User Manual
CyBio Well vario

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EC Declaration of Conformity (reproduction of the content)

Name and address of the manufacturer:

Analytik Jena GmbH
Konrad-Zuse-Straße 1
D-07745 Jena

Herewith we declare, that the product described below

CyBio Well vario
OL3381-25-300 (linear system)
OL3381-25-305 (linear system)
OL3381-25-355 (round table)

is complying with all corresponding requirements of the Machinery Directive 2006/42/EC. In addition the product is in conformity with the EC Directive relating to electromagnetic compatibility 2014/30/EU. The safety objectives of the Low-Voltage Directive are taken into account.

Harmonized Standards used:

EN ISO 12100 - Safety of Machinery - General principles for design - Risk assessment and risk reduction

EN 61010-1 - Safety requirements for electrical equipment for measurement, control and laboratory use

EN 61000-6-2 - EMC - Generic standards: Immunity for industrial environments

EN 61000-6-4 - EMC - Generic standards: Emission for indutrial environments

The person authorized to compile the relevant technical documentation:

Analytik Jena GmbH, Konrad-Zuse-Straße 1, D-07745 Jena

ZERTIFIKAT ◆ CERTIFICATE ◆ 認證證書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTI

CERTIFICATE

No. U8 037158 0009 Rev. 00

Holder of Certificate: **Analytik Jena GmbH**
Konrad-Zuse-Str. 1
07745 Jena
GERMANY

Production Facility(ies): 037158

Certification Mark:

Product: **Laboratory Equipment**
Model(s): **CyBio Well vario**
Parameters:

Rated voltage:	115-230 VAC
Rated frequency:	50/60 Hz
Rated current:	2 A
Protection class:	I

Tested according to:
UL 61010-1:2012/R:2018-11
CAN/CSA-C22.2 No. 61010-1:2012/A1:2018-11
UL 61010-2-081:2019
CAN/CSA-C22.2 No. 61010-2-081:2019

This product was voluntarily tested to the relevant safety requirements referenced on this certificate. It can be marked with the certification mark above. The mark must not be altered in any way. This product certification system operated by TÜV SÜD America Inc. most closely resembles system 3 as defined in ISO/IEC 17067. Certification is based on the TÜV SÜD "Testing and Certification Regulations". TÜV SÜD America Inc. is an OSHA recognized NRTL and a Standards Council of Canada accredited Certification body.

Test report no.: 028-713057923-100

Date, 2021-01-21

(Abdul Sabbagh)

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1 General Information

1.1 Notes on this User Manual

This User Manual contains information regarding CyBio Well vario setup and function. It also provides qualified operator personnel with knowledge as required for the safe handling of the system, its components and related control and evaluation software module CyBio Composer.

Furthermore, this User Manual includes advice on system maintenance and care, providing references to sources of potential faults or malfunction and proposing action for removal of faults.

This User Manual must be readily available to operating and maintenance personnel at all times!

TIP

All information represents the state of knowledge at the date of printing. The manufacturer reserves the right to make changes if deemed necessary in the interest of technical progress.

Conventions

Work instructions involving a timed sequence are numbered, merged to action units and specify related results.

Lists which are not in chronological order are shown as itemized lists, sub-listings as bullet points.

Safety notes are marked with a pictogram and the appropriate signal word (refer to section "Safety Notes" for the meaning of pictograms and signal words used herein). They specify the type, source and consequences of a hazard, giving advice for accident prevention. A safety note always **precedes** instructions on required action.

Software components for control and evaluation are highlighted as follows:

Control buttons, menus, description fields, checker boxes and option fields are shown in bold lettering enclosed in bracket (for example, **[OK]** button, **[Devices]**) menu.

Menu and selection sequences are divided by arrows
(e.g. menu **[File]** ⇒ **[Open]**).

- **References to windows** are shown in italics (e. g. window *Measurement*).
- Field, frame and tab names are shown in bold lettering (for example, **Software** tab, **Position** frame).

Cross references (internal) are marked with an arrow and shown in italics.

1.2 Intended Purpose

The CyBio Well vario provides a simultaneous multi-pipetting tool for automated processing of microplates with 96, 384 or 1536 wells according to the SBS standard. Its basic functions are: dosing, pipetting, dispensing, diluting, rinsing, tip change and pipetting head replacement, as well as transportation of microplates. In addition, it allows non-contact pipetting to be performed when the capillary head is installed. Optional extra functions are, for example, the stockpiling of microplates (when working with stackers) and a reservoir filling station. Depending on the product design version, a head may be replaced from the front or from the back.

The CyBio Well vario pipettor is intended for laboratories doing research and development in the fields of pharmacy, biochemistry, clinical chemistry, combinatorial chemistry, molecular biology, molecular genetics and cell biology, as well as any laboratory where pipetting operations have to be carried out in a highly parallel, rapid and precise manner.

Users are required to operate this system in no way or mode other than described or specified in this User Manual. The system's range of applications is limited by the functional scope of available software and firmware and by the scope of delivery.

1.3 Conforming Use

The term **conforming use** of the CyBio Well vario presumes that:

- the system is operated by qualified and trained research and laboratory personnel
- all operating requirements quoted in this User Manual and described procedural sequences and related safety notes are duly observed
- all specifications in this Manual regarding system start-up, operation, preventive maintenance and care are met
- applicable safety standards or rules are always fulfilled.

Any type of mode of application other than specified herein will be regarded as non-conforming use! Only the operator is liable for any damages that result from this.

TIP

The manufacturer will refuse any claims for warranty and liability for material damage and personal injury if the CyBio Well vario is shown to have been subject to non-conforming use!

The term **non-conforming use** will include, but is not limited to:

- operating the system in medical laboratories
- working with explosive substances
- working in potentially explosive atmospheres

TIP

CyBio Well vario system operation with involvement of dangerous substances will be the sole responsibility of the user!

This includes compliance with all safety requirements for the protection of people and material goods during work with radioactive, infectious, poisonous, corrosive, combustible and other hazardous substances. The user is under obligation to fulfil all requirements on laboratory equipment and the conduct of personnel handling substances of this nature and on the practices in place for cleanness, sterilization, environmental protection and waste disposal.

Users are advised to establish their own work practice and issue related instructions before operating the system with involvement of dangerous substances Accordingly, this User Manual contains no safety notes to protect from personal injury or material damage

caused by substances being examined.

Process control must rely on included manufacturer software. Alterations in or damage to the software may give rise to faults in process and damage the system or its components. Software protection is the sole responsibility of the user.

1.4 Warranty & Liability

The period of warranty and scope of liabilities will be as stipulated under binding law and provided for in the General Terms of Business of the manufacturer.

Warranty will be limited to repair services or replacement of damaged parts. It will exclude consequential damage of any kind. Damage to wearing parts is not included in the warranty.

Any deviation from conforming use as defined in this User Manual (operating requirements, process sequences) will result in restricted acceptance of warranty or liability claims in the event of damage.

In the event of personal injury or material damage, claims for warranty or liability will be refused, unless the CyBio Well vario can be shown to have been operated in accordance with section → *1.3* (→ *„Conforming Use"*).

TIP

This loss-of-warranty clause shall apply to potential periods of interruption in business and to any system component that had not been directly affected by authorized warranty work.

1.5 Scope of Delivery

CyBio Well vario system delivery includes:

- CyBio Well vario
- Transporting unit (linear type or circular type)
- Pipetting head or capillary head
- Compressed air control unit (only for working with capillary head)
- CyBio Composer software
- Toolset
- User manual
- Optional accessories

2 Technical Specifications

General characteristics	
Designation/type	CyBio Well vario
Airborne sound emission	< 70 dB (A)
Dimensional & weight details	
Width x height x depth (without transporting unit)	(284 x 772.5 x 370) mm
Width x height x depth (with 3-place linear transporting unit)	(960 x 772.5 x 370) mm
Width x height x depth (with 4-place linear transporting unit)	(1300 x 772.5 x 370) mm
Width x height x depth (with 5-place linear transporting unit)	(1650 x 772.5 x 370) mm
Width x height x depth (with 10-place circular transporting unit)	(700 x 772.5 x 895) mm
Weight:	
▪ Basic unit (without pipetting head)	31.0 kg
▪ Pipetting head	14.0 kg
▪ Capillary head	10.0 kg
▪ Operation control panel	1.8 kg
▪ Basic unit with carriage and frame	39.5 kg
▪ Basic unit with rotary stage and frame	49.0 kg
Pipetting heads	
Channels	96, 384 or 1536
Volume ranges/working ranges ▪ Wet pipetting ▪ Dry pipetting	 ▪ 25 nl to 250 µl ▪ 200 nl to 250 µl
Dosing volume of 96 piston pipetting head, 250 µl	Randomly selectable in steps of 0.1 µl
Precision for volume range of 10...25 µL	Coefficient of variation ≤ 2 %
Precision for volume range of 25...250 µL	Coefficient of variation ≤ 1 %

Dosing volume of 96 piston pipetting head, 60 µl	Randomly selectable in steps of 0.01 µl
Precision for volume range of 2...3 µL	Coefficient of variation ≤ 3 %
Precision for volume range of 3...5 µL	Coefficient of variation ≤ 2 %
Precision for volume range of 5...25 µL	Coefficient of variation ≤ 1 %
Dosing volume of 96 piston pipetting head, 40 µl	Randomly selectable in steps of 0.01 µl
Precision for volume range of 2...5 µL	Coefficient of variation ≤ 2 %
Precision for volume range of 5...25 µL	Coefficient of variation ≤ 1 %
Dosing volume of 96 piston pipetting head, 25 µL	Randomly selectable in steps of 0.01 µl
Precision for volume range of 2...5 µL	Coefficient of variation ≤ 2 %
Precision for volume range of 5...25 µL	Coefficient of variation ≤ 1 %
Dosing volume of 96 piston pipetting head, 2.5 µL	Randomly selectable in steps of 0.001 µl
Precision for volume range of 0.1...0.25 µl	Coefficient of variation ≤ 7 %
Precision for volume range of 0.25...0.5 µl	Coefficient of variation ≤ 5 %
Precision for volume range of 0.5...2.5 µl	Coefficient of variation ≤ 3 %
Dosing volume of 384 piston pipetting head, 60 µl	Randomly selectable in steps of 0.01 µl
Precision for volume range of 2...3 µL	Coefficient of variation ≤ 3 %
Precision for volume range of 3...5 µL	Coefficient of variation ≤ 2 %
Precision for volume range of 5...25 µL	Coefficient of variation ≤ 1 %
Dosing volume of 384 piston pipetting head, 25 µL	Randomly selectable in steps of 0.01 µl
Precision for volume range of 2...5 µL	Coefficient of variation ≤ 2 %
Precision for volume range of 5...25 µL	Coefficient of variation ≤ 1 %

Dosing volume of 384 piston pipetting head, 2.5 µL	Randomly selectable in steps of 0.01 µl
Precision for volume range of 0.1…0.25 µl	Coefficient of variation ≤ 7 %
Precision for volume range of 0.25…0.5 µl	Coefficient of variation ≤ 5 %
Precision for volume range of 0.5…2.5 µl	Coefficient of variation ≤ 3 %
Dosing volume of 1536 piston, 8 µl	Randomly selectable in steps of 0.01 µl
Precision for volume range of 1…5 µl	Coefficient of variation ≤ 3 %
Precision for volume range of 5…8 µl	Coefficient of variation ≤ 2 %

Capillary head	
Intended use	Parallel transfer of compounds and parallel dispensing into dry microplates
Aspiration	by capillary force effect
Dispensing	by jet of compressed air
Number of capillaries	96, 384
Material of capillaries	Glass
Volume range (fixed) ▪ non-contact pipetting	25 nl, 50 nl, 100 nl, 250 nl, 500 nl, 750 nl, 1000 nl
Precision	Variation coefficient (VC) ≤ 10 % for all volume ranges (measurement of absorbance) Typical values: 250 nl: VC ≤ 1.5 % 100 nl: VC ≤ 2.5 % 25 nl: VC ≤ 8.0 %
Pipette tips	
Single-use tips	250 DW, 250 SW 60 µl, 25 µl, 10 µl polypropylene (PP) single-use tips in standard version, sterile PCR-certified or APR-compatible quality version
Ceramic tips	2.5 µl ceramic tips
Channels	96 or 384
Microplate specifications	
Formats (SBS standard)	96-, 384-, 1536-shallow-well MP 96-, 384-, 1536-deep-well MP
Plate positions	
▪ Linear positions	3, 4, 5
▪ Positions at rotary stage	10

Table 1: General data

TIP

The variation values quoted above can only be guaranteed in the case of strict adherence to the procedure described in section → *„Precision Test"*.

Operating Data	
Utility class	stage unit, sealed and maintained rooms
Permissible altitude	up to 2000 m
Protection class	I
Internal protection standard	IP 20
Interference suppression	EN 55011 (DIN VDE 0875, Part 11) Limit value Class A
Interference immunity	EN 61000-6-2
Operating voltage	230 V ± 10 %, 50/60 Hz 115 V ± 10 %, 50/60 Hz
Operating pressure (only capillary head)	1.72 bar (0.172 MPa; 25 psi)
Protective fusing	230 V: T1.6 A 115 V: T3.15 A
Power consumption	≤ 200 VA
Overvoltage category	II
Degree of contamination	2
Interface	RS 232 C, Sub-D 9-pin
Current firmware version	4.73[1]
Storage & Operating Conditions	
Storage and transport: ▪ Allowable ambient temperature ▪ Allowable relative air humidity	 -10 °C to +50 °C ≤ 85 % at 30 °C
Operation: ▪ Allowable ambient temperature ▪ Allowable relative air humidity	 +15 °C to +35 °C ≤ 75 % at 35 °C, non-condensing
Floor base requirements	Stable, horizontal, dry, free from vibration

1 At the time of printing.

Table 2: Operating Data

3 Safety Notes

3.1 General

TIP

For your own safety and to ensure failsafe and reliable CyBio Well vario system operation, you should carefully read this chapter before proceeding to any kind of start-up work!

You are required to follow all safety notes that precede a description of work procedures in this Manual. The same applies to any message and advisory note appearing on a device display or output for display on the screen by control and evaluation software tools.

3.2 Standards & Guidelines

The CyBio Well vario has been built to meet currently valid rules of technology and generally established requirements on safety engineering.

EU directives

The system and its components have been designed in accordance with basic safety and health requirements in applicable laws, standards and guideline regulations. CE-labeling and a declaration of conformity are included to document the safety of the system and its components.

All specifications regarding safety reference the European Union regulations in their latest binding revisions. Other specific national laws and regulations must be observed.

Besides the safety instructions in this User Manual and the local safety regulations that apply to the operation of the system, the generally
applicable regulations regarding accident prevention, occupational health and safety and environmental protection must be observed and complied with.

TIP

References to potential hazards do not replace the work protection regulations which must be observed.

Guidelines for China

The device contains substances subject to regulation (according to RoHS regulation SJ/T 11363-2011).

Symbol	Meaning	Comment
	China RoHS label	Analytik Jena warrants that these substances will not be released from the device within the next 25 years provided the device is employed as intended.

3.3 NRTL Certification

Symbol	Meaning	Comment
	NRTL symbol	The CyBio Well vario system has been tested by an approved certification institute for its functional and safety characteristics. It may be consequently marked with the certification mark.

3.4 Symbols & Signal Words Used Throughout This Manual

To alert to potentially dangerous situations or provide useful advice, this User Manual uses the following symbols and signal words. Safety instructions are always placed before an action.

WARNING

**Indicates a potentially hazardous situation which,
if not prevented, can result in death or most serious injuries (incapacitation).**

CAUTION

**Indicates a potentially hazardous situation which,
if not prevented, can result in light or minor injuries and material damage.**

TIP

Provides operator advice and other particularly useful information for situations involving no danger or harm.

ENVIRONMENTAL PROTECTION

Provides operator advice and information that may prove helpful for the proper disposal and handling of selected substances and materials.

3.5 Safety labeling provided at the system

TIP

Affixed warning notes and safety symbols are an integral part of the system and its components and must be followed under any circumstances!

Check warning labels and safety symbols for intactness and completeness before you begin any kind of start-up action. Do not proceed to start-up action if you have identified a missing or damaged warning note or safety symbol!

Damaged or missing warning notes or safety symbols may lead to faulty action with consequential injury to persons or material damage to equipment! Warning notes and safety symbols must not be removed! Immediately replace any damaged warning notes or safety symbols!

The following safety symbols are affixed on the system:
→ *„Safety symbols" on page 13*.

Safety symbol	Meaning	Comment
	Warning of a Hazard point	Warns of mechanical hazard from mechanically moving system parts
	Warns of dangerous electrical voltage	
	Warns of hand injury	Warns of crushing/pinching by mechanically moving parts
Warning note	**Meaning**	**Comment**
	Warns of dangerous electrical voltage Warns of fire	Never open the system! Repair work should only be carried out by qualified expert personnel! Replace defective fuses by fuses of the specified type!
	Warns of crushing or pinching accidents	Consider the pipetting head's weight for installation or deinstallation work. The capillary head weighs 10 kg/22 lbs.
	Warns of compressed air (only capillary head)	Make sure that the maximum specified pressure is not exceeded.
werkseitig 230 V eingestellt factory set 230 V or werkseitig 115 V eingestellt factory set 115 V	Indicates factory setting for permissible (under national standard) supply voltage level	Connection to supply voltage of a different level may result in the destruction of electrical or electronic components! No claim for warranty or liability will be accepted in this case!
Caution! Head change with magazine adapter only	Warns of potential material damage	Do not exchange the head, unless you have installed a magazine adapter.

Table 3: Safety symbols

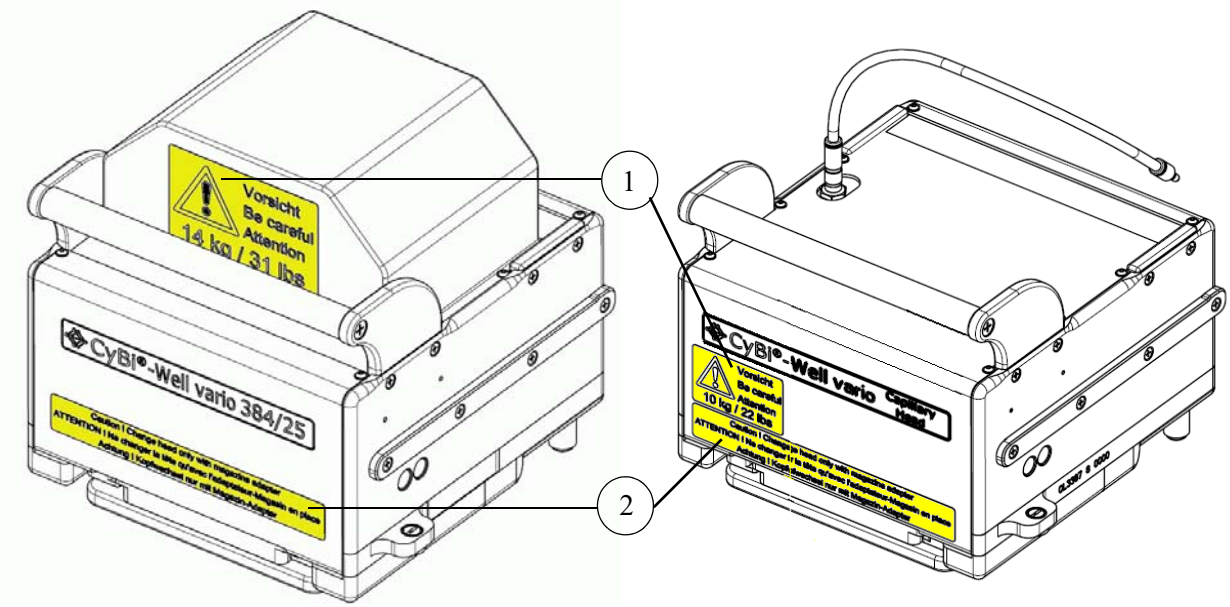


Fig. 1: Safety labeling at pipetting head and capillary head

1 Warning note "Weight"
2 Warning note "Magazine adapter"

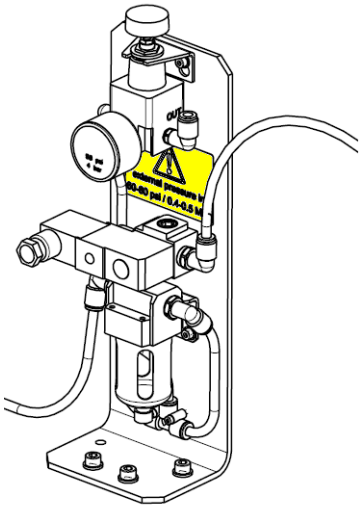
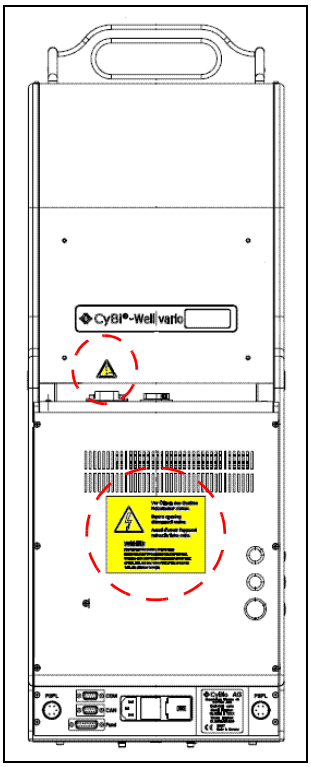
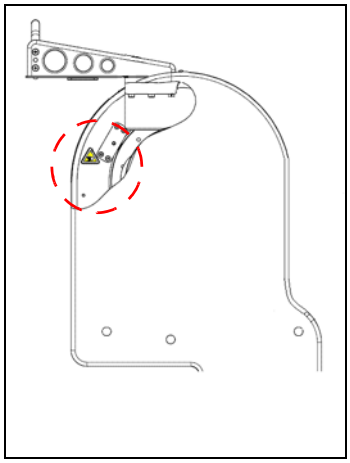


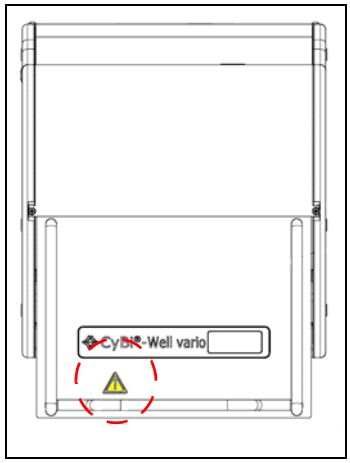
Fig. 2: Safety labeling at compressed air control unit (only capillary head)



Rearside view of system



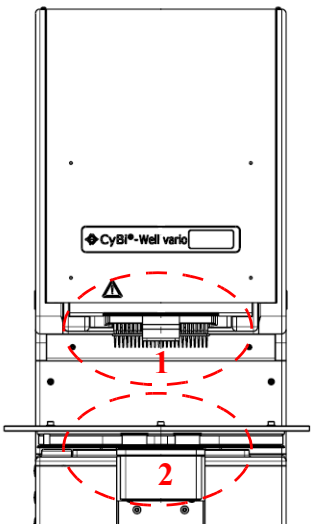
on both sides in head area with top cover open



Head cover on system front side

Fig. 3: Safety labeling provided at the system

3.6 Mechanical Danger Zones



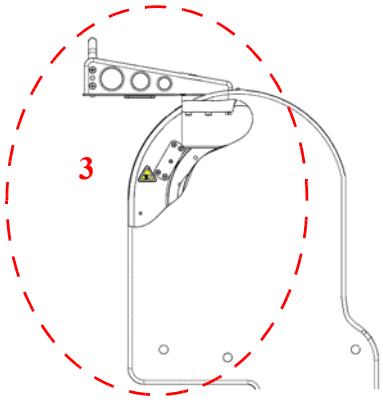


Fig. 4: Danger zones at pipettor

1 Magazine clamping device
2 Lifter
3 Head cover

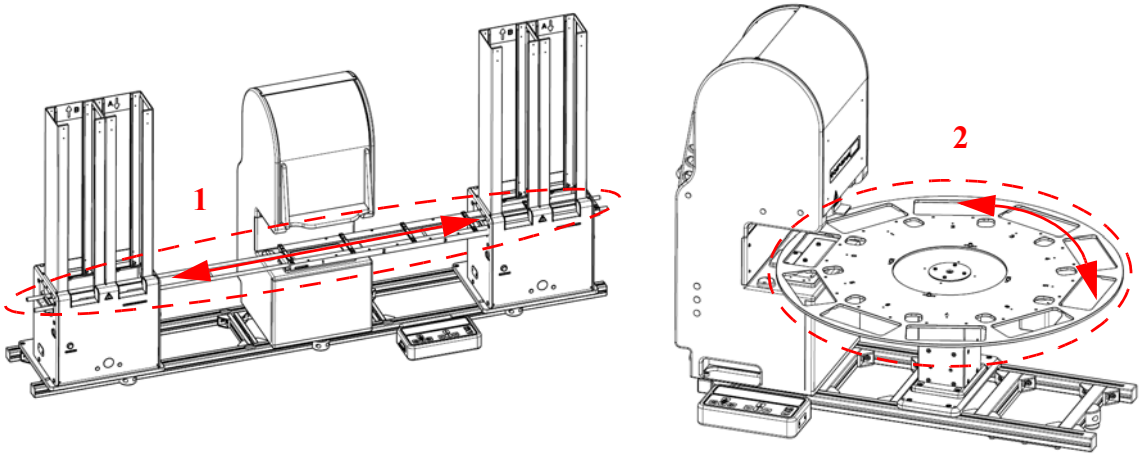


Fig. 5: Danger points at transporting unit

1 Linear transporting unit:
2 Circular transporting unit

Motion of CyBio Well vario assemblies may create hazards to operating personnel. Failure to observe warning notes may result in pinching or crushing of one's hands. Any intervention performed with the system in operating state may cause damage to its hardware or to samples being processed.

- Do not place your hands or fingers, including objects you are holding, into a mechanical motion path at any time during stacker operation Danger zones are:
  - Magazine clamping device
  - Lifter
  - Head cover
  - Carriage with transport rails or rotary stage
- Faulty action or misoperation may cause material damage or physical injury. Always use software tools to correct potentially faulty microplate motion or switch power at the main switch off before you begin any kind of intervention!
- To abort a running program, you may press the cancel button (→ *refer to page 26*).
- Loading a tip magazine without pipette tips may cause damage to dosing pistons. Never load an empty tip magazine.
- Prevent lifter motion up to tips level.
- Always restore the lifter to zero-position before you trigger motion of the transporting unit.
- Keep your hands and fingers clear of the carriage motion path of a stacker.

3.7 General Safety Notes

Follow these general safety rules:

- Do not analyze or use aggressive substances of a type that may compromise the stable performance of the system or its components (→ *refer to page 21*)!
- Do not make changes in system engineering design, unless by prior agreement with the manufacturer!
- Do not manipulate or damage software or software configuration settings!
- Do not operate the system with safety devices in a defective state or with safety and protection devices installed in a nonconforming manner!
- Operate the system only at a line voltage that complies with nameplate specifications!
- Observe prescribed maintenance intervals (→ *refer to page 104*)!
- Use only accessory items, consumable materials and spare parts specified in this User Manual or provided or recommended by the manufacturer!
- Service and repair work and procedures for starting up or shutting down for transportation may not be performed by anyone other than authorized service personnel!
- Unauthorized modifications or changes, especially such that affect the safety of the staff and the environment, are generally not allowed.

3.8 Requirements for Operating Personnel

- The system may not be started up, operated or maintained other than by duly trained expert personnel having received instructions on operational safety. Such training will also include familiarization with the contents of this Manual and manuals of related system components or additional equipment units as may be appropriate from case to case.
- The operation or servicing of the device by minors or individuals under the influence of alcohol, drugs or medication is not permitted.
- It must be ensured that only authorized personnel work at the system.
- The operating personnel must be familiar with the dangers arising from the substances used. Appropriate personal protective equipment should be applied if necessary.
- Before a break in operation or on completion of work, adequate measures should be taken for skin cleaning and skin protection.
- You are prohibited from eating, drinking, smoking or using open fire at or near the system installation site!

3.9 Safety Requirements for Transportation & Installation

The system must be installed by service personnel of the manufacturer or duly trained and authorized expert personnel in all cases. Unauthorized assembly and installation is not permitted. Incorrect installation can create serious hazards.

Follow these general safety rules:

- Insufficiently secured components pose a risk of injury! For transportation, system components must be secured as prescribed in the relevant transporting equipment manuals or in this User Manual.
- Only transport the system in its original packaging! Make sure that all shipping retainers are installed and system components are completely empty where necessary.
- In order to prevent damage to people's health, relocation (lifting and carrying) of system components within a laboratory complex must be done with due consideration and observation of currently binding benchmark specifications and limit values applicable to the lifting and carrying of loads without the use of aids.

3.10 Safety Notes for Operation

3.10.1 General

- Operating personnel are obliged to convince themselves of the proper technical condition of the system and its components, including any safety devices, before they can proceed to action for powering up. This applies in particular after each modification or extension of the system or its repair.
- Do not operate the system, unless all protective devices (fuses) are in place, properly installed and fully functional.
- Protection and safety devices must not be removed, altered or defeated during normal operation.
- Ensure easy access to the main power switch, as well as emergency shutdown and locking points at any time during system operation.
- Take care that all ventilation devices of the system are in a properly functioning condition. Obstructed ventilation grids, air inlet/outlet slits, etc. may result in malfunction or system damage.
- Operating personnel are required to immediately notify the owner of any change identified in the system and likely or known to impact the level of safety

3.10.2 Compressed air

- Compressed air may prove a source of danger if operators are not familiar with the way it must be handled. For this reason, the system may not be operated by anyone other than qualified personnel.
- Apply compressed air only in operating conditions as described herein.
- Make sure that the maximum allowed pressure is not exceeded.
- Ensure that the counterlocking nut is properly tightened on completion of operating pressure setting.
- Switch compressed air supply off for idle system periods and drain the inner system space.
- Do not use compressed air that contains chemicals, synthetic oils with organic solvents or etching gases, etc., because such impurities may result in maloperation of the system.
- On failure to remove condensate from air filters and microfilters, there may be outflow of condensate on the output side and consequential malfunction of the compressed air duct. Always track the condensate reservoir filling level for this reason.
- Work for preventive maintenance or replacement of compressed air duct components may only be performed by persons properly trained in the handling of compressed air.

3.10.3 Explosion Protection, Fire Prevention

- The CyBio Well vario must not be operated in an explosive environment or using explosive substances.
- Smoking or using open fire are forbidden inside of the operating room!
- Operating personnel must be duly informed about the locations and the proper handling of fire-extinguishing equipment in the operating room.

3.10.4 Electrics

- Working on electrical and electronic parts of the system and its components may only be carried out by a suitably qualified electrician according to latest binding electrical regulations.
- Never start up the device if cables are damaged (e.g. cuts in cabling, worn or chafed places)!
- Observe prescribed maintenance intervals (→ *refer to page 104*).
- The main power plug includes a ground (PE) contact that may only be connected to a to a socket with ground contact. The grounding conductor may not be interrupted (e.g. through the use of a voltage regulating transformer). Do not use extension cables without a grounding conductor!
- Power cabling must be installed in a workmanlike manner!
- To detach this cable from the mains socket, always hold it by the plug.
- Do not contact or hold the line plug with wet hands!
- Under no circumstances may system shielding be removed. There is life-threatening danger due to electrical shock if shielding parts are removed!
- Do not insert objects into a system opening and make sure that no liquid can penetrate through openings or joints into the inner system space.
- The main fuse prevents danger of fire from electrical overload situations. This fuse must not be short-circuited. Also make sure that only a fuse of the type as specified on the back wall is used for replacement.

3.10.5 Maintenance & Care

- CyBio Well vario system maintenance may not be carried out by anyone other than service personnel of the manufacturer or duly authorized and properly trained expert technicians.
- Unauthorized maintenance work may cause damage to the system. For this reason, operating personnel are not allowed to carry out work of any kind other than described in chapter "→ *„Maintenance & Care"*".
- Always switch system power off before you perform work for maintenance or cleaning of the system. Pull the main power plug from the power socket at first.
- Use a slightly moistened (not dripping-wet) piece of cloth to clean exterior surfaces.
- Use only original accessory items and original spare parts or such accessories and spare parts that are recommended by the manufacturer (refer to chapter → *„Accessories &Spare Parts"*). Follow all advisory notes in chapter → *„Maintenance & Care"*.

3.10.6 Handling of Dangerous Substances

The system owner is solely responsible for compliance with all safety requirements in place for the protection of persons and material goods during work involving radioactive, infectious, toxic, etching, combustible and other dangerous substances.

For system operation involving dangerous substances, users are recommended to issue their own internal operating instructions. This User Manual includes no safety notes aimed at preventing personal injury or material damage that may be caused by substances being examined.

3.10.7 Chemical Resistance

The manufacturer cannot be held liable if the operator of the device analyzes aggressive substances which may affect the durability of the components.

- Particular caution should be used when handling leaches, acids or organic solvents, because these may reduce the system's lifetime.
- Use only substances that are compatible with the materials quoted herein.

Components in direct physical contact with substances being processed:

Component	Material
Pipette tips	PP
2.5 µL ceramic tips	Ceramic
Capillary tips	Glass, PS (polystyrene)
Piston seals[1]	PE-HD
Reagent cups	PMMA or PTFE
Tubes	Silicone
Wash tubs	PEAK
Reservoir	PEEK, Teflon, stainless steel

1 Aerosols may lead to indirect contact between the substances and the piston seals or the piston. The pistons are made of stainless steel, the piston seals of polyethylene (high density).

None of the components mentioned above are resistant to any of the following substances:

Substances*
Hydrofluoric acid (HF)
Highly concentrated acids
Cleaning powder
Paint thinner
Naphtha (straight-run gasoline)
Gasoline
Acetone
Cleaning spray
Ozone

Table 4: Substances

*This table is not exhaustive

Do not use solvents (thinners), aggressive detergents, flammable liquids or etching leaches for cleaning. Disregarding this advice may cause damage to system shielding or the operation control panel.

TIP

If in doubt, consult the manufacturer.

3.11 Rules of Conduct in Cases of Emergency

- In the event of a situation involving potential danger or danger of an accident, system power supply must be turned off at once, using the main power switch or the emergency pushbutton and/or by detaching the mains plug from the line socket!

Since prompt reaction can save lives in a situation of danger, make sure that the following requirements are met:

- The operating staff must be familiar with the location of safety equipment, accident and danger alarms as well as first aid and rescue equipment as well as their handling.
- The operator is responsible for the respective training of the operating staff.
- All equipment for first aid (first-aid kit, eyewash bottles, stretcher, etc.) as well as equipment for firefighting (fire extinguishers) must be within reach and easy to access. All equipment has to be in a sound condition and should be checked regularly.

4 Technical Description

4.1 System Setup

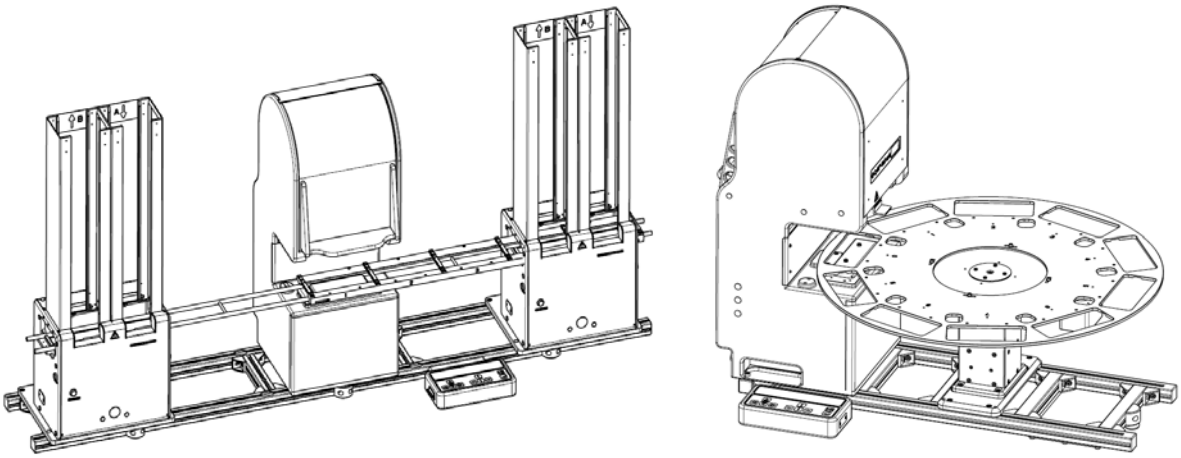
TheCyBio Well vario multi-channel pipettor is of modular design to facilitate different configurations for adaptation to a variety of customer applications. The system provides one essential advantage: only a few easy steps are required to replace the pipetting head or the capillary head with another head. Systems with a capillary head include a compressed air control unit attached to the frame. The tube for compressed air supply is connected to the terminal at the capillary head.

In addition, two different transporting mechanisms are available:

- CyBio Well vario with linear transporting unit
- CyBio Well vario with circular transporting unit

Linear transporting unit: The linear transporting unit is intended for motion of a 3-, 4- or 5-place carriage in one plane. A carriage place is able to transport a microplate, reservoir or a washing trough. Depending on the product configuration, a pipetting head can be replaced from a front position or a backside position.

Circular transporting unit: This transporting mechanism is able to provide single plane transportation of microplates, reservoirs and wash troughs on 10 places of a rotary stage. The pipetting head can be replaced working from the system's back side.



Linear transporting unit: Circular transporting unit

Fig. 6: CyBio Well vario with linear (shown with stackers) and circular transporting unit

The various functional units of the CyBio Well vario are shown in → *Fig. 7* (version with linear transporting unit). Their functions are explained in the following chapters.

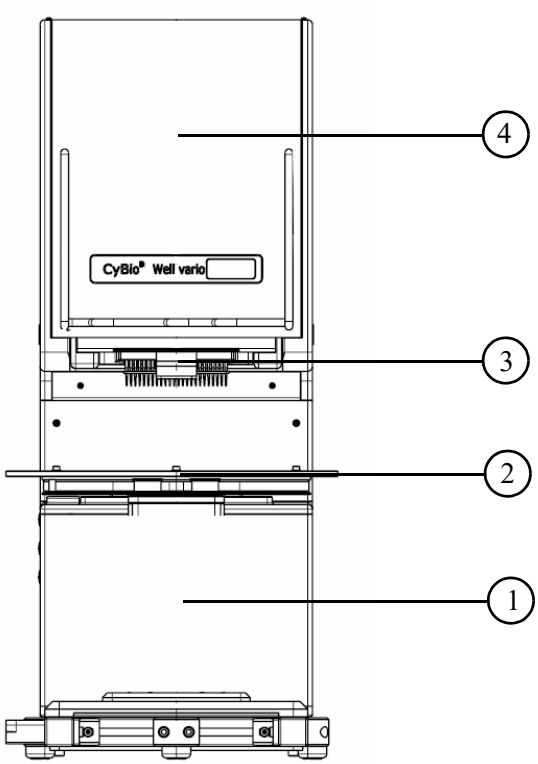


Fig. 7: General view of CyBio Well vario (head replacement from the front version)

1 Basic Unit
2 Transport rails
3 Tip magazine
4 Pipetting head

Type plate/
Connection value label

Fig. 8: Type plate / connection value label

Information on the type label:

- Manufacturer's information
- Product designations (type designation, trade name)

- Identification mark (model, serial number)
- Year of manufacture

Information on the connection value label:

- Fuse
- Frequency, output

4.2 Component Description

4.2.1 Basic Unit

The basic unit contains four motors with functions as follows:

- Positioning motion of microplate in X- and Y-direction (2 motors)
- Lifter motion:
  - Raising a microplate into position under the pipetting head
  - Transferring a microplate into position under the pipetting head in X- and Y-direction as appropriate for a given microplate type (2 motors)
  - Placement of a microplate onto the carriage or rotary stage (initial position)
- Carriage motion in horizontal direction along the transport rails or rotary motion of rotary stage in horizontal direction

TIP

Zero-position is correctly positioned as part of a system initialization routine.

Product version: Head replacement from the front; head change from the front

The main switch for switching system power on and off is located on the front of the basic unit (→ *see Fig. 32*).

Product version: Head replacement from the back; head change from the back

The main switch for switching system power on and off is located on the back of the basic unit (→ *see Fig. 33*).

4.2.2 Operation control panel

The CyBio Well vario multi-channel pipettor may be connected to the operation control panel for working in manual mode. The various control panel elements are shown in → *Fig. 9*.

Available functions are:

- Horizontal and vertical microplate motion
- Selection of menu functions
- Entries for pipetting volume

Fig. 9: Operation control panel

1 Triangle keys
2 LCD display (2-line, 40 characters long)
3 Arrow keys
4 Cancel key
5 Enter key

Control keys have assigned functions as follows:

Triangle keys

Trigger lifter and carriage or rotary stage motion

Keys for triggering lifter motion

For down-motion or up-motion of the lifter.
If both keys are simultaneously pressed for a short while, the lifter will move fully down to its zero-position

Keys for horizontal carriage or rotary stage motion

The effect on pressing of these keys depends on the current lifter position.
Vertical position 0 mm:
Horizontal motion to carriage places or rotary stage places.
Vertical position > 0 mm:
384X pipetting head: Motion to positions A1 to B2 for 1536 wells
96X pipetting head: Motion to positions A1 to B2 for 384 wells or to A1 to D4 for 1536 wells.

Arrow keys

For menu selection and parameter input

Keys for menu selection:

For moving through a menu in forward and backward direction

Keys for parameter settings

For changes in program parameters

Enter key

Confirms input or current process.

Cancel key [ESC]
Aborts a running program for motion, aspiration, dispensing or tip change (clamping).
On pressing **[ENTER]**, the microplate carriage will move to position 1 in initialization mode
When programming mode is currently set, this key will switch to the next highest menu level.

4.2.3 Pipetting heads

The CyBio Well vario multi-channel pipettor accepts different types of multi-channel pipetting heads for expedited and highly precise processing of microplates with 96/384/1536-well capacity. The system is equally suited for both types of microplates: shallow well and deep well.

Pipetting head motion is powered by two motors with assigned functions as follows:

- Piston drive
- Clamping and releasing of magazine holder

A pipetting head can easily and quickly be replaced either from the front or the back, depending on the product version, by manual action (→ *see Fig. 10*). For more convenient removal or installation of a pipetting head, the head has a handle attached to it and the magazine adapter provides a recessed handle. Rails are located on the lateral sides of a pipetting head for guided installation or removal motion. For exchange of pipetting head, → *refer to page 78*.

The following types of pipetting head are optionally available*:

Pipetting head	Volumes
96-channel (piston) pipetting head	250 µl
	60 µl
	40 µl
	25 µl
	2.5 µl
384-channel (piston) pipetting head	60 µl
	25 µl
	2.5 µl
1536-channel (piston) pipetting head	8 µl

*See also price list.

Table 5: Choice of pipetting heads

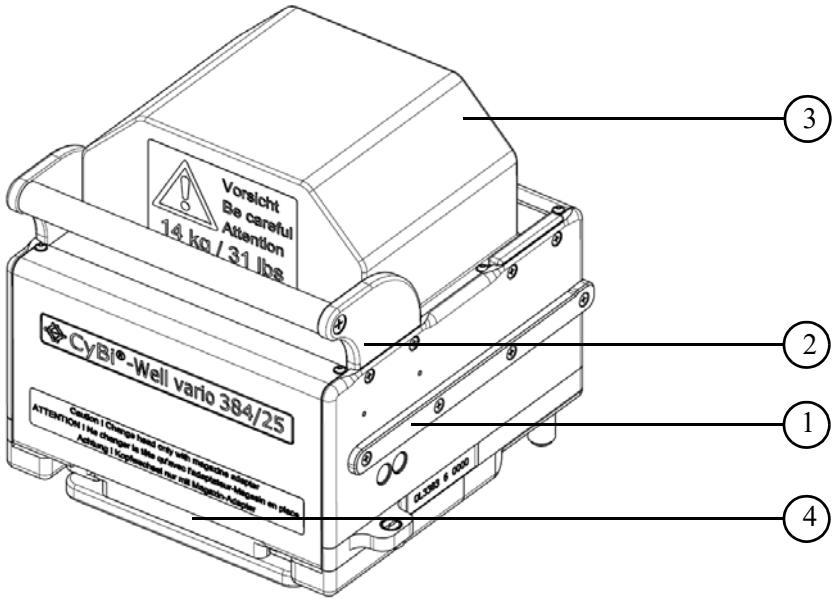


Fig. 10: Pipetting head with magazine adapter

1 Rail
2 Handle
3 Pipetting head
4 Magazine adapter

4.2.4 Pipetting head CyBio Well vario 1536/8 µl

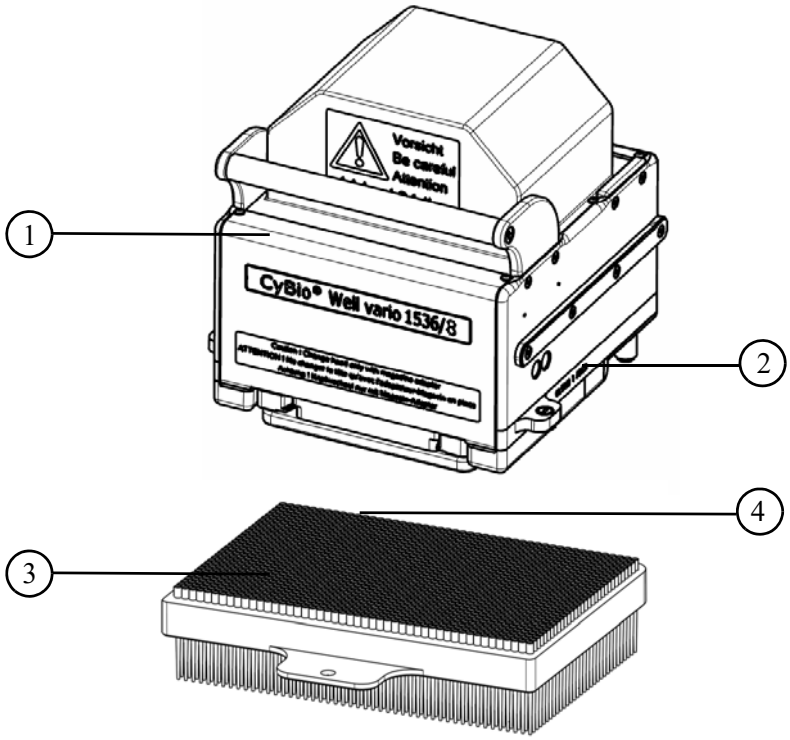
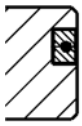


Fig. 11: Pipetting head CyBio Well vario 1536/8 µl

1 Pipetting head[1]
2 Serial number
3 TipTray (1536, schematic diagram)
4 Label

Description	Label/volume	Material (Tips)	Drawing number	*Pos. 4, → Abb. 11*[1]
Fixed TipTray (1)	S 1 µl	steel	OL5021-24-588[2]	 Coding magnet
Fixed TipTray (2)	G 8 µl	glass[3]	OL5021-24-585	
Re-Fill TipTray	8 µl	PP[4]	OL5021-12-511	

1 For identifying the tray type (when inserting into the pipetting head).
2 Other variants – see price list.
3 Carrier material (parylene-coated glass tips)
4 Polypropylene.

1 Type of pipetting head is detected by firmware when inserting into the basic unit.

4.2.5 Capillary Head

The capillary head includes a magazine holder for capillary magazines. The clamping motor fixes a capillary magazine. The capillary head also provides a terminal for connection of the air supply tube (→ *see Fig. 12*, → *No. 5*). A jet of compressed air is applied to completely dispense a previously aspirated amount of liquid into a microplate. A gasket is provided at the bottom of the head to prevent lateral emergence of compressed air above the capillary magazine.

The capillary head can be quickly and easily replaced, either from the system front side (front side) or its backside (back side), depending on the particular product version (→ *see Fig. 12*). For convenient removal from, or insertion into the system, the capillary head has a special handle. In addition, a recessed handle in the magazine adapter can be used as further aid. Rails mounted to the lateral sides of the capillary head provide for guided motion during removal or installation of the head. For replacement of the capillary head, → *refer to page 78*.

Optionally available capillary magazines are*:

Capillary Magazines	Volumes
96 or 384 capillaries	25, 50, 100, 250, 500, 750, 1000 nL

*See also price list.

Table 6: Available choice of capillary magazines

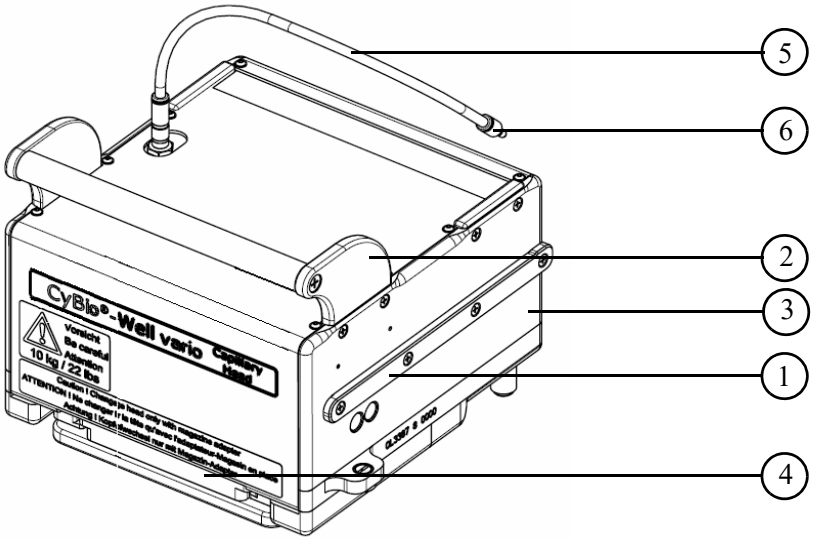


Fig. 12: Capillary head with magazine adapter

1 Rail
2 Handle
3 Capillary Head
4 Magazine adapter
5 Compressed air supply tube
6 Terminal connector

4.2.6 Tip Magazine (Pipetting Head)

A tip magazine holds 96 or 384 pipette tips. It maintains the pipette tips in an airtight-sealed condition while a pipetting process is going on.

In the event of a pipetting head replacement or with major idle periods of the system, affected pipette tips must be kept in special tip tray packages.

Fig. 13: CyBio TipTray

4.2.7 Capillary Magazine (Capillary Head)

A magazine contains 96 or 384 capillaries. A capillary consists of glass. This means that a sample will only make contact with this inert material.

Depending on their assigned fixed volume, the various capillary tips have color codes (→ *see Fig. 14*):

Color code	Volume
White	25 nl
red	50 nl
yellow	100 nl
green	250 nl
blue	500 nl
orange	750 nl
purple	1000 nl

Fig. 14: Capillaries – color code and volumes

In cases of agglutination or breakage, glass capillaries can be replaced individually (→ *refer to section 19.2.5*). For major idle periods or transportation, the capillary magazine must always be placed into its special transporting box.

4.2.8 Terminals

Located on the rear panel are the system terminals, interfaces and fuses (→ *see Fig. 16*). Warning notes must be observed in all cases and replaced immediately on noticing damage (→ *see Fig. 15*).

Fig. 15: View of rearside panel

1 Warning label
2 Information label
3 Connector panel

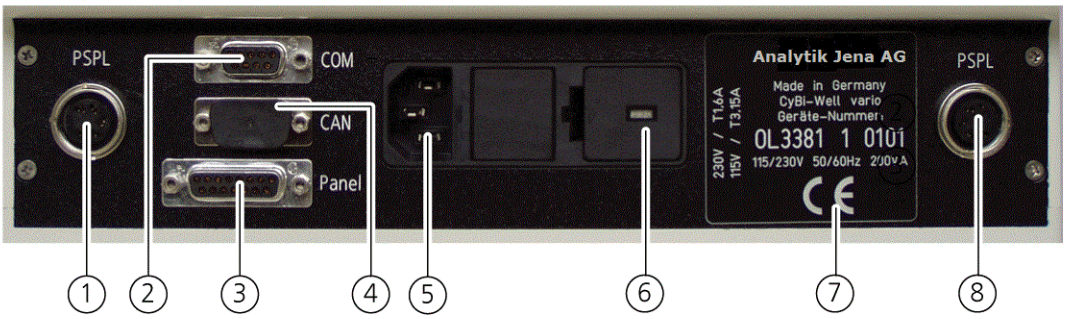


Fig. 16: Connector panel (for head replacement from the front version)

1 PSPL-SV, terminal for external device
2 COM RS 232 (Sub-D socket, 9-pole)
3 Terminal for operation control panel
4 CAN jack
5 Terminal for CyBio Well vario line power inlet
6 CyBio Well vario line fuse
7 Nameplate with product specs[1]
8 PSPL-SV, terminal for external device

1 Schematic diagram – for more details see → *„Type plate/ Connection value label" on page 24*

4.2.9 Compressed Air Control Unit

For compressed air supply, **oil-free** compressed air of a maximum 5 bar pressure (0.5 MPa; 73 psi) must be available on site. The compressed air control unit is mechanically attached to the system frame. Customer service personnel will connect the compressed air supply tube to the system via the compressed air control unit (→ *Fig. 17*) with vacuum extraction (for capillary wash station) and adjust the specified operating pressure of 1.72 bar (0.172 MPa; 25 psi).

CAUTION

Faulty pressure settings may damage the system!

Pressure settings made by customer service personnel must not be changed! Make sure that the counterlocking nut below the setting wheel is properly tightened. In the event of damage that can be shown to result from unauthorized changes in operating pressure, the manufacturer will refuse any liability!

TIP

If the operating pressure setting is too small, the CyBio Well vario with capillary head may provide only restricted functionality and capabilities.

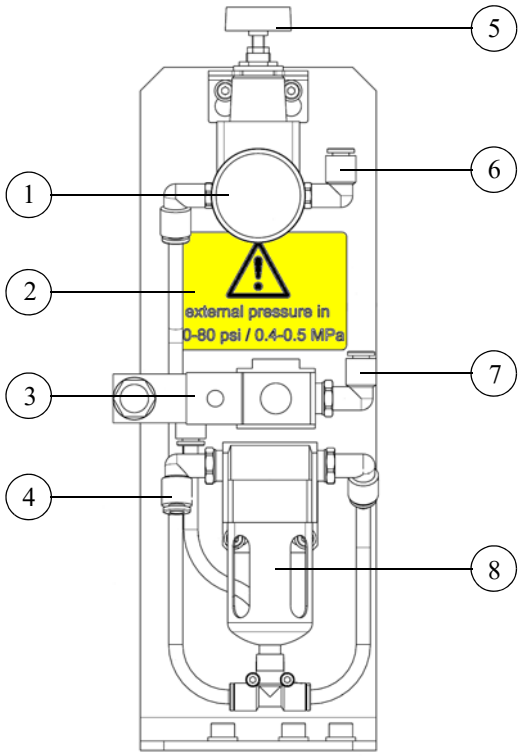


Fig. 17: Compressed air control unit with magnetic switch for vacuum extraction of the capillary wash station

1 Manometer
2 Safety note on compressed air
3 Solenoid valve
4 Tube connection for compressed air supply
5 Adjusting wheel for setting the operating pressure
6 Tube connection for capillary head
7 Tube connection for vacuum extraction
8 Condensate collector

4.3 Tip Wash Station 1536 Set

4.3.1 General

The tip wash station consists of:

- wash tub with one inlet (green) and one outlet (red)
- suction tub

Wash tub

Inlet and outlet are each realized via a peristaltic pump (e.g. via a TWS module).

The tube connections are shown in the overview (→ *Fig. 18*).

The wash tub is filled with washing liquid via the peristaltic pump.

The inside of the tips is washed by aspirating the washing liquid; the tips are washed on the outside by immersion. The peristaltic pump for draining has a pre-run and post-run process and runs at a higher speed. This prevents the wash tub from overflowing.

A sensor attached to the inlet tube, directly above the supply bottle, is used to monitor the proper supply of clean washing liquid. In the event of an interruption in the washing liquid supply, an error message is generated by the control software.

Suction tub

The aspiration is achieved by vacuum.

The tube connections are shown in the overview (→ *Fig. 19*).

4.3.2 Summaries

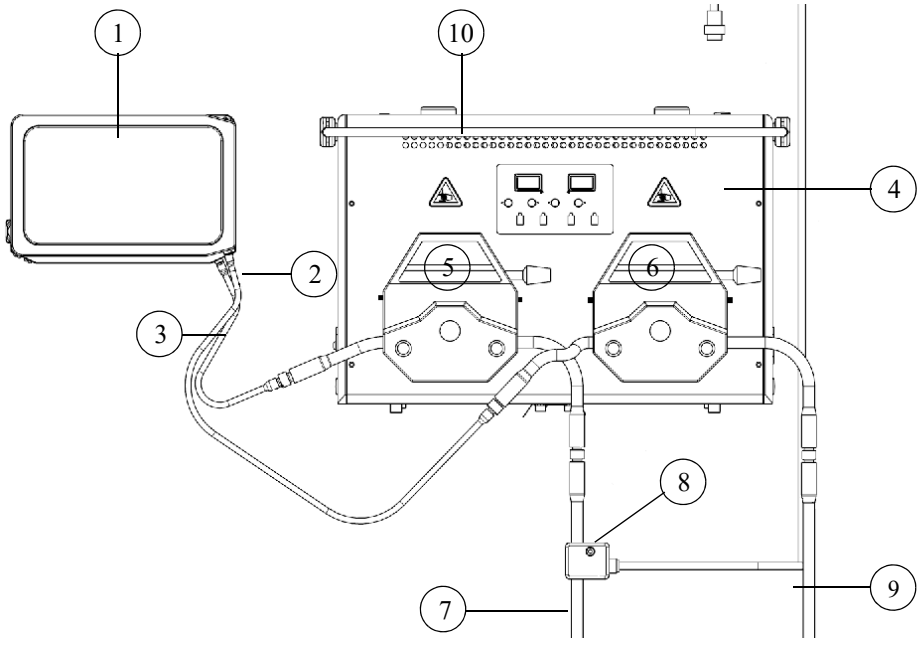


Fig. 18: Wash tub

1 Wash tub
2 Outlet connection
3 Inlet connection
4 TWS module
5 Peristaltic pump inlet
6 Peristaltic pump outlet
7 Supply tube (reagent container)
8 Tube sensor
9 Outlet tube (waste receptacle, drainage)
10 Tube deflector

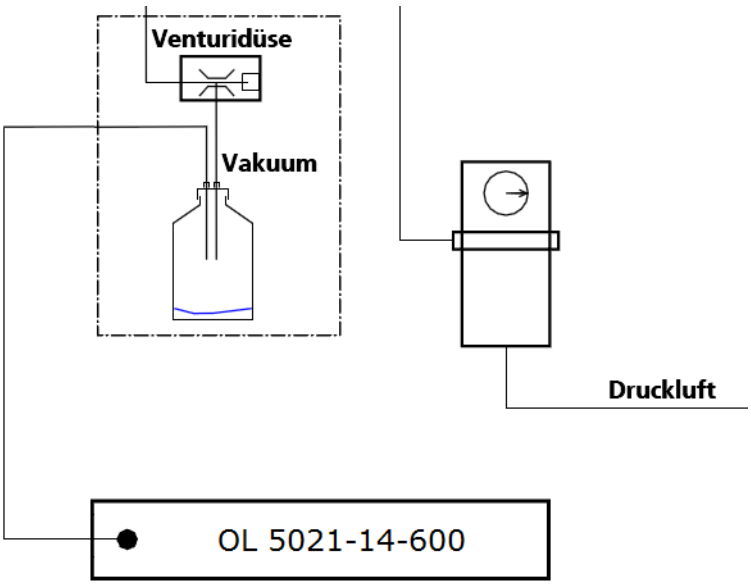


Fig. 19: Suction tub

- Vacuum unit→ *refer to page 36*
- Clear compressed air unit→ *refer to page 33*
- Suction tub (OL5021-14-600)

4.3.3 Safety Notes

The following safety symbols are affixed on the TWS module:

Safety symbol	Meaning	Comment
	Risk of crushing	Warns of crushing of limbs by moving system parts

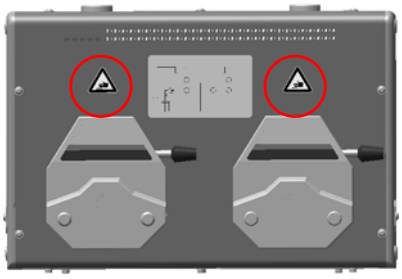


Fig. 20: Warning symbols on the TWS module

Danger areas

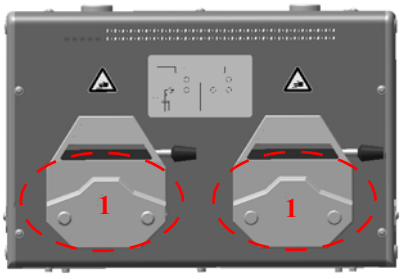


Fig. 21: Danger areas on the TWS module

1 Peristaltic pumps

- Do not place your hands or fingers, including objects you are holding, into the peristaltic pump at any time during operation

4.3.4 Component Description

Vacuum unit

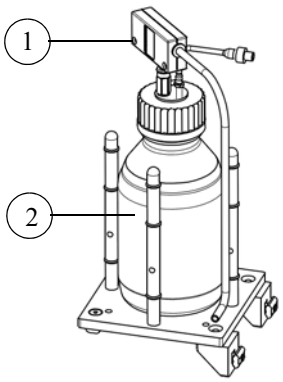


Fig. 22: Vacuum unit

1. Vacuum generator
   - Connections: SUP, EXH, VAC
2. Bottle
   - VAC connections
   - Suction tub connections

The vacuum unit consists of a vacuum pump and a waste bottle. By means of vacuum the liquid is aspirated and directed into the waste bottle.

TIP

Pay attention to the fill level in the waste bottle to prevent overflow.
Empty the bottle regularly.

TWS module

The TWS module is used for conveying and for aspirating liquids. The module is equipped with two peristaltic pumps, which can also be controlled individually.

The power supply to the system is provided by the corresponding pipettor or by a power supply module, where the label specifying the permissible mains voltage is attached.

The TWS module is controlled via the control software.

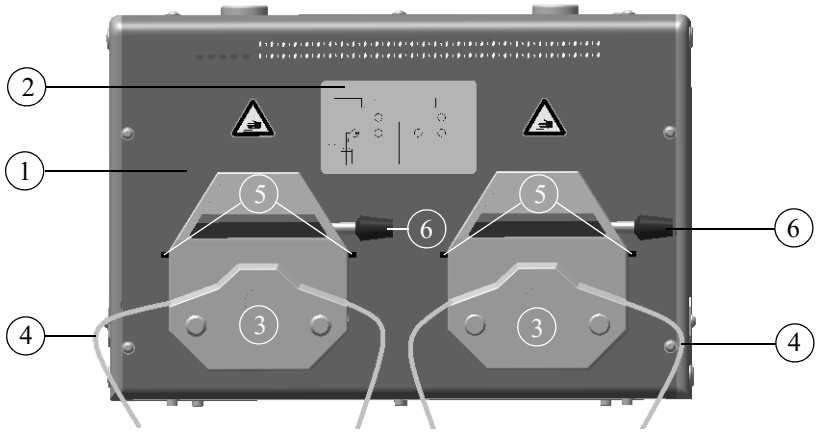


Fig. 23: TWS module with 2 peristaltic pumps

1 TWS module
2 Tube diagram
3 Peristaltic pumps
4 Tube
5 Tube locks
6 Lever

NOTE

Material damage due to aggressive acids and lyes as well as organic solvents!

The tubes used in the peristaltic pumps come into direct contact with the liquid to be pumped. Be sure to check the resistance of the tubes used against acids, lyes and organic solvents!

Tubes made of silicone peroxide are supplied as standard.

TIP

If you are unsure about the use of certain substances, please contact Analytik Jena GmbH.

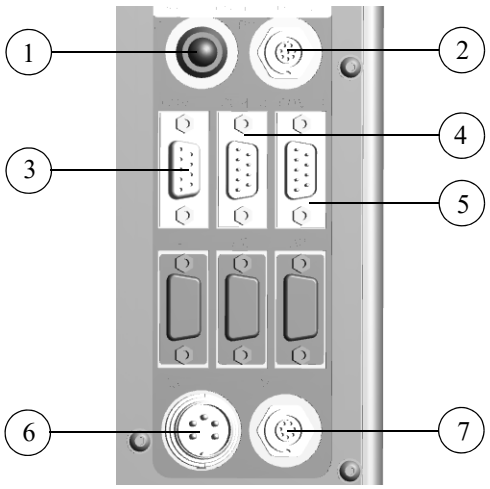


Fig. 24: TWS module – connections (rear side)

1	B 1	Operating status indicator
2	B 2 (BC)	Output for connection of a barcode reader
3	COM 1	Host PC
4	COM 2	Main system (z. B. CyBio Well vario)
5	COM 3	following device
6	B 3 (PSPL)	Power supply
7	B 4 (SW)	Switching output

Peristaltic pumps

The TWS module is equipped with Masterflex Easy-Load peristaltic pumps. The peristaltic pump conveys liquids to the tip wash station or aspirates the liquids there.

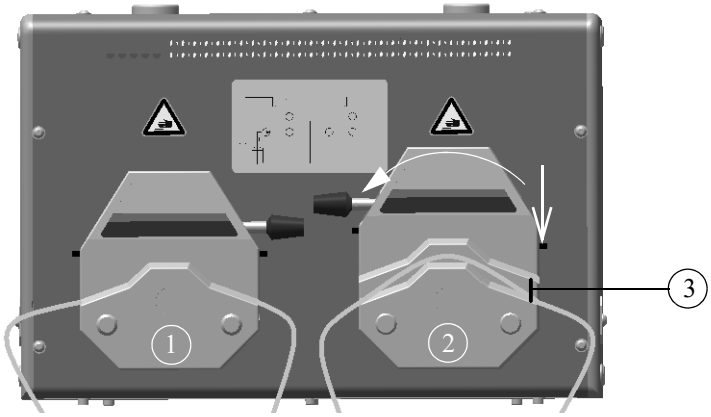


Fig. 25: Peristaltic pump – closed and open

1 Peristaltic pump, closed
2 Peristaltic pump, open
3 Fixed tube

By actuating the levers on the peristaltic pumps, the pumps can be opened or closed, making it easy to insert or remove the tubes. The tube lock holds the tubes in place. This prevents them from shifting during operation.

4.3.5 Operation

The TWS module and the tip wash station are controlled by the control software. The pumps can be controlled individually.

TIP

When using the wash tub for the first time, place it in a liquid with low surface tension. This then ensures that all pipette tips are washed evenly.

Peristaltic pumps: Inserting the tubes

CAUTION

There is danger of crushing or pinching while the pump is in action.

Terminate all currently running system programs or switch system power off before you begin work at a peristaltic pump.

1. Switch peristaltic pump lever to the left
   ✓ Pump is open.
2. Insert the tube according to the direction of transport
3. Return lever of peristaltic pump into rightmost position.
4. Push right and left tube locks into locked position.
   ✓ Pump is closed and ready for operation.

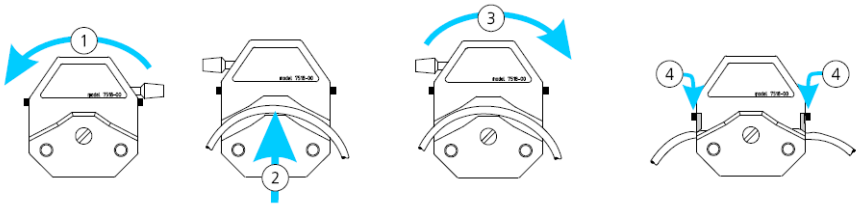


Fig. 26: Insertion of Tube into Peristaltic Pump

The pumps' direction of rotation determines the direction in which liquid will be transported
(→ *see Fig. 27 on page 39*).

The rollers of the inlet pump (left side) move counterclockwise; this means that the liquid is pumped from right to left; the right tube end must be submerged in the storage vessel for washing liquid and the left tube end leads to the inlet of the washing tub.

The rollers of the outlet pump (right side) move clockwise; this means that the liquid is pumped from the left to the right; the left tube end is connected to the outlet of the wash tub; the right tube end leads to the waste container or drain.

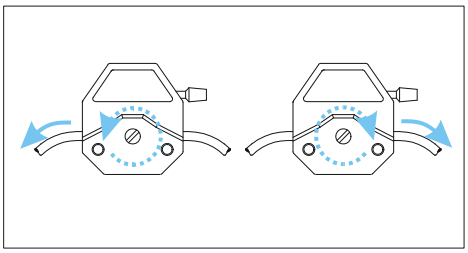


Fig. 27: Peristaltic pump on TWS module
direction of rotation and delivery of liquid

4.4 Dabbing station

Observe the instructions for use (→ *page 43*) when using the dabbing station (OL5021-14-600)!

4.4.1 Introduction

A pipetting cycle basically consists of aspirating the liquid into the tips, dispensing the liquid, ejecting the residual liquid and returning the pistons to the starting position (zero position). Each time the pipette tips are moved out of the liquid after residual ejection, a film of liquid remains at the lower end of the tip, even if residual ejection was performed with an additional volume of air.

This liquid film is aspirated back into the pipette tips when the pistons are returned to the zero position. In principle, this residual liquid can lead to carryover. In conventional pipette tips, this liquid film usually bursts due to the conically expanding inner diameter. The liquid is then located on the inner wall and can be removed, for example, with a subsequent washing cycle, thus avoiding carryover. However, a small amount of liquid will always remain in the tips which corresponds to that in a manually pre-moistened tip. This behavior is shown in figure → *Fig. 28*.

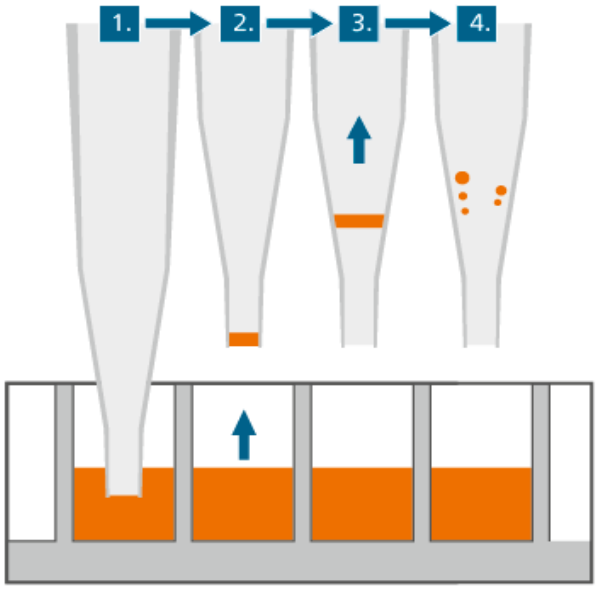


Fig. 28: Typical behavior of the residual liquid in normal pipette tips when resetting the pistons to the zero position

1 Tip in liquid after residual ejection
2 Tip is moved out of liquid, residual liquid film remains
3 Piston is moved to zero position; residual liquid is aspirated into pipette tip
4 Liquid film bursts, residual liquid can be removed with subsequent washing cycle

This behavior changes in the case of very small tips ≤ 10 µl made of polypropylene and capillaries made of glass, steel or ceramic. As the inner diameter does not expand upwards, or only very slightly, the liquid film does *not* burst when the pistons are returned to the zero position and the residual liquid cannot be removed.

This leads to carryover and, in the worst case, can result in an accumulation of the residual liquid in the pipetting head (→ *Fig. 29*).

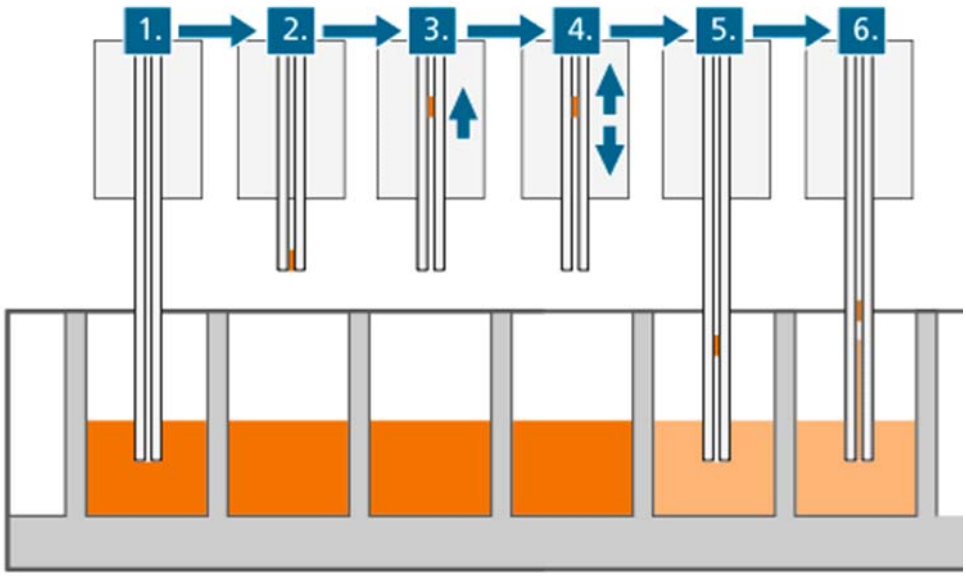


Fig. 29: Typical behavior of the residual liquid in the case of small pipette tips and capillaries

1 Tip in liquid after residual ejection
2 Tip is moved out of liquid, residual liquid film remains
3 Piston is moved to zero position; residual liquid is aspirated into pipette tip
4 Liquid film remains in the pipette tip
5 (and 6) Carryover in the next pipetting cycle

Proper use of the dabbing station can prevent this carryover.

TIP

Before each resetting of the pistons to the zero position, it is *imperative* that the residual liquid is completely removed from the tips by dabbing on the fleece surface of the dabbing station.

For the accurate transfer of small volumes, reverse pipetting with additional stroke or additional volume is generally recommended in order to exclude falsification of the uptake volumes due to capillary effects.

Residual ejection should always be performed on the dabbing station with *activated* vacuum in order to completely remove the residual liquid from the tips.
(→ *Fig. 30*).

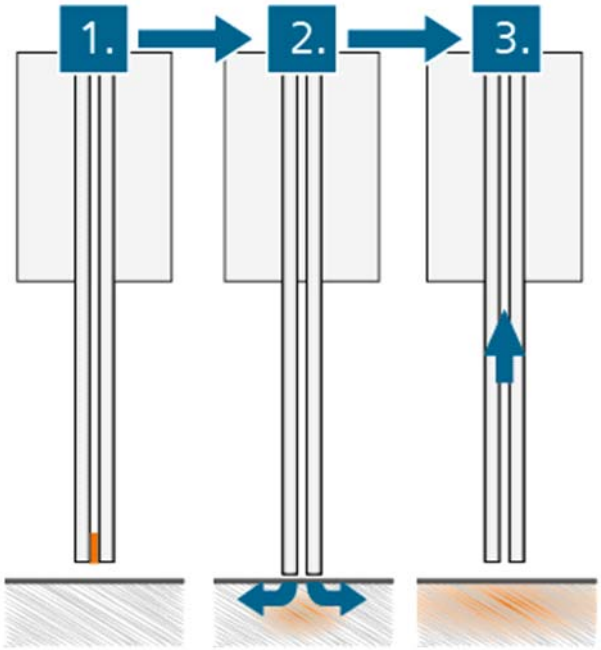


Fig. 30: Removing the residual liquid from the pipette tip

1 Residual liquid in pipette tip or capillary

2 Removal of residual liquid by gently pressing the pipette tips onto the fleece of the dabbing station during residual ejection

3 Resetting the pistons to the zero position

4.4.2 Functionality

Thedabbing fleece is made of glass fibers and is therefore chemically inert to the greatest possible extent.
Even when wet, the fleece still has sufficient capillarity to "passively" absorb small amounts of liquid. The fleece should always be used in two layers. On the one hand, this increases its absorption capacity for liquids, and on the other hand, it makes the dabbing surface thicker and thus softer. This better ensures that all tips touch down on the fleece and that the residual liquid thus comes into close contact with the fleece.

This is also supported by the fact that the surface of the dabbing station is mounted on springs. The fleece itself is placed on a porous glass plate. By means of a vacuum, liquid is extracted from the fleece and transferred to a waste container. This does not dry the fleece!

After residual ejection of reagents or test substances on the dabbing station, cross-contamination could also occur when dabbing again. Therefore, it is necessary to clean the fleece and, at the same time, the tips or capillaries after such a transfer. This is done by taking up the washing liquid into the tips and discharging it just above the surface of the fleece, followed by a residual ejection with contact to the fleece and parallel vacuum aspiration. This cleans both the tips and the fleece (→ *Fig. 31*).

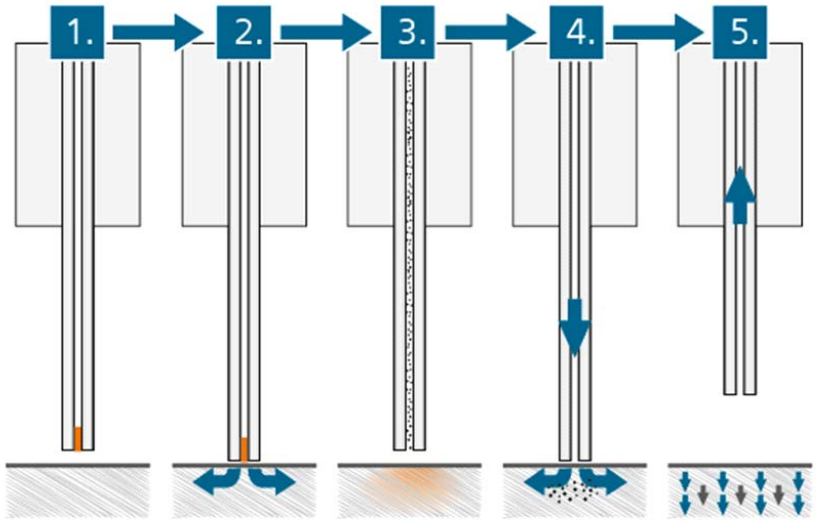


Fig. 31: Complete removal of the residual liquid from the pipette tips or capillaries by washing the dabbing fleece

1 Residual liquid in pipette tip or capillary
2 Removal of residual liquid by gently pressing the pipette tips onto the fleece of the dabbing station during residual ejection
3 Tip with washing liquid
4 Dispensing of the washing liquid (contact-free) onto the fleece and aspiration of the residual liquid (with contact)
5 Aspiration of the washing liquid from the fleece and resetting of the pistons to zero position

4.4.3 Composers Scripts

Example 1

Residual ejection of small amounts of liquid and resetting of the pistons to zero position e.g. after reverse pipetting or washing → *page 127*.

Example 2

Large volume of liquid in tips e.g. washing liquid or removal of liquid from wells (e.g. for ELISA, change of cell medium) → *page 128*.

Example 3

Residual ejection of "problematic" liquids, such as solutions containing surfactants or proteins, cell culture medium, etc. → *page 129*.

4.4.4 Important Instructions for Using the Dabbing Station

Always use *two* layers of dabbing fleece!

Moisten a new fleece (e.g. with water), as unused cloths can be hydrophobic. Add 30 to 50 ml of water to the fleece and create a vacuum using the control software.

Replace the fleece if necessary!

In case of *low* use (a few plates per day) – once a week → *page 103*.

TIP

In case of *extensive* use or if there are solids in the liquid that could "clog" the fleece, it should be changed daily.

Never reset the piston to the zero position when the tips or capillaries are still in contact with the fleece.

After use, the dabbing station should be rinsed again with 30 to 50 ml of water.
In addition, rinse with 30-50 ml of 70 % ethanol to prevent bacteria, etc. from multiplying in the moist environment.

The use of the dabbing station can also be advisable for normal tips, especially if the liquids to be transferred tend to foam (e.g. contain proteins or detergents).

4.5 Function

4.5.1 Function With Pipetting Head

The CyBio Well vario multi-channel pipettor is designed as a 96-well or 384-well simultaneously working dosing system to allow automatic processing of microplates in chemical, biological and physical research laboratories.

The system provides six basic functions which, on aggregate, offer a diversity of application options (→ *refer to page 59*). A pipetting head can also be quickly replaced with another one (→ *refer to page 78*). Available options are:

Basic functions	Explanation
Dosing	▪ Aspirates a specified volume of liquid from a trough ▪ Dispenses previously aspirated liquid into a microplate (example) with additional stroke
Pipetting	▪ Aspirates slightly more than a predefined volume of liquid from trough (with additional stroke volume). ▪ Discharges predefined volume, leaving residual volume in pipette tip (differential pipetting). ▪ Dispenses residual volume, for example, into a trough
Dispensing	▪ Aspirates a given total volume as the sum of all defined subvolumes ▪ Dispenses a specified number of subvolumes in a corresponding number of steps
Diluting	▪ Aspirates a great specified volume ▪ Aspirates an air bubble ▪ Aspirates a small specified volume according to a required mixing ratio ▪ Dispenses the total content of tips with additional stroke
Purging	▪ Aspirates and dispenses a specified volume of rinsing liquid in a specified number of rinse cycles
Tip replacement	▪ Performs electro-motoric release of 96-tip, 384-tip or 1536-tip magazine plate. ▪ Removes magazine plate from the system. ▪ Removes used pipette tips from magazine plate. ▪ Fills new set of tips into magazine plate. ▪ Inserts filled magazine plate. ▪ Performs electro-motoric clamping and sealing of magazine plate.

Table 7: System functions

Designed for high precision, including in the submicro liter volume range, and with great versatility, the CyBio Well vario covers a large range of applications. Through adaptation of the positioning system in XY-motion direction, all basic functions of a 96-channel simultaneously working system are also available for 384-channel microplates, using a four-step sequence, and for 1536-channel microplates, using a sixteen-step sequence. A 384-channel simultaneously working system will require four steps to complete a 1536-well microplate.

On integration of one or two stackers, up to fifty microplates can be processed in a fully automated sequence per stacker.

CyBio Well vario operation is controlled via CyBio Composer, a software facilitating easy and expeditious editing of specific laboratory routines. In addition, manual commands may be triggered from the operation control panel
(→ *refer to chapter 7.2.2*).

4.5.2 Function With Capillary Head

The CyBio Well vario with capillary head allows for concurrent compound transfer into dry microplates of small volume capacity (from 25 nl to 1000 nl). This works particularly well where small amounts of liquid must be transferred quickly and in parallel, for example, in:

- Compound management
- Compound (dry) storage
- Assay development, screening/HTS, ADME/Tox
- Genomics, proteomics, ...

Dispensing stock is aspirated by capillary force. This means that 96 or 384 capillaries can be filled simultaneously using the effect of capillary force. In principle, a sample transfer consists of dipping the capillaries into the liquid of a source plate and blowing the contents of the capillaries into a target plate.

Once the capillaries are submerged in the liquid of a source plate, capillary force aspirates liquid into the capillaries so the capillaries fill up "of their own accord". Dispensing is accomplished with a short jet of compressed air to transfer the contents of capillaries to a target plate. System operation is also controlled by CyBio Composer software. Manual operation is equally possible (→ *refer to chapter 7.2.2*).

Basic functions	Explanation
Dispensing	▪ Aspirates a given total volume, making use of capillary force effect ▪ Dispenses a given total volume with a jet of compressed air
Tip replacement	▪ Performs electro-motoric unclamping of a magazine plate with 96 or 384 capillaries ▪ Capillary magazine is removed from the system ▪ New capillary magazine is inserted ▪ Performs electro-motoric clamping and sealing of magazine plate.

The active capillary wash station ensures reliable cleaning of the capillaries.

5 Transportation & Storage

5.1 Transport

CAUTION

Environmental influences, mechanical shocks or formation of condensed water may destroy individual system components!

Adequate precautions should be taken to protect all components from environmental impacts, mechanical shock or formation of condensed water during transportation or shipment! Temporary open-air storage of the system is prohibited!

CAUTION

Transportation with the pipetting head still in place is likely to cause damage to the pipetting head and the system!

Do not transport the CyBio Well vario, unless you have removed the pipetting head! System transportation with a pipetting head still mounted will not be permissible. Failure to comply will void any claims for warranty and liability!

CAUTION

Improper packaging is likely to cause damage to the system!

Use only original packing for transportation and shipment of the system and its accessories.

To prepare the system for transportation, proceed as follows:

1. Remove tip magazine, then insert magazine adapter into pipetting head (→ *refer to chapter 7.2.4*).
2. Perform system shut-down (→ *refer to chapter 10*).
3. Deinstall pipetting head from the CyBio Well vario.
4. Use only original packaging for transportation. Contact your competent service partner for original packing items if necessary!
5. Secure all movable parts using cable ties or adhesive tape.
6. To provide padding for system components, insert shock PE material as necessary.

Special notes regarding transportation:

- Use utmost caution when handling the system for transportation. This is necessary to prevent damage as a result of force impacts or negligence in loading or unloading procedures
- During transportation, major temperature variations with likely formation of condensed water, mechanical shocks and vibration should be prevented.
- Use separate packing for transportation of pipettor head and magazine adapter.

5.2 Storage

If the CyBio Well vario is not installed immediately after arrival of product shipment or is not required for a longer period of time, it should preferentially be stored in its original packing case.

Climatic requirements on facilities for system storage are as follows:

- Temperature range:-10 ˚C to +50 ˚C
- Allowable relative air humidity:≤ 85 % at 30 ˚C, non-condensing

6 Initial Start-Up & Routine Start-Up Procedure

6.1 Site requirements

6.1.1 Installation Requirements

The room which is selected for CyBio Well vario installation must meet the following environmental requirements:

- Temperature range:+15 ˚C to +35 ˚C
- Allowable relative air humidity:≤ 75% at 35 ˚C, non-condensing

The atmosphere inside the operating room should be dust-free to a maximum possible degree, free from drafts and free from etching vapors. You are prohibited from smoking in the operating room.

For pipettor site selection, the following rules should be observed:

- The operating room must have a stable, horizontal, dry and vibration-free floor.
- Do not install the system directly at doors or windows nor close to sources of electromagnetic interference.
- Avoid direct sunlight and radiation from heaters onto the device. Provide air conditioning for the room if necessary.
- Provide easy access to all system parts at all times and do not obstruct ventilation slots by placing other equipment or fixtures on such inlet/outlet positions.

6.1.2 Spatial Requirements

Footprint requirements follow from the dimensional details and the type of selected transporting unit (→ *see „Technical Specifications" on page 5*). You should also provide adequate space for supplementary units and for the PC, monitor and printer.

6.1.3 Power Supply

WARNING

If the grounding conductors are interrupted, there is risk of fatal injury due to electric shock!

Never connect the mains plug of the device to a mains socket without a protective earth contact! Make sure that the protection effect is not rendered ineffective by extension cables without a PE conductor or by the use of a voltage regulating transformer!

CAUTION

Operation at a mains voltage level or frequency other than specified on the nameplate may result in destruction of the pipettor!

Make sure that power supply specifications in the operating room agree with nameplate details! Refrain from start-up action of any kind if power supply data are inconsistent!

The CyBio Well vario requires a single-phase AC power supply net for operation. Power supply is factory-set to 230 V or 115 V and a frequency of 50/60 Hz. Make absolutely certain that nameplate specifications are actually met and power is supplied with values as indicated on the nameplate.

6.1.4 Compressed Air Supply (Only for Capillary Head)

Connection of compressed air supply may be established by no one other than the customer service of the manufacturer or duly authorized expert personnel. Site requirements: **oil-free** compressed air supplied with a maximum pressure of 4 to 5 bar (60 to 80 psi).

CAUTION

Faulty pressure settings may damage the system!

Pressure settings made by customer service personnel must not be changed! In the event of damage that must be ascribed to unauthorized modification in operating pressure, the manufacturer will not assume any liability!

TIP

Too low settings for operating pressure may restrict the functionality and operating capabilities of the CyBio Well vario with capillary head!

6.2 Configuration & Start-Up

In view of the complexity and to ensure failsafe system operation, work for installation and initial start-up of the CyBio Well vario on your premises is must be completely performed by customer service personnel of the manufacturer or duly authorized expert technicians.

Initial start-up essentially includes:

- Installation and adjustment of all system components
- Providing cable connections and connecting power supply cables
- Software installation (factory-performed) and configuration
- Device induction

Check for integrity, completeness and compliance with packing list as you unpack the product shipment. On completion of work for system installation, customer service personnel will perform checks for proper function, providing documented proof of successful testing. Observe firmware version → *„Current firmware version" on page 9*.

6.3 Function Tests

6.3.1 Precision Test

Pipetting head CyBio Well vario 96/384

Testing for variation coefficient (variation coefficient percentage standard deviation) is performed, using a dye solution in a 96 well or 384 well microplate with flat transparent bottom. A suitable vertical photometer is used for measuring. The photometer's own precision must be verified and documented according to manufacturer instructions prior to measurement.

Materials & preparatory action:

- 96 well or 384 well transparent flat-bottom microplate prefilled with 0.1 N NaOH → *Tabelle 9, "Prefill, aspiration and test volumes", auf Seite 52*.

	CyBio Well vario 96-well/250 µL	CyBio Well vario 96-well /60 µl/40 µl/25 µl	CyBio Well vario 384-well 60 µl/25 µl
Diluens	150 µl	150 µl	50 µl

Table 8: Prefill volumes

TIP

A certain inhomogeneity in the rate of evaporation over a microplate will influence the result of testing adversely.
For this reason, you should tape the microplates immediately after diluens has been filled in, after pipetting of the test volume and before shaking. Do not use washed microplates. This may cause excessively great variation in measured values.

- Always use new tips for precision measurement. Rinse new tips before measurement with p-nitrophenol working solution – settings:

Piston speed:	100 rpm
Number of rinse cycles:	20
Rinsing volume:	10 µl

- Testing is performed in manual mode, using an aspiration volume of 20 µl or 10 µl, respectively, and a dispensing volume of 10 µl, 3 µl or 2µL, respectively.
- Dispense the test volume into a microplate (see table below) with prefilled NaOH solution. For test volume dispensing, the Pipette tips should submerge into the prefilled NaOH solution by approximately 1 mm.
  Dispense the remaining volume into the storage reservoir.

	CyBio Well vario 96-well/250 µL	CyBio Well vario 96-well/ 40 µl/ 25 µl	CyBio Well vario 384-well/ 25 µl	CyBio Well vario 96/384-well/60 µl
Aspiration volume	20 µl	10 µl	10 µl	10 µl
Standard test volume*	10 µl	2 µl	2 µl	3 µl
p-nitrophenol dye solution	125 mg/l in 0.1 N NaOH	600 mg/l in 0.1 N NaOH	200 mg/l in 0.1 N NaOH	125 mg/l in 0.1 N NaOH

*Select a dye concentration corresponding to an extinction between 0.4 and 1.2 OD at 405 nm.

Table 9: Prefill, aspiration and test volumes

- Tape the microplates after pipetting of the test volume and before shaking.
- Use an orbital shaker for mixing of substances.

	96-well microplate	384-well microplate
Orbital shaker with 700 rpm	Shake for 15 min 30min break Shake for 15 min	–
Centrifuge with 2000 rpm	Centrifuge 2 min 15 min break Centrifuge 2 min	Centrifuge 2 min 15 min break Centrifuge 2 min
Orbital shaker[1] with 1100 rpm	–	Shake for 15 min 45 min break Shake for 15 min

1 Alternative option (with orbital shaker)

Table 10: Mixing times

- Measure extinction in vertical photometer.
- Evaluate measured data as a preparatory stage of CV value determination.
- Compare obtained CV result with CV values in chapter → *„Technical Specifications"*.

Pipetting head CyBio Well vario 1536/8 µl

TIP

Dispense residual fluid (in the tips) onto the dabbing station (if possible, "Pipetting" mode).
In any case, the tips should be dabbed off on the dabbing station before completion of the pipetting/dispensing cycle (Composer: piston in zero position; operation control panel: dabbing break) in order to avoid carryover due to residual liquid that always remains on the tips.

Testing for variation coefficient (variation coefficient percentage standard deviation) is performed, using a dye solution in a 1536 well microplate with flat transparent bottom. A suitable vertical photometer is used for measuring. The photometer's own precision must be verified and documented according to manufacturer instructions prior to measurement.

Materials & preparatory action:

- 1536 well (transparent flat-bottom) microplate prefilled with 0.1 N NaOH[1] volumes as follows: 7 µl

TIP

A certain inhomogeneity in the rate of evaporation over a microplate will influence the result of testing adversely.
For this reason, you should tape the microplates immediately after diluens has been filled in, after pipetting of the test volume and before shaking. Do not use washed microplates. This may cause excessively great variation in measured values.

- Always use new tips for precision measurement. Rinse new tips before measurement with p-nitrophenol working solution and settings as follows:

Piston speed:	100 rpm
Number of rinse cycles:	10 – 20
Rinsing volume:	5 µl

- The test is performed in "Pipetting" mode.
- Dispense the test volume into a microplate with prefilled NaOH solution. For test volume dispensing, the Pipette tips should submerge into the prefilled NaOH solution by approximately 1 mm. Dispense the remaining volume into the storage reservoir.

	CyBio Well vario 1536-well/8 µL
Aspiration volume	1 µl
Standard test volume[1]	1 µl
p-nitrophenol[2] **dye solution**	1.6 mM

1 Select a dye concentration corresponding to an extinction between 0.5 and 0.8 OD at 405 nm.
2 Sigma 73560

Table 11: Aspiration and test volumes

- Tape the microplates after pipetting of the test volume and before shaking.
- Use an orbital shaker for mixing of substances.

	1536-well microplate
Orbital shaker with 1000 rpm	Shake for 10 min Allow to rest for 30 to 45 min; Shake for 10 min

Table 12: Mixing times

- Measure extinction in vertical photometer.
- Evaluate measured data as a preparatory stage of CV value determination.
- Compare obtained CV result with CV values in chapter
→ *„Technical Specifications" on page 5*.
- Procedure in case of individual variances ≥ 20%
→ *„Result of leak testing" on page 55*.

1 + 0.01% detergent (e.g. Chaps, Tween; Triton-x100 or similar).

6.3.2 Accuracy Test

Accuracy defines the degree to which a measured dispensed volume (mean value of all readings measured for a 96, 384 or a 1536 well microplate) is in agreement with a predefined (target) volume.

Materials & preparatory action:

- Laboratory balance with 1 mg minimum resolution.
- The selected laboratory balance must be subject to regular calibration (check for calibration mark).
- Lidded 96, 384 or 1536 well flat-bottom microplate.

NOTE

Since new microplates, typically, are vacuum-packed, a selected microplate must be unpacked at least one week before testing (the weight of a new microplate may decrease or increase as a result of evaporation and absorption respectively).

- Accuracy testing is performed with de-ionized water (1 bar and 998 mg/cm³).

Test sequence

- Mount a reservoir with deionized water in a place on the carriage or the rotary stage.
- Mount a microplate adapter in another place of the carriage or the rotary stage.
- Moisten tips using a rinsing procedure as follows: number of cycles – 20, volume – 25 µl
- CyBio Well vario 1536: number of cycles 10 to 20, volume – 5 µl. Dab off tips.
- Accuracy testing is performed in manual 'Pipetting' mode. The appropriate volume is aspirated with an additional stroke of 0.5 µL.
- Weigh the microplate in empty and lidded state.
- Unlid the plate and place it onto the adapter.
- Dispense the desired volume into the microplate immediately thereafter.
- Lid the microplate again.
- Weigh the microplate in filled and lidded state.
- The time interval between empty-state and filled-state weighing should not be greater than 15 seconds.
- Evaluate the measured results for variances of actual volume against nominal volume.
- At least three readings should be taken for each volume.

6.3.3 Leak Test

Leak testing is required, in order to make sure that the pipettor head is free from points of leakage. Subject to testing are the pistons, the pipette tips and the silicon membrane.

Testing is performed through aspiration of a certain volume of dye solution into the pipetting tips and visually tracking the level of liquid over a time of two hours (96 wells) or using a different procedure for 384 well pipetting heads, which is described further below.

Test sequence:

- Make sure the system is in a horizontal position. Carefully place a spirit level onto the transport rails for this purpose. Use setting screws for horizontal adjustment as necessary.
- Remove old tips.
- Thoroughly inspect silicon membrane for cracks or sedimentation, using a suitable light source. Carefully clean the silicon membrane using a dust-free, slightly moistened piece of cloth. Exert only moderate pressure, in order to prevent unwanted shifting of the membrane. Use caution to prevent sedimentation remaining in the membrane openings as you wipe the membrane clean. Allow the membrane to dry.
- Install tip magazine with new tips and clamp the tips.
- Bring the reagent reservoir into position under the tips.
- Raise the reagent reservoir to tips level – the pipette tips should submerge by at least 2 mm below the surface of the test solution.
- Moisten the pipette tips on the inside by performing five rinse cycles.
- Aspirate 50 % (of end volume) of dye solution.

TIP

Keep the pipette tips submerged during leak testing, in order to prevent formation of droplets at their ends, because droplets may falsify the result of testing.

- Visually check the liquid level of all pipette tips over at time of two hours. Document all tips with a non-conforming liquid level.
- Visual testing may be hard to perform with 384-well/25 µl pipette tips. In cases like this, you should follow a procedure similar to → *„Precision Test"*: After half an hour, completely dispense the nominal volume into a 384 well microplate with flat transparent bottom containing prefilled buffer solution and measure extinction in the vertical photometer. The volume dispensed per pipetting tip should not deviate from the mean value by more than 20 %.

Result of leak testing

CyBio Well vario 96

There must be no perceivable difference in the filling height of the various pipetting tips on completion of testing.

CyBio Well vario 384/CyBio Well vario1536

There must be no individual variances ≥ 20 % on completion of testing.

A drop in the fill level of a tip suggests a potential leak in this tip. First clean the sealing mat (remove dust, etc.). Repeat this test with new pipette tips. If the leak is found to occur in the same place, you should contact the manufacturer or your service partner.

6.3.4 Precision Test (Capillary Head)

To perform precision testing, use the following procedure.

Preparation: To wet an inserted capillary magazine, use process settings as follows:

Rinse cycles:	3x	
Rinsing liquid:	Water	
Aspiration	8 sec.	by capillary force
Submergence depth of capillaries for aspiration	4 mm	
Dispensing	1 sec.	by pressure (25 psi, 1.72 bar)
Dispensing gap:	1.5 mm	

TIP

This gap between the capillaries and the microplate must be kept in all cases. This prevents pressure-dispensed liquid from spurting out.

Procedure: Allow 8 seconds for taking in p-nitrophenol (in DMSO) by capillary force. Then dispense this solution into a 384 well microplate with transparent bottom for 1 second at a pressure of 25 psi (1.72 bar). Fill the microplate up with 50 µl of 0.1 N NaOH solution (e. g. with a pipetting head). Place the microplate onto a plate shaker and let it shake for 10 min at 700 to 1000 rpm Allow the plate then to rest for 10 min. Perform measurement of absorbance at 405 nm after this rest time.

Rinse the microplate three times with water again after testing.

Result:

Variation coefficient: (CV) < 10 %

Typical values:

Capillary magazine	CV
25 nl	< 9 %
100 nl	< 3 %
250 nl	< 2 %

The p-nitrophenol solution filling should have a concentration of approximately 120 µMol for measurement. This is necessary to achieve an approximate absorption value of 0.6.

This requires initial concentration values as follows:

Capillary magazine	Initial concentration of p-nitrophenol (in DMSO)
25 nl	240 mmol
50 nl	120 mmol
100 nl	60 mmol
250 nl	24 mmol
500 nl	12 mmol
750 nl	8 mmol
1000 nl	6 mmol

Precision testing may also be combined with fluorescence measurement.

7 Operation

7.1 Switching the CyBio Well vario on

To switch the CyBio Well vario on, proceed as follows:

1. Check that CyBio Well vario power cord is correctly connected to the line power supply point.
2. For operation with a capillary head, check for proper setting of compressed air supply. Having installed the capillary head, connect the head's compressed air supply tube to its terminal point at the compressed air control unit
3. Set the on/off switch on the front of the device (head replacement from the front version) or on the rear of the device (head replacement from the back version) to position "I" (siehe Abb. 32 or → *Fig. 33*).
   ✓ Once power is available, the CyBio Well vario is ready for action and can be operated in manual control or computer control mode.

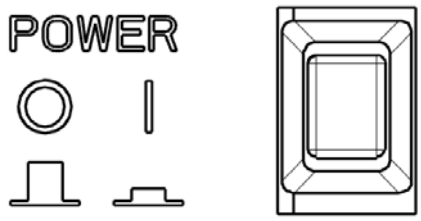


Fig. 32: Power on/off switch on front panel

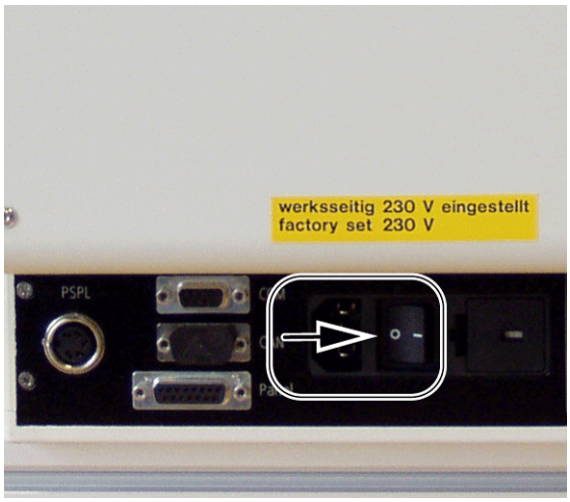


Fig. 33: Power on/off switch on rear panel

7.2 Operating the CyBio Well vario from Operation Control Panel

7.2.1 Overview of Menu Items

Pipetting head

The description in this section is restricted to manual control mode. For operating instructions regarding PC mode and PC interface, you should consult the "CyBio Composer Plugin Pipettor" User Manual.

The CyBio Well vario can be operated from the operation control panel that is located beside the system. Once system power is switched on, various menus will be available in

manual control mode, each of which provides further options for selection and execution of sub-programs and system functions (→ *see Fig. 34* and → *Fig. 35* respectively).

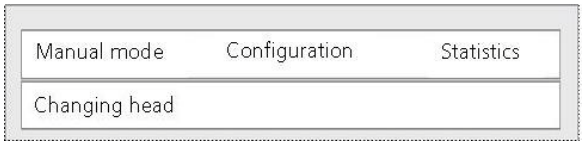


Fig. 34: Display screen – main menu

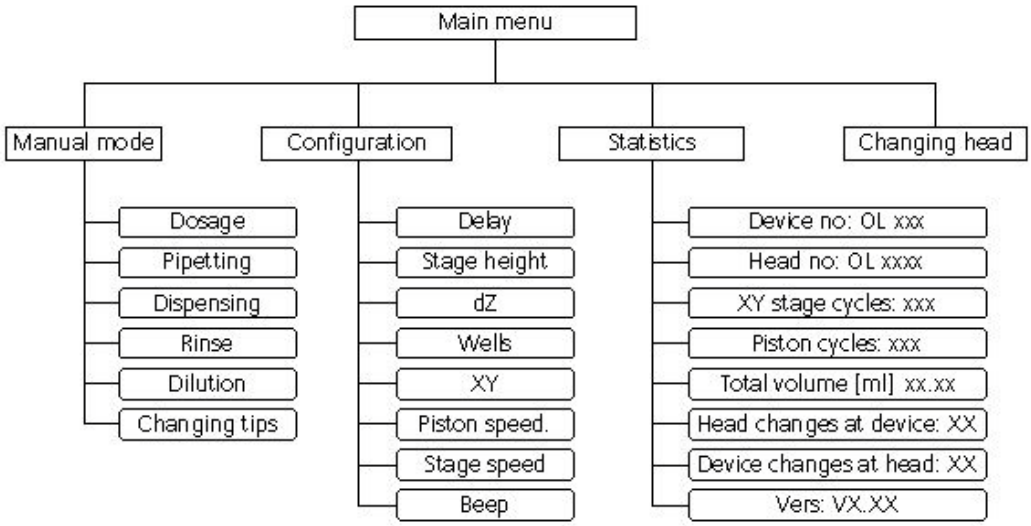


Fig. 35: Menu structure diagram view with pipetting head

Select a menu or submenu using ← or → arrow key. Confirm your selection with the ↵ key.

TIP

If you had been working in a submenu at the moment of switching power supply off, the same menu will be restored when power becomes available again.

Capillary head

Again, this section only describes manual control mode action. For instructions regarding PC operating mode and PC interface, you should refer to the "CyBio Composer Plugin Pipettor" User Manual.

The CyBio Well vario can be operated from the operation control panel that is located beside the system. Once system power is switched on, various menus will be available in manual control mode, each of which provides further options for selection and execution of sub-programs and system functions (→ *see Fig. 34* and → *Fig. 35* respectively).

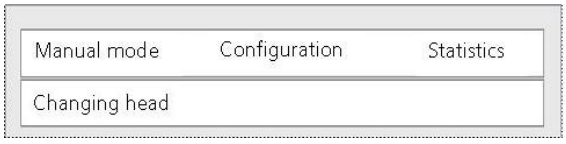


Fig. 36: Display – main menu

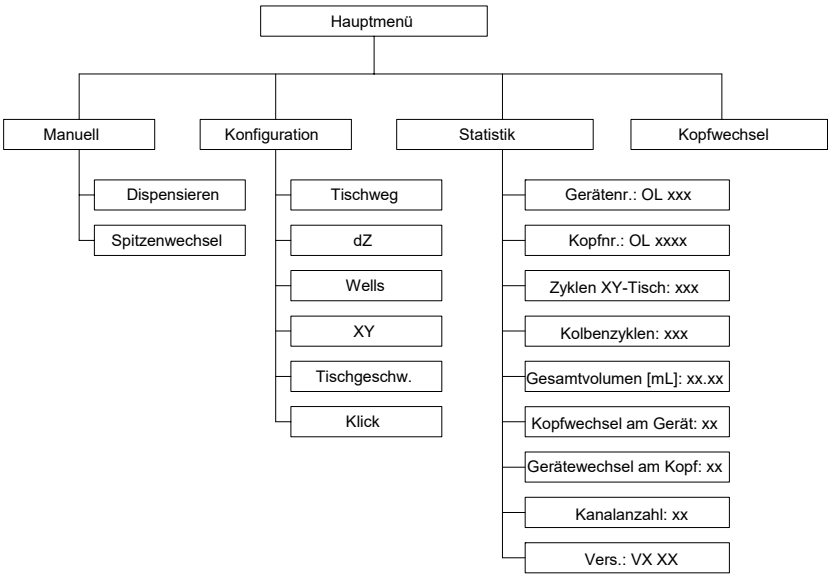


Fig. 37: Menu structure diagram view with capillary head

Select a menu or submenu using ← or → arrow key. Confirm your selection with the ↵ key.

TIP

If you had been working in a submenu at the moment of switching power supply off, the same menu will be restored when power becomes available again.

7.2.2 Menu [Manual]

Pipetting head

Six basic functions are available in manual control mode:

- Dosing
- Pipetting
- Dispensing
- Diluting
- Tip replacement
- Purging

Each individual action must be performed by an operator. The advantage is convenience of operation. For example, manual mode provides a straightforward means for processing a single microplate.

Dosing

This basic function provides for aspiration of a specified volume of liquid and dispensing of this volume with additional stroke:

1. Select an aspiration volume.

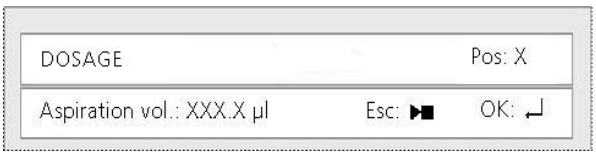


Fig. 38: Display screen – dosing – aspiration volume

2. Move a container with liquid into position under the tips (trough, microplate).

   Trigger carriage or rotary stage motion, using ◁ or ▷ as necessary to reach the required position.

   To raise the lifter, use △, to lower the lifter, use ▽.

   Note:

   With the lifter in raised position, you can set the following positions via ◁ or ▷:

384X pipetting head:	Motion to positions A1 to B2 for 1536 well operation
96X pipetting head:	Motion to positions A1 to B2 for 384 well operation or Motion to positions A1 to D4 for 1536 well operation

3. Select **[Start]** menu item, then confirm your selection by pressing key ↵. This will trigger a dosing cycle.

Fig. 39: Display screen – dosing – start

   ✓ A preselected volume is aspirated in accordance with the setting for [dosage] function. For the time of aspiration, the lifter and carriage (rotary stage) control unit is inactive.

4. To dispense an aspirated volume of liquid, move a microplate into position under the tips.

   Trigger carriage or rotary stage motion, using ◁ or ▷ as necessary to reach the required position.

   To raise the lifter, use △, to lower the lifter, use ▽.
   Note:

   With the lifter in raised position, you can set the following positions via ◁ or ▷:

96X pipetting head:	Motion to positions A1 to B2 for 384 well operation or
	Motion to positions A1 to D4 for 1536 well operation
384X pipetting head:	Motion to positions A1 to B2 for 1536 well operation

5. Confirm established position via key ↵, in order to trigger a volume dispensing cycle

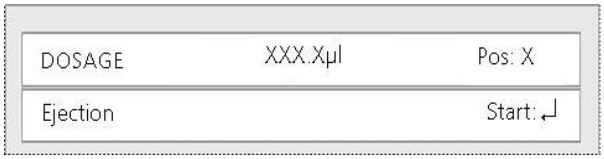


Fig. 40: Display screen – dosing – dispensing

   ✓ The aspirated volume will be dispensed with a subsequent delay time as preset in the [Configuration] menu.

6. In a break for dabbing, you may use ◁, ▷, △ or ▽ as necessary to position the tips more conveniently for dabbing.
   On termination of the dabbing break, the pistons will return to zero-position.

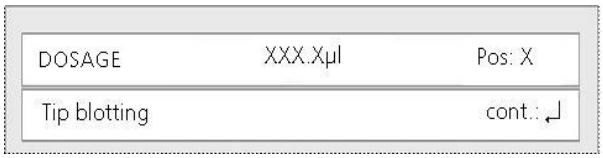


Fig. 41: Display screen – dosing – dabbing break

Pipetting

This basic function provides for aspiration of a greater volume of liquid, which is subsequently dispensed. This is followed by ejection of the residual volume. This procedure allows for higher accuracy, because there is no residue of liquid on the inner wall of a tip, which otherwise has to be taken into account.

1. Select a dispensing volume.

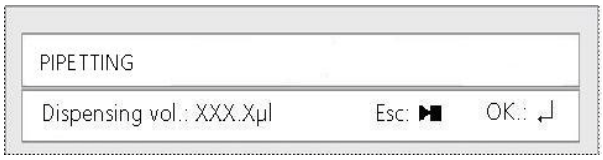


Fig. 42: Display screen – pipetting – dispensing volume

2. Select an aspiration volume.
   Note:
   The preset value for aspiration is 2 µl above dispensing volume by default. It can, however, be varied if necessary.

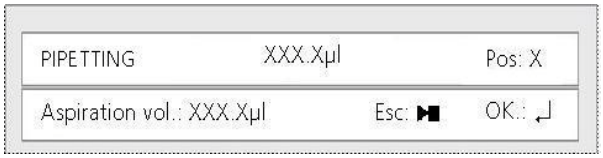


Fig. 43: Display screen – pipetting – aspiration volume

3. Move a container with liquid into position under the tips (trough, microplate).
   Trigger carriage or rotary stage motion, using  or  as necessary to reach the required position.
   To raise the lifter, use  , to lower the lifter, use  .
   Note:
   With the lifter in raised position, you can set the following positions via  or  :

96X pipetting head:	Motion to positions A1 to B2 for 384 well operation or
	Motion to positions A1 to D4 for 1536 well operation
384X pipetting head:	Motion to positions A1 to B2 for 1536 well operation

4. Select **[Start]** menu item.
   Note:
   On selection of **[Exit]**, you can exit the **[Manual]** menu without actually triggering the process.

Fig. 44: Display screen – pipetting – start

5. Confirm your selection by pressing  . This will trigger a pipetting process.

✓ A preselected aspiration volume is aspirated in accordance with [pipetting] function settings. While dispensing lasts, the lifter and carriage (rotary stage) control unit remains inactive.

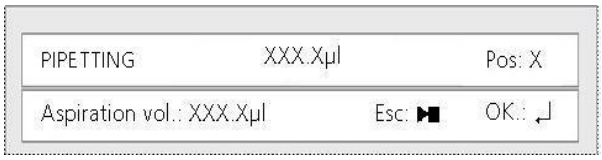


Fig. 45: Display screen – pipetting – aspiration volume

6. To pipette an aspirated volume of liquid, move a microplate into position under the tips.

   Trigger carriage or rotary stage motion, using ◁ or ▷ as necessary to reach the required position.

   To raise the lifter, use △, to lower the lifter, use ▽.

   Note:

   With the lifter in raised position, you can set the following positions via ◁ or ▷:

96X pipetting head:	Motion to positions A1 to B2 for 384 well operation or
	Motion to positions A1 to D4 for 1536 well operation
384X pipetting head:	Motion to positions A1 to B2 for 1536 well operation

7. Confirm established position via key ↵, in order to trigger a volume dispensing cycle

   ✓ The aspirated volume will be dispensed with a subsequent delay time as preset in the [Configuration] menu.

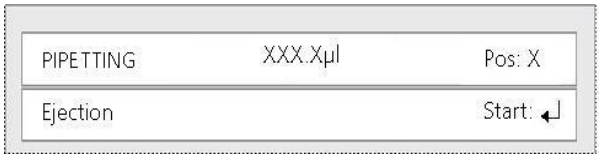


Fig. 46: Display screen – pipetting – dispensing

8. Press keys ◁, ▷, △ and ▽ as required to bring a container into position under the tips for residual ejection.

9. Confirm established position by pressing ↵, in order to trigger a residual ejection cycle.

   ✓ This will eject the differential amount of dispensing volume and aspiration volume and wait for a time, once started, as preset via configuration [Configuration] menu.

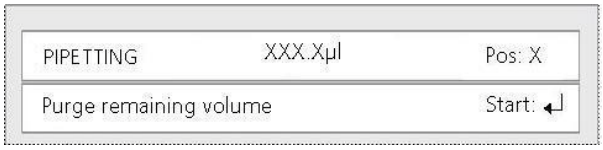


Fig. 47: Display screen – pipetting – residual ejection

10. In a break for dabbing, you may use , , or as necessary to position the tips more conveniently for dabbing. On termination of the dabbing break, the pistons will return to zero-position.

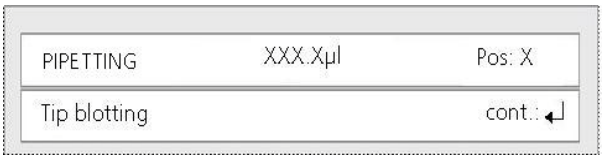


Fig. 48: Display screen – pipetting – dabbing break

Dispensing

Aspirates a total volume equal to the sum of all specified sub-volumes. The specified sub-volumes are then dispensed in an according number of steps.

TIP

Depending on the type of pipetting head, the total of subvolumes must not exceed the maximum volume.

1. Enter a value for number of subvolumes.

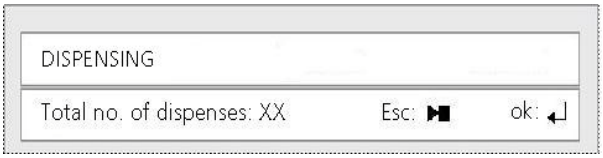


Fig. 49: Display screen – dispensing – number of volumes

2. Define single dispense stroke volume.

   Note:
   Repeat this entry as many times as there are subvolumes to be processed.

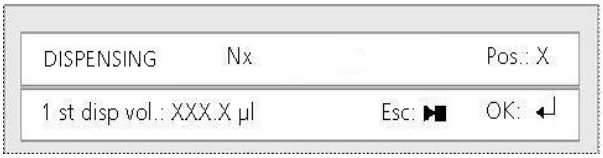


Fig. 50: Display screen – dispensing – dispensing volume

3. Select an aspiration volume.

   Note:
   The aspiration volume is preset to 2 µl above subsummed dispensing volume by default. It can, however, be varied if necessary.

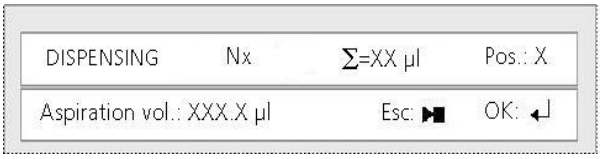


Fig. 51: Display screen – dispensing – aspiration volume

4. Move a container with dispensing stock into position under the tips (trough, microplate).

   Trigger carriage or rotary stage motion, using  or  as necessary to reach the required position.

   To raise the lifter, use  , to lower the lifter, use  .

   Note:

   With the lifter in raised position, you can set the following positions via  or  :

96X pipetting head:	Motion to positions A1 to B2 for 384 well operation or
	Motion to positions A1 to D4 for 1536 well operation
384X pipetting head:	Motion to positions A1 to B2 for 1536 well operation

5. Select **[Start]** menu item.

   Note:
   On selection of **[Exit]**, you can exit the **[Manual]** menu without actually triggering the process.

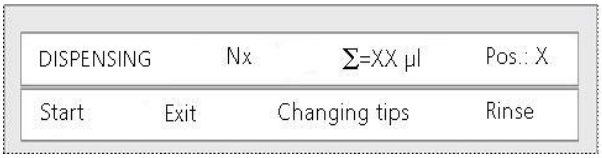


Fig. 52: Display – dispensing – start

6. Confirm your selection by pressing  , in order to trigger a dispensing cycle.
   ✓ The preselected volume is aspirated. While dispensing lasts, the lifter and carriage (rotary stage) control unit remains inactive.

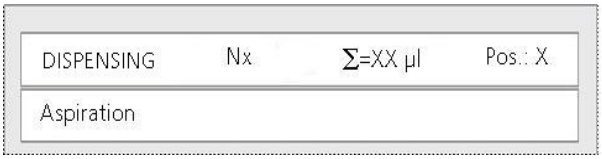


Fig. 53: Display screen – dispensing – aspiration

7. Move a microplate into position under the tips for dispensing

   Trigger carriage or rotary stage motion, using  or  as necessary to reach the required position.

   To raise the lifter, use  , to lower the lifter, use  .

   Note:

   With the lifter in raised position, you can set the following positions via  or  :

96X pipetting head:	Motion to positions A1 to B2 for 384 well operation or
	Motion to positions A1 to D4 for 1536 well operation
384X pipetting head:	Motion to positions A1 to B2 for 1536 well operation

8. Confirm established position via key  , in order to trigger a volume dispensing cycle
   ✓ Specified subvolumes will be dispensed. This cycle is repeated as many times as necessary to execute the number of defined subvolumes.

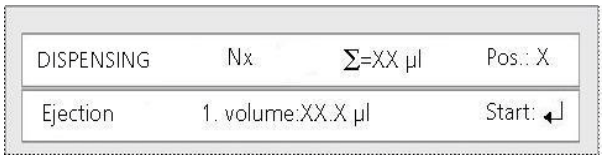


Fig. 54: Display screen – dispensing – ejection

9. Move a microplate into position under the tips for dispensing

   Trigger carriage or rotary stage motion, using ◁ or ▷ as necessary to reach the required position.

   To raise the lifter, use △, to lower the lifter, use ▽.

10. Press keys ◁, ▷, △ and ▽ as required to bring a container into position under the tips for residual ejection.

11. Trigger residual ejection by pressing key ↵.

    ✓ The differential amount of a total dispensing volume and an aspirated volume is dispensed, once the cycle has started. This is followed by a delay time as preset in [Configuration] menu.

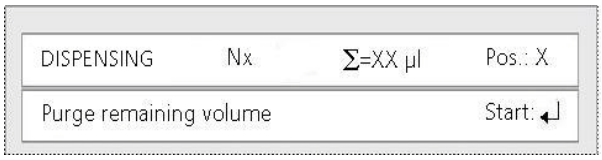


Fig. 55: Display screen – dispensing – residual ejection

12. In a break for dabbing, you may use ◁, ▷, △ or ▽ as necessary to position the tips more conveniently for dabbing. On termination of the dabbing break, the pistons will return to zero-position.

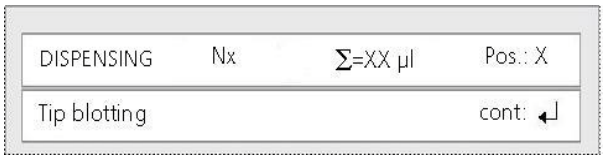


Fig. 56: Display screen – dispensing – dabbing break

Diluting

Aspirates two volumes separated by an air bubble in a preset mixing ratio and dispenses the two volumes with additional stroke.

TIP

Depending on the type of pipetting head, the total of subvolumes must not exceed the maximum volume.

1. Enter a value for number of subvolumes.

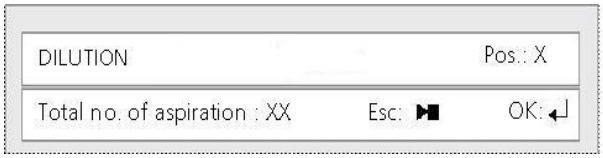


Fig. 57: Display screen – diluting – number of volumes

2. Enter aspiration volume settings.

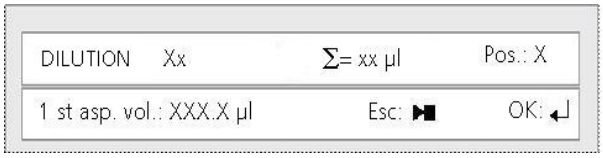


Fig. 58: Display screen – diluting – aspiration volume

3. Move a container with liquid into position under the tips (trough, microplate).

   Trigger carriage or rotary stage motion, using  or  as necessary to reach the required position.

   To raise the lifter, use  , to lower the lifter, use  .

   Note:

   With the lifter in raised position, you can set the following positions via  or 

96X pipetting head:	Motion to positions A1 to B2 for 384 well operation or
	Motion to positions A1 to D4 for 1536 well operation
384X pipetting head:	Motion to positions A1 to B2 for 1536 well operation

4. Select **[Start]** menu item.
   Note:
   On selection of **[Exit]**, you can exit the **[Manual]** menu without actually triggering the process.

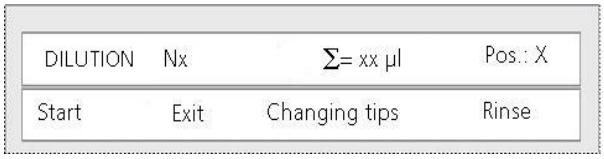


Fig. 59: Display screen - diluting - start

5. Use key  for confirmation. This is necessary to trigger a dilution process.

6. To trigger aspiration of subvolumes, press key  .
   Note:
   Repeat this process as many times as there are subvolumes.

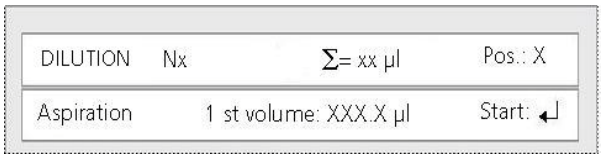


Fig. 60: Display screen – diluting – aspiration

7. Move a microplate into position under the tips for ejection.

   Trigger carriage or rotary stage motion, using ◁ or ▷ as necessary to reach the required position.

   To raise the lifter, use △, to lower the lifter, use ▽.

   Note:

   With the lifter in raised position, you can set the following positions via ◁ or ▷:

96X pipetting head:	Motion to positions A1 to B2 for 384 well operation or Motion to positions A1 to D4 for 1536 well operation
384X pipetting head:	Motion to positions A1 to B2 for 1536 well operation

   Confirm established position via key ↵, in order to trigger a volume dispensing cycle

   Note:

   Operation stops for a waiting time as defined in menu **[Configuration]** on completion of the process.

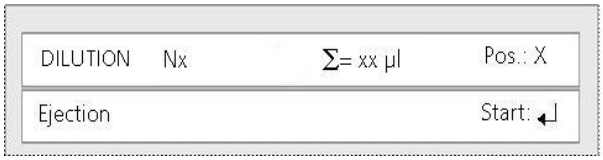


Fig. 61: Display screen – diluting – ejection

8. In a break for dabbing, you may use ◁, ▷, △ or ▽ as necessary to position the tips more conveniently for dabbing. On termination of the dabbing break, the pistons will return to zero-position.

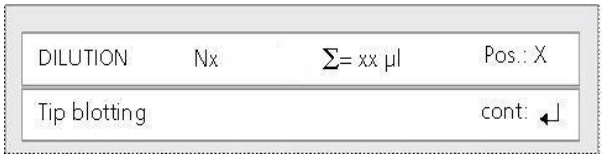


Fig. 62: Display screen – diluting – dabbing break

Tip replacement

CAUTION

There is danger of finger crushing/pinching and damage to pistons!

The magazine plate is released and clamped with electro-motoric power. For a tip change, the magazine plates must be inserted until hard stop position. Prevent physical contact with the magazine plate as automatic tip clamping is in process!

1. Select tip change basic function in **[Manual]** menu.
   ✓ The magazine plate with pipette tips is automatically released.

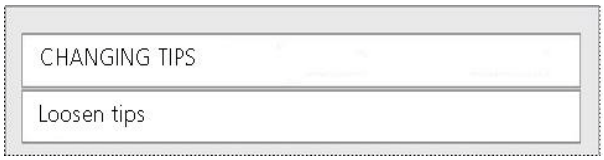


Fig. 63: Display – tip change – tip release

2. Remove tip magazine from the pipettor.

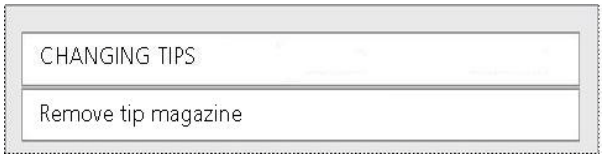


Fig. 64: Display – tip change – magazine removal

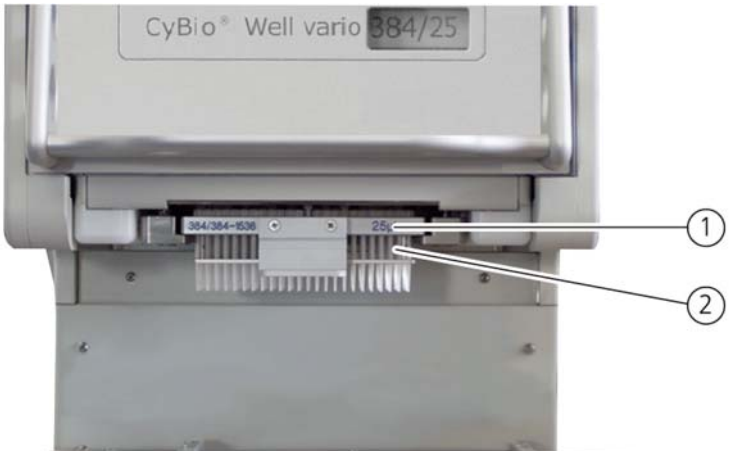


Fig. 65: Tip magazine change (for head replacement from the front)

1 Magazine plate
2 Pipette tips

CAUTION

There is danger of piston or system damage!

Remember that only tip-filled magazines may be inserted and clamped! Insertion of a magazine is monitored by a microswitch. If a magazine is placed in a non-conforming manner, an "Insert magazine (with tips)" prompt will appear.

Should the microswitch fail to respond, pipettor parts, notably, the pistons may suffer damage. Shut the pipettor down and promptly notify the manufacturer in this case.

3. Insert a magazine plate with tips until mechanical stop position. Make sure that the magazine is evenly seated on the frame. If the magazine is correctly placed, you may trigger an automatic magazine plate clamping cycle.

Note:
If a magazine is misplaced, the microswitch will be triggered and the screen display a "Insert magazine (with tips)" prompt.

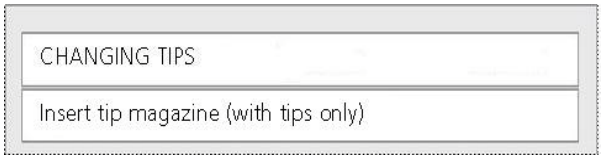


Fig. 66: Display – tip change – magazine insertion

4. Confirm clamped state by pressing key .
   Note:
   Once the magazine plate is fixed, the screen will display the menu in which a tip change was selected.

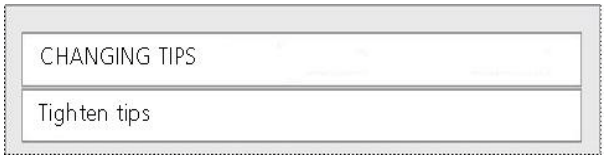


Fig. 67: Display – tip change – tightening of tips

Purging

Aspirates or dispenses a specified volume of rinsing liquid in a defined order of rinsing cycles.

1. Enter a value for the number of rinsing cycles (maximum: 20).

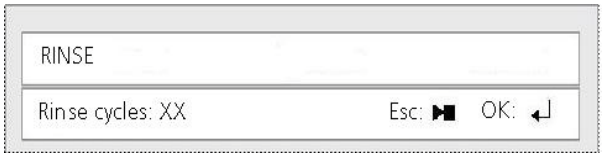


Fig. 68: Display screen – rinsing - number of rinsing cycles

2. Move a rinsing vessel into position under the tips for rinsing.

   Trigger carriage or rotary stage motion, using ◁ or ▷ as necessary to reach the required position.

   To raise the lifter, use △, to lower the lifter, use ▽.

3. Confirm established position by pressing key ↵.

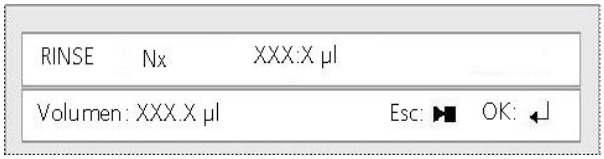


Fig. 69: Display screen – rinsing - volume

4. Trigger rinsing by clicking key ↵.

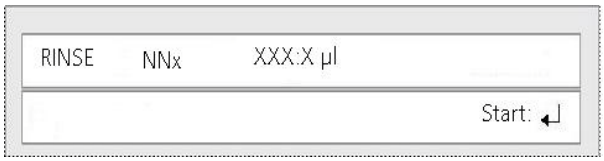


Fig. 70: Display screen – rinsing - start

✓ The screen will alternately display [Aspire] and [Dispense] until a defined number of rinsing cycles has been completed.

Fig. 71: Display screen – rinsing - aspiration

Fig. 72: Display screen – rinsing - dispensing

5. In a break for dabbing, you may use , , or as necessary to position the tips more conveniently for dabbing. On termination of the dabbing break, the pistons will return to zero-position.

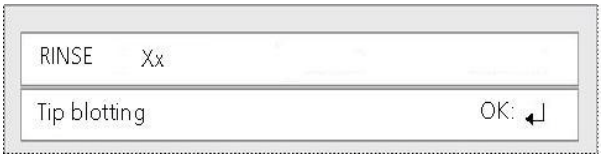


Fig. 73: Display screen - rinsing - dabbing break

Note:
On completion of rinsing, the menu will appear in which rinsing was selected.

Capillary head

There are two basic functions available in manual mode:

- Dispensing
- Tip replacement

Each individual action must be performed by an operator. The advantage is convenience of operation. For example, manual mode provides a straightforward means for processing a single microplate.

Dispensing

A total volume that depends on the type of capillary is aspirated by capillary force. Compressed air is then applied to dispense this volume into the microplate.

Select item **[Manual]** in the main menu.

This will display the following box:

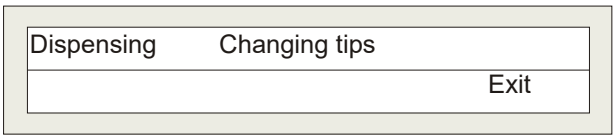


Fig. 74: Display - dispense - tip change

Select the **[dispense]** menu item:

This will display the following box:

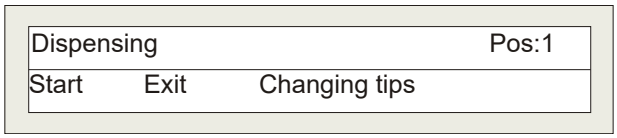


Fig. 75: Display - dispense

1. Move a container with dispensing stock into position under the tips (trough, microplate).

   Trigger carriage or rotary stage motion, using or as necessary to reach the required position. Raise the lifter by pressing and aspirate stock for dispensing. Lower the lifter again by pressing .
2. Move a microplate into position under the capillary tips for dispensing.

Trigger carriage or rotary stage motion, using or as necessary to reach the required position.

To raise the lifter, use , to lower the lifter, use .
You should also note the following:

If a 96-channel capillary magazine has been inserted, a positional shift must be included for 384-well or 1536-well processing. The same applies in the case of 1536-well processing with a 384-channel capillary magazine. If this is not the case, continue with *Punkt* 4.
Always define the type of plate to be processed in the **[Configuration]** => **[Wells]** menu (→ *refer to page 74*→ *„Wells"*).

CAUTION

Prevent damage to a capillary due to faulty settings for dispensing position.

Transfer the XY-stage into the correct position for processing of 384-channel or 1536-channel microplates.

To transfer the XY-stage into the correct position, proceed as follows:

3. Raise the lifter into trigger position by pressing , lower the lifter by pressing , so it will move out of the microplate wells.
   Note:
   With the lifter in this position, you can use or as necessary to set the following XY-positions:

96X capillary magazine:	■ Motion to positions A1 to B2 for 384 well operation ■ Motion to positions A1 to D4 for 1536 well operation
384X capillary magazine:	■ Motion to positions A1 to B2 for 1536 well operation

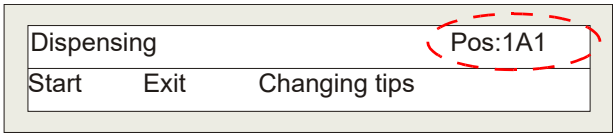


Fig. 76: Display - dispense with position selection

4. Select **[Start]** menu item.

   Note:
   On selection of **[Exit]**, you can exit the **[Manual]** menu without actually triggering the process.

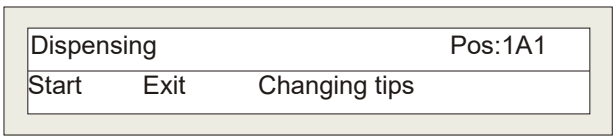


Fig. 77: Display – dispensing – start

5. Confirm your selection by pressing , in order to trigger a dispensing cycle.
   ✓ The previously aspirated volume is dispensed again. While dispensing lasts, the lifter and carriage (rotary stage) control unit remains inactive.

Tip replacement

CAUTION

There is danger of finger pinching and damage to capillary tips!

The magazine plate is released and clamped with electro-motoric power. For a tip change, the magazine plates must be inserted until hard stop position. Prevent physical contact with the magazine plate as automatic tip clamping is in process!

1. Select tip change basic function in **[Manual]** menu.
   ✓ The magazine plate with capillary tips is automatically released.

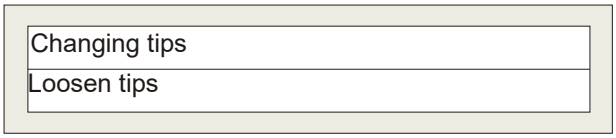


Fig. 78: Display – tip change – tip release

2. Remove tip magazine from the pipettor.

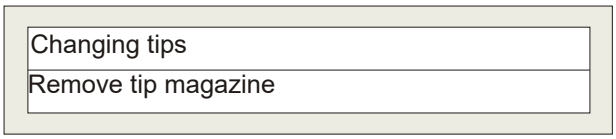


Fig. 79: Display – tip change – magazine removal

Fig. 80: Capillary magazine change (version: head replacement from the front)

1 Capillary magazine
2 Capillary tips

CAUTION

Prevent damage to the system!

Only capillary-filled magazines may be inserted and clamped! Insertion of a magazine is monitored by a microswitch. If a magazine is placed in a non-conforming manner, an "Insert magazine (with tips)" prompt will appear.

Should this microswitch fail, the system may suffer damage. Shut the pipettor down and promptly notify the manufacturer in this case.

3. Insert a capillary magazine with tips until mechanical stop position. Make sure that the magazine is evenly seated on the frame. If the magazine is correctly placed, you may trigger an automatic magazine plate clamping cycle.

Note:
If a magazine is misplaced, the microswitch will be triggered and the screen display a "Insert magazine (with tips)" prompt.

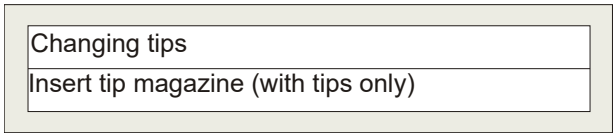


Fig. 81: Display – tip change – magazine insertion

4. Confirm clamped state by pressing key  .
   Note:
   Once the magazine plate is fixed, the screen will display the menu in which a tip change was selected.

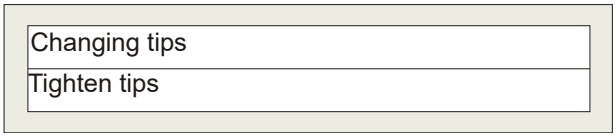


Fig. 82: Display – tip change – tightening of tips

TIP

Please note the microplate settings when you perform a magazine change.

TIP

A tip change can also be performed via [Dispense] menu (→ *Fig. 75*).

7.2.3 Menu [Configuration]

Pipetting head

Pipettor settings can be adapted to specific user or application requirements. This can be achieved via the **[Configuration]** menu:

1. Restores the main menu should the pipettor be working in a different submenu.
2. Use key ← or → in the main menu to select the **[Configuration]** submenu.
3. Confirm your selection with the ↵ key.
   ✓ You are working in the [Configuration] menu now.

Fig. 83: Display – configuration menu (pipetting head)

4. Select appropriate parameter and enter desired values in **[Configuration]** menu, (refer to description below). Confirm each input by pressing ↵.

Working in the **[Configuration]** menu you can set the following parameters:

Waiting Time

Because of the small opening of tips and the resulting resistance they offer to the flow of liquid, a reasonable time setting should be added to allow for pressure compensation during aspiration or dispensing cycles. Too small settings for waiting time may reduce precision.

Note:
A waiting time which is set in this menu will only be valid for manual mode.

Stage Motion Length

For defining a maximum available length of stage motion (lifter height). This setting prevents mechanical collision of a vessel with tips. It also facilitates different applications, for example, the picking up of liquid over a cell lawn or the pipetting onto the bottom of a microplate from a preselected distance. The height position can be adjusted in steps of 0.1 mm.

CAUTION

There is danger of tips suffering damage or getting destroyed!

A value setting for lifter height will only be effective in manual mode so it may be exceeded in software-controlled operation mode!

dZ

For updating the vertical setting value for the lifter following necessary replacement of the lifter (setting value inscribed on lifter bottom on shipment). This will automatically correct vertical lifter adjustment so previously edited programs need not be changed in terms of height coordinates.

Wells

This option can be used to select a mode for manual lifter motion adapted to a given one out of various plate types (e.g. motion to positions of a 384 well microplate or a 1536 well microplate). The correct plate type must be set in order to guarantee that a tip is located in the middle of its companion well.

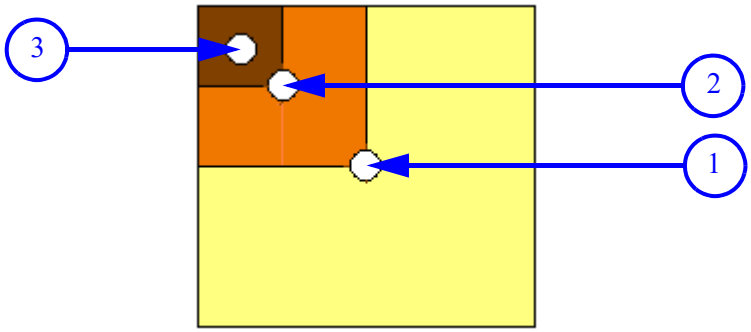


Fig. 84: A1 well target positions for 96/384/1536 well microplate

1 A1 well target position for 96 well microplate
2 A1 well target position for 384 well microplate
3 A1 well target position for 1536 well microplate

The diagram view illustrates that the tips will come down onto the edge of wells in the case of a faulty plate type setting.

Example:
If a 1536 well microplate were to be processed with a 96 tip magazine, the tip would come down in point 1 of figure 56.

Solution:
Set 1536 for plate type in **[Configuration]** => **[Wells]** menu. Perform manual motion to A1 well position for 1536 well microplates before dispensing (point 3 in figure 56).

XY This menu item is intended for storing internal XY correction values for lifter motion. In the event of necessary lifter replacement (according to manufacturer specification provided on lifter underside), you can update your lifter settings here.

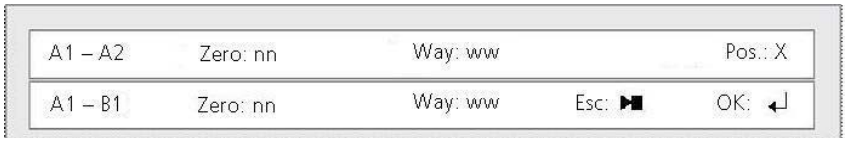


Fig. 85: Display – XY correction values

The first entries in a line indicate the direction. The coordinates for zero point (nn) correspond to those of a 96 well microplate.

The path, however, represents the distance to a 384 well or 1536 well in the corresponding coordinate direction (refer to details on underside of lifter).

On selection of a coordinate, the lifter moves to the assigned position and can thus be easily inspected for correct adjustment. A microplate of transparent material is recommended for lifter adjustment.

Piston speed Piston speed (pumping rate) is a selectable parameter. This setting will only be effective in manual mode, since programs running in PC-controlled mode include their own previously stored pump speed values. A rotation speed of 300 rpm corresponds to an approximate dispensing rate of 123 µl/s achieved with a 250 µL capacity pipetting head or a 12.3 µL/s rate achieved with a 25 µl pipetting head.

You can enter an end value for motion speed here. Software settings can be made for end speed, or starting speed and end speed or for the motion characteristic.

Stage speed A stage speed setting will be valid for lifter motion, carriage motion and rotary stage motion. You can enter an end value for motion speed here. Software settings can be made for end speed, or starting speed and end speed or for the motion characteristic.

CAUTION

With excessively high settings for carriage motion or rotary stage motion, there may be overflow of liquid from the reagent troughs. Select a reasonably reduced speed value if necessary.

TIP

In manual mode, lifter motion is limited to a maximum speed of 17 mm/s (60 rpm). This is necessary to enable a more precise height setting. In program-controlled (computer-controlled) mode, the limiting value is around 40 mm/s (140 rpm).

Click Allows you to set an acoustic click for confirmation of each keystroke. You can switch the click on and off.

Capillary head Pipettor settings can be adapted to specific user or application requirements. This can be achieved via the **[Configuration]** menu:

1. Restores the main menu should the pipettor be working in a different submenu.
2. Use key ← or → in the main menu to select the **[Configuration]** submenu.
3. Confirm your selection with the ↵ key.
   ✓ You are working in the [Configuration] menu now.

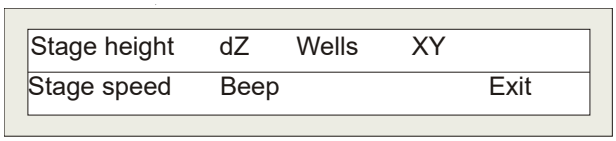


Fig. 86: Display – configuration menu (capillary head)

4. Select appropriate parameter and enter desired values in **[Configuration]** menu, (refer to description below). Confirm each input by pressing ↵.

Working in the **[Configuration]** menu you can set the following parameters:

Stage motion length For defining a maximum available length of stage motion (lifter height). This setting prevents mechanical collision of a vessel with tips. It also facilitates different applications, for example, the picking up of liquid over a cell lawn or the pipetting onto the bottom of a microplate from a preselected distance. The height position can be adjusted in steps of 0.1 mm.

CAUTION

There is danger of tips suffering damage or getting destroyed!

A value setting for lifter height will only be effective in manual mode so it may be exceeded in software-controlled operation mode!

dZ For updating the vertical setting value for the lifter following necessary replacement of the lifter (setting value inscribed on lifter bottom on shipment). This will automatically correct vertical lifter adjustment so previously edited programs need not be changed in terms of height coordinates.

Wells This option can be used to select a mode for manual lifter motion adapted to a given one out of various plate types (e.g. motion to positions of a 384 well microplate or a 1536 well microplate). The correct plate type must be set in order to guarantee that a tip is located in

the middle of its companion well.

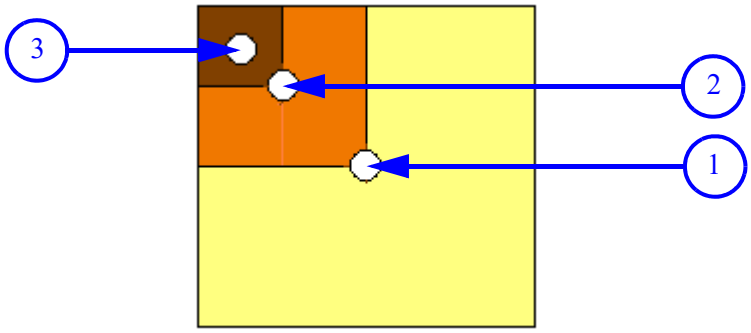


Fig. 87: A1 well target positions for 96/384/1536 well microplate

1 A1 well target position for 96 well microplate
2 A1 well target position for 384 well microplate
3 A1 well target position for 1536 well microplate

The diagram view illustrates that the tips will come down onto the edge of wells in the case of a faulty plate type setting.

Example:
If a 1536 well microplate were to be processed with a 96 tip magazine, the tip would come down in point 1 of figure 56.

Solution:
Set 1536 for plate type in **[Configuration]** => **[Wells]** menu. Perform manual motion to A1 well position for 1536 well microplates before dispensing (point 3 in figure 56).

XY This menu item is intended for storing internal XY correction values for lifter motion. In the event of necessary lifter replacement (according to manufacturer specification provided on lifter underside), you can update your lifter settings here.

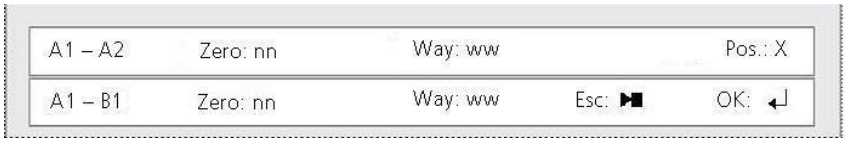


Fig. 88: Display – XY correction values

The first entries in a line indicate the direction. The coordinates for zero point (nn) correspond to those of a 96 well microplate.

The path, however, represents the distance to a 384 well or 1536 well in the corresponding coordinate direction (refer to details on underside of lifter).

On selection of a coordinate, the lifter moves to the assigned position and can thus be easily inspected for correct adjustment. A microplate of transparent material is recommended for lifter adjustment.

Stage speed A stage speed setting will be valid for lifter motion, carriage motion and rotary stage motion. You can enter an end value for motion speed here. Software settings can be made for end speed, or starting speed and end speed or for the motion characteristic.

CAUTION

With excessively high settings for carriage motion or rotary stage motion, there may be overflow of liquid from the reagent troughs. Select a reasonably reduced speed value if necessary.

TIP

In manual mode, lifter motion is limited to a maximum speed of 17 mm/s (60 rpm). This is necessary to enable a more precise height setting. In program-controlled (computer-controlled) mode, the limiting value is around 40 mm/s (140 rpm).

Click Allows you to set an acoustic click for confirmation of each keystroke. You can switch the click on and off.

7.2.4 Menu [Head change]

Replacement of the pipetting head or the capillary head can be performed in the **[Head change]** menu. Each individual action must be performed by an operator. Follow LCD screen prompts which are displayed at the operation control panel, and proceed step by step.

CAUTION

Risk of crushing! Keep clear of the pipettor head's working and motion range, unless operation has stopped. Otherwise, there is high risk of physical injury.

Notably, make sure that all protective covers and shielding panels are mounted and closed, as long as the "Remove head" prompt has not appeared.

TIP

Mechanical motion of various system assemblies creates a crushing hazard for the hands of operating personnel!

For this reason, the pipetting head top cover is monitored electronically. All electrically powered drives will stop immediately on opening of the cover.

TIP

If you had been working in a submenu at the moment of switching power supply off, the same menu will be restored when power becomes available again. This will also apply if a head change procedure was not completed.

Head replacement from the front (only linear transporting unit)

To perform head replacement for "from the front" system version, proceed as follows:

1. Press key  or  in the main menu as necessary to select the **[Head change]** menu, then confirm your selection with  .
   ✓ The magazine plate with pipette tips is automatically released.

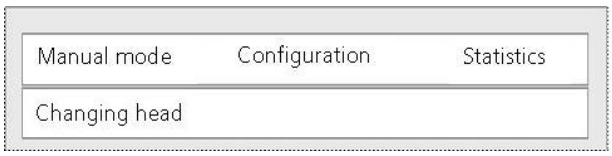


Fig. 89: Display – main menu

2. Remove tip magazine from pipetting head and store magazine in tip tray package.

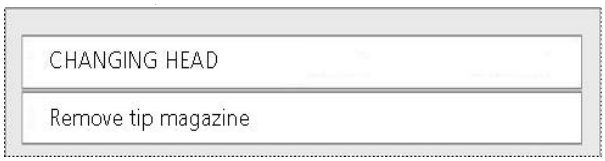


Fig. 90: Display – head change – remove magazine

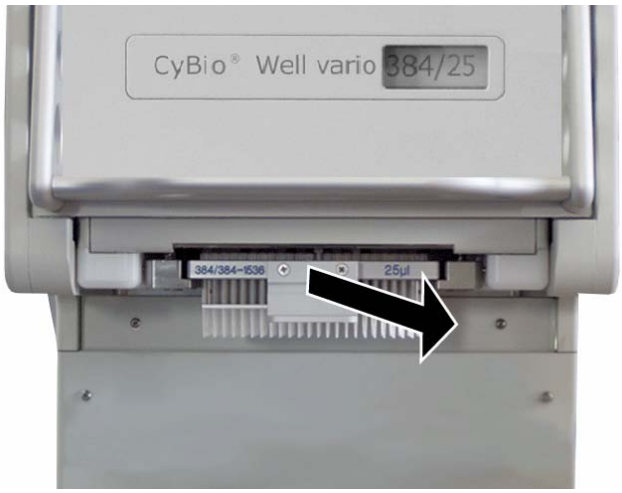


Fig. 91: Remove tip magazine or capillary magazine (head replacement from the front version)

3. Use recessed handle to push the magazine adapter down into the pipetting head until mechanical stop position.

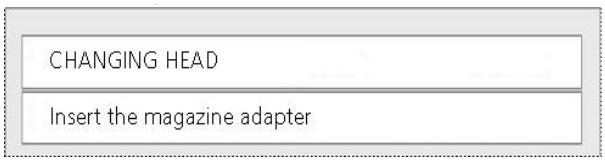


Fig. 92: Display – head change – insert magazine adapter

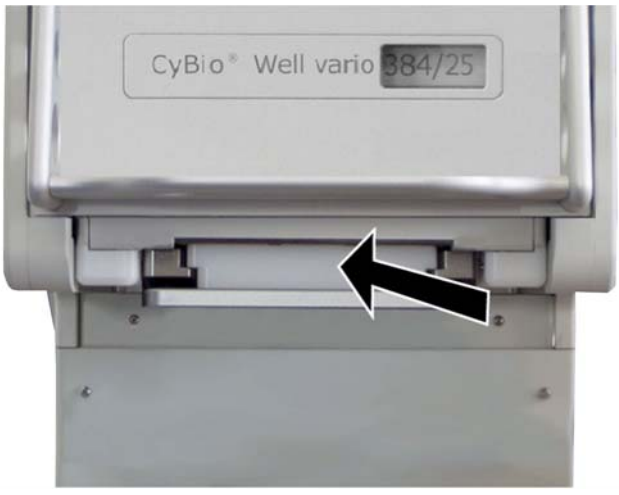


Fig. 93: Insert magazine adapter (head replacement from the front version)

4. Confirm magazine adapter inserted state by pressing key  .
   ✓ The adapter is automatically clamped.

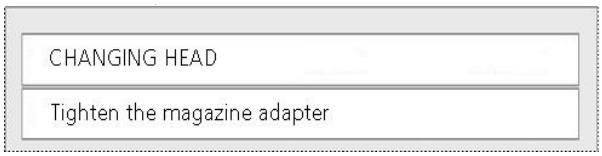


Fig. 94: Display – head change – clamp magazine adapter

5. Wait until prompt for removal of head appears, then confirm by pressing key  .

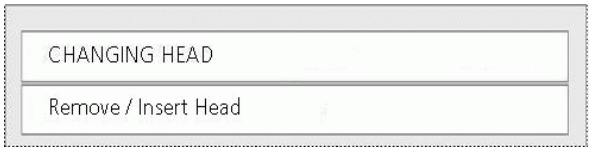


Fig. 95: Display – head change – remove head please

CAUTION

There is danger of crushing or pinching as the cover is opened or closed!

To open or close the cover, hold it at the handle with one hand! Keep the other hand clear of the system space!

6. Hold the handle of the head cover with one hand, then tilt cover up until it engages mechanically.

Fig. 96: Open cover (head replacement from the front version)

CAUTION

Risk of crushing!
A pipetting head weighs approx. 14 kg, a capillary head approx. 10 kg.

Hold the head with both hands.

7. To retrieve the pipetting head or capillary head, proceed as follows:
   - **Only for capillary head:** Disconnect compressed air supply tube from connector terminal at the system, not at the head (→ *see Fig. 121*).
   - Hold pipetting head at its handle with one hand.
   - Slightly raise the pipetting head.
   - Carefully pull the head off, supporting it with the other hand. Use recessed handle at magazine adapter bottom for this purpose.
   - Place pipetting head onto a stable support base.

Fig. 97: Retrieval of pipetting head (from the front head replacement version)

1 Handle
2 Recessed handle at adapter bottom

8. To insert a new pipetting head or capillary head, proceed as follows:
   - Hold pipetting head at its handle with one hand.
   - Use the other hand for support as you push the pipetting head in. Use recessed handle at magazine adapter bottom for this purpose.
   - Hold head rails at the height as indicated by red markers, then push the pipetting head in until mechanical stop position.

Only for capillary head:
   - Connect compressed air supply tube to terminal connector at the system.
   - Check for correct setting of operating pressure.

Fig. 98: Insertion of pipetting head (head replacement from the front version)

1 Handle
2 Red marker
3 Rail
4 Recessed handle at adapter bottom

CAUTION

Risk of crushing!
To open or close the cover, hold its handle with one hand!
Keep the other hand clear of the system space.

9. Tilt cover down until it closes, then release cover.
   ✓ The cover locks by itself. The magazine adapter moves down and unlocks automatically.
10. Pull magazine adapter out of pipetting head from the front. Use recessed handle at magazine adapter bottom for this purpose.

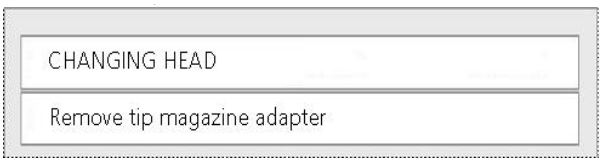


Fig. 99: Display – head change – remove magazine adapter

Fig. 100: Removing magazine adapter (head replacement from the front version)

CAUTION

There is danger of piston or system damage!

The pipetting head may only be loaded with magazines filled with tips or capillaries! Insertion of a magazine is monitored by a microswitch. If a magazine is found to be wrongly inserted, an "Insert tip magazine" prompt will appear.

Microswitch failure may result in damage to the system (notably, pistons). Shut power supply fully down and promptly notify the manufacturer in any such case.

11. Insert tip magazine into pipetting head until mechanical stop position.

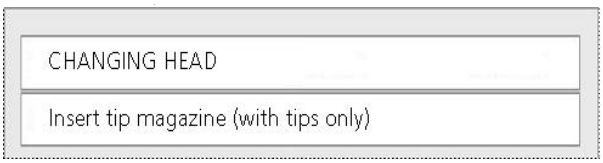


Fig. 101: Display – head change – insert magazine

Fig. 102: Pushing magazine in (head replacement from the front version)

12. Confirm tip magazine clamped state by pressing key .
    ✓ Head replacement is complete. The system is ready again for operation.

Head replacement from the back

To perform head replacement for "from the back" version, proceed as follows:

1. Press key or in the main menu as necessary to select the **[Head change]** menu, then confirm your selection with .

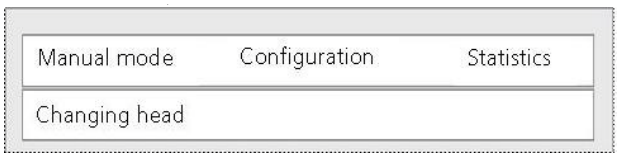


Fig. 103: Display – main menu

2. Remove tip magazine from pipetting head and place magazine into its special storage box.

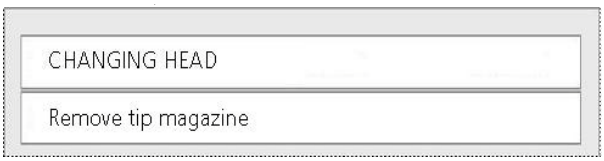


Fig. 104: Display – head change – remove magazine

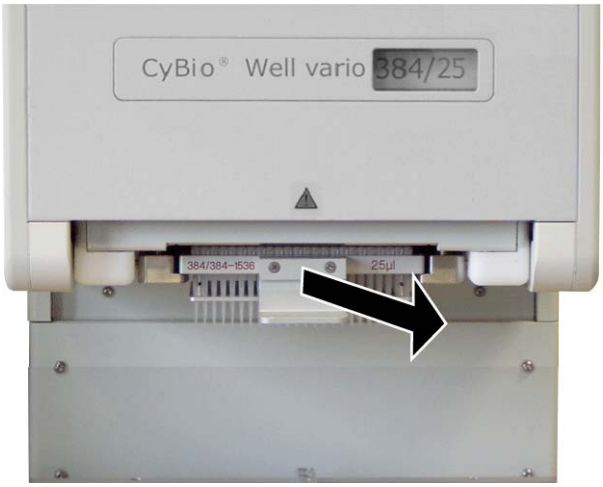


Fig. 105: Removal of tip magazine (head replacement from the back version)

3. Use recessed handle to push the magazine adapter down into the pipetting head until mechanical stop position.

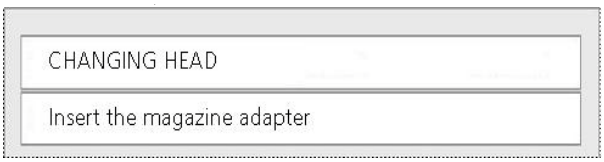


Fig. 106: Display – head change – insert magazine adapter

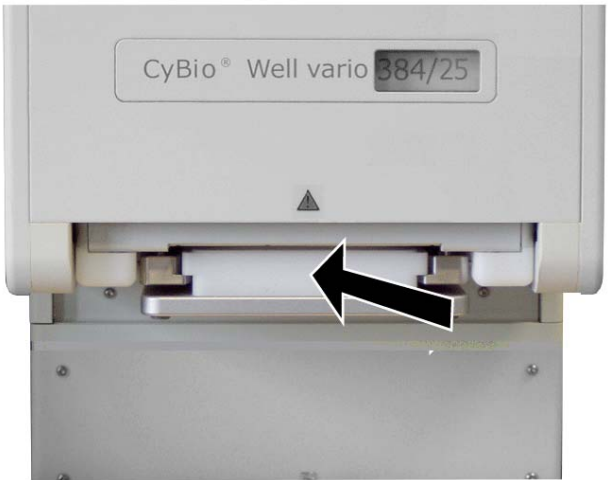


Fig. 107: Insertion of magazine adapter
(head replacement from the back version)

4. Confirm magazine adapter inserted state by pressing key  .
   ✓ The adapter is automatically clamped.

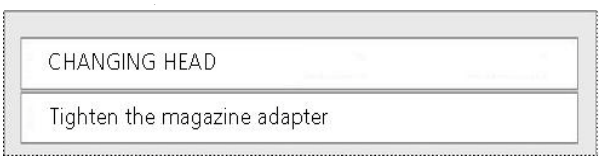


Fig. 108: Display – head change – clamp magazine adapter

5. Wait until prompt for removal of head appears, then confirm by pressing key  .

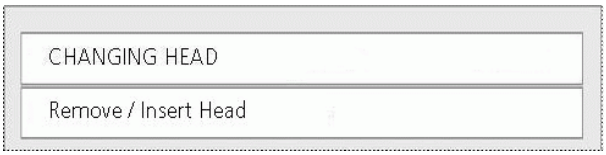


Fig. 109: Display – head change – remove head

CAUTION

There is danger of crushing or pinching as the cover is opened or closed!

To open or close the cover, hold it at the handle with one hand! Keep the other hand clear of the system space!

6. Hold the handle at the back of the head cover with one hand, then tilt cover up until cover mechanically engages.

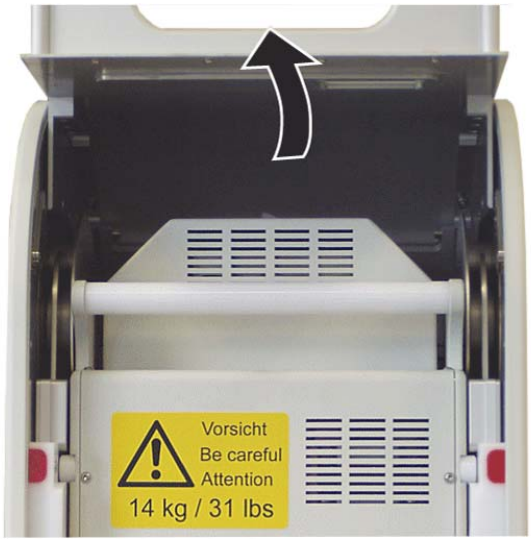


Fig. 110: Opening the cover at the back of the pipettor

CAUTION

Risk of crushing! A pipetting head weighs 14 kg, a capillary head 10 kg.

Always hold the pipetting head with both hands.

7. To remove the pipetting head, proceed as follows:
   - **Only for capillary head:** Detach intermediate connector of compressed air supply tube, do not detach connector at the head end (→ *see Fig. 121*).
   - Hold pipetting head at its handle with one hand.
   - Slightly raise the pipetting head.
   - Carefully pull the head off, supporting it with the other hand.
     Note:
     Use recessed handle at magazine adapter bottom for this purpose.
   - Place pipetting head onto a stable support base.

Fig. 111: Removal of pipetting head (head replacement from the back version)

8. To insert a new pipetting head, proceed as follows:
   - Hold pipetting head at its handle with one hand.
   - Use the other hand for support as you push the pipetting head in.
     Note:
     Use recessed handle at magazine adapter bottom for this purpose.
   - Hold head rails at the height as indicated by red markers, then push the pipetting head in until mechanical stop position.

Only for capillary head:

   - Connect compressed air supply tube for head with inlet terminal of compressed air control unit.
   - Check for correct setting of operating pressure at compressed air control unit.

Fig. 112: Insertion of pipetting head (head replacement from the back version)

CAUTION

Risk of crushing!
To open or close the cover, hold its handle with one hand!
Keep the other hand clear of the system space.

9. Tilt cover down until it closes, then release cover.
   ✓ The cover locks by itself. The magazine adapter moves down and unlocks automatically.

10. Pull magazine adapter out of pipetting head from the front. Use recessed handle at magazine adapter bottom for this purpose.

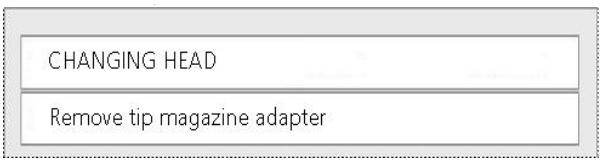


Fig. 113: Display – head change – remove magazine adapter

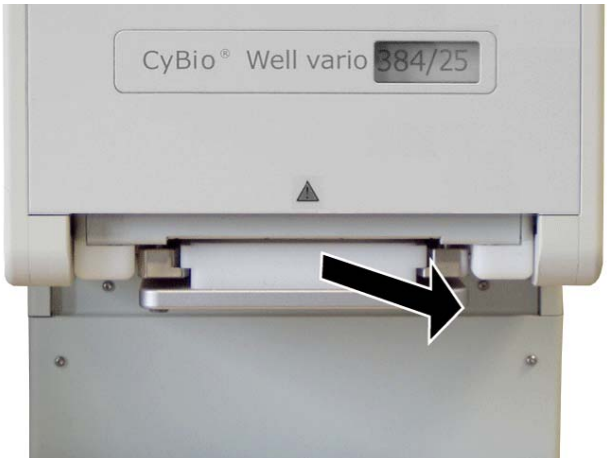


Fig. 114: Removal of magazine adapter
(head replacement from the back version)

CAUTION

There is danger of piston or system damage!

Insert only tip-filled magazines into the pipetting head! Insertion of a magazine is monitored by a microswitch. If a magazine is found to be wrongly inserted, an "Insert tip magazine" prompt will appear.

A microswitch failure may result in damage to the system (notably, pistons). Shut power supply fully down and promptly notify the manufacturer in any such case.

11. Insert tip magazine into pipetting head until mechanical stop position.

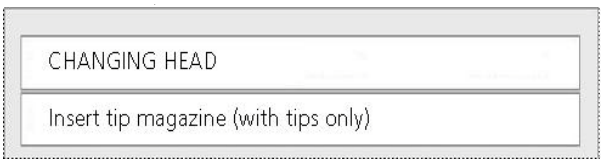


Fig. 115: Display – head change – insert magazine

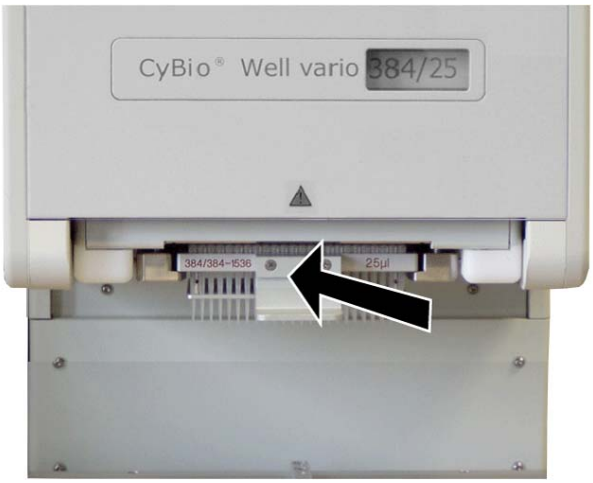


Fig. 116: Insertion of tip magazine (head replacement from the back version)

12. Confirm tip magazine clamped state by pressing key 
    ✓ Head replacement is complete. The system is ready again for operation.

7.2.5 Special functions

CAUTION

There is danger of damage to the system due to incorrect parameter settings, following a reset of operating parameters!

Operating parameters are preferably set by the customer service of the manufacturer! Before resetting an operating parameter and setting a new value by yourself, make sure you have consulted with the appropriate customer service personnel at first!

For powering-on, there are some option to generate special functions. The following functions will be available when you press the appropriate key during a procedure for powering on:

Button 	Selects language: English or German. Select the language using the cursor above the keys  and  . Confirm selection by pressing  .
Button 	Resets all drive parameters All CyBio Well vario drive parameters are reset to manufacturer's values.

Button 

Resets all operating parameters

Resets all system parameters, including drive parameters, to manufacturer values. On pressing of this key, the following system parameters must be set manually again.

Drive parameters

Are valid for powering of the pump motor (piston drive), the carriage (rotary stage) motor and the lifter motor:

- Starting rpmm.
- End rpm
- Number of steps to reach end rpm

Device parameters

- Language
- Waiting Time
- Maximum lifter height
- Lifter height compensation dZ
- Plate type selection (available for 96-well head operation only)
- XY-stage shift setting

7.3 Switching the CyBio Well vario off

Pipetting head

To switch the CyBio Well vario off, proceed as follows:

1. Wait until the CyBio Well vario has completed all work operations.
2. Use the main switch to switch the CyBio Well vario off.
3. Close CyBio Composer control software session if necessary and switch the PC off.
   ✓ The CyBio Well vario is safely out of service now.

Capillary head

To switch the CyBio Well vario off, proceed as follows:

1. Wait until the CyBio Well vario has completed all work operations.
2. Clean the capillary head before switching power off. To clean, proceed as follows:

Washing procedure:

- Solution for alkaline washing:
  - 10% RBS35 solution (Carl Roth GmbH; item no. 9238)

    a) Keep submerged in 10% RBS35 solution for 30 minutes, submersion depth of capillary tips - about 4 mm

    b) Perform 10 washing runs with distilled water → aspiration time - 8 seconds dispensing - 1 second at 25 psi

- Solution for acidic washing:
  - Universal decalcificator (e. g. sidol 1+1 diluent)

    a) Keep submerged in sidol for 30 minutes, submersion depth of capillary tips - about 4 mm

    b) Perform 10 washing runs with distilled water → aspiration time - 8 seconds dispensing - 1 second at 25 psi

3. Use the main switch to switch the CyBio Well vario off.
4. Switch compressed air supply off.
5. Close CyBio Composer control software session if necessary and switch the PC off.
   ✓ The CyBio Well vario is safely out of service now.

7.4 Specific System Details (Pipetting Head)

Aspiration and dispensing of liquid is accomplished by piston motion. All piston suspension points have a mechanical freeplay (slackness). This means: After each reversal in piston motion direction, the piston drive initially covers a certain travel length without actually moving the pistons, and, hence, without aspirating or dispensing any liquid. This motion length corresponds to the freeplay.

In order to prevent dosing errors, a volume cycle is organized in such a way that the piston reversal point lies outside of the actual pipetting range (motion into zero-position, aspiration with additional stroke) or is corrected by suitable compensatory motion (dispensing with additional stroke).

7.4.1 Aspiration With Additional Stroke

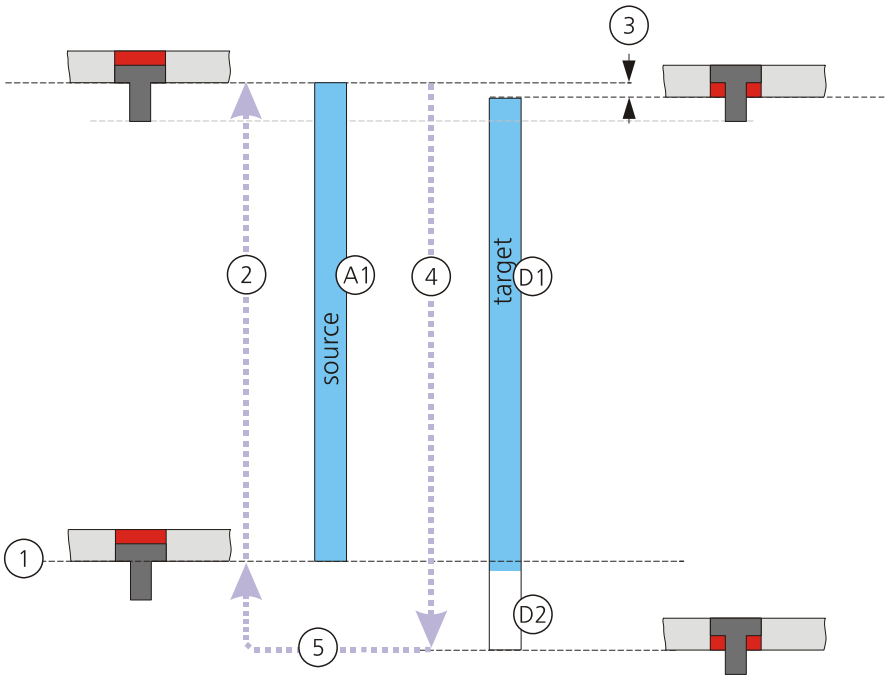


Fig. 117: Aspiration with additional stroke

1 Zero-position
2 Aspirate volume with additional stroke and reverse piston direction
3 Upper freeplay
4 Exactly dispense volume (single volume or partial volumes)
5 Residual dispensing
6 Motion to zero-position

A1 = D2: nominal pipetting volume

A2: additional aspiration volume

D1: additional volume being dispensed < A2 (additional stroke)

D2: nominal pipetting volume

D3: residual volume (proportional to freeplay)

D4: Air

This is the recommended standard procedure for precise pipetting.

Piston motion starts in zero-position (1) and continues beyond the position that corresponds to nominal pipetting volume. The pistons are then lowered back into this position (2). The amount of freeplay (3) is excluded by this procedure. At the time of direction reversal, an additional volume (D1) is dispensed. Due to piston reversal, this volume is smaller than the aspirated additional stroke volume (A2). The tip retains the nominal pipetting volume (D2) and a residual volume (D3).

Exact volumes can be dispensed in the next step (4) (in a single step or a multi-step sequence). After the nominal pipetting volume has been dispensed, the pipetting tip will contain the residual volume (D3) that results from upper direction reversal. This volume is

dispensed with additional stroke (5) into a waste box or the reservoir. Since the stroke length is greater than actually required for the residual volume (D3), the residual volume is completely dispensed. Finally, the amount of air is dispensed (D4). A volume cycle is completed by "Motion into zero-position".

A "Move pistons into zero-position" command (6) triggers upward piston motion to their initial positions, thus excluding the lower freeplay.

This process must be triggered with no liquid present, i.e. the lifter must be in such a position that the tips cannot make contact with liquid. Liquid which is aspirated in the process may result in dosing errors or contamination of pistons.

7.4.2 Aspiration without additional stroke

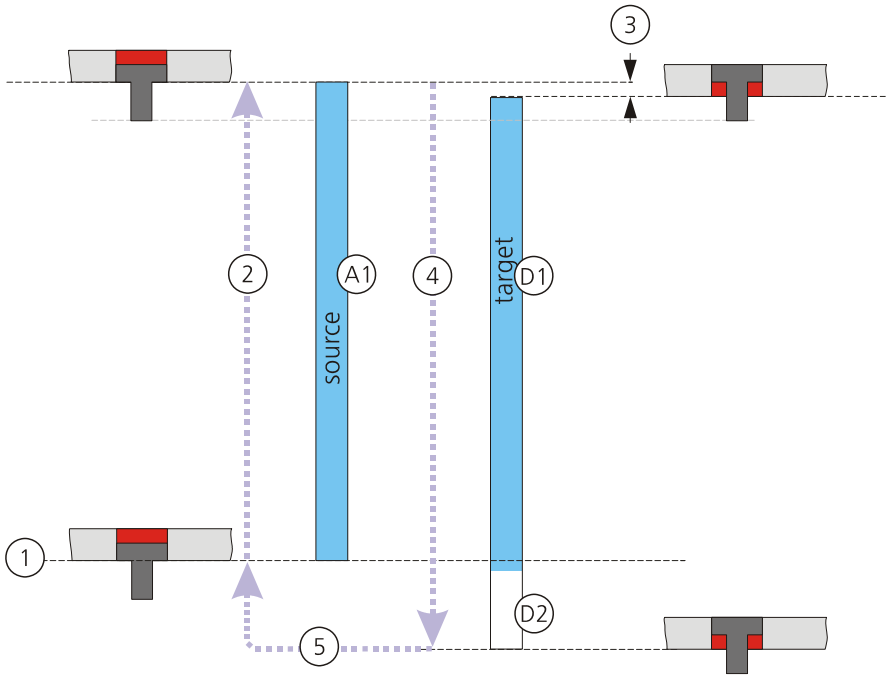


Fig. 118: Aspiration without additional stroke

1 Zero-position
2 Aspiration
3 Upper freeplay
4 Dispensing with additional stroke
5 Motion to zero-position

A1=D1: nominal pipetting volume

D2: Air

Where liquid is aspirated without an additional stroke, it must be dispensed in a single step, in order to achieve precise results. This cycle must provide for a motion length that is greater for dispensing (4) than that for aspiration (2). Since the reversal point of piston motion lies within the motion range that is covered by the pistons for dispensing, no volume is dispensed on excession of the upper freeplay (3). If dispensing motion covers a motion length that is greater than actually required for a given nominal volume, the previously aspirated volume will be completely dispensed from the pipette tip, with subsequent dispensing of air (D2).

A "Move pistons into zero-position" command (5) triggers upward piston motion to their initial positions, thus excluding the lower freeplay.

This process must be triggered with no liquid present, i.e. the lifter must be in such a position that the tips cannot make contact with liquid. Liquid which is aspirated in the process may result in dosing errors or contamination of pistons.

7.4.3 Volume Cycle

Standard cycle:
- Aspiration with additional stroke
- Dispensing (single volume or subvolumes)
- Residual dispensing
- Motion to zero-position

Simplified cycle (only for dispensing of single volumes):
- Aspiration without additional stroke
- Dispensing with additional stroke
- Motion to zero-position

7.4.4 Waiting Time

Piston motion always creates a state of underpressure or overpressure during an aspiration or a dispensing cycle. In order to maintain the specified system precision, pressure equalization in the tips must be allowed to finish. This is supported by a specific "Interruption" software command. A waiting time of two seconds proves long enough with most watery solutions.

7.5 System Precision (Pipetting Head)

The CyBio Well vario works based on the principle of air displacement. This means that 96 or 384 pistons, which are mechanically connected with a common drive, perform motion in 96 or 384 air spaces created by the pipette tips and internal seals. The volume resolution capability of piston motion corresponds to one tenth, one hundredth or one thousandth of a micro liter.

The achievable degree of precision is limited and influenced by:

- the wettability of tips,
- the dimensional stability of their outlet opening,
- the way the system and involved liquids are handled.
- physical and chemical properties of liquid
- the quality of microplates

You are also advised to note the following:

TIP

Liquid is aspirated or dispensed as a result of underpressure or overpressure created by piston motion. In either case, the process will not be completed before pressure balance state has been reached. The time required to reach this state depends - among other factors - on the properties of the liquid being handled. For this reason, adequate pause times should be included with all operating sequences as necessary.

TIP

When working with dry tips, pressure equalization of a different kind will occur after filling. It takes a longer to finish, because an air vapor pressure will build up in the air cushion inside the tip above liquid level, resulting in liquid emerging from the tips.

This can be prevented by triggering a few initial rinse program cycles, until the air inside the tip is saturated with vapor. Even after a longer downtime with tips in filled condition, no liquid will emerge on completion of preventive rinsing.

TIP

By wetting the tips with liquid, you may influence the achievable level of precision and accuracy. As a matter of importance, tips should therefore be submerged into the liquid volume just as much as necessary for a particular process. In addition, the depth of submergence should always be the same in multi-cycle mode. This can be achieved by maintaining a constant reservoir filling level with the help of the sensor-controlled reservoir pump.

TIP

For precise work results, you are advised to use a non-shedding slightly moistened scrubbing towel to dab the tips. You may place the towel onto a standard microplate (for example).

8 Troubleshooting

Malfunction or faults during operation will be displayed on the working screen. Where a fault situation was clearly caused by operator action, operation can be resumed, once the fault has been removed (switch power off and on again for greater safety).

Check all potential fault sources on occurrence of a fault. If problems remain after this check or on identification of an undescribed fault, you should notify the customer service of the manufacturer or their authorized service partner.

8.1 Error Messages

The following fault messages may be displayed by the CyBio Composer software:

Error/error code	Cause	Remedy
1	Tip clamping device defective	Notify customer service
2	Undefined head type	Notify customer service
3	RAM fault	Notify customer service
4	Tips are loose	Switch power supply off and on again.
5	Magazine not fully inserted	Remove and insert magazine once again.
	Tip magazine of older make/ back corners are not rounded.	Replace tip magazine or have magazine reworked by dealer/ service personnel.
	Tip magazine edges or corners deformed resulting from drop impact.	Replace tip magazine or have deformation removed.
7	System error	Notify customer service
8	Failure to find internal zero-position of pump system.	You may be able to remove this error by performing an exchange of tips. Note: On repeated occurrence of this fault, repair work is necessary!
9	Parameter error: host computer has transferred wrong parameters to CyBio Well vario pipettor.	Check for system configuration in CyBio Composer software.
10	Host computer triggered a command that is not available in the pipettor.	Check command and repeat command transfer.
11	Pump drive has reached upper limit position.	You may be able to remove this error by performing an exchange of tips. Note: On repeated occurrence of this fault, repair work is necessary!
12	Pump drive has reached lower limit position.	You may be able to remove this error by performing an exchange of tips. Note: On repeated occurrence of this fault, repair work is necessary!

Error/error code	Cause	Remedy
15	The lifter cannot find its internal lower zero position.	Switch power supply off and on again. Note: On repeated occurrence of this fault, repair work is necessary!
16	Error by external device, (plate transfer unit, drip-catcher)	Switch power supply off and on again. Note: On repeated occurrence of this fault, repair work is necessary!
18	Host computer triggered command that requires more parameters.	Check software for this command.
20	Operator break of running program sequence.	
21	Error on calculating motor characteristic.	Parameter settings cannot be carried out. Select new parameters.
22	Error on carriage motion or rotary stage motion.	Remove obstacle or clean carriage and transport rails or rotary stage.
24	Command cannot be executed at this moment.	Wait until previous command has finished.
26	Z-drive motion error	Switch power supply off and on again.
27	Failure to detect pipetting head.	Unseat pipetting head once again, then restore it to working position. Switch system power off and on once again.
29	Internal bus error	Switch power supply off and on again. Note: Notify customer service if error occurs repeatedly.
30	Safety circuit interrupted (special system configuration).	Check safety circuit of external devices.
31	Error by external device	Notify customer service
32	Error on float-point operation	Switch power supply off and on again. Note: Notify customer service if error occurs repeatedly.

Table 13: Error code table

In addition, the following faults may occur:

Error message	Cause	Remedy
No aspiration allowed at this point.	The system tries to aspirate a volume, following an aspiration or a dispensing cycle, despite the fact that the pistons have not yet returned to their zero-positions.	Correct program sequence as necessary.
Aspirated volume too small.	Aspirated volume is too small.	Valid values are within the range of 0.1 µL to 25 µL or 2 µL to 250 µL, depending on the type of pipetting head. Correct these values accordingly.
Command requires more parameters.	Command was transferred to pipettor with some required parameters missing.	Check transfer cables for proper condition.
		Check that available software version is actually configured for your system (refer to *Hardware system information* window in **[Devices]**) menu.
		On failure to remove this error, you should notify the customer service.
Command unavailable in this system state	A command was triggered, but cannot be successfully completed in the present system state, for example, command attempted switching the XY-position controller for 384-well microplates to a new position, while vertical drive motion was out of switching range limits.	Change parameter settings of fault-triggering command to permissible values.
Wrong parameters	Software transferred wrong parameters to system.	Check that available software version is actually configured for your system (refer to *Hardware system information* window in **[Devices]**) menu.
		Check system connections for proper state.
		On failure to remove this error, you should notify the customer service.
Error on calculating motor characteristic.	Value settings for system motor characteristic are unrealistic.	Correct parameter settings as necessary.
Error on communicating with interface	Interface transmission error which cannot be located in greater detail.	Check PC and system for proper connection.
		Check configuration of serial interface and PC.
Error on horizontal drive motion	Horizontal motion was obstructed by incorrectly seated microplate.	Remove microplate and mount it correctly.

Error message	Cause	Remedy
No residual ejection	After aspiration of a volume, there was no residual ejection of dosing stock during the remaining program sequence. On completion of a program, there must be no dosing liquid left in the pipette tips.	Ad a **[Dispense with additional stroke]** command at the appropriate point in a sequence.
Faulty horizontal position	Command includes invalid setting for horizontal position.	Check your software and hardware configurations for mutual agreement (refer to *Hardware system information* window in **[Devices]**) menu.
Faulty height	Command includes invalid height specification.	Check your software and hardware configurations for mutual agreement.
System not operational	System currently unable to accept commands. If this error occurs during a program start, a program was typically canceled while the system waited for a keypress signal.	Press a key at the CyBio Well vario and try again.
Failure to find internal zero-position of piston motion drive.	System was unable to find the zero-position for piston motion.	Perform a change of tips. Repair work is necessary if this error persists.
No tip magazine available	System failed to detect a tip magazine.	Insert a tip magazine if no tip magazine available.
		Remove and reinsert tip magazine if a magazine had been installed.
No or faulty communication with X-Y-stage	Data transfer to stage controller interrupted.	Switch CyBio Well vario power supply shortly off and on again.
Pistons not in lower zero-position	On triggering of a **[Move piston to zero-position]** command, pistons were not transferred to the range below zero-position by command **[Dispense with overstroke]**.	Add this command at the appropriate place in the program sequence.
Command unavailable	Software transferred wrong command to the system.	Check that available software version is actually configured for your system (refer to *Hardware system information* window in **[Devices]**) menu. If all settings are found to be correct, check system connections for proper condition. If this fails to remove the error, you should notify the customer service.

Error message	Cause	Remedy
Illegal command	Transfer cables are in a non-conforming state.	Check transfer cables for proper condition.
	Software version not configured for your system.	Check that available software version is actually configured for your system (refer to *Hardware system information* window in **[Devices]**) menu.
		On failure to remove this error, you should notify the customer service.
Communication aborted	User break of currently running program	
Microplate size not supported by software	System displays microplate size that is not supported by software.	Notify customer service and request software version that is matched to this system version.
Program memory location not free	Reports attempted storage of a program in a location that is already occupied.	Delete program number, then save a new program at this location. Note: The command which relates to this error is not supported in the given program.
Piston drive failed to reach upper end position	Piston motion has not reached its upper end position.	Remove this error by performing an exchange of tips. If the error persists, repair work is required. Notify customer service
Piston drive failed to reach lower end position	Piston motion has not reached its lower end position.	Remove this error by performing an exchange of tips. If the error persists, repair work is required. Notify customer service
Sum of all volumes in a program unequal zero	The sum of volumes aspirated and ejected in a program is unequal zero. On adding all signed cycle values up with each other, their sum must equal zero within a given program.	Correct setting values appropriately.
Sum of volumes too great	The sum of all volumes aspirated and dispensed is too great. Valid values are within the range of 2 µl to 250 µl. On adding all signed cycle values up with each other, this range must not be exceeded.	Correct setting values appropriately.
Sum of volumes before and after block is unequal zero	The sum of volumes aspirated and ejected in a current block (program, combined commands, repeat modules) is unequal zero. On adding all cycle values up with each other, their sum must equal zero within a given block.	Correct setting values appropriately.

Error message	Cause	Remedy
Text too long	Text which is intended for output to the system display is too long.	Shorten output text.
stage reached upper end position	stage motion has reached its upper end position.	Use keyboard at the CyBio Well vario to trigger stage motion into lowermost position. To do this, press both direction keys at the same time. This will automatically trigger a drive calibration routine.
stage reached lower end position	stage motion has reached its lower end position.	Use keyboard at the CyBio Well vario to trigger stage motion into lowermost position. To do this, press both direction keys at the same time. This will automatically trigger a drive calibration routine.
Unknown keyboard code	The code of a key which was pressed at the system control panel is unknown to software. This error occurs following an attempt to trigger a program file that was created using a more recent than the currently installed software version.	Use latest software version in this case. If this can be discarded as potential error cause, the particular file is likely to have suffered damage. Create a new program file.
Volume too small	The sum of all volumes aspirated and dispensed is too small. Valid values are within the range of 2 µl to 250 µl. If all signed cycle values are added up with each other, the result must not be below the lower limit of this range.	Correct setting values appropriately.
Capillary head does not dispense in a conforming manner.	Blocked or broken capillaries	Replace clogged or broken capillaries (→ *refer to section 19.2.5*)
	No air supply or faulty controller setting of compressed air control unit.	Check air supply. In the event of controller misadjustment at the compressed air control unit, restore the correct operating pressure (→ *„Technical Specifications"*).
Capillary head does not correctly dispense into the microplate	Microplate mispositioned	Check configuration for correct plate type setting.

Table 14: Further error messages

TIP

Motion of all electric-powered mechanical components will immediately stop on opening of the head cover.

8.2 Errors By Compressed Air Control Unit (Capillary Head)

Error	Cause	Remedy
No pressure at output.	Fixed opening clogged.	Replace component or fixed opening (customer service).
Compressed air leakage at outlet opening	Dust in sealing part of main valve	Remove dust from valve seat by replacement of seat component or by cleaning of valve guide (customer service)
	Membrane has a defect	Replace membrane (customer service)

9 Maintenance & Care

9.1 Safety Notes

WARNING

Note that contact with voltage-carrying system parts may lead to physical injury or even death!

Switch system power off and detach power cable from the line socket before you proceed to any kind of maintenance or care! Make sure that the system is protected from accidental restoration of power!

Operating personnel are prohibited from performing work for maintenance, repair or adjustment of voltage-carrying system parts! Maintenance, repair or adjustment of system modules under electrical voltage may only be carried out by a qualified electrician!

CAUTION

Penetrating liquid may cause material damage to electrical and electronic components!

Make sure that no liquid can penetrate into the inner space during any kind of work for maintenance or care.

TIP

Intervention into mechanical or electronic parts in the inner CyBio Well vario space may not be performed by anyone other than customer service personnel of the manufacturer or specially authorized expert technicians.

To ensure that your CyBio Well vario preserves optimal adjustment condition and will faultlessly function over a longer period of time, we recommend the conclusion of a service/maintenance contract.

Maintenance and care work items should be performed on a regular basis at specified intervals (refer to table → *page 104*, observing these general rules:

- Never use cleaning powder, paint thinners or solvents like petrol or acetone to clean the system! These substances will attack the surface of shielding and cover panels (→ *„Chemical Resistance" on page 21*).
- Use a soft piece of cloth slightly moistened with mild soap or disinfectant solution to clean system enclosure surfaces.
- Contamination and natural wear of modules give rise to increased strain levels and, hence, an increased probability of failure. Check for signs of wear and tear on assemblies under mechanical strain and initiate necessary replacements promptly on identifying wear and tear.
- Spraying disinfectants or similar agents onto system surfaces is classified as a dangerous procedure and prohibited for this reason. Sprays contain gases that can ignite.
- All systems parts capable of manual or motorized motion are subject to natural wear. Similarly, electronic components have no unlimited lifetime.

NOTE

Dirt, e.g. dried-on liquid, may increase wear dramatically in some cases. Always maintain clean working conditions!

9.2 Maintenance Work

9.2.1 Overview

The following table lists required maintenance and care work items with related periodicities.

Maintenance Action	Maintenance interval		
	Weekly	Monthly	Every six months
Clean transport rails with carriage or rotary stage	x		
Use mild cleaning agent or disinfectant to clean the tip wash trough	x		
Wash tubing	x		
Replace used tips	x		
Clean tip magazine, autoclave magazine if necessary (pipetting head)	x		
Check filter of compressed air control unit for condensate level and drain if necessary (only for systems with capillary head) → *refer to section 19.2.9*		x	
Clean all liquid-holding vessels and the outside of tubes with disinfectant		x	
Clean tubes with disinfectant or autoclave tubes		x	
Inspect sealing plate (pipetting head) for clean condition		x	
Inspect carriage or rotary stage for visible damage and clean as necessary ▪ Remove tip magazine ▪ Switch power off ▪ Remove microplates or reservoirs Only linear transporting unit ▪ Take carriage off and clean with mild cleaning agent or disinfectant ▪ Mount carriage again			x
Inspect lifter for damage and clean if necessary			x
Perform a precision test (→ *refer to page 51*)			x
Perform a leak test (→ *refer to page 55*)			x
Check electrical components and cabling, test grounding (PE) conductor (only qualified electrician!)			x
Check and clean compressed air control unit (customer service personnel only)			x
Dabbing station → *page 43*	x		

Table 15: Maintenance intervals

The piston sealing components are subject to strong wear and tear, conditional upon the number of motion cycles completed. Typically, their service life exceeds 250 000 cycles. For this specification, it is assumed that pistons and seals are free from contamination.

TIP

Dirt, e.g. dried-on liquid, may increase wear dramatically in some cases. Always maintain clean working conditions!

9.2.2 Lubricating Transport Rails (Linear Transporting Unit)

1. Remove carriage
2. Grease rails with ultra-thin layer of silicon lubricant
3. Wipe redundant lubricant off
4. Mount carriage

9.2.3 Cleaning the Lifter

TIP

XY-lifter motion must not be obstructed by unwanted objects. Otherwise, the life time of motors will diminish significantly.

Contamination and natural wear of modules give rise to increased strain levels and, hence, an increased probability of failure. Check for signs of wear and tear on assemblies under mechanical strain and initiate necessary replacements promptly on identifying wear and tear.

Check lifter for dirt at regular intervals. Clean if necessary.

9.2.4 Tip Magazine (Pipetting Head)

CAUTION

Direct contact of the tip magazine and the pistons may damage the pistons.

Never install a tip magazine without tips into the pipettor! A tip magazine inserted with no tips installed will void any warranty claims!

TIP

Before system down-times of several hours or several days, the tips should be unclamped. The tip magazine must remain installed in any such case.

Operating the CyBio Well vario in manual or automatic mode, you should carefully watch for and remove residual air bubbles from the tips. Otherwise, the liquid in affected tips will reach an excessively high fill level. There is danger of pistons coming into contact with liquid and suffering contamination in such cases. This may happen if liquid is drawn from vessels with insufficient filling level or if tips are not introduced deep enough.

Make sure that pistons cannot come into contact with liquid during motion into zero-position. Repeated faulty operation may lead to excessively high fill levels and a situation of the kind as described above.

9.2.5 Replacement of Capillaries

Toolset A set of tools is available for replacement of capillaries or adjustment of their glass tips (*119*).

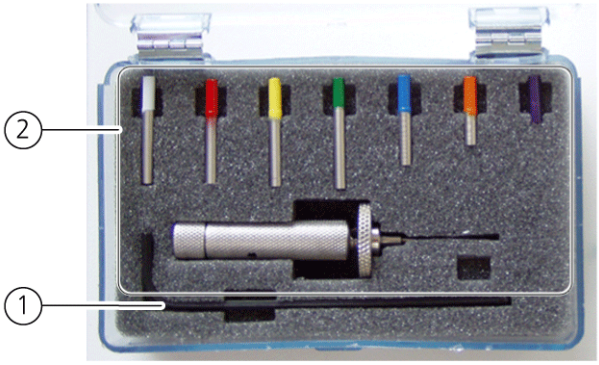


Fig. 119: Toolset

1 Allen key for replacement of capillaries
2 Special tool for adjustment of glass tips

Replacing capillaries in capillary magazine

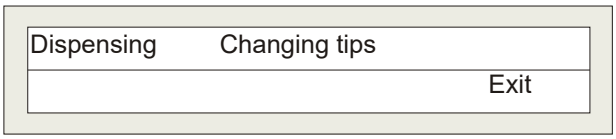
CAUTION

Glass capillaries are fragile! There is danger of physical injury from glass splinters!

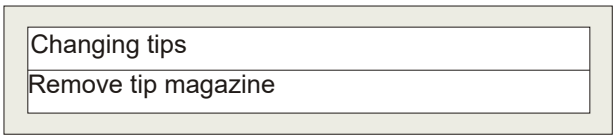
Proceed with adequate caution when replacing a capillary cassette or individual capillaries! Keep capillary magazines always in the storage box. This is necessary to prevent damage to capillaries.

To replace a capillary, proceed as follows:

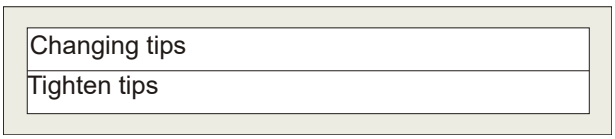
1. Select **[Manual]** => **[Tip change]** in the menu:



2. Retrieve the capillary magazine, once it has been released.



3. Place the capillary magazine into its storage box. The box provides a safe place of storage so individual capillaries can be replaced without any risk of breakage.
4. Exchange individual capillaries as required using the tool supplied. To do this, use Allen key to unscrew a defective capillary. Then install and fix a new capillary.
5. Install the capillary magazine back into the capillary head and press "Enter" key at the control panel. The capillary magazine will be clamped again.



✓ Its capillaries have been replaced.

9.2.6 Cleaning the Carriage (Linear Transporting Unit)

TIP

Carriage performance depends on the current state of the transport rails. Remove pockets of dirt, contamination or damage of transport rails immediately.

To clean the carriage, proceed as follows:

1. Switch CyBio Well vario power off at the main power switch, then disconnect the power plug from the socket.
2. Remove tip magazine from pipetting head for safety reasons (→ *refer to page 104*).
3. Remove all microplates, reservoirs or washing troughs.
4. Remove carriage from the transport rails by raising it at the front and the back end by equal amounts simultaneously. Proceed with due care, in order to prevent damage.
5. Clean the carriage and transport rails using a mild detergent or disinfectant.
6. Carefully place the carriage back onto the transport rails.
7. Carefully push tip magazine back into the holder at the pipetting head. Make sure that tip magazine is correctly placed on completion of work.
8. Reconnect power plug to mains socket and switch CyBio Well vario power on at the main switch.
   - ✓ The system will be re-initialized and becomes operational again.

9.2.7 Cleaning the Rotary Stage (Circular Transporting Unit)

To clean the rotary stage, proceed as follows:

1. Switch CyBio Well vario power off at the main power switch, then disconnect the power plug from the socket.
2. Remove tip magazine from pipetting head for safety reasons (→ *refer to page 104*).
3. Remove all microplates, reservoirs or washing troughs.
4. Clean the rotary stage using a mild detergent or disinfectant.
5. Carefully push tip magazine back into the holder at the pipetting head. Make sure that tip magazine is correctly placed on completion of work.
6. Reconnect power plug to mains socket and switch CyBio Well vario power on at the main switch.
   - ✓ The system will be re-initialized and becomes operational again.

9.2.8 Sealing Plate (Pipetting Head)

TIP

Where pipette tips are changed at shorter intervals, fine fluff-ball stock or dust may settle on the sealing plate, thus impairing the efficiency of sealing.

You are advised to follow these rules:

1. Do not use pipette tips covered with dust.
2. Check sealing plate for cleanness once in a month.
3. Trigger a tip changing cycle and remove the tip magazine for inspection and cleaning. The sealing plate can now be accessed from the bottom. Use a non-shedding slightly moistened cloth for cleaning.
4. Proceed with utmost caution in order to prevent unwanted position-shifting of the sealing plate. Otherwise, there is danger of plate openings getting clogged with fluff balls.

5. Do not remount the tips, until the sealing mat has fully dried.

9.2.9 Compressed Air Control Unit – Draining Condensate

CAUTION

Danger! Splashing!

When draining condensate, hold a piece of cloth underneath the drain screw.

Regularly check the view glass at the compressed air control unit for condensate level. If liquid can be perceived in its lower part, hold a piece of cloth below the drain screw and remove condensate by releasing the drain screw (→ *see Fig. 120*).

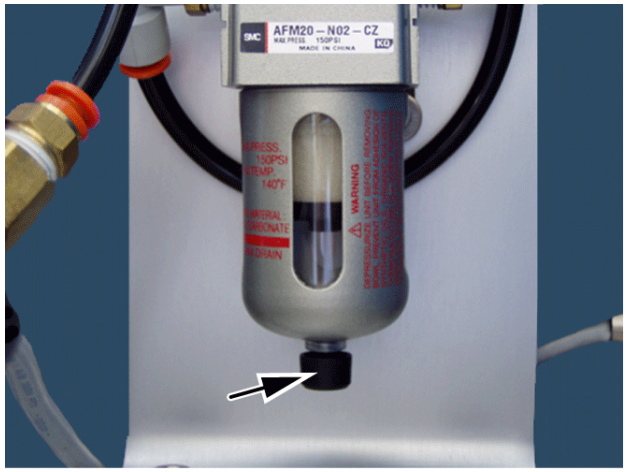


Fig. 120: Compressed air control unit - condensate drain outlet

10 Decommissioning

CAUTION

There is danger of injury and damage to the pipettor if cables are removed before power is switched off!

Do not remove cables as long as they are energized! Make absolutely certain that power supply has been cut before you remove a cable!

If the CyBio Well vario is not required for a longer period of time, perform shut-down action as described hereafter:

1. Remove the tip magazine and place it into the tip tray package or remove the capillary magazine and place it into its special storage box.
2. Install plate adapter in the head.
3. Trigger a head change routine (→ *refer to section 17.2.4*) to remove the head from the system.
4. **Only for capillary head:** Disconnect compressed air supply tube from connector of compressed air control unit. Leave short tube end connected to the head.

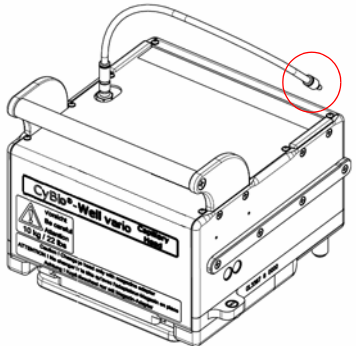


Fig. 121: Disconnectible air supply inlet

5. Transfer power switch into position "0".
6. **Only for capillary head:** Switch compressed air supply off and drain the system space until pressure-relieved state is achieved.
7. Switch system power supply off (using main switch or socket bar for this purpose).
8. Disconnect power cord from socket bar or line power socket.
9. Disconnect compressed air supply tube from inlet connector at compressed air control unit.
10. Remove all microplates.
11. Clean and disinfect the pipettor and its components as described in handling instructions for the most recently used materials and substances.
12. Protect the system from sedimentation of dust.
    ✓ The system has been completely shut down.

TIP

A sub-menu you had been working in when power was switched off will be restored when power becomes available again.

11 Accessories &Spare Parts

11.1 Pipetting Heads & Pipette Tips

TIP

The pipettor and its accessories are factory-matched to each other. Use only accessories recommended by the manufacturer.

The manufacturer will refuse any warranty in the event of damage or function failure as a result of system operation with unspecified accessory items.

For CyBio Well vario pipettor operation, the following accessory and spare part items are available (depending on purchased product version):

Pipetting heads (exchangeable from the front)	Ordering code number
CyBio Well vario2.5 µl pipetting head 96-fs	OL3381-24-230
CyBio Well vario25 µl pipetting head 96-fs	OL3381-24-730
CyBio Well vario40 µl pipetting head 96-fs	OL3381-24-750
CyBio Well vario60 µl pipetting head 96-fs	OL3381-24-780
CyBio Well vario250 µl pipetting head 96-fs	OL3381-24-830
CyBio Well vario2.5 µl pipetting head 384-fs	OL3381-24-130
CyBio Well vario25 µl pipetting head 384-fs	OL3381-24-630
CyBio Well vario60 µl pipetting head 384-fs	OL3381-24-680
CyBio Well vario8 µl pipetting head 1536-fs	OL5021-24-130
Pipetting heads (exchangeable from the back)	**Ordering code number**
CyBio Well vario2.5 µl pipetting head 96-bs	OL3381-24-235
CyBio Well vario25 µl pipetting head 96-bs	OL3381-24-735
CyBio Well vario40 µl pipetting head 96-bs	OL3381-24-755
CyBio Well vario60 µl pipetting head 96-bs	OL3381-24-785
CyBio Well vario250 µl pipetting head 96-bs	OL3381-24-835
CyBio Well vario2.5 µl pipetting head 384-bs	OL3381-24-135
CyBio Well vario25 µl pipetting head 384-bs	OL3381-24-635
CyBio Well vario60 µl pipetting head 384-bs	OL3381-24-685
CyBio Well vario8 µl pipetting head 1536-bs	OL5021-24-135

Pipette tip magazines (single-use tips) for 96-well and 384-well pipetting heads
CyBio Spitzenmagazin 250 µl DW (only 96-well pipetting head)
CyBio Spitzenmagazin 250 µl SW (only 96-well pipetting head)
CyBio Spitzenmagazin 60 µl SW
CyBio Spitzenmagazin 25 µl SW
CyBio Spitzenmagazin 10 µl SW
Pipette tip magazines (ceramic tips) for 96-well and 384-well pipetting heads
CyBio Spitzenmagazin 2.5 µl DW
Adjustable magazine for ceramic tips
2.5 µl DW

TIP

For more detailed information about available Pipette tips and magazines, you should consult our latest catalog or visit us on the Internet.

11.2 Capillary Magazines

96-channel and 384-channel capillary magazines, including 10 reserve capillaries
25 nl capillary magazine
50 nl capillary magazine
100 nl capillary magazine
250 nl capillary magazine
500 nl capillary magazine
750 nl capillary magazine
1000 nl capillary magazine
Spare capillaries (pack of10 pieces)
25 nl, 50 nl, 100 nl, 250 nl, 500 nl, 750 nl, 1000 nl

TIP

We recommend using an adjustable magazine to adjust the approach height. This is available for 96 and 384 capillary magazines (→ *refer to section 111.3*).

11.3 Further Accessories

Available accessories for CyBio Well vario operation are:

- Stacker and microplate adapter
- Tip wash station, capillary wash station
- Barcode reader
- Peristaltic pumps
- Plate transfer unit
- Reagent cooling system
- Tip changer
- Reservoirs
- Adjustable magazine 96 and 384 for capillary wash station
- Tube guide on carriage for tip and capillary wash stations
- Toolset for replacement of capillaries (→ *refer to section 19.2.5*)

TIP

Detailed information about available accessories can be obtained directly from the manufacturer or the Internet.

Pipetting head CyBio Well vario 1536/8 µl

Consumables

Description	Volume	Material (Tips)	Ordering code number	Label
Fixed TipTray (1)	1 µl	steel	OL5021-25-588[1]	S[2]
Fixed TipTray (2)	8 µl	Glass	OL5021-25-585[3]	G
Re-Fill TipTray	8 µl	PP[4]	OL5021-25-511[5]	

1 In case.
2 With coding magnet.
3 In case.
4 Polypropylene.
5 Tray.

Wear parts

Description[1]	Comment	Ordering code number
Dabbing fleece	Exchangeable insert for suction tub OL5021-14-600	OL5021-25-615

1 Status of the compilation: 08/2015.

12 Waste Disposal

12.1 Consumables

ENVIRONMENTAL PROTECTION

Consumable materials must be disposed in accordance with binding workplace safety and environmental provisions of law.

12.2 Reagents

ENVIRONMENTAL PROTECTION

- Biological samples must be treated in accordance with locally binding regulations for the handling of infectious material.
- Hazardous substances and related containers may not be disposed as domestic waste nor be allowed to penetrate into a sewage system or the soil. The appropriate rules and practices must be closely followed for disposal of such substances.

12.3 System & Accessories

TIP

Unless agreed otherwise, the system or its components must be disposed of in accordance with the statutory provisions after their use. The responsibility rests with the owner of the system.

The statutory basis for the disposal are the following EU directives or their implementation in national law within the EU:

- EU Directive RoHS
- EU Directive waste electrical and electronic equipment

A 1 CyBio Well vario System

NOTE

This User Manual Supplement provides an overview of the CyBio Well vario system as a whole. It is only valid if used in combination with CyBio Well vario and Stacker User Manuals. For specific information regarding the various modules, you are referred to the relevant descriptions in CyBio Well vario (→ *refer to page 1*) and Stacker User Manuals.

A CyBio Well vario system consists of a CyBio Well vario with a linear 4-position or 5-position carriage and not less than one stacker that can be located on the right-hand side or the left-hand side of the system. A stacker allows a large amount of microplates to be stored and processed in an efficient manner. The microplates are directly supplied by the transporting unit of the CyBio Well vario. Per stacker one peristaltic pump (for filling of reservoirs) and one barcode reader may be connected. The fill level of reservoirs is monitored by fill level sensors. One CyBio Well vario is able to supply two stackers and one external module with electric power. CyBio Composer software controls CyBio Well vario system operation.

For specific stacker information, you should consult the "Stacker" User Manual.

A 1.1Overview

Because of its modular setup, the system is available in a variety of configurations. To provide an example of CyBio Well vario system configuration a CyBio Well vario with linear transporting unit (5 positions) and two stackers (with peristaltic pump) is shown below.

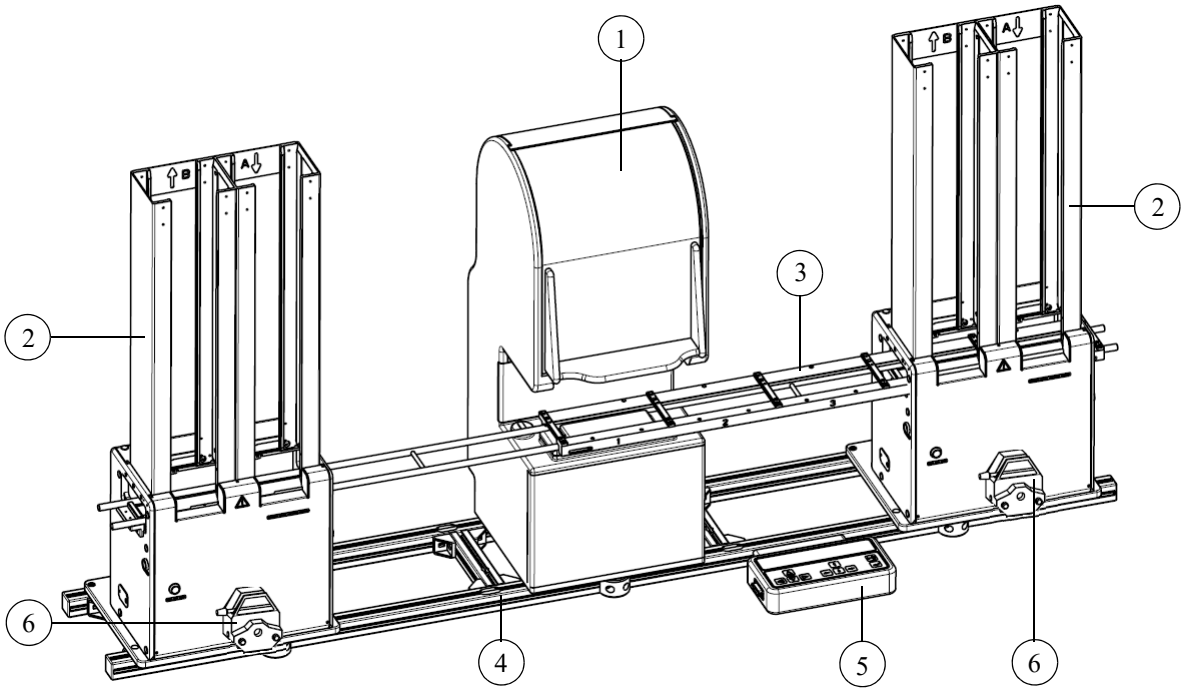


Fig. 122: CyBio Well vario system with two stackers

1 CyBio Well vario
2 Stacker
3 Linear transporting unit
4 Base frame
5 Operation control panel
6 Peristaltic pump

A 1.2Technical Specifications

TIP

For specific performance details of the various modules, you are referred to the appropriate user manuals of the CyBio Well vario (→ *refer to chapter 2*) and the stacker.

A 1.2.1Phys. Dimensions & Weight Details of CyBio Well vario System With 2 Stackers

CAUTION

The system is designed as a desk-top device. Make sure the laboratory bench has adequate load-bearing capacity (compare with weight specifications) before you install the system.

Dimensions	
Max. width	1640 mm
Height with stackers (standard version)	850 mm
Depth	445 mm
Weight	
CyBio Well vario System with 2 stackers	ca. 80 kg (w/o accessories)

A 1.2.2Operating Data

Utility class	Desk-top device; for use in enclosed and clean spaces
Protection class	1
Internal protection standard	IP 20
Operating voltage	230 V ± 10 %, 50/60 Hz 115 V ± 10 %, 50/60 Hz
Power consumption	≤ 250 VA
Airborne sound emission	< 70 dB (A)
Interfaces	RS 232 C, Sub-D 9-pin

A 1.3Safety Notes

TIP

You are also advised to follow all safety notes (→ *refer to chapter 3*) in the CyBio Well vario User Manual and the Stacker User Manual.

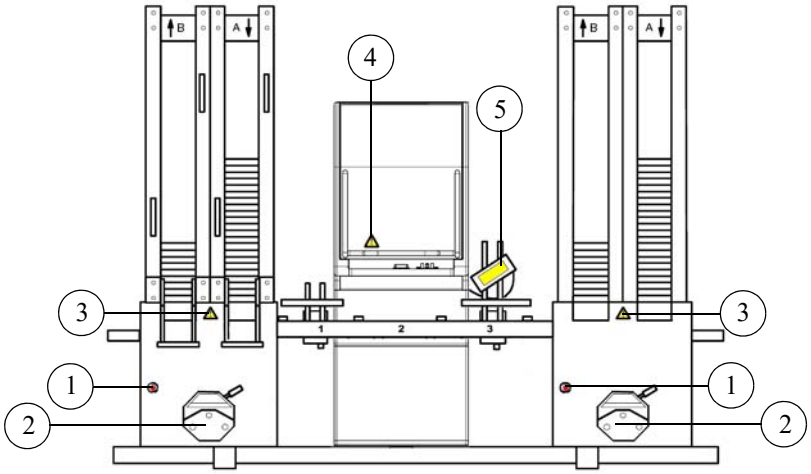


Fig. 123: Warning notes and safety devices

1 Stop-and-Down pushbutton for stacker
2 Warning text at peristaltic pump
3 Warning notes at stacker lifter
4 Warning label at pipetting head
5 Warning note at barcode reader and warning text

A 1.3.1Mechanical Hazards

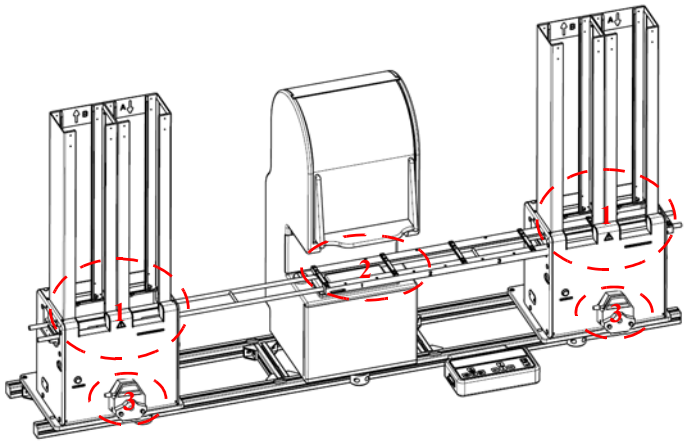


Fig. 124: Danger zones of CyBio Well vario system

1 Lifter of stackers
2 Lifter of pipettor
3 Peristaltic pump

A 1.4Device Versions

Possible combinations are:

Name	Quantity CyBio Well vario	Number of stackers
Stacker – CyBio Well vario	1	1
CyBio Well vario – stacker	1	1
Stacker – CyBio Well vario – stacker	1	2
EXT – system	2	3

A 1.4.1Setup Versions

Possible setup versions are:

- close location (in relation to pipetting module)
- remote location (in relation to pipetting module)

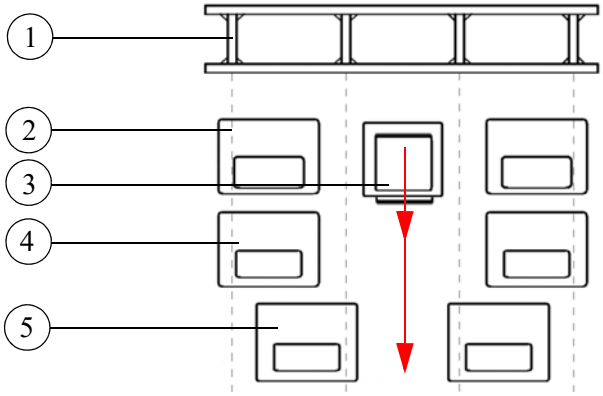


Fig. 125: Setup versions on base frame

1 Base frame
2 Mounting plate for pump module (accessory item) and extension module (accessory item)
3 CyBio Well vario
4 Stacker mounting plate in remote location
5 Stacker mounting plate in close location

A 1.5Installation & Startup Procedures

TIP

Work for installation and initial start-up of the CyBio Well vario system may not be performed by anyone other than service personnel of the manufacturer or that of specifically authorized contractors.

A 1.5.1Cabling Diagram

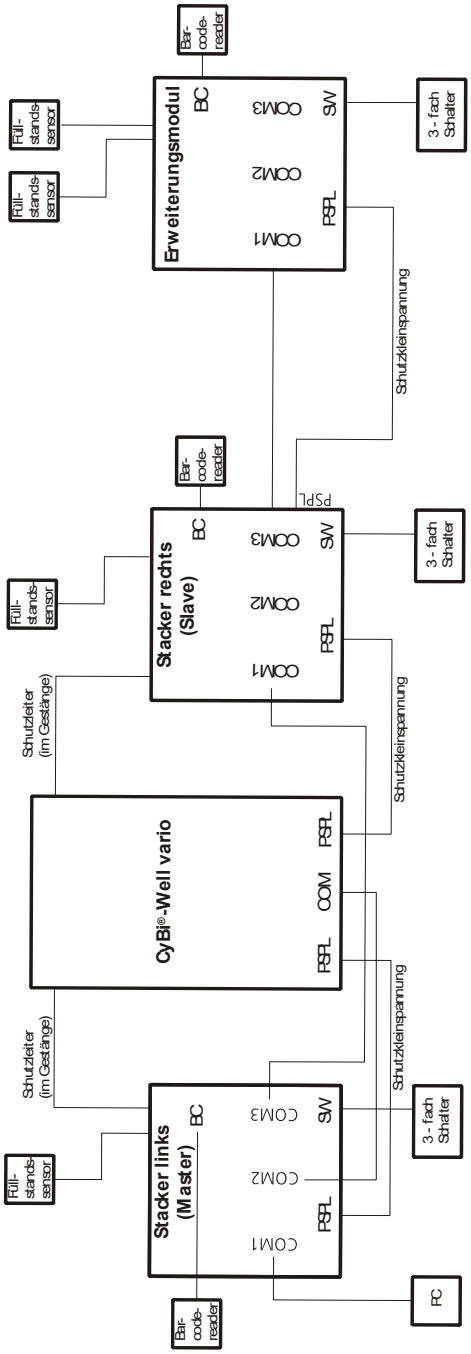


Fig. 126: Cabling diagram of a CyBio Well vario system with 2 stackers and extension module

A 1.5.2Tubing

Reservoir filling station

The pump for reservoir filling is located at the stacker. The pump's direction of rotation determines the direction in which liquid will be transported (→ *Fig. 127*).

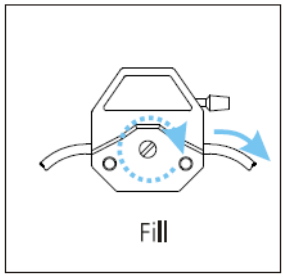


Fig. 127: Direction of rotation and delivery of liquid for peristaltic pump at the stacker

"Fill" command: The rollers of the peristaltic pump rotate clockwise. This means that liquid is pumped from the left to the right. The left tube end must be submerged in the reagent vessel while the right tube end connects to the reservoir.

A 1.5.3Insertion of Tube into Peristaltic Pump

CAUTION

There is danger of crushing or pinching while the pump is in action.

Terminate all currently running system programs or switch system power off before you begin work at a peristaltic pump.

1. Switch peristaltic pump lever to the left
   ✓ Pump is open.
2. Insert tube in same direction as shown in → *chapter A 1.5.2*.
3. Return lever of peristaltic pump into rightmost position.
4. Push right and left tube locks into locked position.
   ✓ Pump is closed and ready for operation.

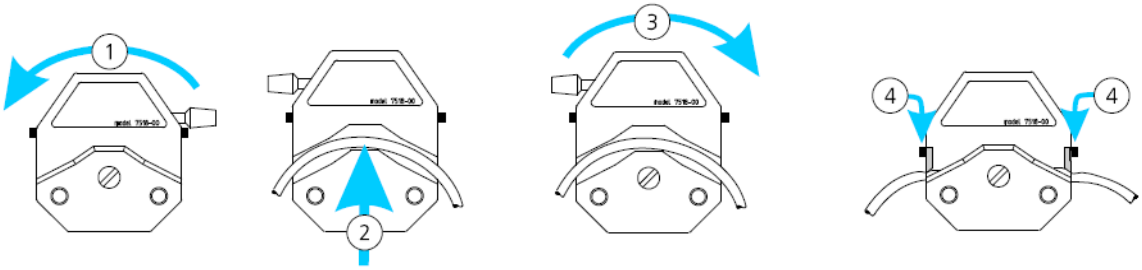


Fig. 128: Insertion of tube into peristaltic pump

A 1.6Operation

A 1.6.1Operating Modes

The following operating modes are available when working with a CyBio Well vario system:

- Working with manual control unit (→ *refer to chapter 7.2*):
  - Manual mode
  - Configuration
  - Statistics
- PC-controlled operation (refer to Plugin Pipettor Software ManualCyBio Composer)

A 1.6.2PC Mode

PC interface

Data transfers between the CyBio Well vario, stackers, additional modules and the control computer are accomplished via a serial RS-232C interface.

- Characters are of uneven parity, each consisting of 8 data bits and 2 stop bits. This data format cannot be changed.
- The baud rate is fixed at 19200 Baud. It cannot be changed.

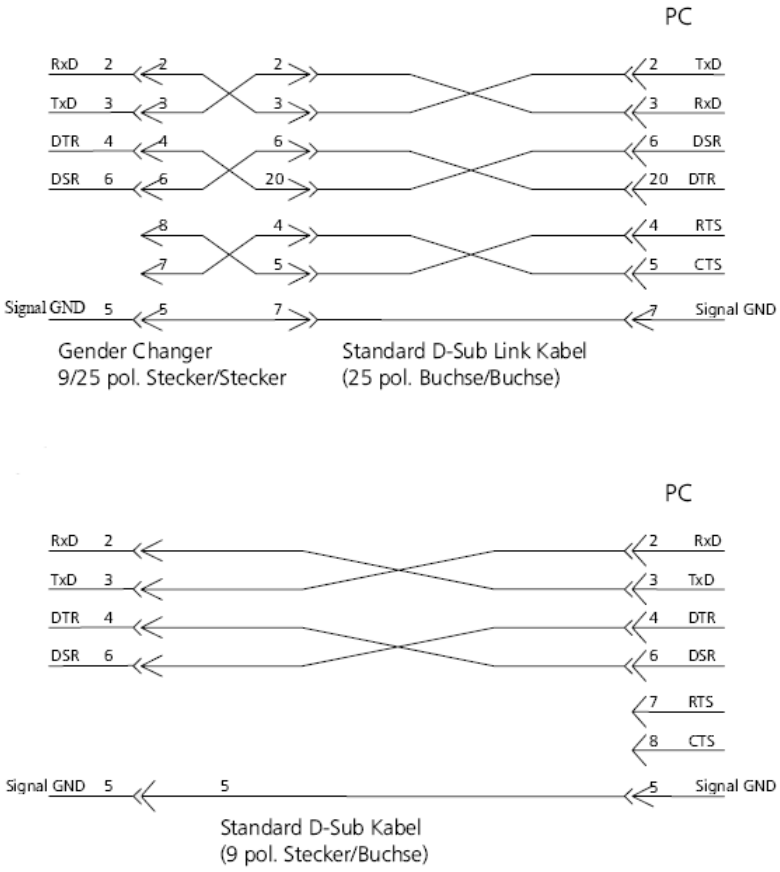


Fig. 129: CyBio Well vario connection to a 9- or a 25-pole RS232-PC jack

Pin assignments at the CyBio Well vario

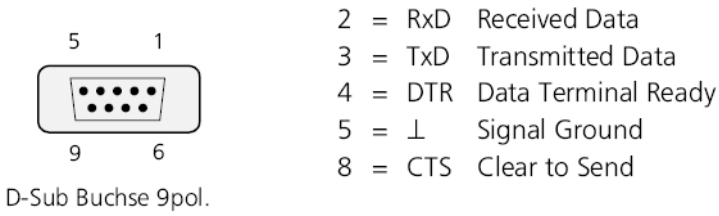


Fig. 130: Pin assignments of 9-pole D-Sub jack (CyBio Well vario)

Pin assignments at stacker

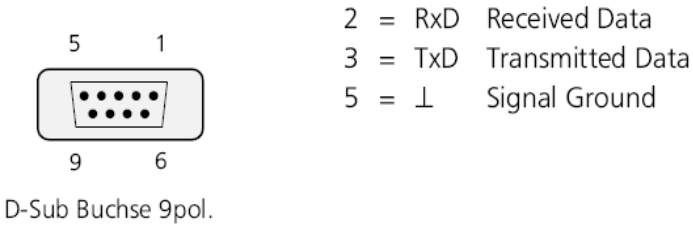


Fig. 131: Pin assignments of 9-pole D-Sub jack (stacker)

A 1.7Maintenance & Care

TIP

All advisory notes (→ *refer to chapter 9*) in the CyBio Well vario User Manual and the Stacker User Manual have unrestricted validity and must be followed.

A 1.8Troubleshooting

TIP

You are also advised to observe all notes (→ *refer to chapter 8*) given in the CyBio Well vario User Manual and the Stacker User Manual.

On identifying a fault situation or malfunction during CyBio Well vario system operation, you should consult the error codes table on → *page 96* and the additional table that is provided below, in order to check for all potential error sources.

Should difficulties persist or faults develop after this check other than described in the relevant module error tables and the table below, you are requested to notify the customer service of the manufacturer or your authorized service agent.

Error/Error code	Cause	Remedy
System fails to work despite availability of power supply, display remains dark.	Mains plug not properly connected to mains socket or the system's combi-seal.	Insert mains power plug correctly.
	Mains socket is de-energized.	Use other mains socket.
	System inlet fuse is defective.	Pull mains plug and replace inlet power fuse. (make sure that fuse rating matches specifications at the system or quoted on → *page 9* of chapter "Technical Specifications")
System reports "tip magazine not inserted" error.	Tip magazine of older make/back corners are not rounded.	Replace tip magazine.
	Tip magazine edges or corners deformed resulting from drop impact.	Replace tip magazine.
Carriage fails to reach positions, motor drive makes "rumbling" noise.	Tight carriage motion.	Raise carriage from sliding rails and clean carriage (→ *page 104*), especially the spring-loaded catches.
	Sliding rails deformed.	Carefully straighten until sliding rails are parallel again.
Lifter does not move or does not move far enough up.	Setting for lifting height "0" or too small.	Set required lifting height in configuration menu.

Table 16: Further errors

A 2 Scripts

The following exemplary scripts illustrate the handling of the dabbing station[1]:

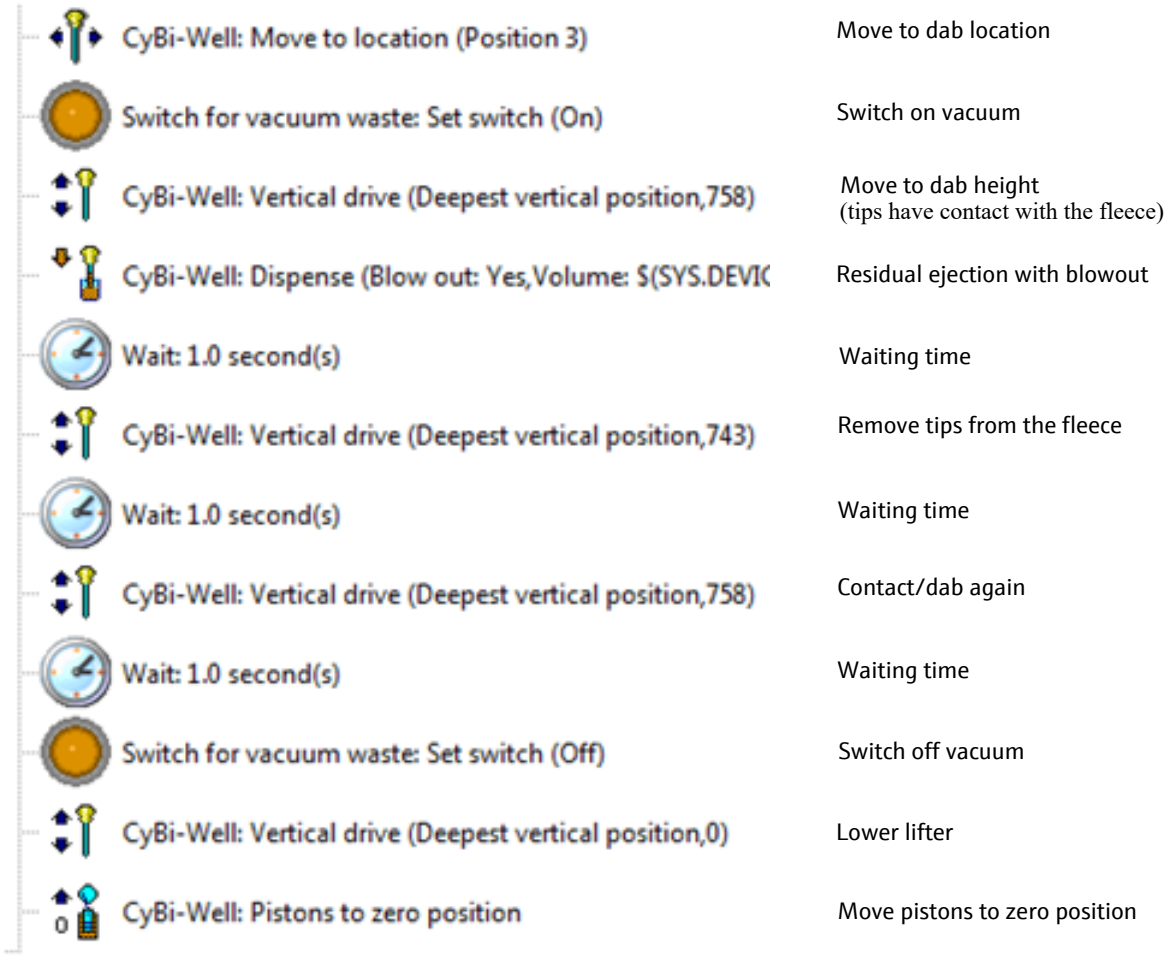


Fig. 132: Example 1

1 OL5012-14-600 – for description and function see section from → *page 40*.

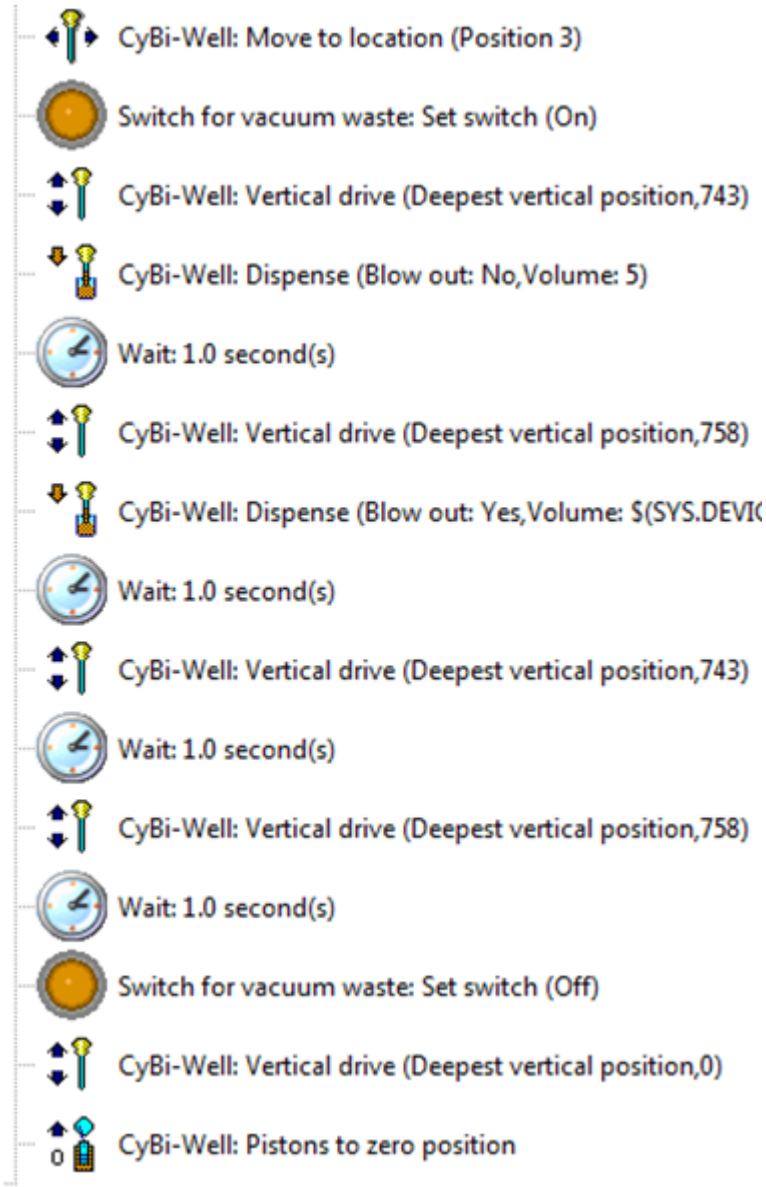


Fig. 133: Example 2

It may happen that after dabbing or even while dabbing on the wet fleece, a thin film of liquid remains / forms on the tips. In this case, it is necessary to burst this film with an increased additional volume/blowout. Since only a limited blowout volume is available mechanically, 1 µl of air (air gap) must be taken up before pipetting in this case, which is available as additional blowout volume at the end of the cycle (the 1 µl additional volume taken up as air gap at the beginning of the procedure is not included in the script excerpt shown below).

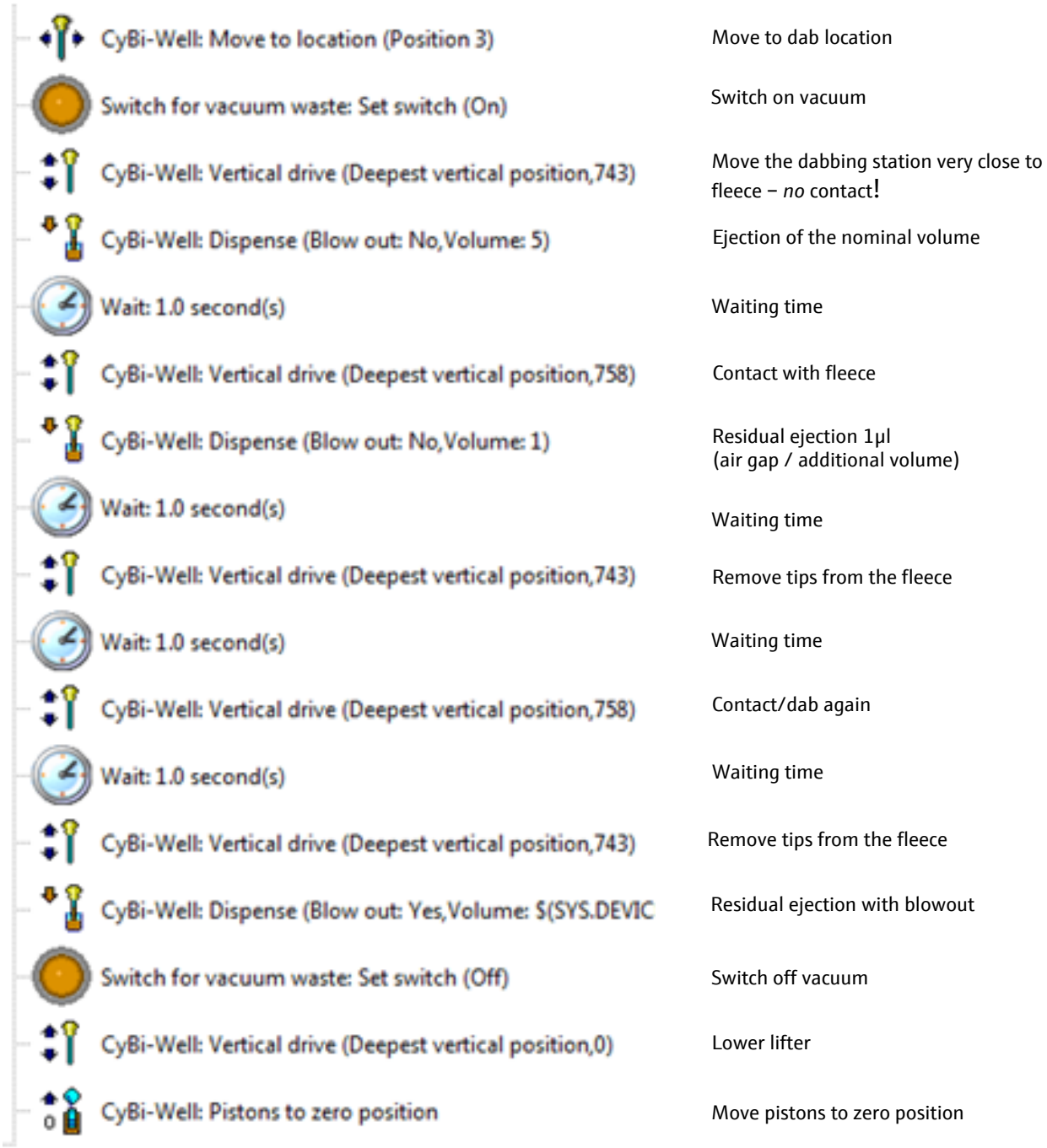


Fig. 134: Example 3

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