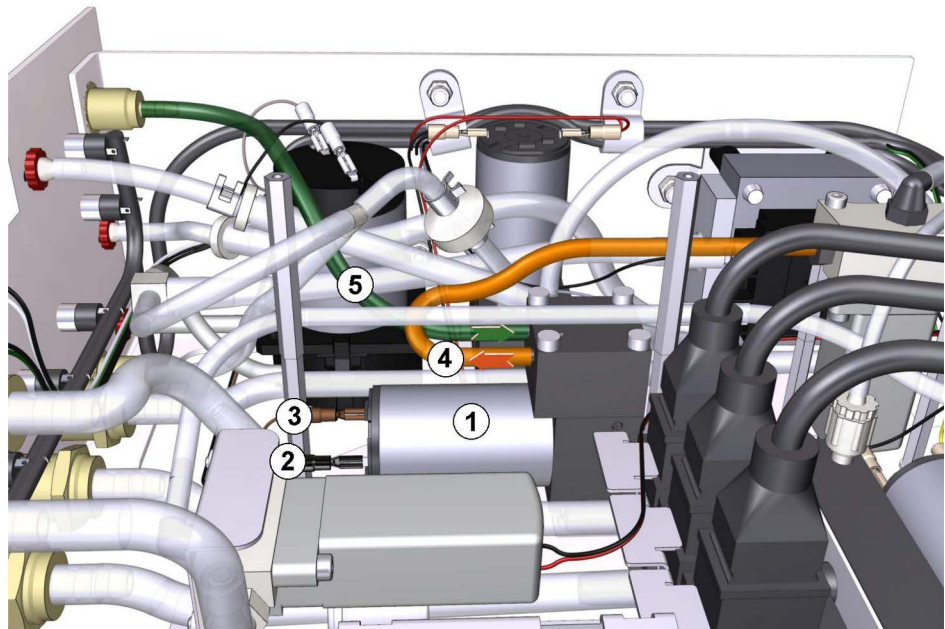


Figure 18-7: System liquid pump (with colored pump tubings)

4. Pull the tubing (4) down from the system liquid pump (1).
5. Pull the tubing (5) down from the system liquid pump (1).
6. Remove the four retaining screws on the underside of the pumps module.
7. Remove the system liquid pump (1).

INSTALLATION

8. Install the system liquid pump (1).
9. Tighten the four retaining screws on the underside of the pumps module.

NOTICE

Take notice of the flow direction!

10. Put the tubing (5) up to the system liquid pump (1) inlet.
11. Put the tubing (4) up to the system liquid pump (1) outlet.

12. Plug the two connectors to the system liquid pump (1).
 - Plus: brown cable (3)
 - Minus: black cable (2)
13. Install the liquid protection (see chapter 17.7.7 on page 17-25).
14. Install the pumps module (see chapter 18.7.1 on page 18-7).

18.7.4 REPLACEMENT OF TUBING CASSETTE OF THE WASHER WASTE PUMP

REMOVAL



1. Remove the pumps module (see chapter 18.7.1 on page 18-7).
2. Open the tube clamp (1) next to the T-fitting.

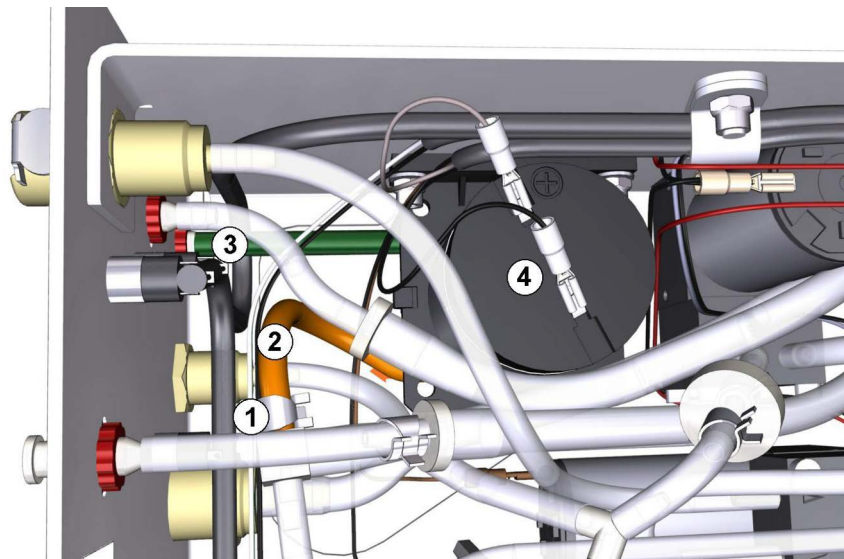


Figure 18-8: Tube clamp next to the T-fitting (with colored pump tubings)

3. Pull the tubing (2) down from the T-fitting.
4. Pull the tubing (3) down from the washer aspiration bottle 1 connector (black).
5. Remove the tubing cassette (5) by pressing the clips (6) at top and bottom of the cassette and pulling down the tubing cassette.

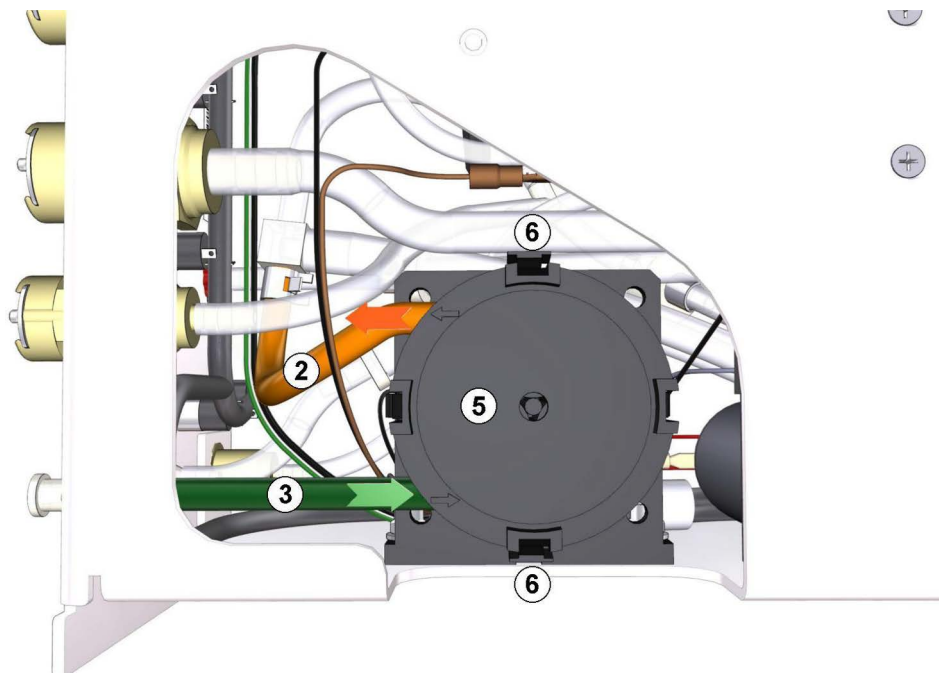


Figure 18-9: Tubing cassette (with colored pump tubings)

INSTALLATION

6. Cut the tubings (2 and 3) of the new tubing cassette (5) to a length of 60 mm.
7. Push the new tubing cassette (5) onto the motor axle of the pump motor (4) until the clips snap in.

NOTICE

Take notice of the flow direction!

8. Put the tubing (3) up to the washer aspiration bottle 1 connector (black).
9. Put the tubing (2) up to the T-fitting.
10. Install the tube clamp (1) next to the T-fitting.
11. Install the pumps module (see chapter 18.7.1 on page 18-7).

18.7.5 REPLACEMENT OF WASHER WASTE PUMP MOTOR

See chapter 17.7.10 on page 17-29

18.7.6 REPLACEMENT OF WASHER ASPIRATION PUMP

See chapter 17.7.11 on page 17-30

18.7.7 REPLACEMENT OF WASH STATION PUMP

See chapter 17.7.12 on page 17-32

18.7.8 REPLACEMENT OF DISPENSE PUMP (WASH BUFFER PUMP)

See chapter 17.7.13 on page 17-33

18.7.9 REPLACEMENT OF LIQUID FILTER

REMOVAL



1. Remove the pumps module (see chapter 18.7.1 on page 18-7).
2. Remove the liquid protection (see chapter 17.7.7 on page 17-25).
3. Remove the two nuts (1).

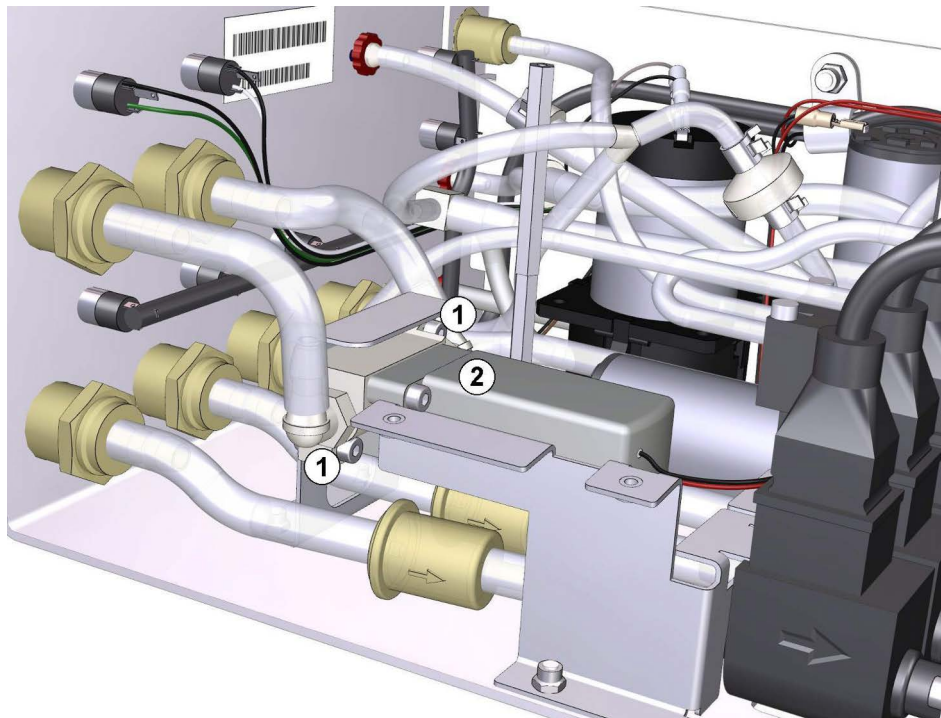


Figure 18-10: Installed IFA wash buffer toggle valve

4. Put the IFA wash buffer toggle valve (2) aside.
5. Pull the tubing between damaged filter (3, 4, or 5) and dispense pump down from the filter.

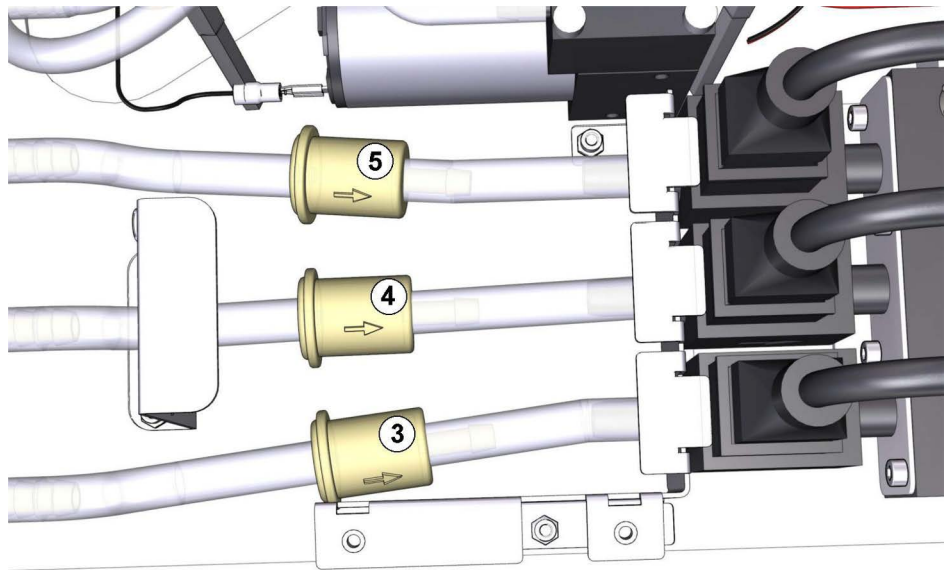


Figure 18-11: Installed liquid filters

6. Pull the tubing between damaged filter (3, 4, or 5) and fitting down from the filter.

INSTALLATION

7. Insert the new liquid filter (3, 4, or 5).

NOTICE

Take notice of the flow direction!

8. Put the tubing between filter (3, 4, or 5) and fitting up to the filter.
9. Put the tubing between filter (3, 4, or 5) and dispense pump up to the filter.
10. Install IFA wash buffer valve (2) and tighten both screws (1).
11. Install the liquid protection (see chapter 17.7.7 on page 17-25).
12. Install the pumps module (see chapter 18.7.1 on page 18-7).

18.7.10 REPLACEMENT OF WASH BUFFER MANIFOLD

See chapter 17.7.15 on page 17-36

18.7.11 REPLACEMENT OF IFA WASH BUFFER PUMP

REMOVAL

1. Remove the pumps module (see chapter 18.7.1 on page 18-7).
2. Remove the liquid protection (see chapter 17.7.7 on page 17-25).
3. Disconnect the two connectors (2 and 3) of the IFA wash buffer pump (1).

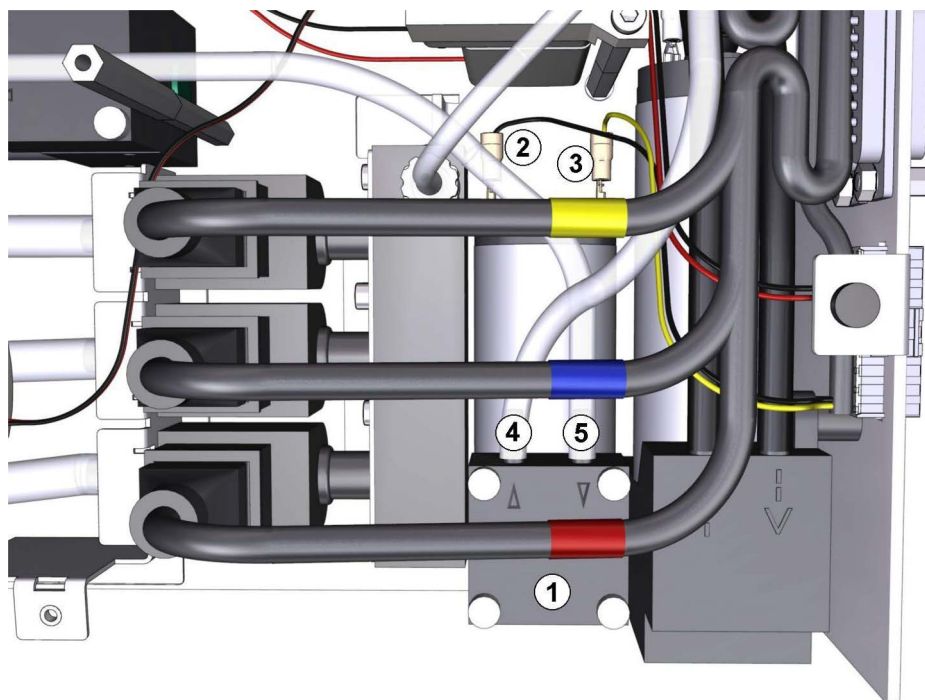


Figure 18-12: Installed IFA wash buffer pump

4. Pull the tubing (4) down from the IFA wash buffer pump (1).
5. Pull the tubing (5) down from the IFA wash buffer pump (1).
6. Remove the four retaining screws on the underside of the pumps module.
7. Remove the IFA wash buffer pump (1).

INSTALLATION

8. Install the IFA wash buffer pump (1).
 9. Tighten the four retaining screws on the underside of the pumps module.
-

NOTICE

Take notice of the flow direction!

10. Put the tubing (5) up to the IFA wash buffer pump (1) inlet.
11. Put the tubing (4) up to the IFA wash buffer pump (1) outlet.
12. Plug the two connectors to the IFA wash buffer pump (1).
 - Plus: yellow cable (3)
 - Minus: black cable (2)
13. Install the liquid protection (see chapter 17.7.7 on page 17-25).
14. Install the pumps module (see chapter 18.7.1 on page 18-7).

18.7.12 REPLACEMENT OF IFA WASH STATION PUMP

REMOVAL



1. Remove the pumps module (see chapter 18.7.1 on page 18-7).
2. Remove the liquid protection (see chapter 17.7.7 on page 17-25).
3. Disconnect the two connectors (2 and 3) of the IFA wash station pump (1).

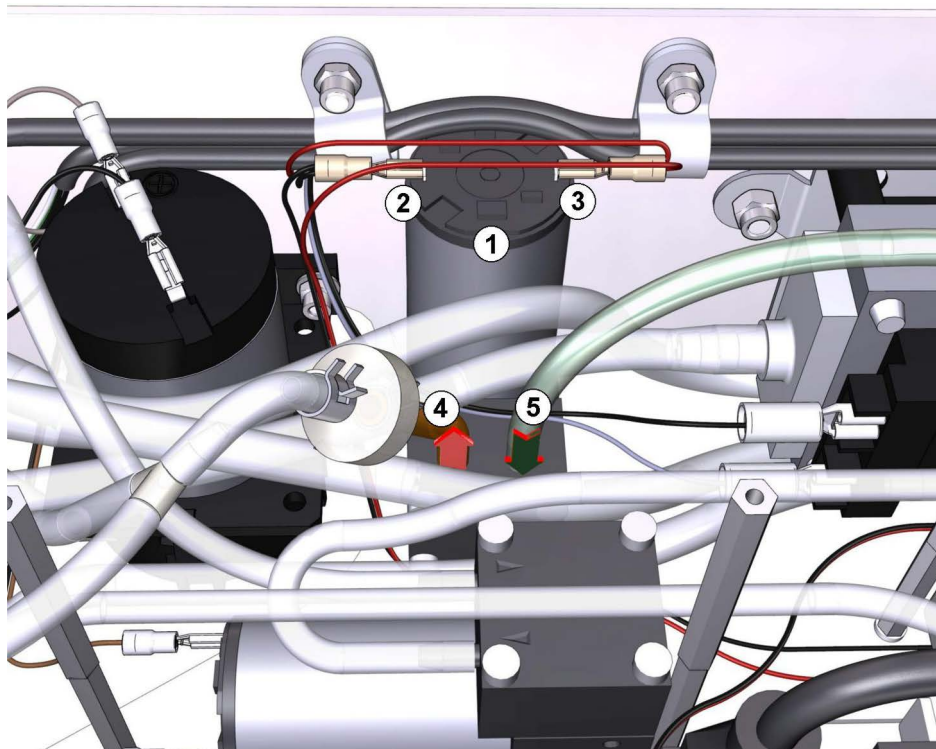


Figure 18-13: Installed IFA wash station pump

4. Pull the tubing (4) down from the IFA wash station pump (1).
5. Pull the tubing (5) down from the IFA wash station pump (1).
6. Remove the four retaining screws on the side of the pumps module.
7. Remove the IFA wash buffer pump (1).

INSTALLATION

8. Install the IFA wash buffer pump (1).
9. Tighten the four retaining screws on the underside of the pumps module.

NOTICE

Take notice of the flow direction!

10. Put the tubing (5) up to the IFA wash station pump (1) inlet.
11. Put the tubing (4) up to the IFA wash station pump (1) outlet.
12. The contacts of the IFA wash station pump (1) must be bent flat to the outside.
13. Plug the two connectors to the IFA wash station pump (1).
 - Plus: red cable (3)
 - Minus: black cable (2)
14. Install the liquid protection (see chapter 17.7.7 on page 17-25).
15. Install the pumps module (see chapter 18.7.1 on page 18-7).

18.7.13 REPLACEMENT OF CHECK VALVE (IFA WASH STATION PUMP)

REMOVAL



1. Remove the pumps module (see chapter 18.7.1 on page 18-7).
2. Remove the liquid protection (see chapter 17.7.7 on page 17-25).
3. Open both tube clamps next to the check valve (1).

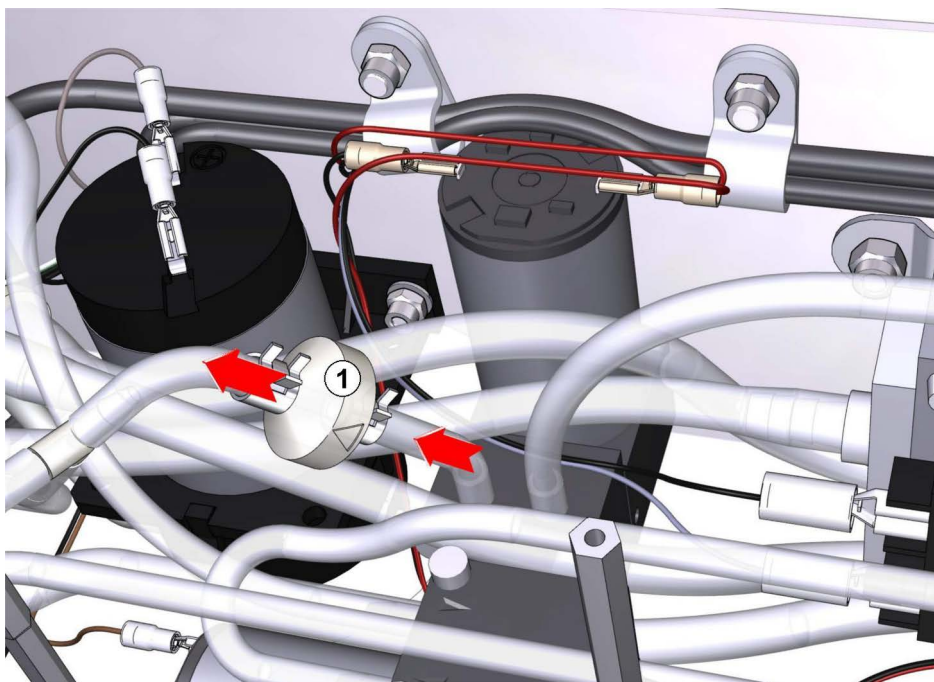


Figure 18-14: Installed check valve

4. Pull the tubings down from the check valve (1).
 5. Remove the check valve (1).
-
6. Put the tubings with the tube clamps up to the new check valve (1).

INSTALLATION

NOTICE

Take notice of the flow direction (see arrow on the valve)!

7. Install the liquid protection (see chapter 17.7.7 on page 17-25).
8. Install the pumps module (see chapter 18.7.1 on page 18-7).

18.8 SERVICE SOFTWARE

See chapter 14.7 on page 14-32

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19 ELECTRIC CONNECTIONS, SIGNALS AND SWITCHES

This chapter shows an overview of the electronic boards of the instrument.

19.1 OVERVIEW OF ELECTRIC CONNECTIONS

INSTRUMENTS WITH ALL-IN-ONE- PC

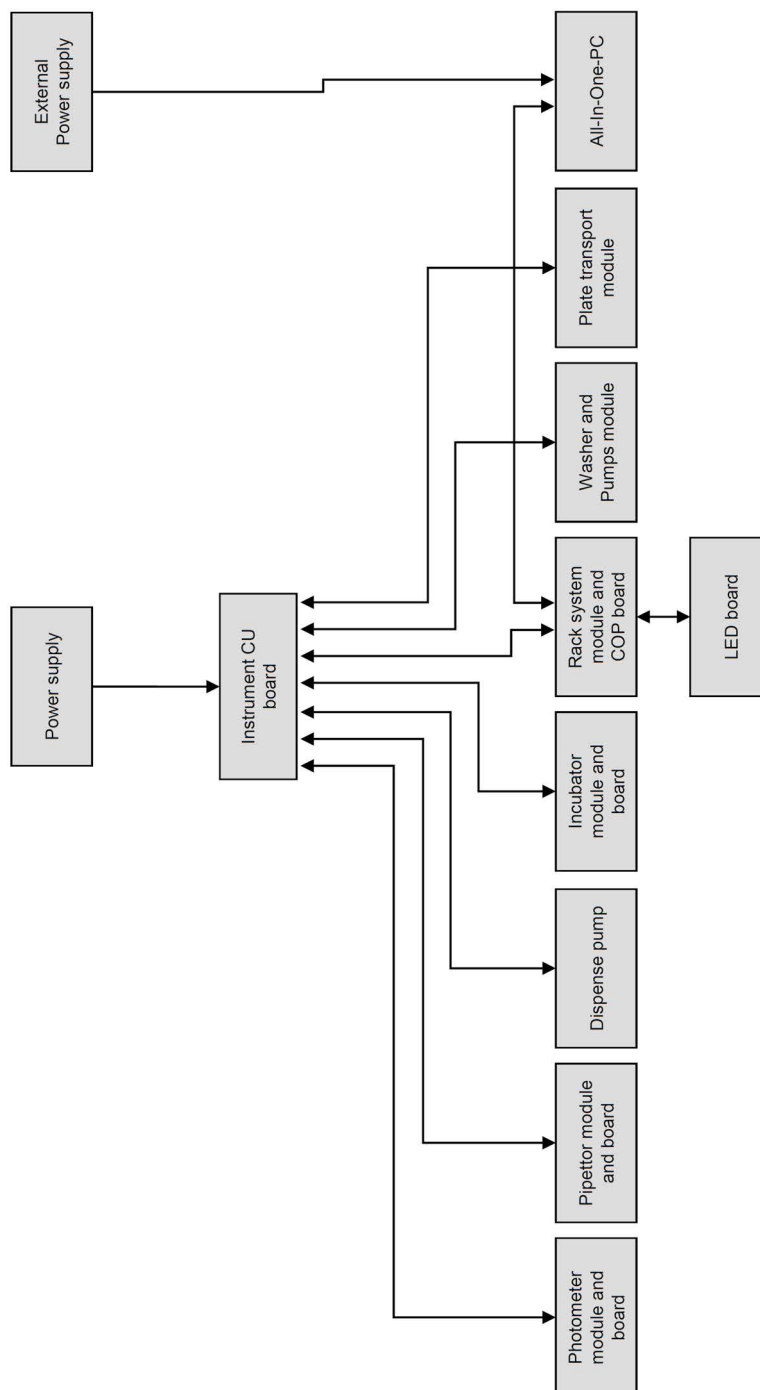


Figure 19-1: Electrical connections plan (Instruments with All-In-One-PC)

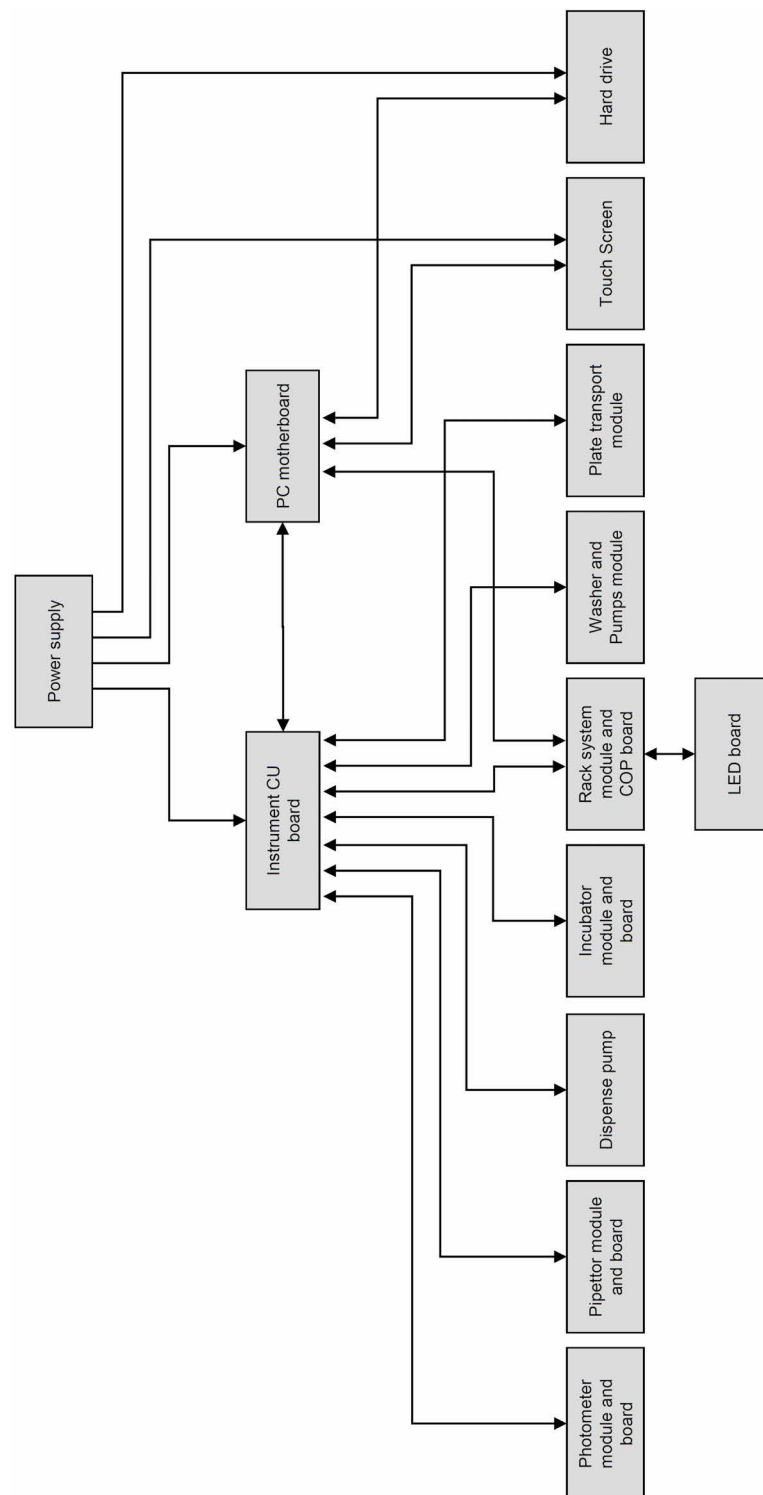
INSTRUMENTS
WITH SEPARATE
PC AND TOUCH
SCREEN

Figure 19-2: Electrical connections plan (Instruments with separate PC and touch screen)

19.1.1 PC AND TOUCH SCREEN

INSTRUMENTS WITH ALL-IN-ONE-PC

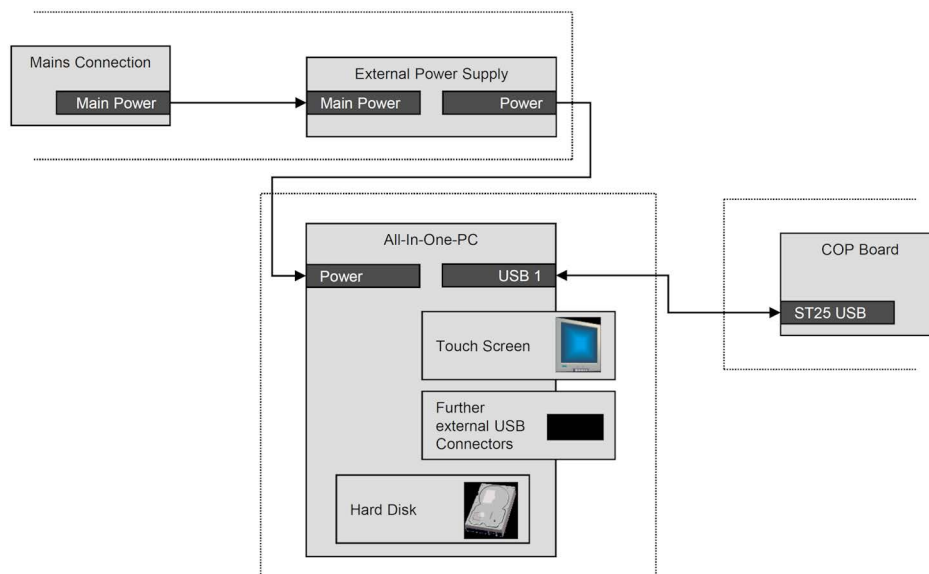


Figure 19-3: Instruments with All-In-One-PC

INSTRUMENTS WITH SEPARATE PC AND TOUCH SCREEN

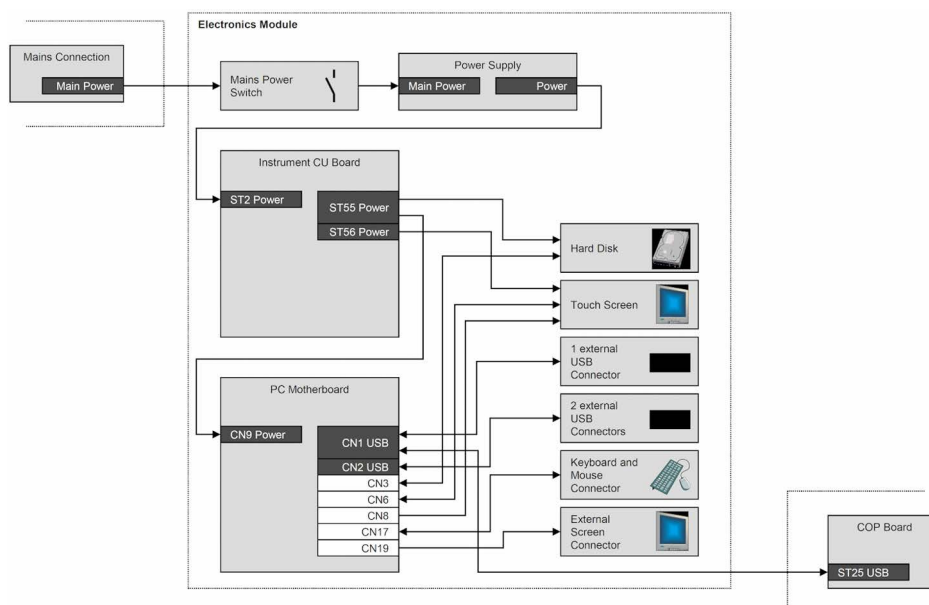


Figure 19-4: Instruments with separate PC and touch screen

19.1.2 INSTRUMENT CU BOARD <=> INCUBATOR MODULE

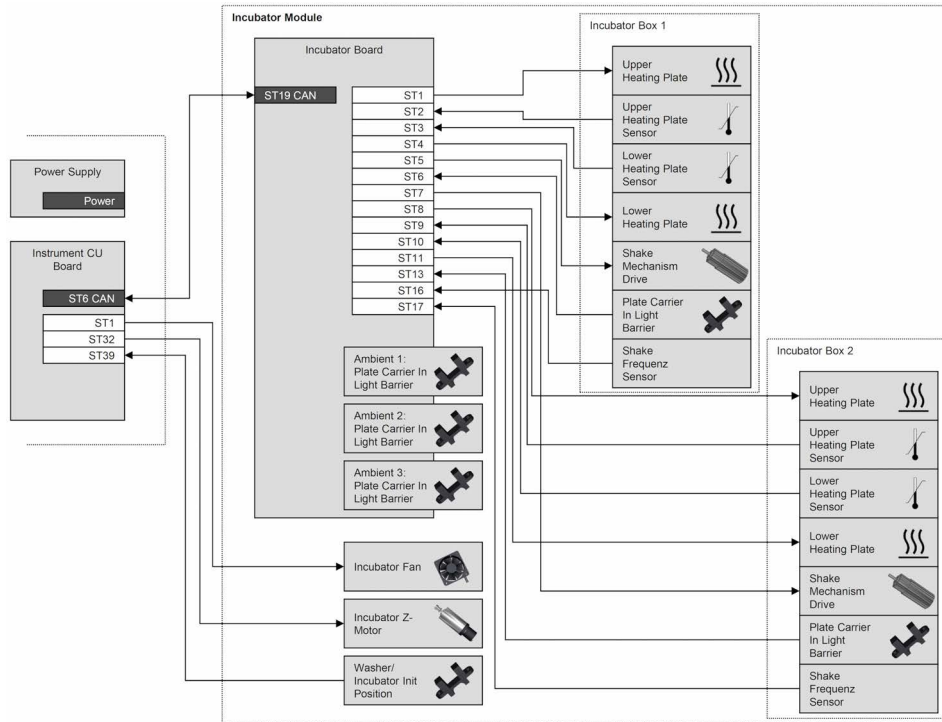


Figure 19-5: Instrument CU Board <=> Incubator Module

19.1.3 INSTRUMENT CU BOARD <=> PHOTOMETER MODULE

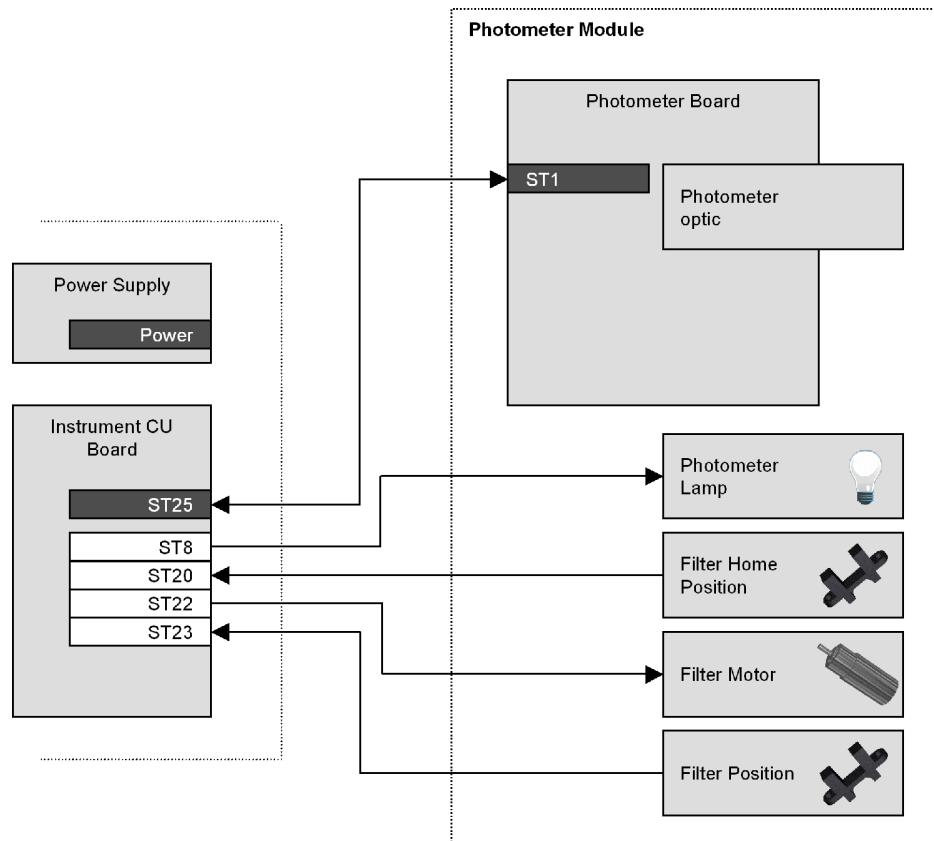


Figure 19-6: Instrument CU Board <=> Photometer Module

19.1.4 INSTRUMENT CU BOARD <=> PIPETTOR MODULE

PIPETTOR MODULE (VERSION 3)

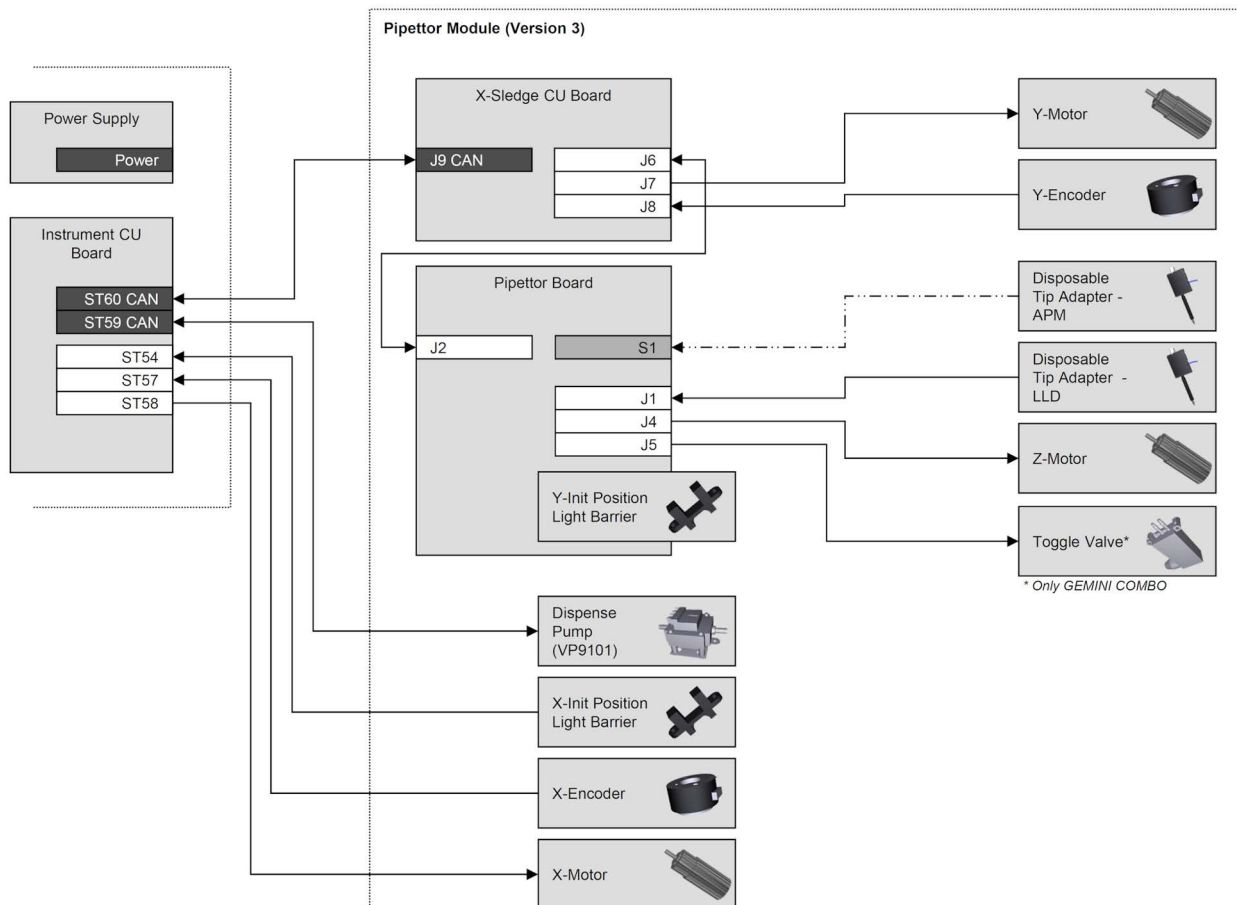


Figure 19-7: Instrument CU Board <=> Pipettor Module (Version 3)

PIPETTOR MODULE (VERSION 2)

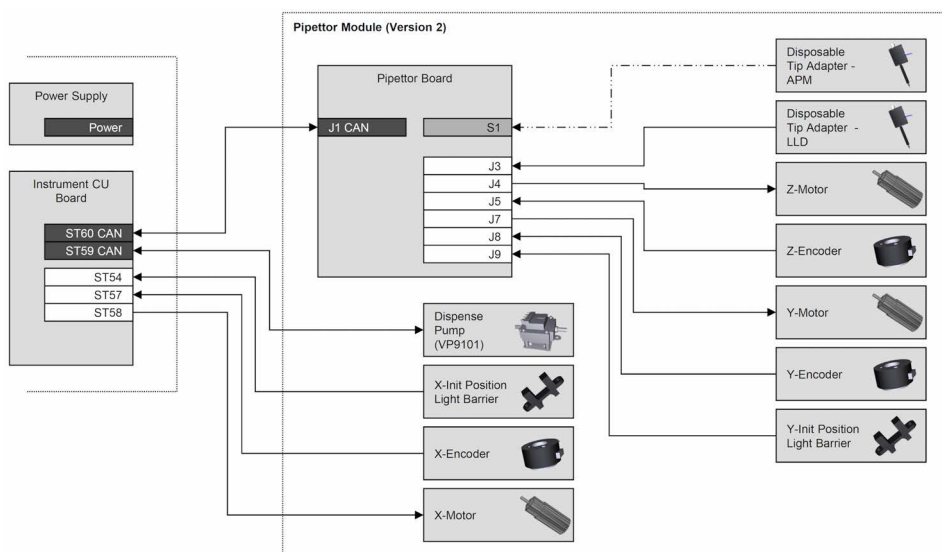


Figure 19-8: Instrument CU Board <=> Pipettor Module (Version 2)

19.1.5 INSTRUMENT CU BOARD <=> PLATE TRANSPORT MODULE

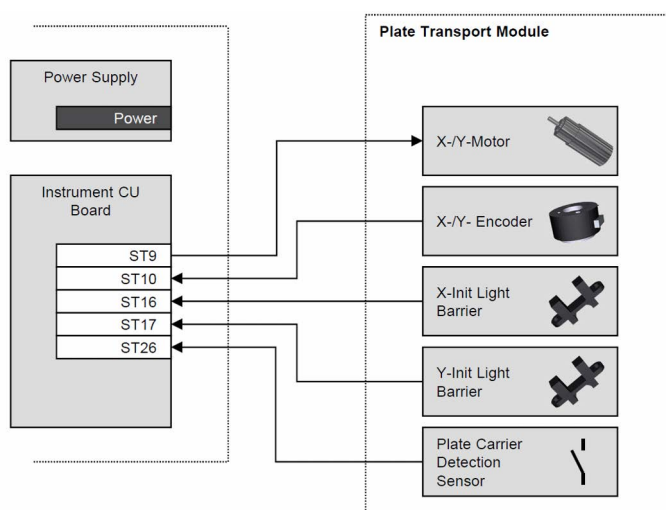


Figure 19-9: Instrument CU Board <=> Plate Transport Module

19.1.6 INSTRUMENT CU BOARD <=> LOADING BAY MODULE

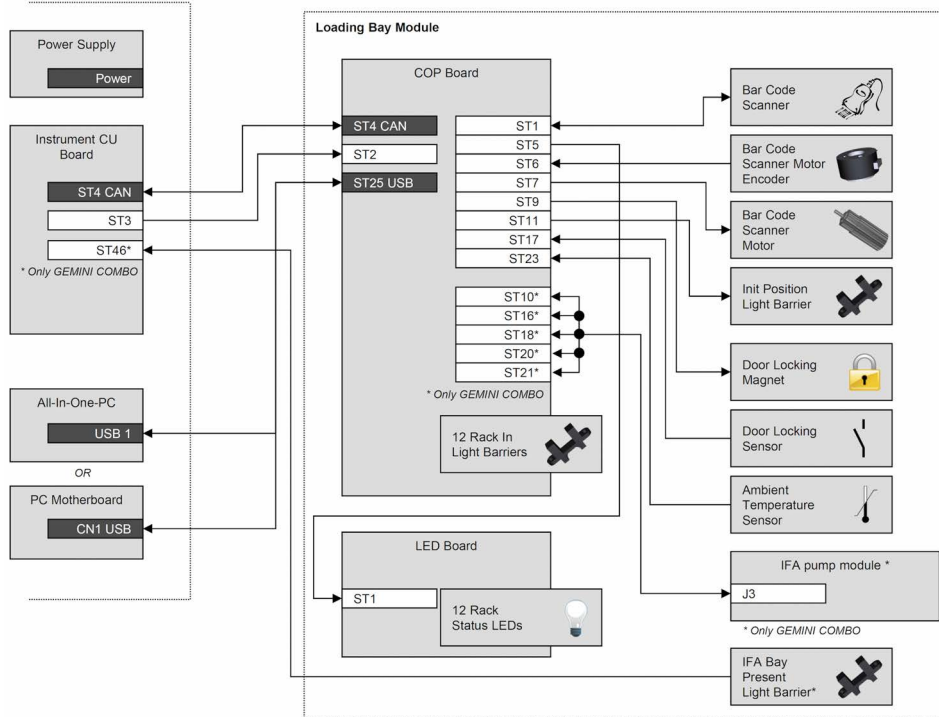


Figure 19-10: Instrument CU Board <=> Loading Bay Module

19.1.7 INSTRUMENT CU BOARD <=> WASHER AND PUMPS MODULE

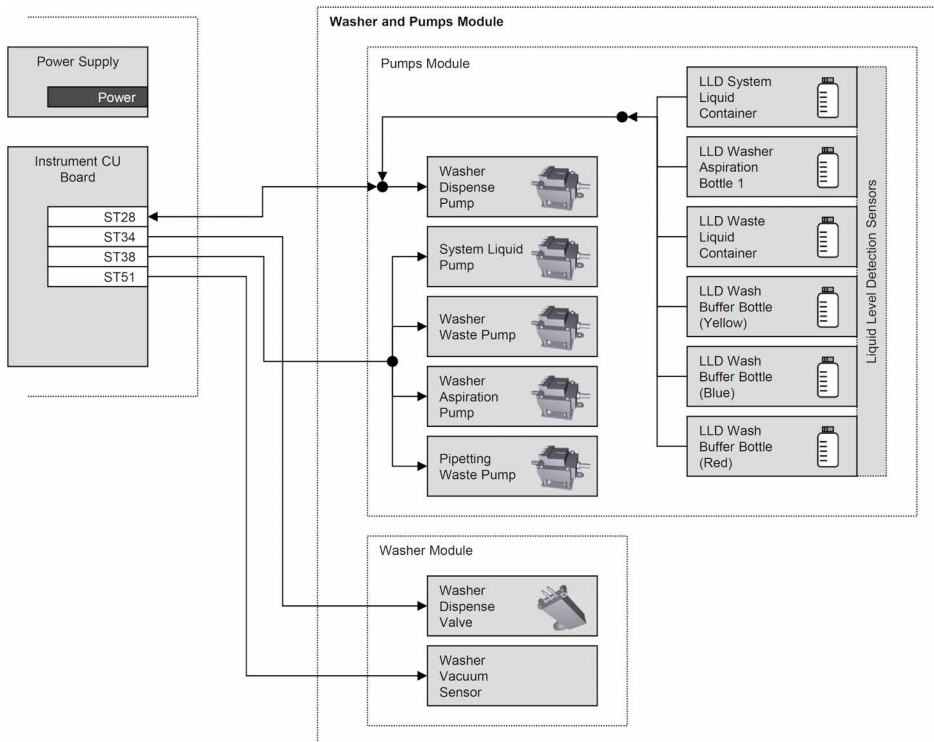


Figure 19-11: Instrument CU Board <=> Washer and Pumps Module

GEMINI COMBO: See also chapter 19.1.6 on page 19-9.

19.2 ELECTRONICS MODULE

This section shows an overview of the electric components of the electronics module with electric connection.

INFO

Note information about the CAN-bus (see chapter 9.3.1 on page 9-7)!

19.2.1 INSTRUMENT CU BOARD

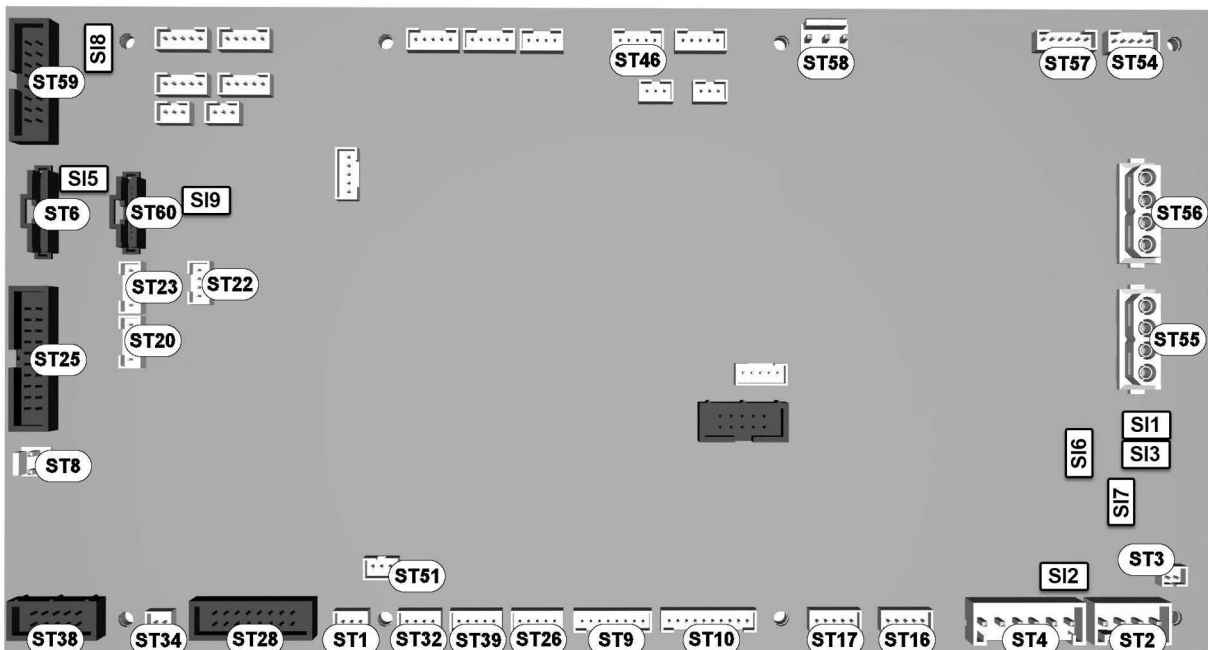


Figure 19-12: Instrument CU board

Number	Connection
ST1	Incubator fan
ST2	From power supply output
ST3	Connection to COP board (ST2) - power switch
ST4	CAN-bus to COP board (ST4)
ST6	CAN-bus ribbon cable to incubator board (ST19)
ST8	Photometer lamp
ST9	Plate transport X-/Y-motors
ST10	Plate transport X-/Y-encoders
ST16	Plate transport X-init light barrier
ST17	Plate transport Y-init light barrier
ST20	Photometer filter home position
ST22	Photometer filter motor
ST23	Photometer filter position
ST25	Ribbon cable to photometer board (ST1)
ST26	Plate transport plate carrier detection sensor
ST28	Ribbon cable to pumps module (connector 9+, see chapter 17.2.2 on page 17-3)
ST32	Incubator Z-motor
ST34	Washer dispense valve
ST38	Ribbon cable to pumps module (connector 10+, see chapter 17.2.2 on page 17-3)
ST39	Washer/Incubator init position
ST46	GEMINI: Unused GEMINI COMBO: IFA bay presence sensor
ST51	Washer vacuum sensor
ST54	Pipettor X-init position
ST55	Power connection to PC board and hard-disk Info: This connection is only for instruments with separated touch screen and PC.
ST56	Power connection to touch screen Info: This connection is only for instruments with separated touch screen and PC.
ST57	Pipettor X-encoder
ST58	Pipettor X-motor
ST59	CAN-bus ribbon cable to diluter pump (VP9101)

Number	Connection
ST60	Pipettor version 2: CAN-bus ribbon cable to pipettor board (J1) on the pipettor X-sledge Pipettor version 3: CAN-bus ribbon cable to the X-sledge CU board (J9)

Table 19-1: Connections of the instrument CU board

VOLTAGE CHECK

Test point	Voltage
ST2 - Pin 1 + 2	+ 24 V
ST2 - Pin 3 + 4	GND
ST52 - Pin 3	+ 5 V
ST52 - Pin 2	GND

Table 19-2: Voltage check

* The test point is located on the back of the board.

FUSES

Number	Connector	Fuse
SI1	(ST2)	PTC-SI., 1.35A/30V, 8.9x3mm
SI2	ST4	Time-Lag fuse 3.15A/250V, slow
SI3	(ST2)	Time-Lag fuse 3.15A/250V, slow
SI5	ST6	Time-Lag fuse 3.15A/250V, slow
SI6	ST2	Time-Lag fuse 3.15A/250V, slow
SI7	(ST2)	SMD-SI., 0.3A/60V, PTC-resettable
SI8	ST59	Time-Lag fuse 3.15A/250V, slow
SI9	ST60	Time-Lag fuse 3.15A/250V, slow

Table 19-3: Fuses of the instrument CU board

19.2.2 PC MOTHERBOARD

INFO

Generations of the instrument

This chapter is only for instruments with separated touch screen and PC.

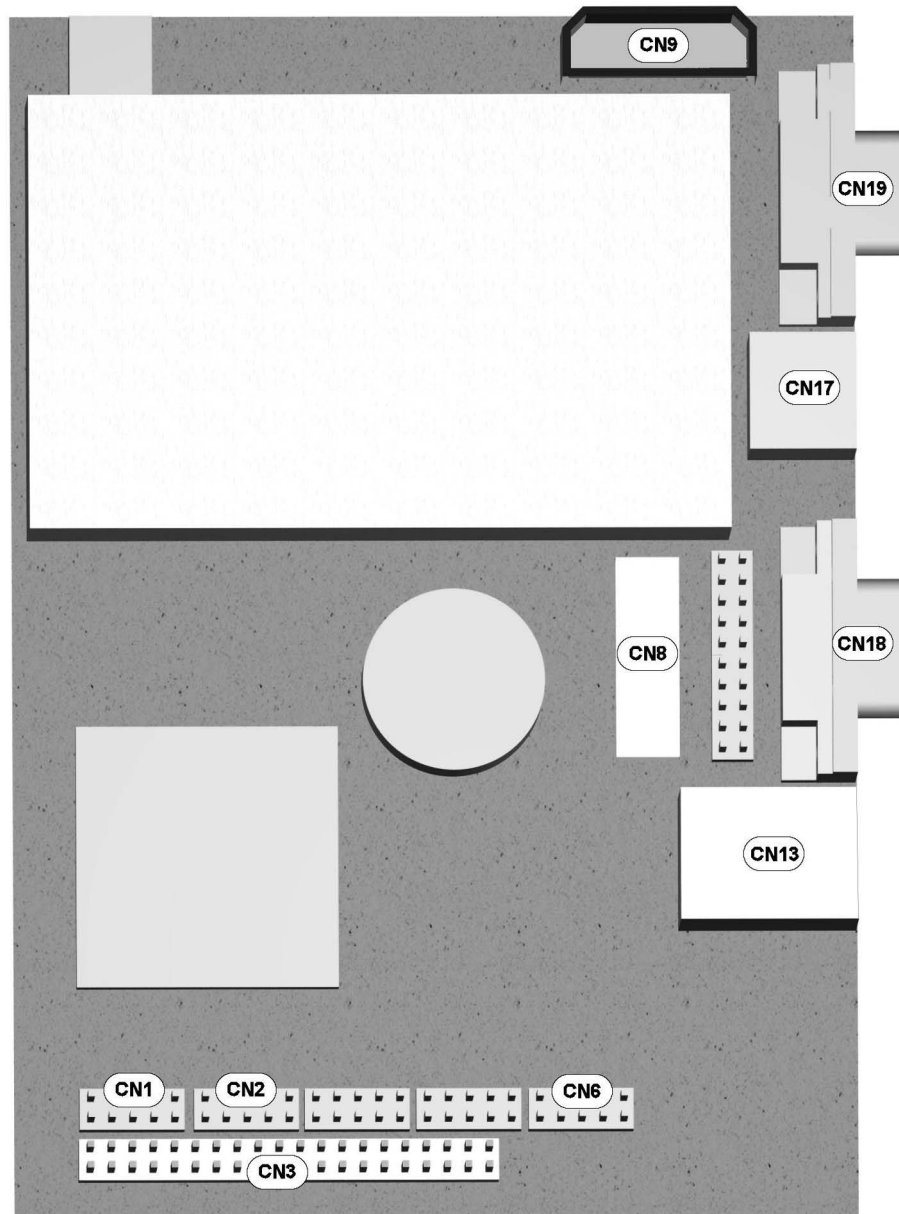


Figure 19-13: PC motherboard

Number	Connection
CN1	USB 2.0 port 1 connector <ul style="list-style-type: none"> • COP board USB connector (ST25) • Upper USB connector (external)
CN2	USB 2.0 port 2 connector <ul style="list-style-type: none"> • Middle USB connector (external) • Lower USB connector (external)
CN3	Primary IDE hard drive connector Note: The red marked cable must be on the left side!
CN6	Touch screen - serial port COM 2 connector Note: The blue cable must be on the upper left pin!
CN8	Touch screen - Dual channel LVDS connector
CN9	Power connector from instrument CU board (ST55)
CN13	External Ethernet 10/100 base-TX RJ-45 phone jack
CN17	External mouse/keyboard - Mini-DIN PS/2 connector
CN18	External serial port COM 1 connector
CN19	External CRT display connector

Table 19-4: Connections of the PC motherboard

19.3 INCUBATOR MODULE

This section shows an overview of the electric components of the incubator module with electric connection.

INFO

The incubator fan is controlled by the washer/pipettor firmware.

19.3.1 INCUBATOR BOARD

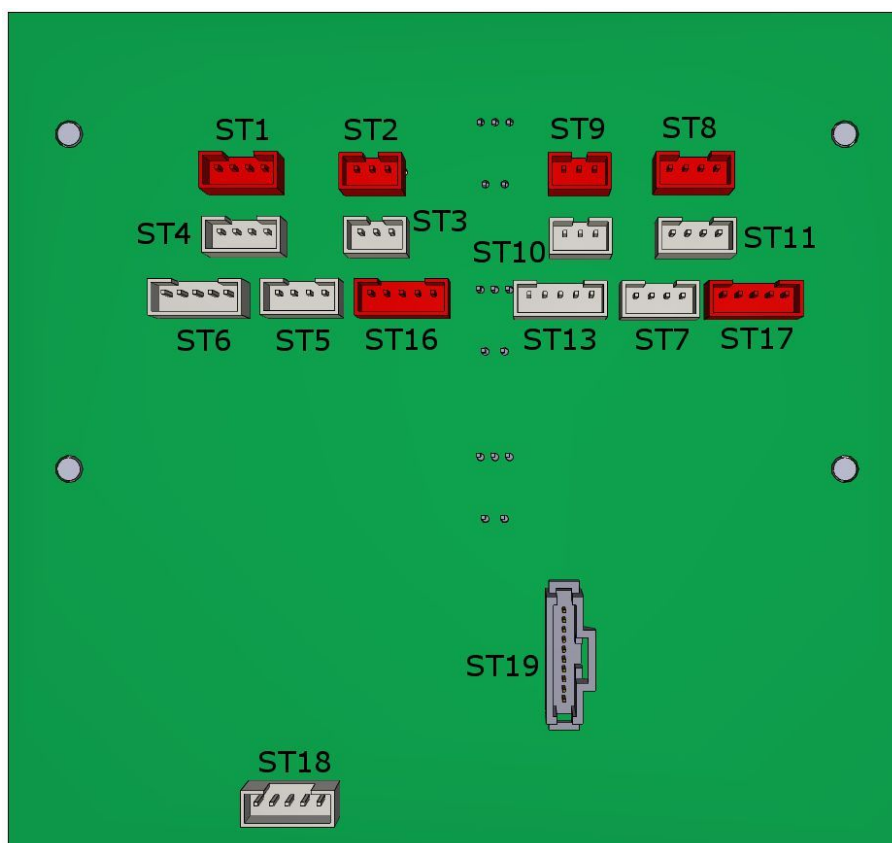


Figure 19-14: Incubator board (Part no. 7620116100) - front side

Number	Connection
ST1	Incubator box 1 - upper heating plate
ST2	Incubator box 1 - upper heating plate sensor
ST3	Incubator box 1 - lower heating plate sensor
ST4	Incubator box 1 - lower heating plate
ST5	Incubator box 1 - shaking mechanism drive
ST6	Incubator box 1 - plate carrier in light barrier
ST7	Incubator box 2 - shaking mechanism drive
ST8	Incubator box 2 - upper heating plate
ST9	Incubator box 2 - upper heating plate sensor
ST10	Incubator box 2 - lower heating plate sensor
ST11	Incubator box 2 - lower heating plate
ST13	Incubator box 2 - plate carrier in light barrier
ST16	Incubator box 1 - shake frequency sensor
ST17	Incubator box 2 - shake frequency sensor
ST18	Download connector
ST19	CAN-bus to instrument CU board (ST6)

Table 19-5: Connections of the incubator board

INFO

The plate carrier in light barriers of the ambient positions are on the back side of the incubator board.

VOLTAGE CHECK

Test point	Voltage
ST19 - Pin 2/3/4	+ 24 V
ST19 - Pin 1/5/8/11/12	GND
TP4*	+ 5 V
TP5*	GND

Table 19-6: Voltage check

* The test point is located on the back of the board.

19.4 PHOTOMETER MODULE

This section shows an overview of the electric components of the photometer module with electric connection.

19.4.1 PHOTOMETER BOARD

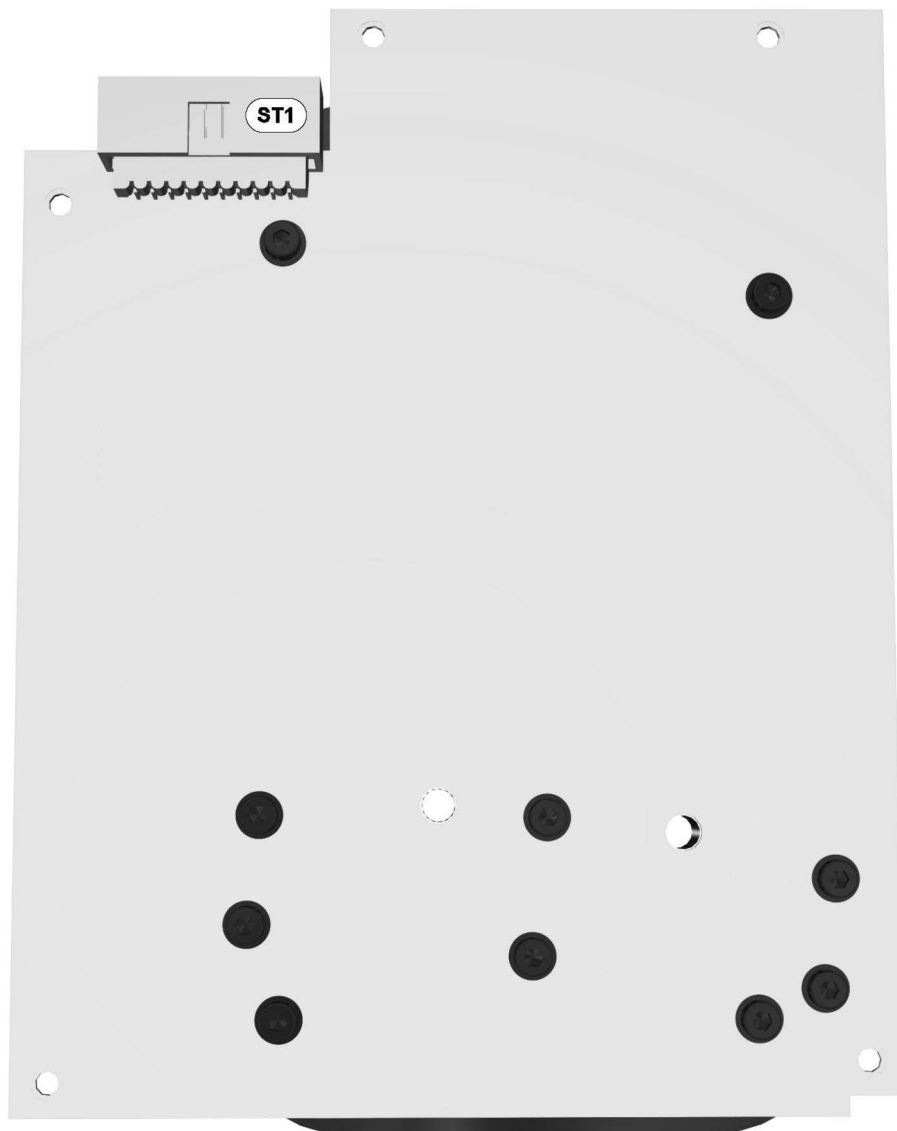


Figure 19-15: Photometer board (Part no. 7620111501)

Number	Connection
ST1	Ribbon cable to instrument CU board (ST25)

Table 19-7: Connections of the photometer board

VOLTAGE CHECK

Test point	Voltage
ST1 - Pin 20	+ 24 V
ST1 - Pin 1	+ 5 V
ST1 - Pin 2/19	GND
TP11*	+ 24 V
TP9*	+ 5 V
TP7*	- 5 V
TP12*	GND

Table 19-8: Voltage check

* The test point is located on the back of the board.

19.5 PIPETTOR MODULE

This section shows an overview of the electric components of the pipetting module with electric connection.

19.5.1 PIPETTOR BOARD

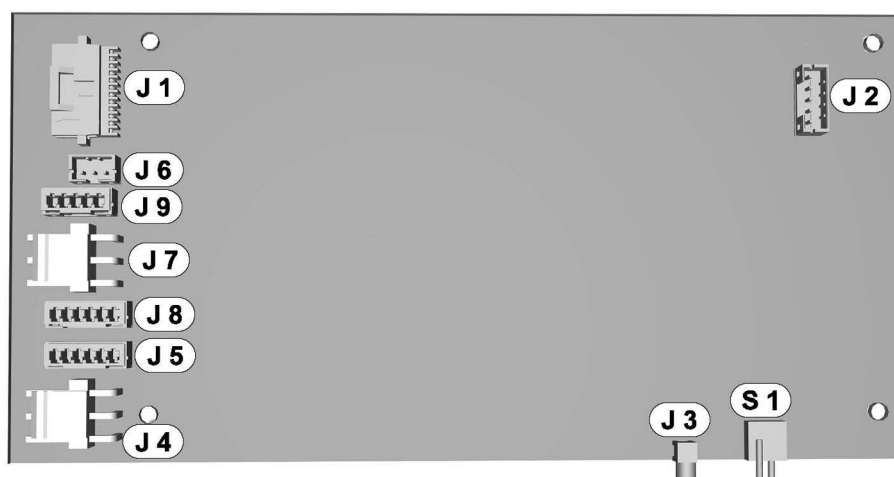


Figure 19-16: Pipettor board

Number	Connection
J1	CAN-bus ribbon cable to instrument CU board (ST60)
J2	Download connector
J3	Liquid level detection cable (LLD cable) from the disposal tip adapter
J4	Z-motor
J5	Z-encoder
J6	Not used
J7	Y-motor
J8	Y-encoder
J9	Y-init light barrier (Y-home position)
S1	Sensor: APM tubing from the disposal tip adapter (only for APM pipetting systems)

Table 19-9: Connections of the pipettor board

19.6 PIPETTOR MODULE (VERSION 3)

This section shows an overview of the electric components of the pipetting module with electric connection.

19.6.1 X-SLEDGE CU BOARD

Part no. 7620514500

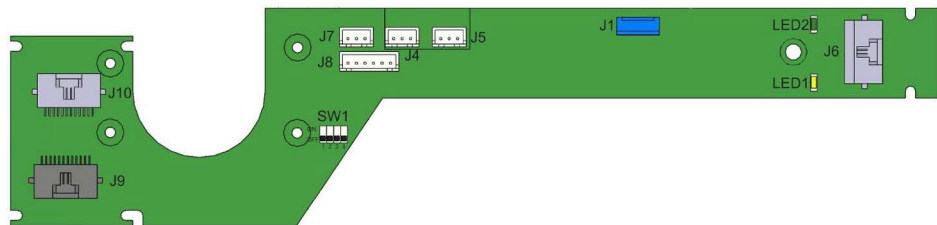


Figure 19-17: X-sledge CU board

Number	Connection
J1	Download connector
J4 (EXT-OUT1)	Not used
J5 (EXT-OUT2)	Not used
J6	Y-sledge CU board (J2)
J7 (Y-MTR)	Y-motor
J8 (Y-ENC)	Y-motor encoder
J9	CAN-bus ribbon cable to instrument CU board (ST60)
J10	Not used

Table 19-10: Connections of the X-sledge CU board

DIP-Switch		Meaning
SW1	1	OFF
	2	OFF
	3	OFF
	4	OFF

Table 19-11: DIP-Switches of the X-sledge CU board

LED	Meaning
LED1	Not used
LED2	+5 V

Table 19-12: LEDs of the X-sledge CU board

VOLTAGE CHECK

Test point	Voltage
TP1	+ 24 V
TP2	+ 5 V
TP3	GND

Table 19-13: Voltage check

19.6.2 Y-SLEDGE CU BOARD

Part no. 7620517400, 10100000290, 10100001647

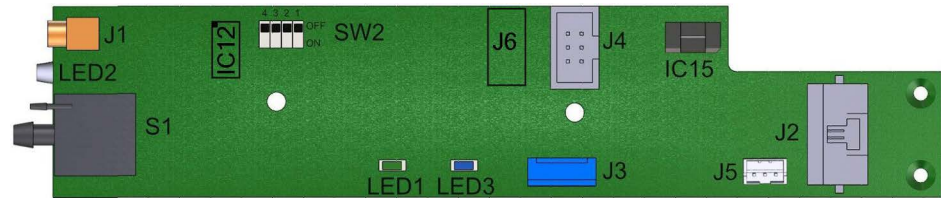


Figure 19-18: Y-sledge CU board

Number	Connection
J1	Liquid level detection (LLD)
J2 (X-Sledge PCB)	X-sledge CU board (J6)
J3 (Download)	Download connector
J4 (Z-Drive)	Z-drive motor
J5 (PWR1)	GEMINI: Unused GEMINI COMBO: Toggle valve V1 between liquid waste extraction and closed.

Table 19-14: Connections of the Y-sledge CU board

DIP-Switch	Meaning
SW2	1 OFF
	2 OFF
	3 OFF
	4 OFF

Table 19-15: DIP-Switches of the Y-sledge CU board

Sensor	Meaning
IC15	Y-init light barrier (Y-home)
S1	Pressure sensor

Table 19-16: Sensors of the Y-sledge CU board

LED	Meaning
LED1	+5 V
LED2	Not used
LED3	Liquid level detection <ul style="list-style-type: none"> • ON: Search level • OFF: Level found

Table 19-17: LEDs of the Y-sledge CU board

VOLTAGE CHECK

Test point	Voltage
J6 - Pin 3	+ 5 V
J6 - Pin 2/5	GND
IC12 - Pin 8	+ 24 V
IC12 - Pin 1	+ 12 V
IC12 - Pin 2/3/6/7	GND

Table 19-18: Voltage check

19.7 IFA PIPETTOR MODULE (OPTIONAL)

See Pipettor Module (Version 3) (see chapter 19.6 on page 19-21).

19.8 PLATE TRANSPORT MODULE

The plate transport module is connected to the instrument CU board (see chapter 19.2.1 on page 19-11).

19.9 LOADING BAY MODULE (RACK SYSTEM) AND COP

This section shows an overview of the electric components of the loading bay module with electric connection.

19.9.1 COP BOARD

Part no. 7620010300, 10100000082, 10100000881, 10100002370, 10100003134

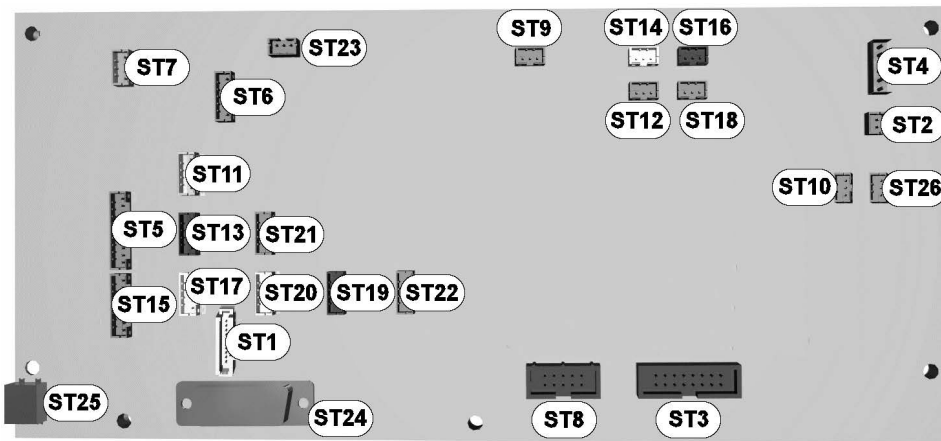


Figure 19-19: COP board

Number	Connection
ST1	Loading bay barcode scanner
ST2	Connection to instrument CU board (ST3) - Power switch
ST3	Unused
ST4	CAN-bus to instrument CU board (ST4)
ST5	Connection to LED board (ST1)
ST6	Barcode scanner motor encoder
ST7	Barcode scanner motor
ST8	Unused
ST9	Door locking magnet (COP firmware 01.0101 and above)/unused (older COP firmware)
ST10	GEMINI: Unused GEMINI COMBO: IFA pump module J3
ST11	Barcode scanner init position light barrier
ST12	Door locking magnet (only COP firmware 01.0100)/unused (newer COP firmware)
ST13	Unused
ST14	Unused
ST15	Unused
ST16	GEMINI: Unused GEMINI COMBO: IFA pump module J3
ST17	Door locking sensor
ST18	GEMINI: Unused GEMINI COMBO: IFA pump module J3
ST19	Unused
ST20	GEMINI: Unused GEMINI COMBO: IFA pump module J3
ST21	GEMINI: Unused GEMINI COMBO: IFA pump module J3
ST22	Unused
ST23	Ambient temperature sensor
ST24	Unused
ST25	USB to PC board (CN1) or to the USB-port of the All-In-One-PC.
ST26	Unused

Table 19-19: Connections of the COP board

NOTICE

Connection of the door locking magnet: Use ST9 only for COP firmware 01.0101 and above, otherwise use ST12.

VOLTAGE CHECK

Test point	Voltage
ST4 - Pin 1	+ 24 V
ST4 - Pin 6	GND
ST15 - Pin 7	+ 5 V
ST15 - Pin 6/8	GND

Table 19-20: Voltage check

19.9.2 LED BOARD



Figure 19-20: LED board

Number	Connection
ST1	Connection to COP board (ST5)

Table 19-21: Connections of the LED board

19.10 WASHER AND PUMPS MODULE

INFO

The incubator fan is controlled by the washer/pipettor firmware.

19.10.1 PUMPS MODULE

The washer and pumps module is connected to the instrument CU board (see chapter 19.2.1 on page 19-11).

Number	Connection
J1	Module connector to instrument CU board ST28 (liquid level detection sensors and washer diluter pumps)
J2	Module connector to instrument CU board ST38 (system liquid pump, washer waste pump, washer aspiration pump, pipetting waste pump)

Table 19-22: Connections of the pumps module

19.10.2 IFA PUMPS MODULE

The IFA pumps module is connected to the instrument CU board (see chapter 19.2.1 on page 19-11).

Number	Connection
J1	Module connector to instrument CU board ST28 (liquid level detection sensors and washer diluter pumps)
J2	Module connector to instrument CU board ST38 (system liquid pump, washer waste pump, washer aspiration pump, pipetting waste pump)
J3	Module connector to COP board ST10, ST16, ST18, ST20, and ST21 (IFA wash buffers liquid level detection sensors, IFA wash station pump, IFA wash buffer toggle valve, and IFA wash buffer pump)

Table 19-23: Connections of the pumps module

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20 TEACHING

This chapter describes the teaching procedure of the pipettor module and the plate transport module in detail. In the first section "Safety" additionally to the general safety notes (see chapter 1.2 on page 1-6) safety notes are specified, which concern particularly the teaching procedures. The next sections describes the teaching procedures separated on pipettor module and plate transport module.

Before leaving the manufacturer, the pipettor and the plate transport of the instrument are adjusted exactly. Nevertheless, it is recommended to check the settings before starting the instrument for the first time. This procedure has to be repeated also when parts for maintenance reasons have been changed.

NOTICE

It is necessary to validate new teaching positions!

20.1 SAFETY

NOTICE

Do not lean on the loading bay barcode scanner unit!

20.2 TEACHING THE PIPETTOR MODULE

INFO

It is necessary to use an external keyboard for teaching!

20.2.1 PIPETTOR TEACH TOOLS

20.2.1.1 MTP TEACHING TOOL

Teaching of dilution and pipette position coordinates.



Figure 20-1: MTP teaching tool

20.2.1.2 POSITION ADJUSTMENT TOOL

Teaching of Z-coordinates.

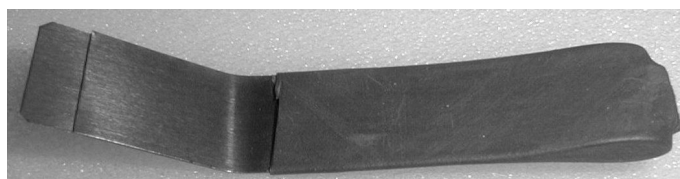


Figure 20-2: Position adjustment tool

20.2.1.3 LOADING BAY TEACH TOOL

Teaching of loading bay.

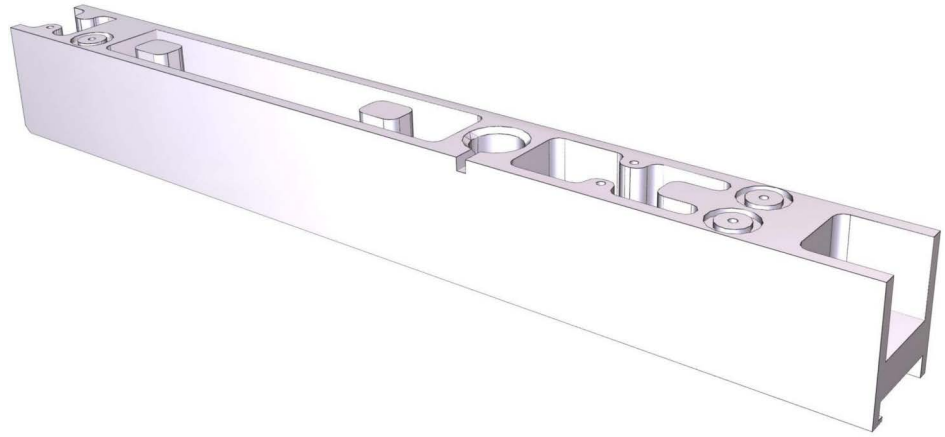


Figure 20-3: Loading bay teach tool

20.2.2 START OF TEACHER SOFTWARE AND GENERAL INFORMATION

INFO

It is necessary to remove the loading bay grid of the loading bay!

INFO

It is necessary to use an external keyboard for teaching!

INFO

If the service software or the user software was running before, this programs have to be closed!



1. Shut down the computer and switch off the instrument.
2. Install an external keyboard (see chapter 2.1.5.1 on page 2-13).
3. Optional: Install an external monitor (see chapter 2.1.5.2 on page 2-13).
4. Switch on the instrument.
5. Start the teacher: Press on the **Teacher** icon on the desktop or select the **Teacher** entry in the **Start** menu.
6. Enter the password and press on the **OK** button.
7. After that, the teacher asks you about the pipettor configuration:
Press on the **Yes** button, if an APM-pipettor installed. Otherwise press on the **No** button.
8. After that, the teacher asks you about the pipettor configuration:
Press on the **Yes** button (**GEMINI**), if an APM-pipettor installed. Otherwise press on the **No** button (**GEMINI COMBO**).

The pipettor is initialized and a graphical representation of the working area with the different working positions appears:

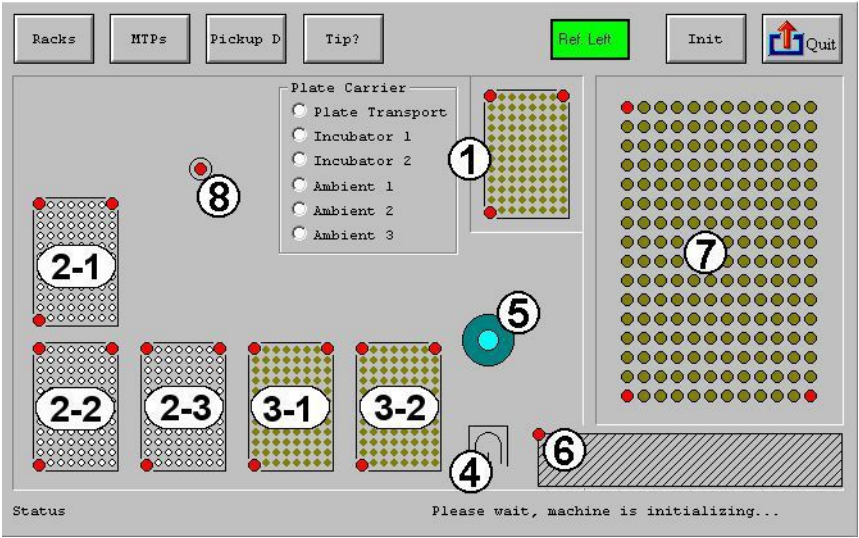


Figure 20-4: Teacher main dialog

Position/Button	Meaning	Explanation
1	Load/unload/pipetting position	chapter 20.2.5 on page 20-14
2	Disposable tip racks	chapter 20.2.6 on page 20-16
3	Dilution or archive plates Position 3-1 can also be used for disposable tip racks	chapter 20.2.7 on page 20-18
4	Tip eject station	chapter 20.2.8 on page 20-19
5	Pipettor wash station	chapter 20.2.9 on page 20-20
6	Restricted area	chapter 20.2.10 on page 20-21
7	Loading bay	chapter 20.2.11 on page 20-22
8	Park position	chapter 20.2.12 on page 20-25
Init	Initialize the pipettor	
MTPs	Teaching microplates	chapter 20.2.14 on page 20-28
Pickup D	Picks up a disposable tip. The only positions where you need a tip are the loading bay and the individual reagent/sample racks.	chapter 20.2.2.3 on page 20-10
Plate Carrier	Current plate carrier positions	chapter 20.2.5 on page 20-14
Quit	Exit teacher software	
Racks	Teaching racks	chapter 20.2.13 on page 20-26
Ref. Left	Teaching reference position Note: Teach/Check this position first!	chapter 20.2.3 on page 20-11
TIP?	Teaching tip type determination position	chapter 20.2.4 on page 20-13

Table 20-1: Use of the teacher main dialog

⚠ WARNING



Risk of injury by moving pipettor

The pipettor could cause injury during movement.

- Never put your head, hand or arm into the opened instrument.
- Never put your hand into the loading bay.
- Respect alarm sound before X-/Y-movement.

It is recommended to carry out the automatic module test after the teaching, see chapter 12.7.7 on page 12-80.

20.2.2.1 HANDLING

Clicking on a specific position of the graphical allows modification of the coordinates at the different positions. The pipettor moves to the currently set X- and Y-coordinates and the **Adjust Position** dialog appears:

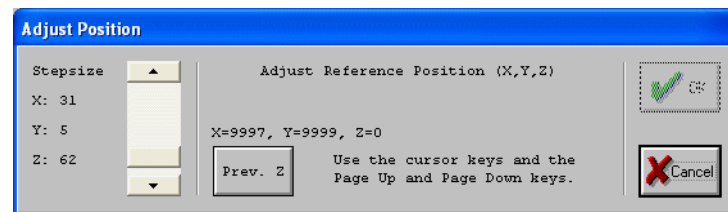


Figure 20-5: Adjust Position dialog

In order to avoid damage of the disposable tip adapter, the Z-axis does not move automatically. The following keys of the keyboard can be used for adjusting the pipettor to the correct position:

Key:	Action:
+	Increases the step size.
-	Decreases the step size.
<i>Cancel</i>	Rejects all changes for the taught position.
<i>Cursor down</i>	Moves the pipettor to the front (Y-axis - changes steps of X on screen).
<i>Cursor left</i>	Moves the pipettor to the left (X-axis - changes steps of Y on screen).
<i>Cursor right</i>	Moves the pipettor to the right (X-axis - changes steps of Y on screen).
<i>Cursor up</i>	Moves the pipettor to the rear (Y-axis - changes steps of X on screen).
<i>End</i>	Z-max position Notice: Can lead to pipettor crash. Should be only used, if the service technician can be certain, that the Z-max position was taught not to low.
<i>Enter</i>	Next position
<i>OK</i>	Saves the (changed) coordinates of the taught position.
<i>Page down</i>	Moves the pipettor down (Z-axis).
<i>Page up</i>	Moves the pipettor up (Z-axis).
<i>Shift</i>	Moves the pipettor down the Z-axis in five steps to 1/2, 3/4 and 7/8 of the previous set Z-position.

Table 20-2: Use of the **Adjust Position** dialog

Generally the step size of the movements can be adjusted by the step size bar. If the bar is adjusted to the bottom, the pipettor can be moved with minimum steps. The **Prev. Z** button moves the pipettor to the Z-position which was stored before.

NOTICE

The **Prev. Z** button should only be used if it is sure that the needle might not hit the bottom! To reach the final position in X/Y/Z, small step sizes must be used!

All positions with adjustment points, which are marked in red, must be taught. For the teaching of the dilution positions, pipette positions, and loading bay positions teaching tools have to be used. The correct position is reached, if the tip adapter is inside the specific point of the teaching tools.

INFO

When checking the coordinates, be aware of the technical error of the axis in X-,Y- and Z-direction; a tolerance of 3 steps (minimal step size) can be accepted!

20.2.2.2 Z-ADJUSTMENT WITH POSITION ADJUSTMENT TOOL

Firstly adjust the X-/Y-position. Then adjust the Z-position, that the thin part of the position adjustment tool (see chapter 20.2.1.2 on page 20-2) fits between teach tool and tip adapter. The thick part has to touch against the tip adapter.

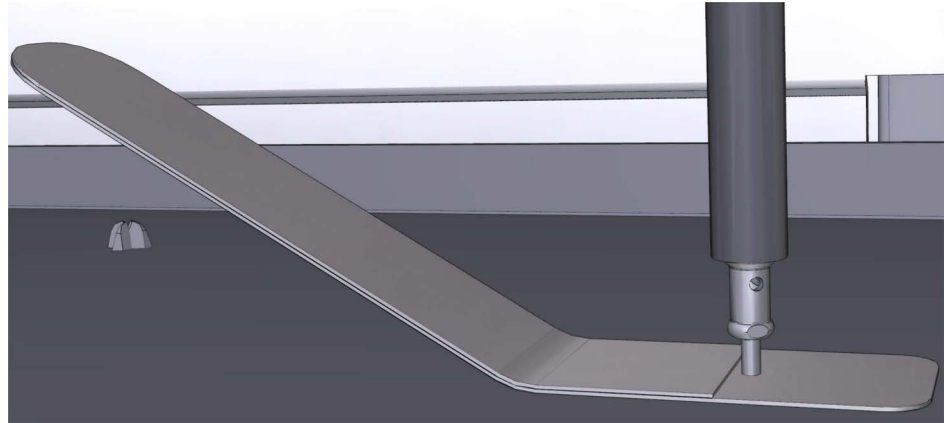


Figure 20-6: Z-adjustment with position adjustment tool

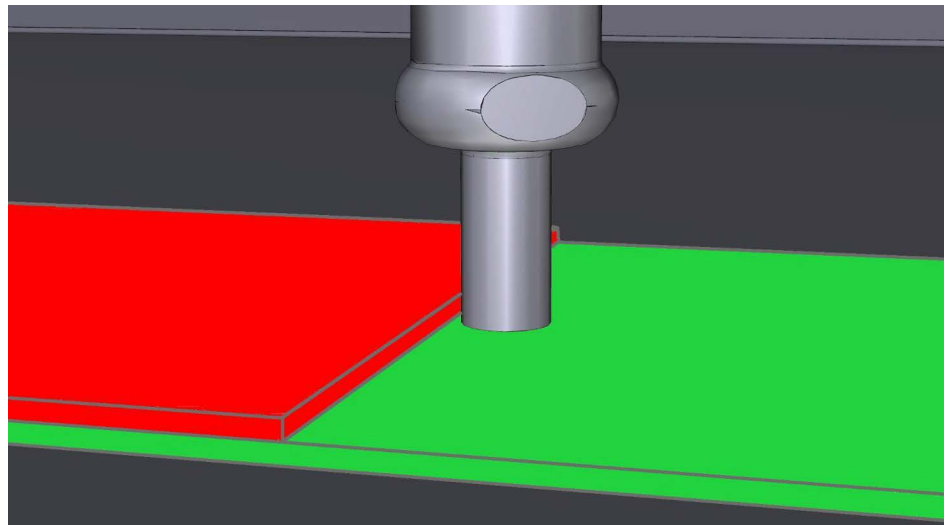


Figure 20-7: Detailed view: Position adjustment tool with colored surfaces (green = ok / red = not ok)

20.2.2.3 PICK-UP DISPOSABLE TIP

Put a 300 μ l disposal tip into the disposable tip rack 2-1 position A1 (see chapter 20.2.2.2 on page 20-4) and press the **Pickup D** button. The pipettor picks-up the disposable tip.

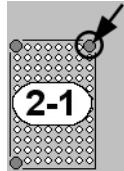


Figure 20-8: Rack 2-1 position A1

20.2.2.4 RESOLUTION OF PIPETTOR STEPS

Conversion to Teacher steps:

Axis:	Steps/mm:	mm/steps:
X	31.1526	0.032100049
Y	5.803	0.17232466
Z	57.803	0.01730014

Table 20-3: Resolution of pipettor steps

20.2.3 TEACHING REFERENCE POSITION

Due to the fact that the setting of dilution positions, disposable racks, etc. are all related to the reference position in some cases, it is enough to teach the reference position. Therefore, it is also important to teach the reference position before all other positions.

By clicking on the **Ref. left** button, the pipettor moves to the last taught reference position (except the Z-axis) next to the load/unload/pipetting position.

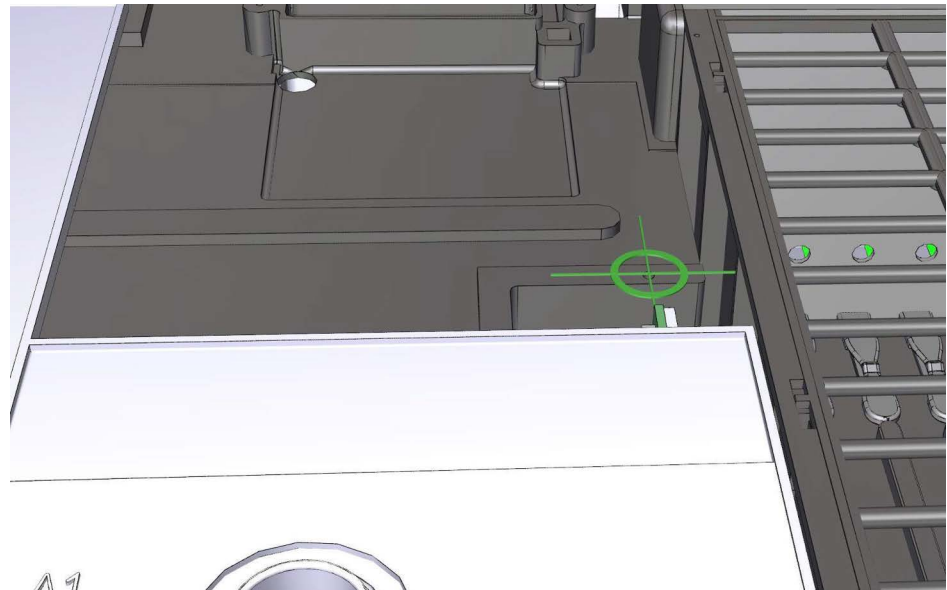


Figure 20-9: Reference position

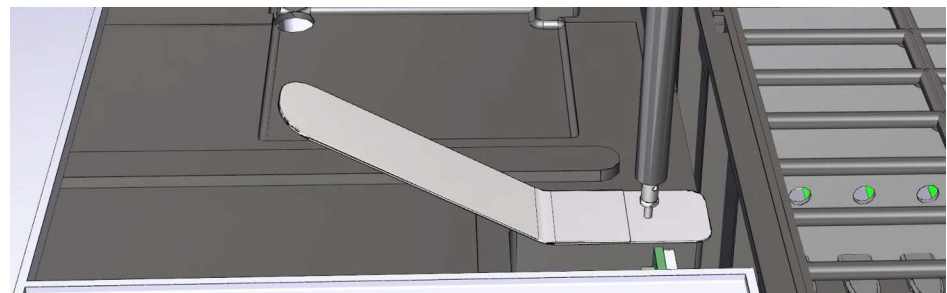


Figure 20-10: Taught reference position

The correct reference position is reached if the tip adapter (without a tip) touches the reference point (with position adjustment tool). If this position has been adjusted, it can be stored by pressing the **OK** button.

INFO

If the positions are only checked (not changed in any direction), the teaching of this position (before saving the last position) must be finished by pressing the **Cancel** button. This has to be done by all different positions in the teacher!

TEACHING

TEACHING THE PIPETTOR MODULE

INFO

If the pipettor crashes (motors de-energized) while teaching any position, the pipettor must be initialized by pressing the **Init** button.

20.2.4 TEACHING TIP TYPE DETERMINATION POSITION

As tip type determination position, the surface of the loading bay (right side) has to be used.

By clicking on the **Tip?** button the pipettor moves to the last taught position (except the Z-axis).

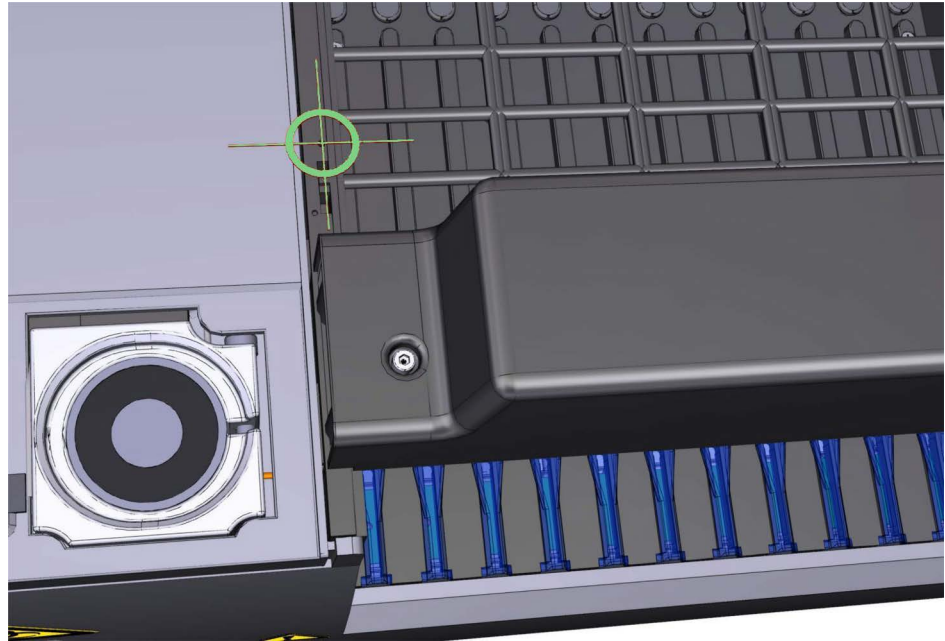


Figure 20-11: Tip type determination position

The correct position is reached if the tip adapter (without a tip) touches the surface of the loading bay (with position adjustment tool).

If this position has been adjusted it can be stored by pressing the **OK** button.

20.2.5 TEACHING LOAD/UNLOAD/PIPETTING POSITION

By clicking on the load/unload/pipetting position on the screen, the plate transport moves a plate carrier to the load/unload/pipetting position, and the teacher software shows a message to load the MTP teaching tool (see chapter 20.2.1.1 on page 20-2). Load the MTP teaching tool on the load/unload position (A1 = sloped edge) and press on the **OK** button. The pipettor moves to the stored X- and Y-coordinates of position (P1).

NOTICE

After loading the MTP teaching tool in the plate carrier, make sure that the plate carrier is snapped into the plate transport sledge correctly. There must be a 1 mm gap on the right side of the carrier. Also check if all carriers are straight and lie even on the sledge. When pushing the plate carrier or the MTP teaching tool down, there must be no play exceeding 0.1 mm, see chapter 5.4.2 on page 5-7). Twisted carriers must be exchanged!

INFO

Teacher versions 4.42 and above provide a convenient possibility to move any of the instruments plate carriers to the pipetting position.

Select a highlighted plate carrier position in the **Plate Carrier** area to change the plate carrier (see chapter 20.2.2 on page 20-4).

Check if the plate carrier on the plate transport sledge is parallel to the pipettor arm (without mains power):

- Move the pipettor tip adapter to the edge of the plate carrier manually.
- Move the y axis (sledge) of the pipettor arm manually along the plate carrier edge without moving the toothed rack.
- The height of the tip adapter tip over the plate carrier edge must not change more than one millimeter when the sledge is move along the plate carrier.

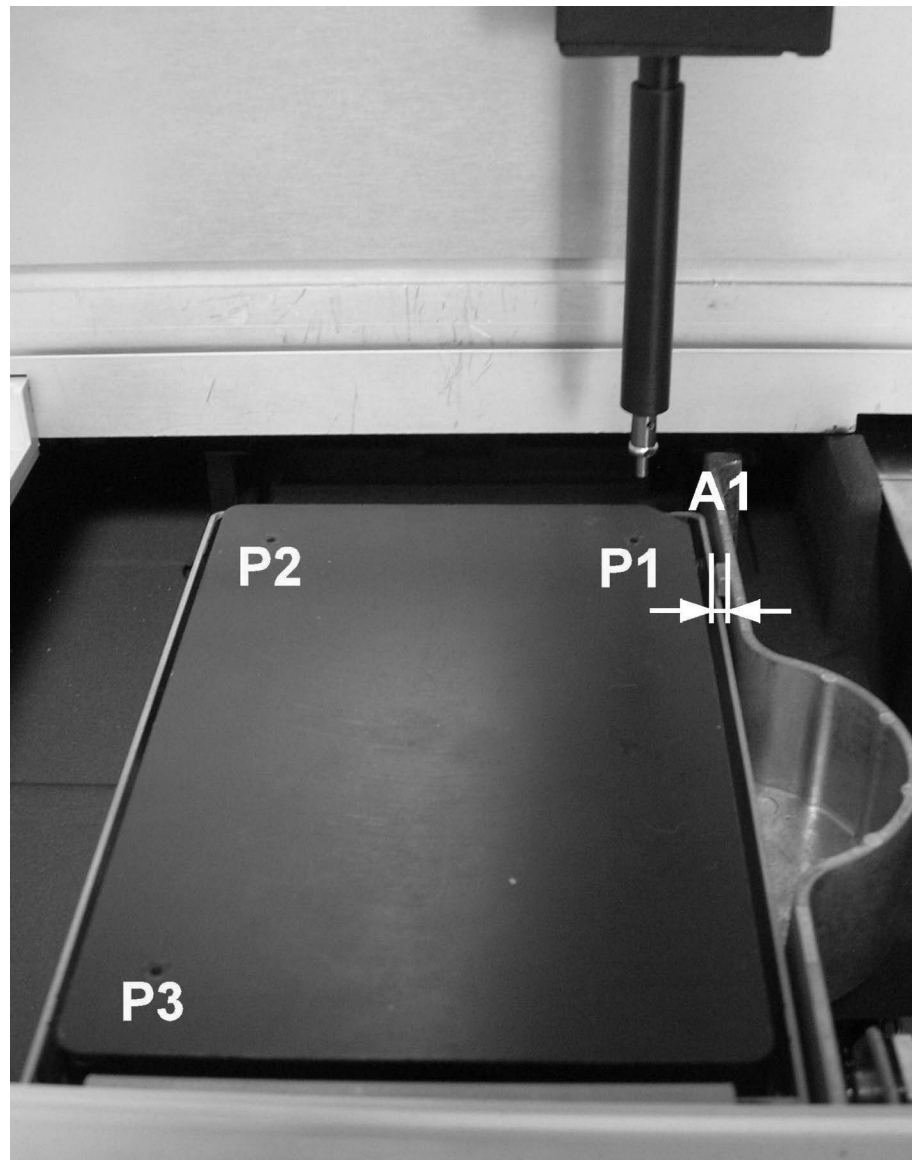


Figure 20-12: MTP teaching tool in the load/unload/pipetting position



Figure 20-13: Taught load/unload/pipetting position

The teaching for this position is correct, if the tip adapter is in the same plane as the specific drill hole of the MTP teaching tool (with position adjustment tool). All three positions have to be taught.

20.2.6 TEACHING DISPOSABLE TIP RACK POSITIONS

Load an empty disposable tip rack on the first disposable tip rack position and press on the first disposable tip rack position on the screen (see chapter 20.2.2 on page 20-4). The pipettor moves to the stored X- and Y-coordinates of position (P1). First teach the X- and Y-coordinates of position (P1). It should be centered in the middle of the opening.

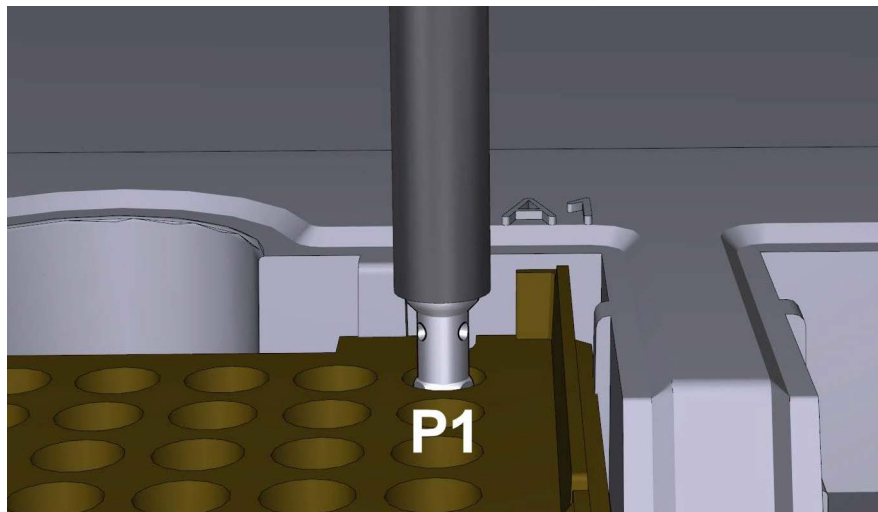


Figure 20-14: Taught X/Y-coordinates

Second teach the Z-coordinate of position (P1). The tip eject sleeve of the tip adapter must just touch the upper area of the empty tip rack.

Set the **Step size** to minimum steps and press on the **+** key once, then press on the **Page down** key once, so that the tip eject pin of the eject mechanism are in the same line with the tip eject sleeve.

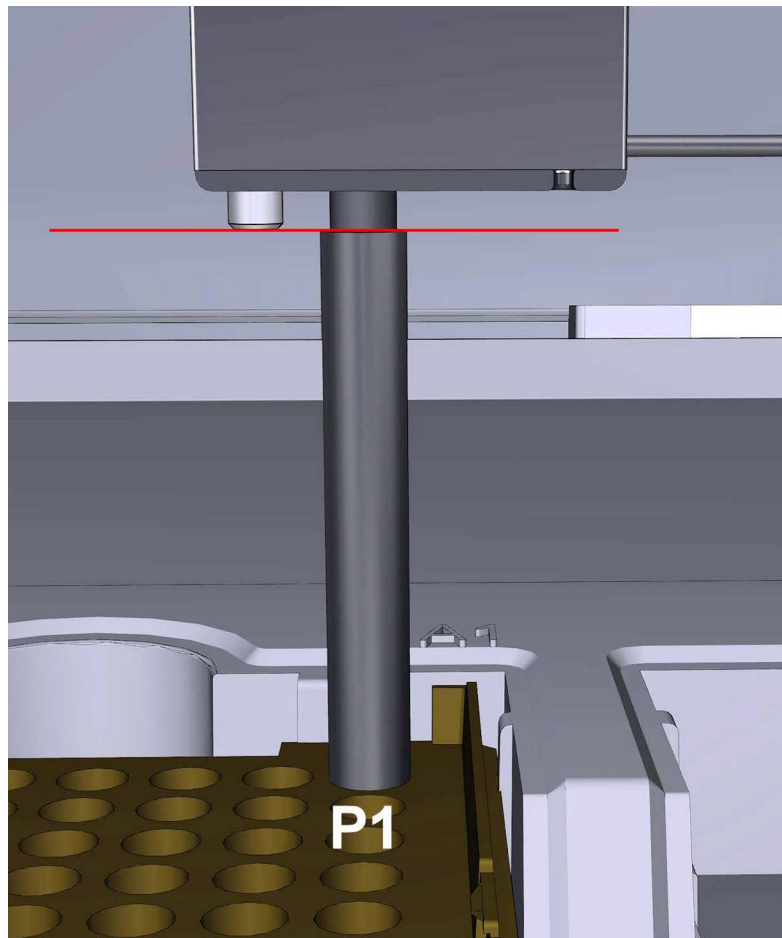


Figure 20-15: Taught Z-coordinate

When the pipettor is positioned correctly, the **OK** button must be clicked. The pipettor moves up to teach the Z-start coordinate. The teaching for this coordinate is correct, if the lower end of the tip adapter is at the height of the desktop. All three positions have to be taught. All three disposable tip rack positions have to be taught.

20.2.7 TEACHING DILUTION OR ARCHIVE PLATES POSITIONS

Lay the metal base plate on the position (see chapter 20.2.2 on page 20-4). Push the metal base plate firmly down so that they lay on the floor completely and evenly. Lay the MTP teaching tool (see chapter 20.2.1.1 on page 20-2) on the same position (A1 = sloped edge).

Press on the dilution or archive plates position on the screen. The pipettor moves to the stored X- and Y-coordinates of position (P1).

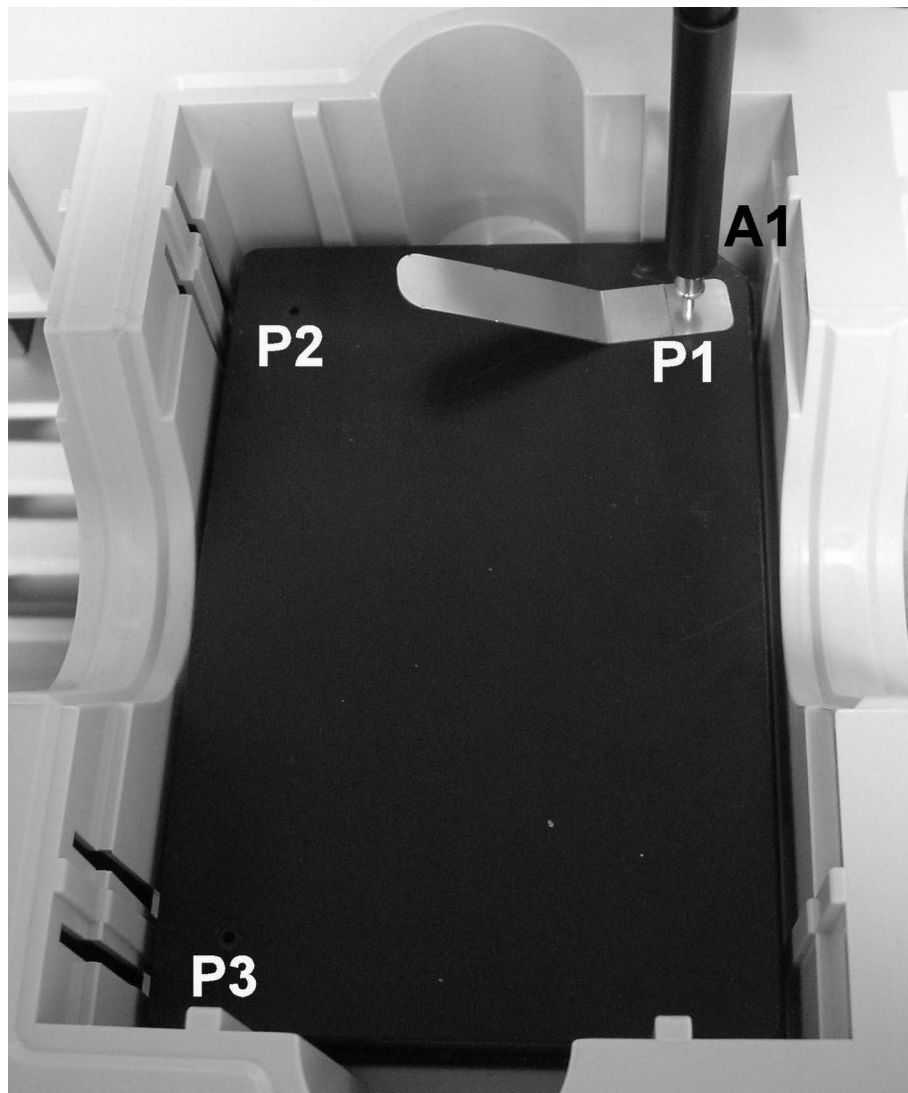


Figure 20-16: MTP teaching tool in the dilution or archive plates position

The teaching for this position is correct, if the tip adapter is in the same plane as the specific drill hole of the MTP teaching tool (with position adjustment tool). All three positions have to be taught.

Both dilution or archive plates positions have to be taught.

20.2.8 TEACHING TIP EJECT STATION

By clicking on the tip eject station on the screen (see chapter 20.2.2 on page 20-4), the pipettor moves to the last taught position (except the Z-axis).

First teach the X- and Y-coordinates:

- X-coordinate: It should be centered in the tip eject station.
- Y-coordinate: It should be centered in the middle of the bump.

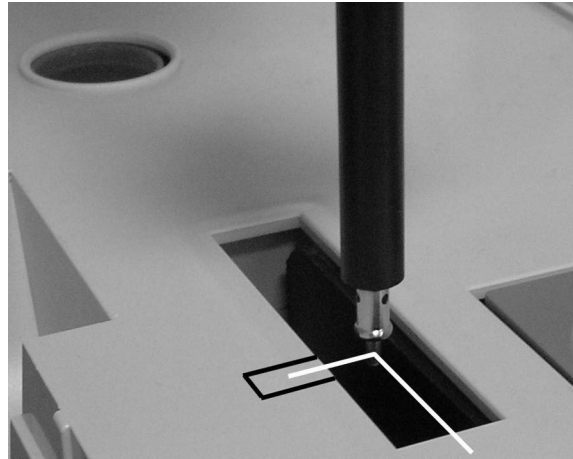


Figure 20-17: X-/Y-coordinates of the tip eject station

Second teach the Z-coordinate. Move the tip adapter down to the bumper. If it touches the bumper, set the **Step size** to minimum steps, then press on the *Page down* key once

When the pipettor is positioned correctly, the **OK** button must be clicked. The pipettor moves up to teach the Z-travel coordinate. The teaching for this coordinate is correct, if the tip eject pin is 1 mm above the bumper (put up the tip eject sleeve with your finger to get the tip eject pin).

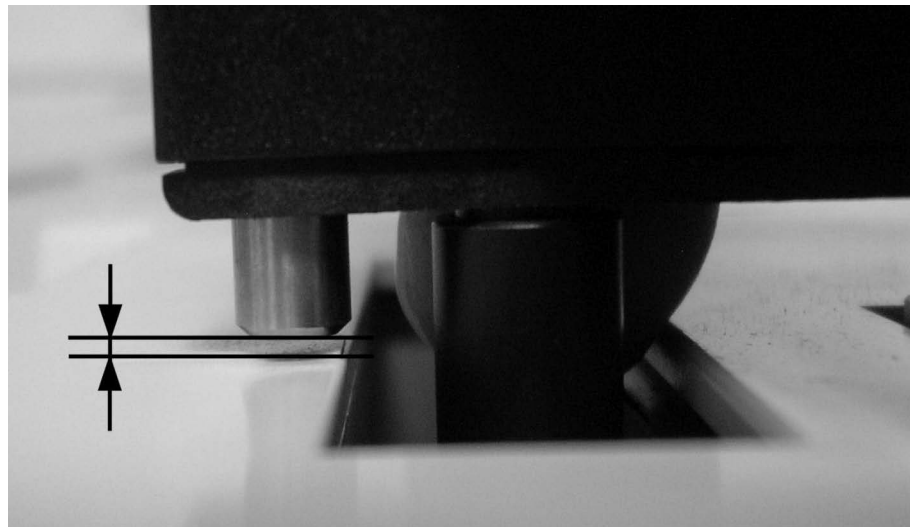


Figure 20-18: Z-travel coordinate

20.2.9 TEACHING PIPETTOR WASH STATION

By clicking on the pipettor wash station on the screen, the pipettor moves to the last taught position (except the Z-axis).

First teach the X- and Y-coordinates:

- X-coordinate: It should be centered in the pipettor wash station.
- Y-coordinate: The distance between lower end of the tip adapter and the rear border of the pipettor wash station should be approximately 5 mm.

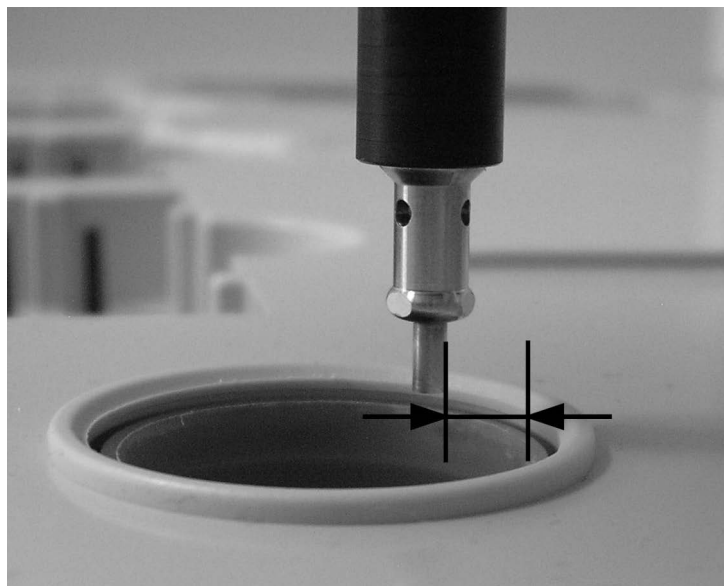


Figure 20-19: X-/Y-coordinates (view from the right hand side)

Second teach the Z-coordinate:

- Between the border of the pipettor wash station and the lower end of the tip adapter must be a distance of 1 to 2 mm.

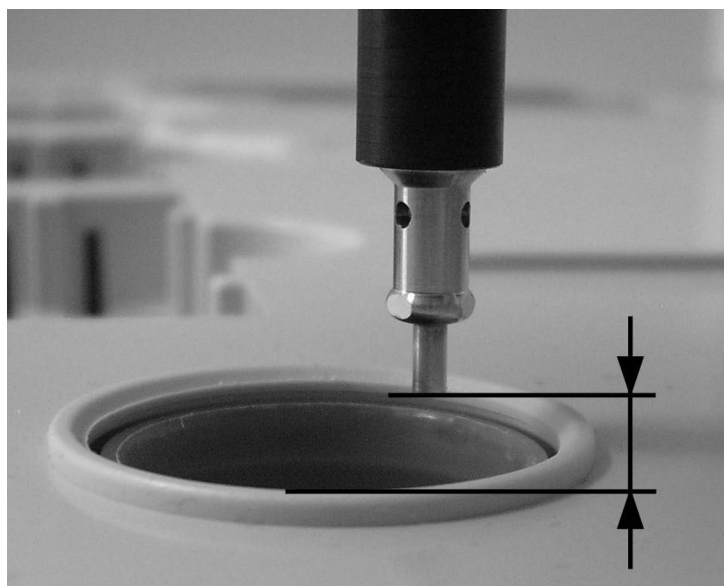


Figure 20-20: Z-coordinate

20.2.10 TEACHING RESTRICTED AREA

INFO

Usually, this position needs not be modified.

By clicking on the restricted area on the screen (see chapter 20.2.2 on page 20-4), the pipettor moves to the last taught position (except the Z-axis).

Teach only the X- and Y-coordinates. The X-coordinate should be between tip discarding device and door magnet. The Y-coordinate should be above the barcode scanner guidance cover to the rear side of the instrument.

At last, press on the **Prev. Z** button.

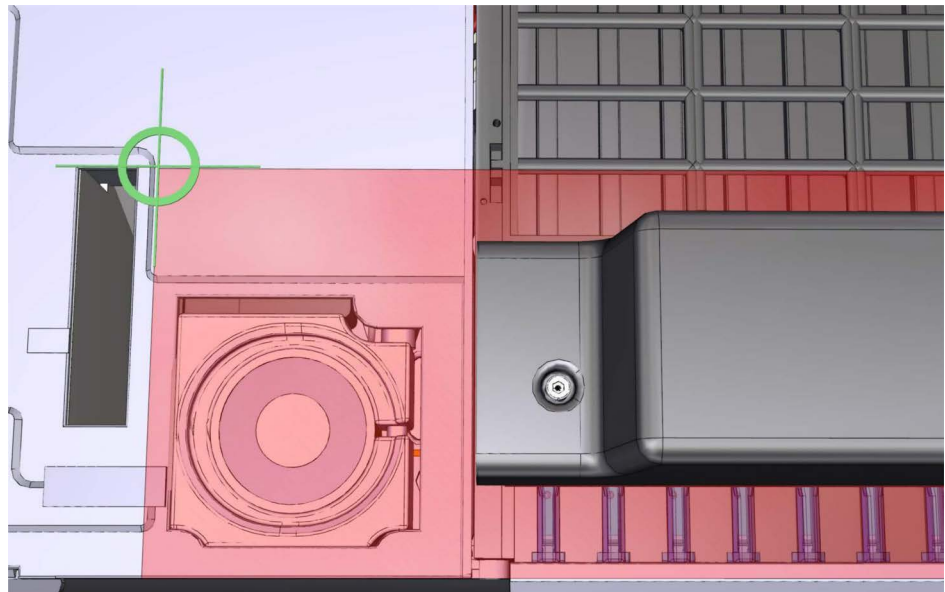


Figure 20-21: X-/Y-coordinates

20.2.11 TEACHING LOADING BAY

INFO

Before teaching it is necessary to remove the loading bay grid (see chapter 16.5.1 on page 16-9).

For teaching of the loading bay, the loading bay teaching tool (see chapter 20.2.1.3 on page 20-3) has to be used and must be inserted in the far left position of the loading bay (note the arrow on the tool). The positions (P1) and (P2) must be taught.

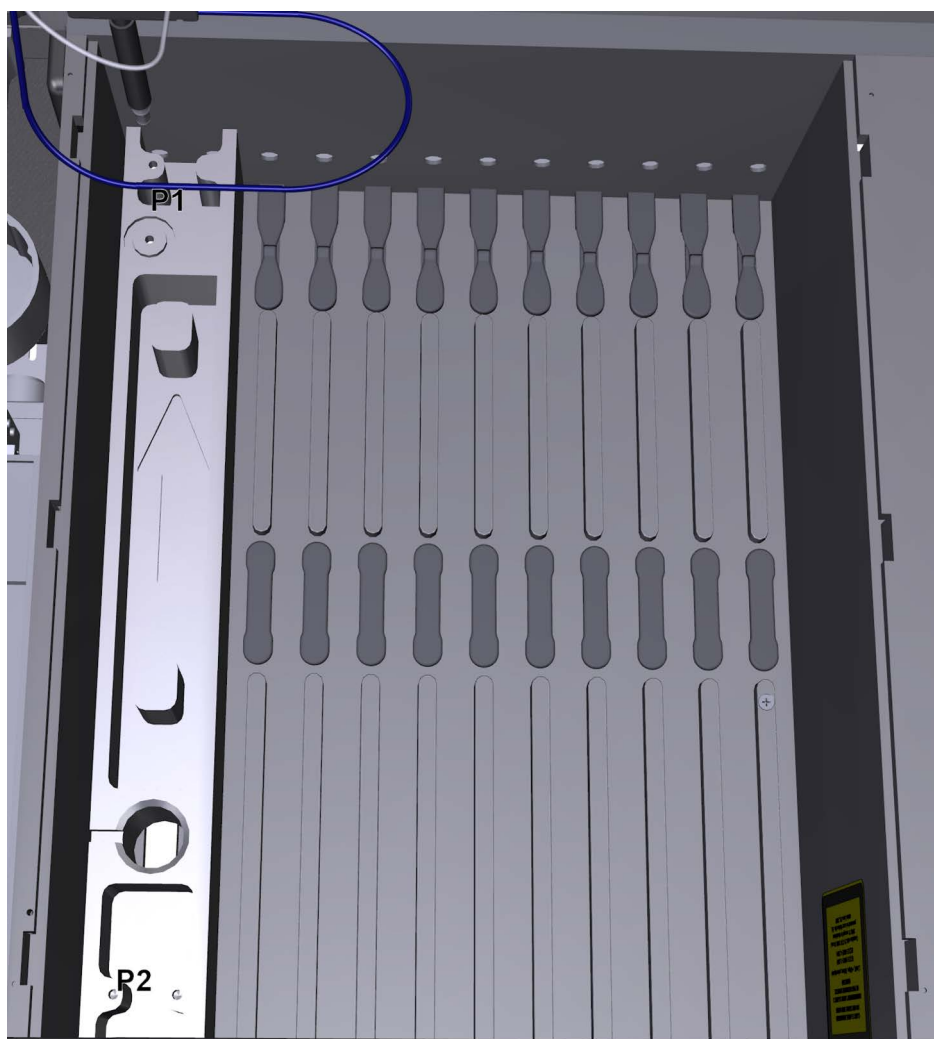


Figure 20-22: Loading bay teach positions (P1 + P2)

Clicking on the loading bay area on the screen (see chapter 20.2.2 on page 20-4) makes the pipettor move to X- and Y-coordinates of position 1 (P1). The correct position is reached if the tip adapter touches the point of the loading bay teaching tool. If this position has been adjusted, it can be stored by pressing the **OK** button.

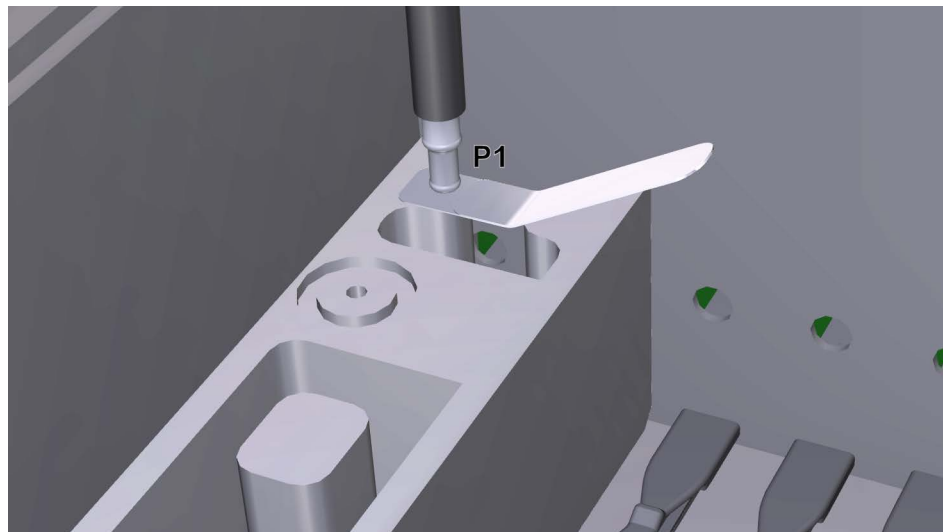


Figure 20-23: Taught position (P1)

Second teach the Z-coordinate of position (P1). Move the pipettor down, so that the tip adapter (without a tip) touches the reference point (with position adjustment tool). If this position has been adjusted, it can be stored by pressing the **OK** button. After teaching of the position (P1), teach position (P2). After teaching of the position (P2), pull out the loading bay teaching tool and insert it in the very right position of the loading bay. Teach position (P3).

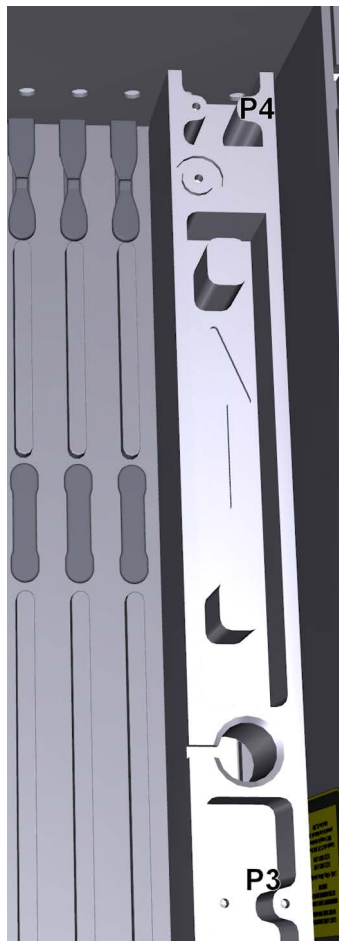


Figure 20-24: Loading bay teach positions (P3)

After teaching of the position (P3), the pipettor moves to position (P4). This position is to check/teach the Z-position.

At last install the loading bay grid and check the loading bay grid (LLD check) (see chapter 16.4.1 on page 16-5).

20.2.12 TEACHING PARK POSITION

By clicking on the park position on the screen (see chapter 20.2.2 on page 20-4), the pipettor moves to the last taught position (except the Z-axis). Teach only the X- and Y-coordinates to the middle of the marked area (see figure). At last, press on the **Prev. Z** button.

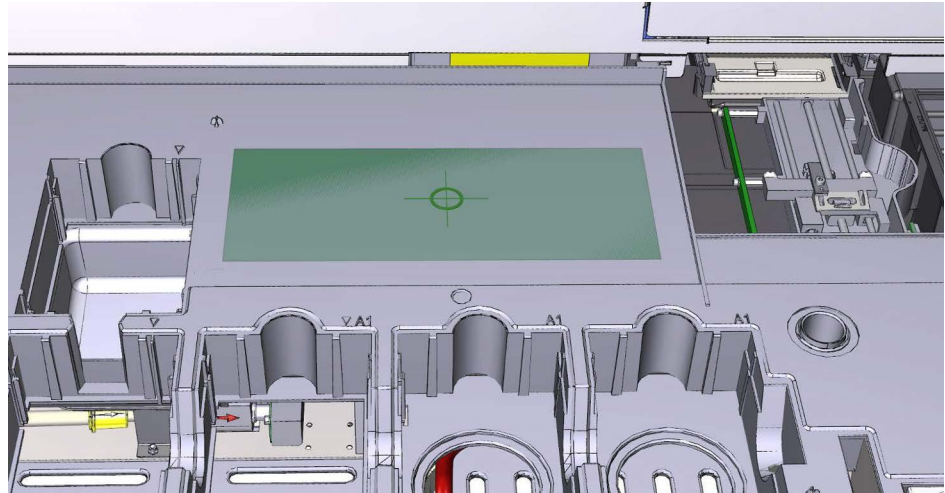


Figure 20-25: Park position/area

20.2.13 TEACHING RACKS

INFO

The sample rack file as provided with the instrument is used for 10 mm tubes. For other tubes used, new rack files have to be created.

INFO

Sample racks should always be adjusted with tubes.

INFO

There is a need to use a 300 µl tip to teach in the racks.

The coordinates which will be set for a specific rack will be related to the loading bay coordinates which have been taught in chapter 20.2.11 on page 20-22. Therefore a specific rack has to be taught only in one track.

Click on the **Racks** button for teaching the rack positions.

Start rack teaching:

- See chapter 20.2.13.1 on page 20-27 to add a new rack.
- Select an existing rack file and click on the **Edit** button to change the rack coordinates.

First enter/edit the **Number of Positions** and the **Rack Width** of the rack in the **Rack Definition** dialog.

Racks for only one tube/bottle type:

- Teach the first and the last rack position.

Racks for different tube/bottle types:

- Teach every rack position.

Choose the rack position you want to teach by the up and down arrow buttons. Enter the tube surface (mm²) of the tube which is positioned in this position. Click on the **Teach** button to teach this position.

The pipettor move to the previously stored X and Y coordinates of the selected position. The X/Y/Zmax positions have to be taught first. The Z-dispense position is always the last position.

ZMAX

Sample racks:

Touch the bottom of the tube carefully (move the Z-axis slowly) and than move 5 steps back (upstairs).

Other racks:

Touch the bottom of the rack carefully (move the Z-axis slowly) and than move 5 steps back (upstairs).

20.2.13.1 ADD A NEW RACK

INFO

Do not use the **Add** button to add a new rack!

In case another Rack type needs to be added to the instrument, the `SampleRack.txt` file needs to be updated.

1. Close the teacher software.
2. Open the `SampleRack.txt` file with notepad.
3. Add the new rack data (see below).
4. Save the file.
5. Close notepad.
6. Copy a rack file (*.rac) with a similar rack format as the new rack.
7. Rename the copied rack file. Use the file name you specified in the `SampleRack.txt` file.
8. Open the teacher software.
9. Select the new rack and teach it (see chapter 20.2.13 on page 20-26).

FILE DESCRIPTION: The `SampleRack.txt` file defines the rack attributes. Each line of the file describes a rack. The syntax is:
`barcode,rack file,positions,barcodes,width,shape,angle,`
`type,leading`

where:

- barcode = rack barcode.
- rack file = ".rac" filename without the extension.
- positions = number of positions on the rack.
- barcodes = number of barcoded positions on the rack.
- width = rack width (# of tracks).
- shape = hole shape, 0=circle, 1=square.
- angle = angle of the bottle (°).
- type = rack type, 0=sample rack, 1=secondary tube rack, 2=reagent rack.
- leading = leading barcode, 0=no, 1=yes.

Example: A 16 position sample rack with a barcode of "-A" and rack file of "A.rac" would be:

`-A,A,16,16,1,0,0,0,0`

20.2.14 TEACHING MICROPLATES (*.MPC FILES)

INFO

There is no additional teaching necessary for all standard microplates!

The coordinates which will be set for a specific microplate will be related to the coordinates which have been taught in the above mentioned steps. Therefore a specific microplate has to be taught only in one position.

For all plates the same procedure can be used as explained below.

Instead of creating a new MPC file, a similar MPC file can be copied and then renamed. After opening the teacher, this MPC file can then be taught exactly.

SHORT TIP

1. Load one short disposable tip onto the instrument (rear left disposable tip rack with tip on the rear right position).
2. Click on the **Pickup D** button.
The pipettor moves to the tip position and loads the disposable tip.

MTP FILE SELECTION

3. Click on the **MTPs** button to load the **MPC File Selection** dialog.
4. Only to create a new MPC file:
 - Enter a unique file name in the field **New MPC File Name**.
 - Click on the **Add** button. The new file name is added to the list.
5. Select a teach position (e.g. microplate area) in the **Area to edit MTP Files**.
6. Select the MPC file which shall be edited and click on the **Edit** button to load the **MPC File Definition** dialog.
7. Edit or enter the version in the field **File Version**.
8. Only to create a new MPC file:
 - Enter the number of columns of the microplate in the field **Columns**.
 - Enter the number of rows of the microplate in the field **Rows**.
 - Enter the surface (in mm²) of a microplate well in the field **Surface**.
9. Load a microplate into the selected position.
10. Click on the **Teach** button.
The pipettor moves to the first teach position.
11. Teach the X-/Y-positions to the center of the well.
12. Click on the **Prev. Z** button.
13. Set the **Stepsize** to the minimal step size.
14. Teach the Zmax position in a way that the tip is touching the bottom of the well and then moved up 4 steps with minimal step size.
15. Click on the **OK** button.
The pipettor moves to the second teach position.
16. Teach the second and the third position in the same way.
17. After the teaching of the X-, Y- and Zmax positions, the Z-dispense position has to be taught.
Therefore the pipettor has to be moved up until the end of the tip is in the same plane as the top of the MTP plus one step with minimal steps size down.

18. After confirming the correct position for Z-dispense adjust the Z-travel position. Therefore the pipettor has to be moved up until the end of the tip is in the same plane as the top of the MTP plus 14 steps with minimal step size up.

AFTER TEACHING

19. Remove the disposable tip and the microplate.

20.2.15 BACKUP TEACHING COORDINATES

INFO

Copy the koordina.dat file (and the *.rac and *.mpc files if they have been changed) into a separate folder on the PC hard disk and/or copy it to an external medium.

20.3 TEACHING THE IFA PIPETTOR MODULE (OPTIONAL)

INFO

It is necessary to use an external keyboard for teaching!

20.3.1 PIPETTOR IFA TEACH TOOLS

20.3.1.1 IFA TEACH CAP

Teaching with the IFA pipetting adapter.



Figure 20-26: IFA teach cap

20.3.2 START OF TEACHER SOFTWARE AND GENERAL INFORMATION

INFO

It is necessary to remove the loading bay grid of the loading bay!

INFO

It is necessary to use an external keyboard for teaching!

INFO

If the service software or the user software was running before, this programs have to be closed!

1. Shut down the computer and switch off the instrument.
2. Install an external keyboard (see chapter 2.1.5.1 on page 2-13).
3. Optional: Install an external monitor (see chapter 2.1.5.2 on page 2-13).
4. Remove the loading bay grid of the loading bay (see chapter 16.5.1 on page 16-9).
5. Switch on the instrument.
6. Start the teacher: Press on the **Teacher** icon on the desktop or select the **Teacher** entry in the **Start** menu.
7. Enter the password and press on the **OK** button.



The pipettor is initialized and a graphical representation of the working area with the different working positions appears:

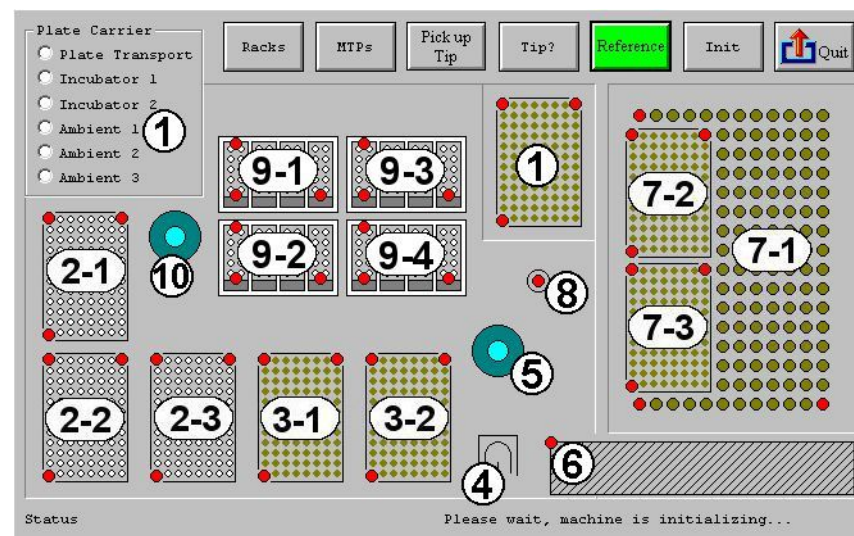


Figure 20-27: IFA teacher main dialog

Position/Button	Meaning	Explanation
1	Load/unload/pipetting position (two areas on the screen)	chapter 20.3.5 on page 20-38
2	Disposable tip racks	chapter 20.2.6 on page 20-16
3	Dilution or archive plates Position 3-1 can also be used for disposable tip racks.	chapter 20.3.6 on page 20-38
4	Tip eject station	chapter 20.2.8 on page 20-19
5	Pipettor wash station	ELISA: chapter 20.2.9 on page 20-20 IFA: chapter 20.3.9 on page 20-40
6	Restricted area	chapter 20.2.10 on page 20-21
7	Loading bay with microplate positions	chapter 20.3.7 on page 20-38
8	Park position	chapter 20.3.8 on page 20-39
9	IFA trays	chapter 20.3.10 on page 20-41
10	IFA pipettor wash station	chapter 20.3.9 on page 20-40
Init	Initialize the pipettor	
MTPs	Teaching microplates	chapter 20.2.14 on page 20-28
Pickup D	Picks up a disposable tip. The only positions where you need a tip are the loading bay and the individual reagent/sample racks.	chapter 20.2.2.3 on page 20-10
Plate Carrier	Current plate carrier positions	chapter 20.3.5 on page 20-38
Quit	Exit teacher software	
Racks	Teaching racks and slides	Racks: chapter 20.2.13 on page 20-26 Slides: chapter 20.3.11 on page 20-42
Ref. Left	Teaching reference position Note: Teach/Check this position first!	chapter 20.3.3 on page 20-35

Position/Button	Meaning	Explanation
TIP?	Teaching tip type determination position	chapter 20.3.4 on page 20-37

Table 20-4: Use of the teacher main dialog

⚠ CAUTION



Mind your head!

Respect alarm sound before X-/Y-movement.

20.3.2.1 HANDLING

See chapter 20.2.2.1 on page 20-7

20.3.2.2 Z-ADJUSTMENT WITH IFA TEACH CAP AND POSITION ADJUSTMENT TOOL

Firstly adjust the X-/Y-position. Then adjust the Z-position, that the thin part of the position adjustment tool (see chapter 20.2.1.2 on page 20-2) fits between teach tool and tip adapter with IFA teach cap (see chapter 20.3.1.1 on page 20-30). The thick part has to touch against the tip adapter.

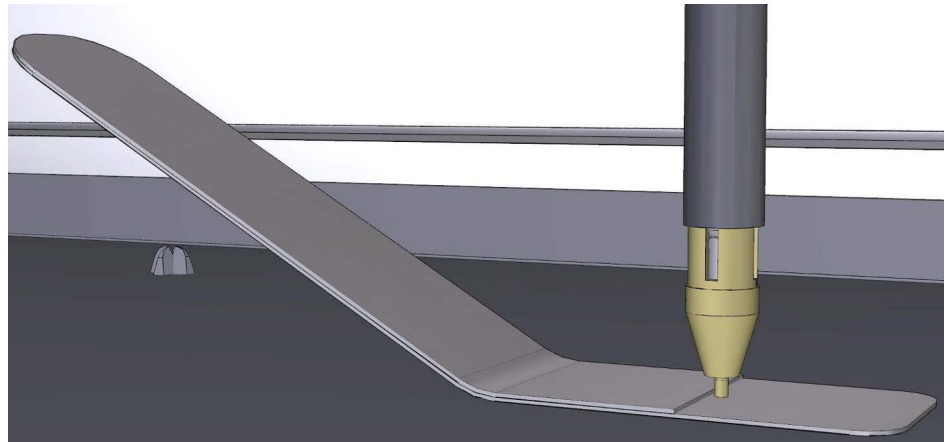
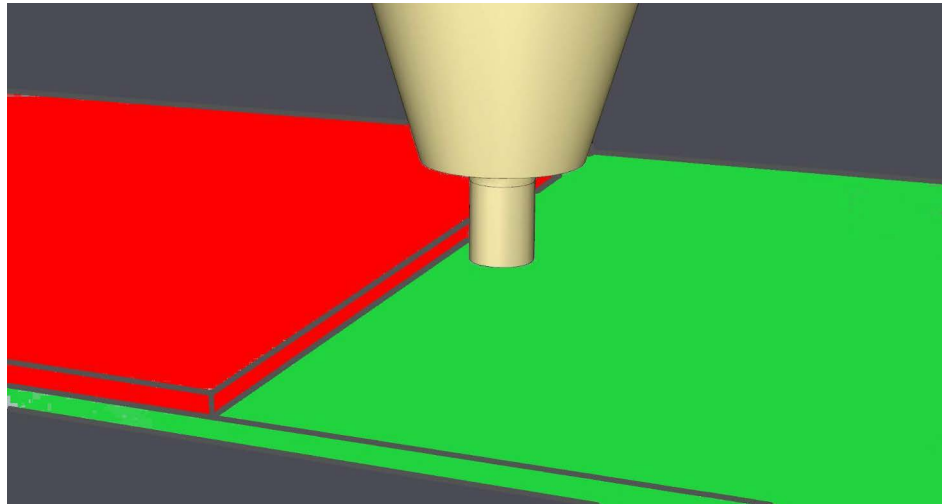


Figure 20-28: Z-adjustment with position adjustment tool and IFA teach cap



*Figure 20-29: Detailed view: Position adjustment tool with colored surfaces
(green = ok / red = not ok)*

20.3.2.3 PICK-UP DISPOSABLE TIP

See chapter 20.2.2.3 on page 20-10

20.3.2.4 RESOLUTION OF PIPETTOR STEPS

See chapter 20.2.2.4 on page 20-10

20.3.3 TEACHING REFERENCE POSITION

Due to the fact that the setting of dilution positions, disposable racks, etc. are all related to the reference position in some cases, it is enough to teach the reference position. Therefore, it is also important to teach the reference position before all other positions.

By clicking on the **Ref. left** button, the pipettor moves to the last taught reference position (except the Z-axis) under the load/unload/pipetting position.

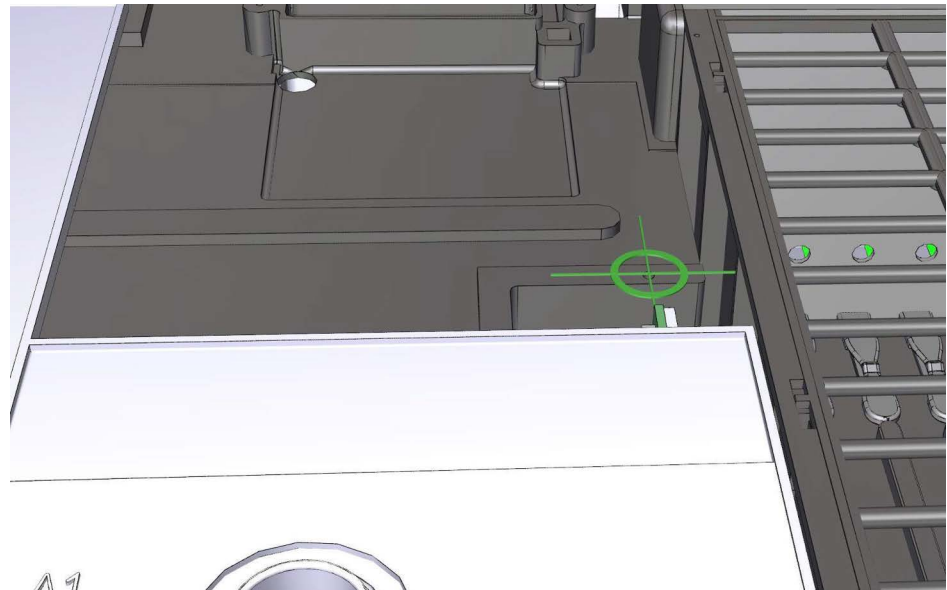


Figure 20-30: Reference position

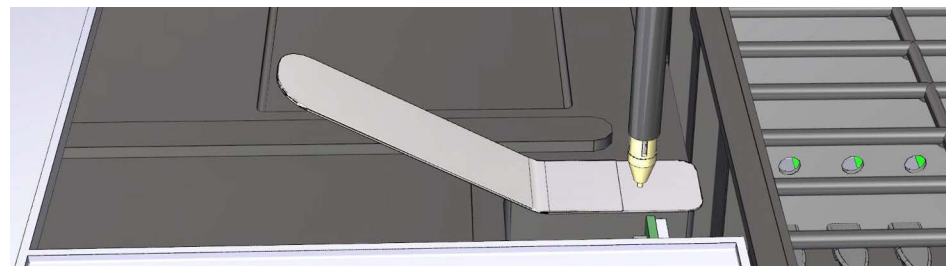


Figure 20-31: Taught reference position

The correct reference position is reached if the tip adapter with IFA teach cap touches the reference point (with position adjustment tool) in the center of the borehole.

If this position has been adjusted, it can be stored by pressing the **OK** button.

INFO

If the positions are only checked (not changed in any direction), the teaching of this position (before saving the last position) must be finished by pressing the **Cancel** button. This has to be done by all different positions in the teacher!

TEACHING

TEACHING THE IFA PIPETTOR MODULE (OPTIONAL)

INFO

If the pipettor crashes (motors de-energized) while teaching any position, the pipettor must be initialized by pressing the **Init** button.

20.3.4 TEACHING TIP TYPE DETERMINATION POSITION

As tip type determination position, the bar between both disposable tip rack positions on the left side has to be used.

By clicking on the **Tip?** button the pipettor moves to the last taught position (except the Z-axis).

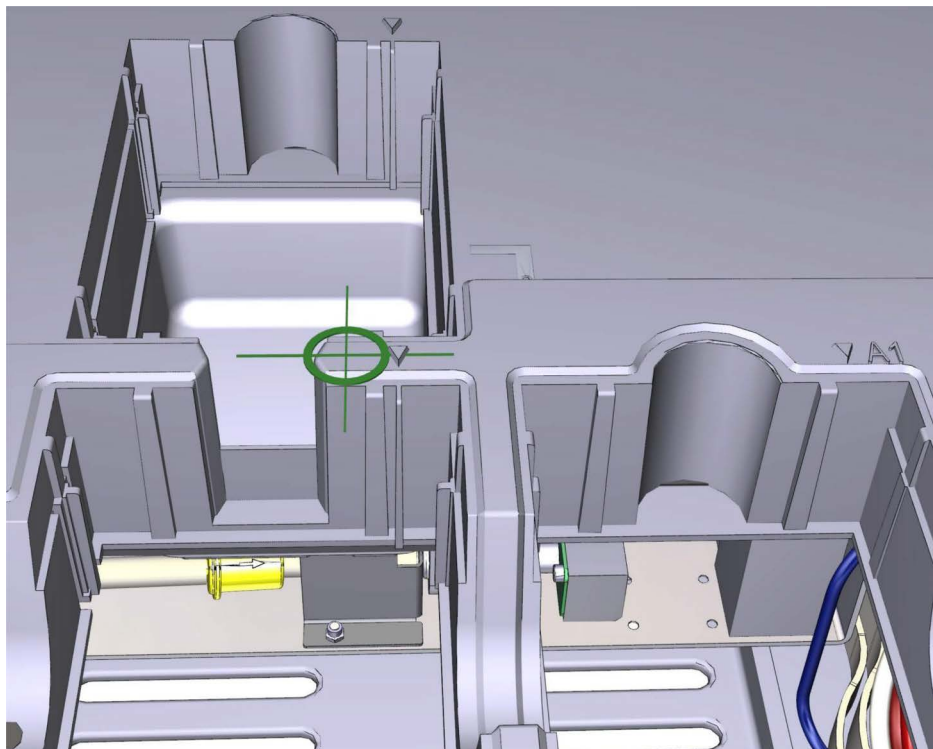


Figure 20-32: Tip type determination position

The correct position is reached if the tip adapter with IFA teach cap touches the surface of the loading bay with position adjustment tool.

If this position has been adjusted it can be stored by pressing the **OK** button.

20.3.5 TEACHING LOAD/UNLOAD/PIPETTING POSITION

INFO

Use the IFA teach cap to teach this position!

For teaching procedure see chapter 20.2.5 on page 20-14.

20.3.6 TEACHING DILUTION OR ARCHIVE PLATES POSITIONS

INFO

Use the IFA teach cap to teach this position!

For teaching procedure see chapter 20.2.7 on page 20-18.

20.3.7 TEACHING LOADING BAY

INFO

Use the IFA teach cap to teach this position!

For teaching procedure see chapter 20.2.11 on page 20-22.

20.3.8 TEACHING PARK POSITION

By clicking on the park position on the screen (see chapter 20.3.2 on page 20-31), the pipettor moves to the last taught position (except the Z-axis).

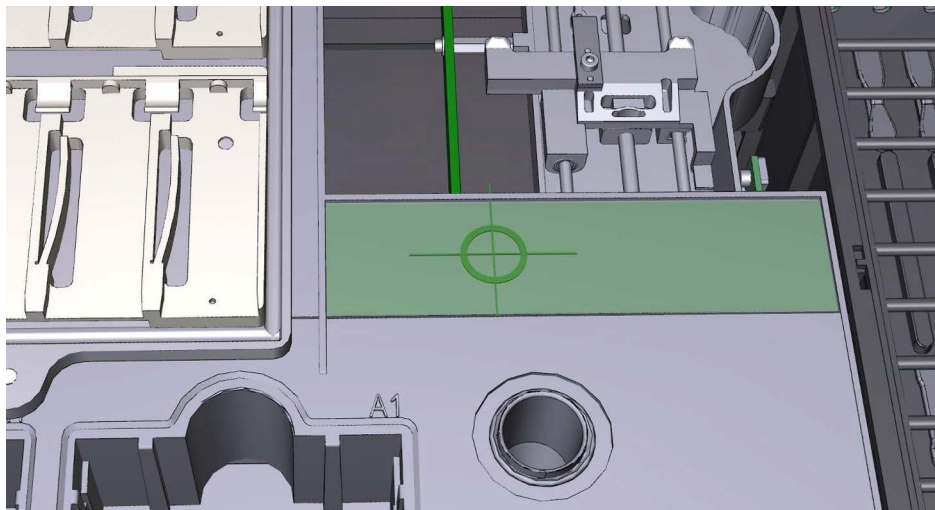


Figure 20-33: Park position/area

Teach only the X- and Y-coordinates to the middle of the marked area (see figure).
At last, press on the **Prev. Z** button.

20.3.9 TEACHING IFA PIPETTOR WASH STATION

As IFA pipettor wash position, the mean small borehole on IFA pipettor wash station has to be used.

By clicking on the IFA pipettor wash station on the screen (see chapter 20.3.2 on page 20-31) the pipettor moves to the last taught position (except the Z-axis).

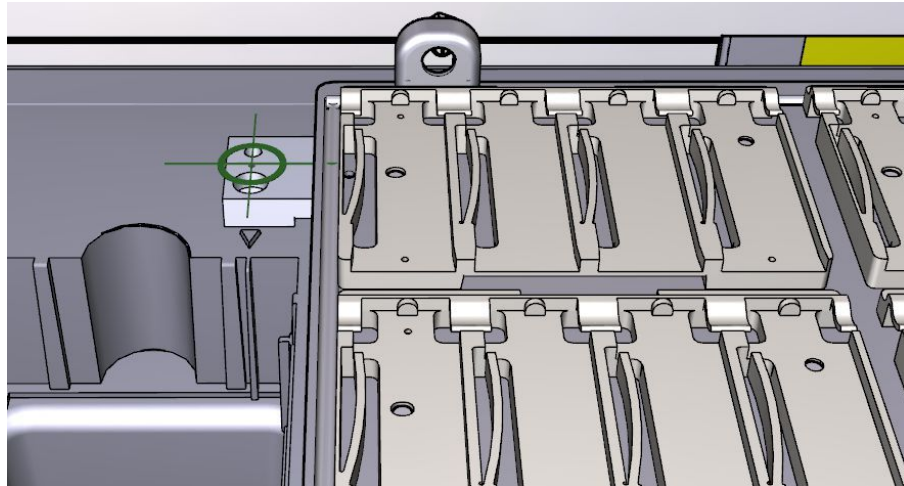


Figure 20-34: IFA pipettor wash station position

The position is reached if the tip adapter with IFA teach cap touches the wash station (with position adjustment tool) in the center of the borehole.

If this position has been adjusted, it can be stored by pressing the **OK** button.

20.3.10 TEACHING IFA TRAY POSITIONS

As IFA tray positions, the three small boreholes on the IFA tray has to be used.

By clicking on one of the IFA tray areas on the screen (see chapter 20.3.2 on page 20-31) the pipettor moves to the last taught position (except the Z-axis) of position 1.

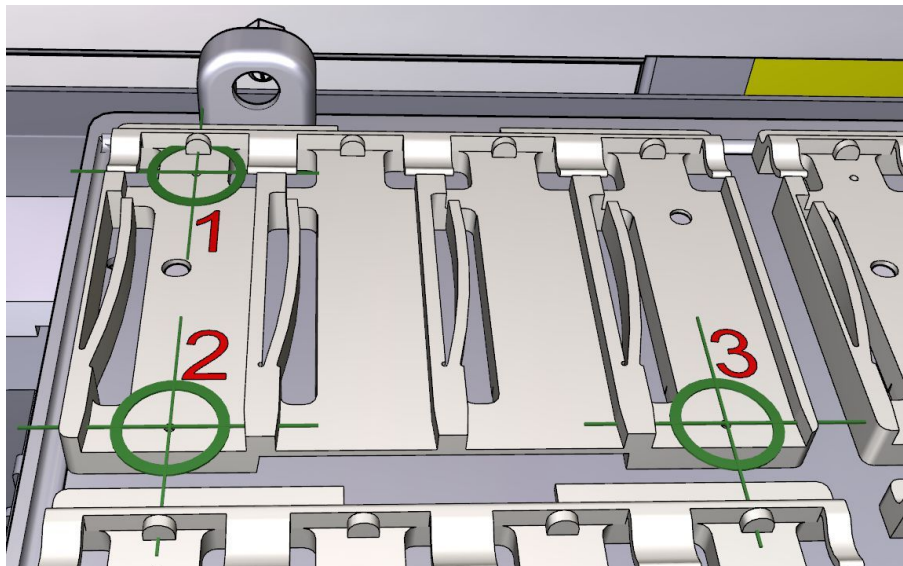


Figure 20-35: IFA tray positions

The position is reached if the tip adapter with IFA teach cap touches the wash station (with position adjustment tool) in the center of the borehole.

NOTICE

Do not use too much force, because the tray is flexible!

If this position has been adjusted, it can be stored by pressing the **OK** button. The pipettor moves to the next position. All three positions have to be taught. All four IFA tray positions have to be taught.

20.3.11 TEACHING SLIDES

The coordinates which will be set for a specific slide will be related to the coordinates which have been taught in the above mentioned steps. Therefore a specific slide has to be taught only in one position.

For all slides the same procedure can be used as explained below.

INFO

Use the IFA teach cap to teach this position!

RACK FILE SELECTION

1. Click on the **Racks** button to load the **Rack File Selection** dialog.
2. Only to create a new Rack file:
 - Enter a unique file name in the field **New Rack File Name**.
 - Click on the **Add** button. The new file name is added to the list.
3. Select as teach position **Slide Area** in the **Area to edit Rack File**.
4. Use track **01** in the field **Track to edit Rack File**.
5. Select the rack file which shall be edited and click on the **Edit** button to load the **Rack File Definition** dialog.
6. Edit or enter the version in the field **File Version**.
7. Only to create a new MPC file:
 - Enter the number of positions of the slide in the field **Number of Positions**.
 - Enter **always 1** in the field **Number of Lanes**.
 - Enter the surface (in mm²) of a slide well in the field **Tube Surface**. Click on the **Apply to all** button.
8. Load a slide into the left position of the rear left tray.
9. **Do not use** the interpolation function.
10. Click on the **Teach** button.
The pipettor moves to the first teach position.
11. Teach the X-/Y-positions to the center of the well.
12. Click on the **Prev. Z** button.
13. Set the **Stepsize** to the minimal step size.
14. Teach the Zmax position in a way that the tip is touching the bottom of the well and then moved up 2 steps with minimal step size.
15. Click on the **OK** button.
The pipettor moves to the next teach position.
16. Teach all positions in the same way.
17. After the teaching of the X-, Y- and Zmax positions, the Z-dispense position has to be taught.
Therefore the pipettor has to be moved up until the end of the tip is high enough that a dispensed drop will not be touched by the tip.
18. After confirming the correct position for Z-dispense adjust the Z-travel position. Therefore the pipettor has to be moved up until the end of the tip is about 1 cm (0.39 inch) above the slide.

AFTER TEACHING

19. Remove the IFA teach cap and the slide.

20.3.12 BACKUP TEACHING COORDINATES

INFO

Copy the koordina.dat file (and the *.rac and *.mpc files if they have been changed) into a separate folder on the PC hard disk and/or copy it to an external medium.

20.4 TEACHING THE PLATE TRANSPORT MODULE

20.4.1 RESOLUTION OF STEPS

20.4.1.1 RESOLUTION OF PLATE TRANSPORT STEPS

Conversion to service software steps:

Axis:	Resolution:
X	1600 steps = 30 mm = one turn
Y	1600 steps = 10 mm = one turn

Table 20-5: Resolution of plate transport steps

20.4.1.2 RESOLUTION OF INCUBATOR STEPS

Conversion to service software steps:

Axis:	Resolution:
Z	1600 steps = 10 mm

Table 20-6: Resolution of incubator steps

20.4.1.3 RESOLUTION OF WASHER STEPS

Conversion to service software steps:

Axis:	Resolution:
Y	1600 steps = 10 mm = one turn (plate transport)
Z	1716 steps = 10 mm

Table 20-7: Resolution of washer steps

INFO

The units in the user software for the washer Z-height is scaled to
1716 steps = 1 mm units.

20.4.2 TEACHING

INFO

It is necessary to use an external keyboard for teaching!

INFO

It is necessary to check all positions!

1. Shut down the computer and switch off the instrument.
2. Install an external keyboard (see chapter 2.1.5.1 on page 2-13).
3. Optional: Install an external monitor (see chapter 2.1.5.2 on page 2-13).
4. Remove the deck top (see chapter 8.3.1 on page 8-9).
5. Switch on the instrument.
6. Start the service software (see chapter 7.1 on page 7-1).
7. The service software displays its main menu.
8. Start the plate transport service software module (see chapter 15.6 on page 15-21).
9. Press on the **Selftest** button.
10. If necessary, insert a plate carrier into the plate transport.
11. Press on the **Edit Positions** button.
The service software shows the **Adjust Positions** dialog see chapter 15.6.1 on page 15-25.

WASHER

12. Press on the **Home XYZ** button in the **Motors** area.
13. Select the position **Washer** in the put-down menu in the **Position** area.
14. Press on the **Move To** button in the **Position** area.
The plate transport moves to the selected position.
15. Press on the **De-energize** buttons in the **X-Axis** and **Y-Axis** areas.
16. Use the X-/Y-belts of the plate transport to adjust the positions in the washer (see chapter 15.1 on page 15-1).
17. If the plate carrier moves easily into the washer, press on the **Get XYZ Position** button.
18. **Only in the X-Axis area:** Press on the **Transfer** button.
19. Enter 0 in the **Y-Axis** and **Z-Axis** areas.
20. Press **Update Positions** button in the **Position** area to save the positions.

READER

21. Press on the **Home XYZ** button in the **Motors** area.
22. Select the position **Reader** in the put-down menu in the **Position** area.
23. Press on the **Move To** button in the **Position** area.
The plate transport moves to the selected position.
24. Press on the **De-energize** buttons in the **X-Axis** and **Y-Axis** areas.
25. Use the X-/Y-belts of the plate transport to adjust the positions in the photometer (see chapter 15.1 on page 15-1).
The plate carrier should be touching the right side of the photometer guiding rails. This is important for photometer adjustment!

26. If the plate carrier moves easily into the photometer, press on the **Get XYZ Position** button.
27. **Only in the X-Axis area:** Press on the **Transfer** button.
28. Enter 27648 in the **Y-Axis** area.
29. Enter 0 in the **Z-Axis** area.
30. Press **Update Positions** button in the **Position** area to save the positions.
31. Press on the **Put** button in the **Position** area to check the position.

INCUBATOR 1 + 2 AND AMBIENT 1 + 2 + 3

NOTICE

Do not activate the override of the shake mechanism in the incubator slots!

32. Press on the **Home XYZ** button in the **Motors** area.
33. Select the position **Incubator 1** in the put-down menu in the **Position** area.
34. Press on the **Move To** button in the **Position** area.
The plate transport moves to the selected position.
35. Enter -20 in the **Lock Offset** field in the **Others** area.
36. Press on the **De-energize** buttons in the **X-Axis** and **Y-Axis** areas.
37. Use the X-/Y-belts of the plate transport to adjust the positions in the incubator (audible click for the Y-axis).
Use the **Up** / **Down** buttons and the steps field below the buttons to adjust the Z-position in the **Z-Axis** area.
Alternatively you can use the **Page up** / **Page down** keys (don't forget to press the **Click here to use keys to move the drives** button). Note that the Z-axis does not have an encoder. Therefore it can not be taught manually.
38. First adjust the X-position: The plate carrier should be centered between the guide rails, the plate carrier can be moved easily into the slot. Then, adjust the Y-position: In the incubator slots, the good Y position is reached when the plate carrier shifts the shake mechanism by approx. 1/4 of its full spring travel. In the ambient slots, the Y-positions must be adjusted in a way that the plate carrier is touching the stop inside the slot, while at the same time the X-axis of the plate transport must not be deformed by the force of the Y-drive.
When X, Y and Z are adjusted, press the **Get XYZ Position** button.
39. Press on the **Transfer** buttons in the **X-Axis**, **Y-Axis** and **Z-Axis** areas.
40. Press **Update Positions** button in the **Position** to save the positions.
41. Press on the **Put** / **Get** buttons in the **Position** area to check the position.
42. Repeat all steps for the positions **Incubator 2**, **Ambient 1**, **Ambient 2**, and **Ambient 3**.
43. Make a backup of the position information by saving the parameters of the plate transport to file.

CHECK POSITIONS

44. Select a position in the put-down menu.
45. Press on the **Cycle** button in the **Position** area to check the saved position.
 - During loading the plate carrier into an incubator/ambient slot:
Plate transport sledge lift off: Z-position to high.
Plate carrier lift off: Z-position to low.
 - During unloading from an incubator/ambient slot, the plate carriers must snap into the plate transport sledge with an audible click.
 - After unloading from the photometer or washer position, the plate carrier must still be snapped in correctly.
 - Note scratch or grind noises. Teach affected positions once more.
46. Press on the **Abort** button to stop the position check.
47. Check **all** positions: In the main window of the plate transport service software, select **All positions** and press on the **Cycle** button. This will move all plate carriers to all slots. At least 2 full cycles should be performed.
48. Close the service software after teaching.
49. Install the deck top (see chapter 8.3.1 on page 8-9).
50. Close the plate transport service software module.

**PHOTOMETER
ADJUSTMENT**

51. Close the plate transport service software module.
52. Start the photometer service software module (see chapter 11.8 on page 11-25)
53. Press on the **Auto Alignment** button to start the auto adjustment procedure.
Requires operator to have adjustment tool.
54. Press on the **Board Test** button to start the board test.
55. Close the photometer service software module.

TEST

56. Start the plate transport service software module.
57. Perform the **Module test** (sensors and short continuous running) (see chapter 15.6.3 on page 15-30).
58. Close the plate transport service software module.
59. Start the incubator service software module.
60. Perform the **Module test** (plate in sensors, heaters, and shake mechanism) (see chapter 10.8.4 on page 10-33).
61. Close the incubator service software module.
62. Close the service software.

21 FIRMWARE UPDATE

This chapter describes the procedure for the firmware update of the modules. At the end of this chapter, possible errors and their remedies in connection with the firmware update are described.

21.1 COMPLETE FIRMWARE UPDATE WITH INSTRUMENT SETUP (PIPETTOR VERSION 3)

INFO

If the teaching software, the service software, or the user software is running before, that programs has to be closed before starting the update procedure!

FIRMWARE UPDATE

1. Open the Windows Explorer (file management).
2. Open the folder `C:\Stratec\InstrumentSetup\` and start the file `IS-Start.exe`.
The Instrument Setup uses the Internet Explorer for running.
3. Check for correct **Port Settings**:
 - **Port**: 3
 - **Baud**: 38400
4. Press on the **Select XML-file** button and open the desired file.
 - **GEMINI** with pipettor version 1: `IS_Config_PIP_V1.xml`
 - **GEMINI** with pipettor version 3: `IS_Config.xml`
 - **GEMINI COMBO**: `IS_Config_COMBO.xml`
5. Press on the **Full Instrument Setup + read all parameters again** button.
6. Wait until the finished message appears.
7. Close the Instrument Setup software/Internet Explorer.

21.2 TROUBLESHOOTING WITH FIRMWARE UPDATE

Error:	Cause:	Action:
Connection problems	Wrong USB configuration	Check the USB configuration
Missing file(s)	File(s) missing in the folder.	Check if all required files in the same folder.

Table 21-1: Troubleshooting with firmware update

22 TECHNICAL DATA

INFO

Specification

Values are achieved under optimal conditions and can vary depending on environmental conditions, instrument status and processing conditions! Specifications are subject to change with notice according to STRATEC's "Change control system".

22.1 POWER REQUIREMENTS

Power requirements of the instrument:

Voltage:	100 V - 240 V +/- 10 %
Amperage:	3.2 A - 1.3 A
Frequency:	50 - 60 Hz
Fuses:	primary 250 VAC / T 4 AH

Power requirements of the All-In-One-PC power supply:

Voltage:	100 V - 240 V (+/- 10 %)
Amperage:	2 A
Frequency:	50 - 60 Hz
DC output:	24 V / 2.5 A

22.2 LASER OF THE BARCODE SCANNER

Class:	Class 2 laser product
Maximal output radiation:	1.7 mW
Pulse duration:	< 420 μ s
Emitted wave length:	655 nm

22.3 INTEGRATED COMPUTER AND CONNECTIONS

Hardware Internal-PC:	
Processor:	Pentium Celeron M
Memory (RAM):	512 MB
Hard disk:	40 GB
Ports:	<ul style="list-style-type: none">• 3 USB ports• 1 external monitor connector• 1 serial RS 232 ports• 1 external mouse/keyboard connector• 1 10/100Base-TX Fast Ethernet (LAN)
Integrated monitor:	15 inch Touch screen

Hardware All-In-One-PC (ELO):

Processor:	Intel Atom Dual-Core
Memory (RAM):	2 GB
Hard disk:	320 GB
Ports:	<ul style="list-style-type: none">• 4x USB ports• 1x external monitor connector• 2x serial RS 232 ports• 1x LAN (Gigabit)
Integrated monitor:	15 inch Touch screen

Hardware All-In-One-PC (Protech):

Processor:	Intel Celeron J1900
Memory (RAM):	4 GB
Hard disk:	500 GB
Ports:	<ul style="list-style-type: none">• 1x USB 3.0 ports (rear)• 4x USB 2.0 ports (rear and side bezel)• 1x external monitor connector• 3x serial RS 232 ports• 1x LAN (Gigabit)
Integrated monitor:	Touch screen, 15 inch

Software:

Operating system	Microsoft® Windows® 10 (64 Bit; UK English) The user software is also compatible to Microsoft® Windows® 7 (32 Bit; UK English)
------------------	---

22.4 INSTALLATION DIMENSIONS AND WEIGHT

Width:	With touch screen on the cover: 97 cm (38.2 inch) With touch screen on the right side: 125 cm (49.2 inch)
Depth:	65 cm (25.6 inch) without waste bag
Height:	75 cm (29.5 inch) cover closed 110 cm (43.3 inch) cover opened
Weight:	100 kg (220.5 lb) without accessories

22.5 ENVIRONMENTAL CONDITIONS

The following table shows the range of conditions needed to run the system safely.

Environmental Condition:	The system is made for indoor use.
Temperature:	Operating: 15 to 30 °C (59 to 86 °F) Storage: 5 to 40 °C (41 to 104°F) Transport: 5 to 40 °C (41 to 104°F)
Humidity:	Operating: 30 - 80 % non-condensing Storage: 10 - 85 % non-condensing Transport: 10 - 85 % non-condensing
Pollution degree:	2
Installation Class:	2
Sunlight:	No direct sunlight May mislead optical sensors and affect performance
Altitude	Up to 2000 m (78740 inch) above mean sea level Storage: as required for air travel
Dust:	No excessive dust

22.6 NOISE

70 dB A (distance 1 m (39.37 inch))

22.7 PACKAGING

Dimensions (WxDxH):	125 cm x 90 cm x 115 cm (49.2 inch x 35.4 inch x 45.3 inch)
Weight:	153 kg (337.3 lb.) with accessories

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23 APPENDIX

23.1 ACCESSORIES AND CONSUMABLES

NOTICE

Non-recommended accessories and consumables

The usage of non-recommended accessories and consumables can produce erroneous results or damage to the instrument.

- Use only the accessories and consumables described herein.
-

See separate spare part list "SPL Gemini" for accessories and consumables.

23.2 SPARE PARTS

See separate spare part list "SPL Gemini".

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