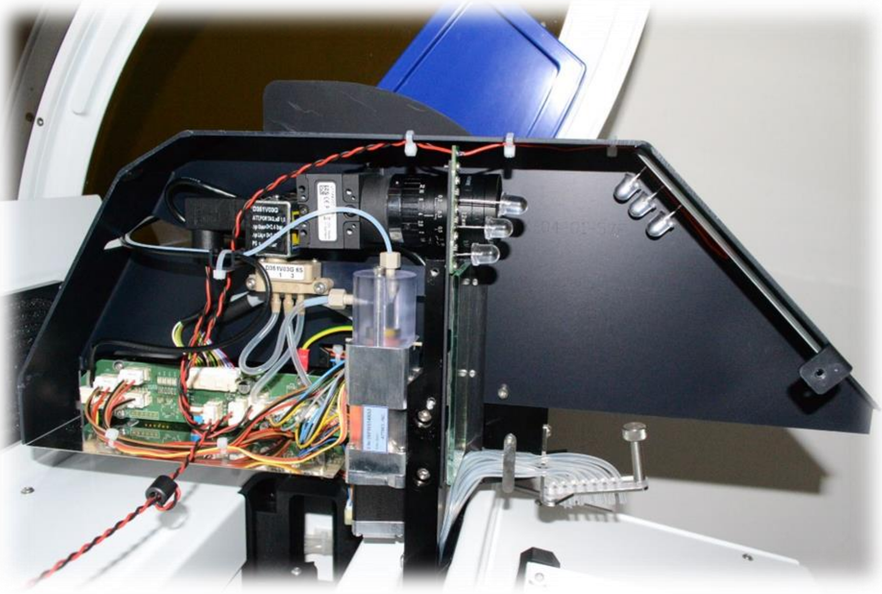

Service manual

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Revision table

Revision	Date	Changes
0	15.1.2013	First official edition
1	27.9.2016	Cleaning bowl maintenance, deleting
2	27.4.2017	Reconstruction of manual contents
3	21.8.2017	Changes for instruments of Variant 3

Obsah/Content

Warning, Cautions and Notes

The following types of notices are used in this publication and highlight important information or warn the user of a potentially dangerous situation:

NOTE

Gives helpful informations.

CAUTION

Indicates a possibility of instrument damage or data loss if instructions are not followed.

WARNING

Indicates the possibility of severe personal injury, loss of life or equipment damage if the instructions are not followed.

INSTRUCTION

Actions to be performed.

WARNING

This symbol indicates the possible presence of biologically hazardous material.
Proper laboratory safety precautions must be observed.

ATTENTION

Negative environmental impacts associated with the treatment of waste.
Do not handle electrical and electronic equipment as unsorted municipal waste.
Collect waste electrical and electronic equipment separately.

WARNING

Risk of fire and explosion!
Several disinfection products can be flammable and when improperly handled can lead to explosions. Proper laboratory safety precautions must be observed.

WARNING

Chemical hazardous and biohazardous waste can be associated with the waste material from the process run on DBH.
Treat these substances and disposables, such as trays, system liquid, etc. in accordance with good laboratory practice guidelines.
Get inquire about appropriate collecting points and approved methods of disposal in your country, state or region.

Use symbols

🏭	Manufacturer
	Date of manufacture
IVD	*In vitro* diagnostics medical device
REF	Catalogue number
SN	Serial number
☣	Indicates the possible presence of biologically hazardous material
CE	Conformité Européenne
☠	Toxic
♨	Hot surface
⌛	Use by
⊘	Single use
	USB
ℹ	Consult service manual
⚠	Warning
📋	Instruction

1 General description

Dynablot Automatic is a computer-controlled instrument designed to automatically perform stripping assay steps. Automation includes these features:

Handling of reagents	filling and aspiration reagents from the reaction wells of the plate
Handling with the sample	reading the sample ID from the bar code on the primary tube, transfering the sample from the primary tube to the reaction well
Incubation	time-controlled incubation of the strips in the reaction wells, mixing of the reagents by rocking the strip plate
Drying	drying the processed strips using the airflow and the tray holder heating
Capturing images	capturing images of the processed strips using a camera system
Data manipulation	saving protocols and strip images in an internal database of device control SW, ability to collaborate with an external evaluation SW in the form of importing and exporting protocols

The device control SW allows the user to perform and monitor:

- preparation and running of the protocol
- routine maintenance of the instrument
- creating and editing assays and tests
- protocol history and maintenance history
- setting the instruments's operating parameters

2 Disposition

2.1 Front View

Picture 1

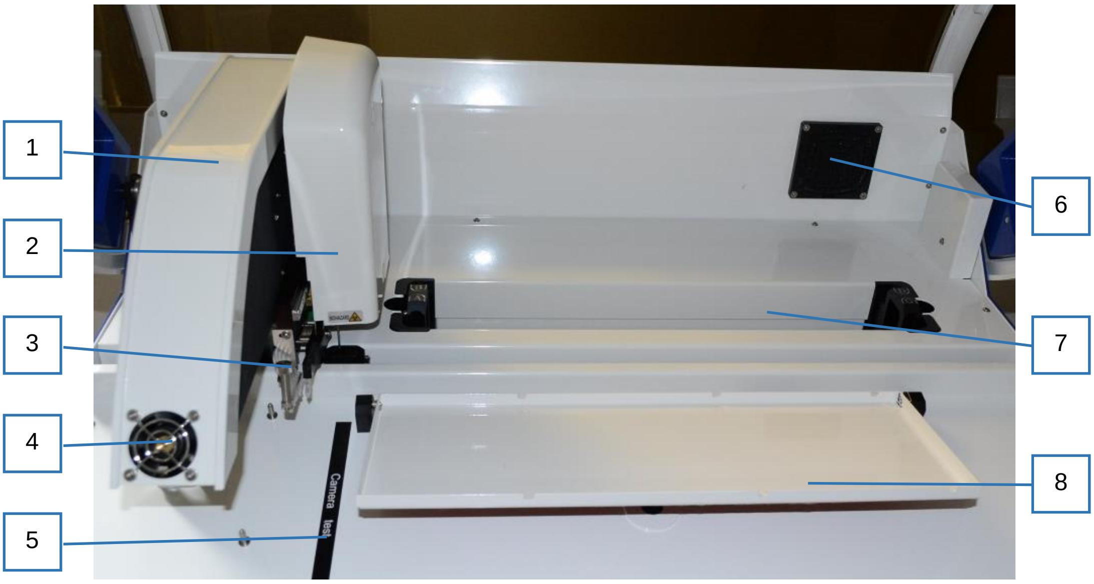
1 - power-on lamp
2 - peristaltic pumps for the reagents
3 - workspace cover
4 - peristaltic pump of the system solution
5 - reagent bottle pad

2.2 Rear View

Picture 2

1 - fans of the workspace
2 - spring struts of the cover
3 - vacuum tube outlet for the waste bottle
4 - vacuum pump exhaust
5 - USB device control connector
6 - USB camera connector
7 - manufacturing label
8 - power supply cable connection with integrated switch and fuse holder
9 - pinch valve of the aspiration cleaning needle cuvette
10 - pinch valve of the strip wells aspiration arm
11 connector of the waste bottle liquid level sensors
12 - connector of the level sensors in the system solution bottle holder
13 - opened holder with the fuses

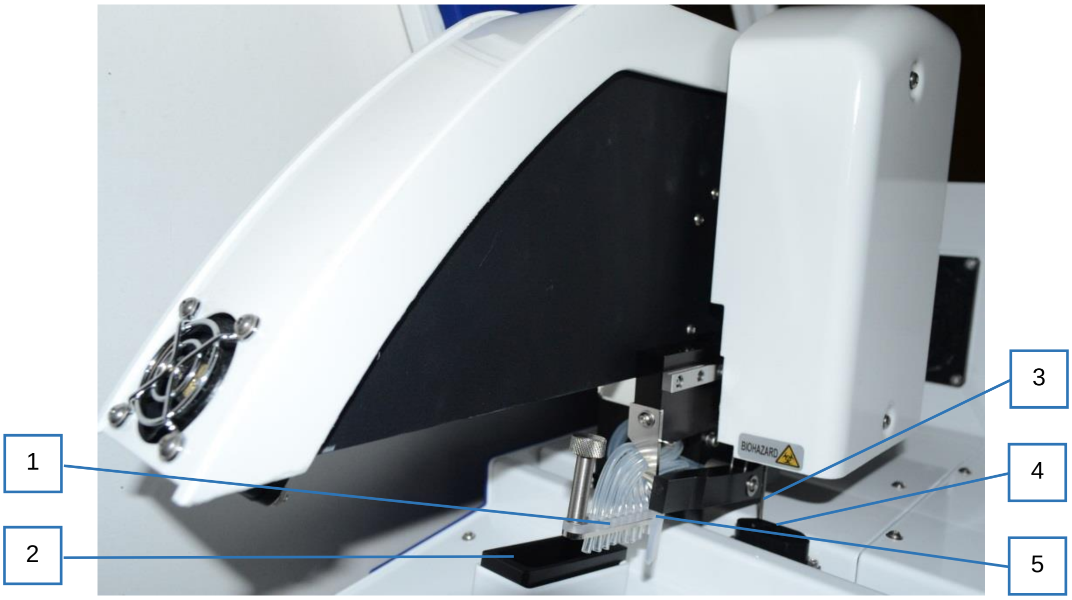
2.3 Workspace



Picture 3

1 - working arm
2 - pipette module
3 - filling and aspirating arms of the reagents
4 - fan of the strip drying
5 - label for the camera checking
6 - right fan of the workspace
7 - space for the sample tube rack
8 - the strips tray holder

2.3.1 Working arm

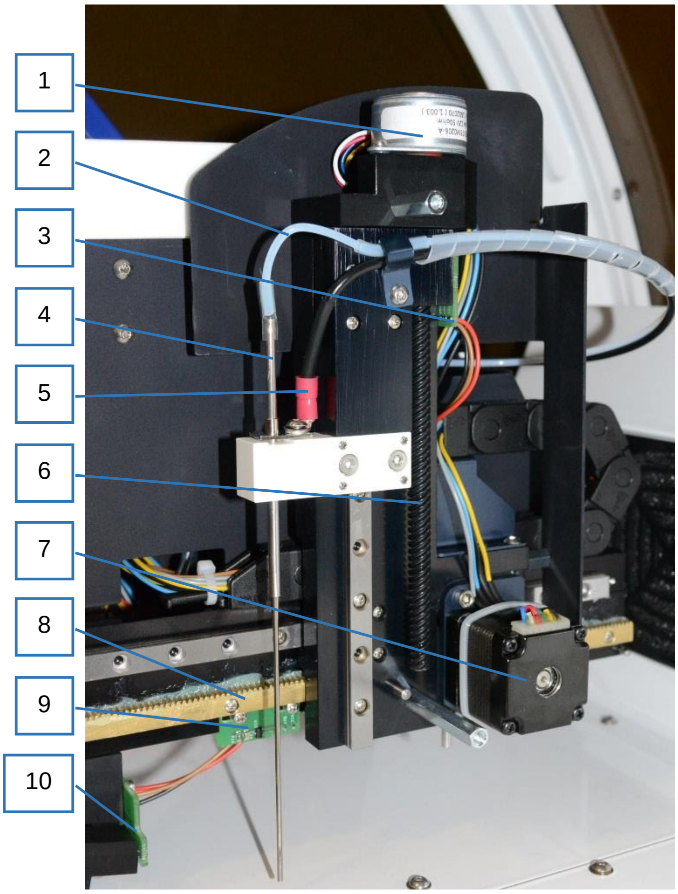


Picture 4

1 – dispensing arm for the reagents
2 – the reagent priming cuvette
3 – pipette needle
4 – needle cleaning cuvette
5 – aspiration arm

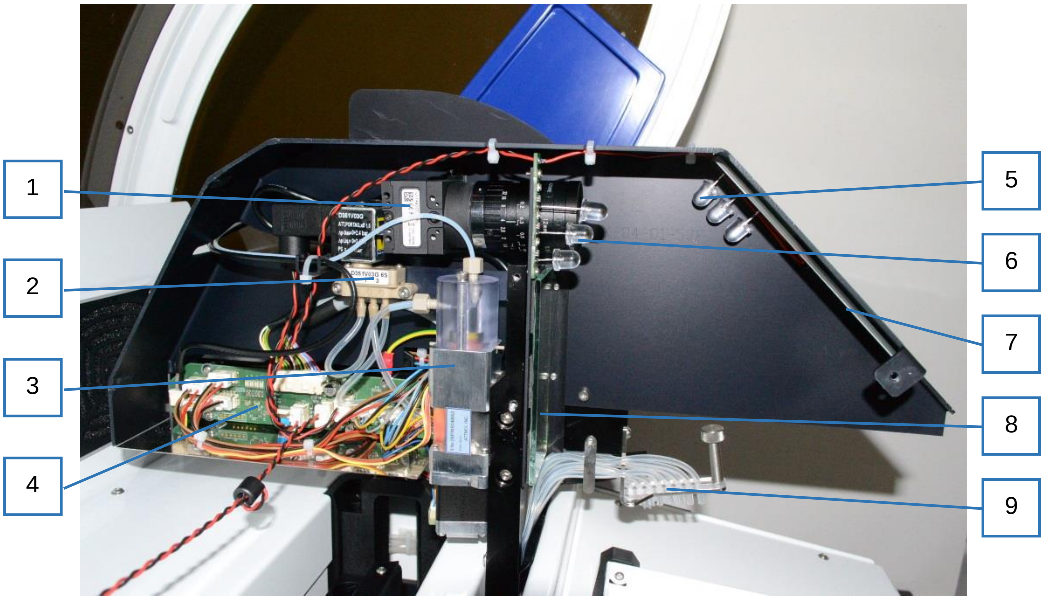
View after removing the cover
of the pipette module

1 – stepper motor of the Z motion
2 – tube between the syringe and the needle
3 – home sensor of the Z motion
4 – pipette needle
5 – level detection circuit cable
6 – bolt of the Z motion
7 – stepper motor of the Y motion
8 – toothed rod of the Y motion
9 – home sensor of the Y motion
10 – sensor of the position of the aspiration arm



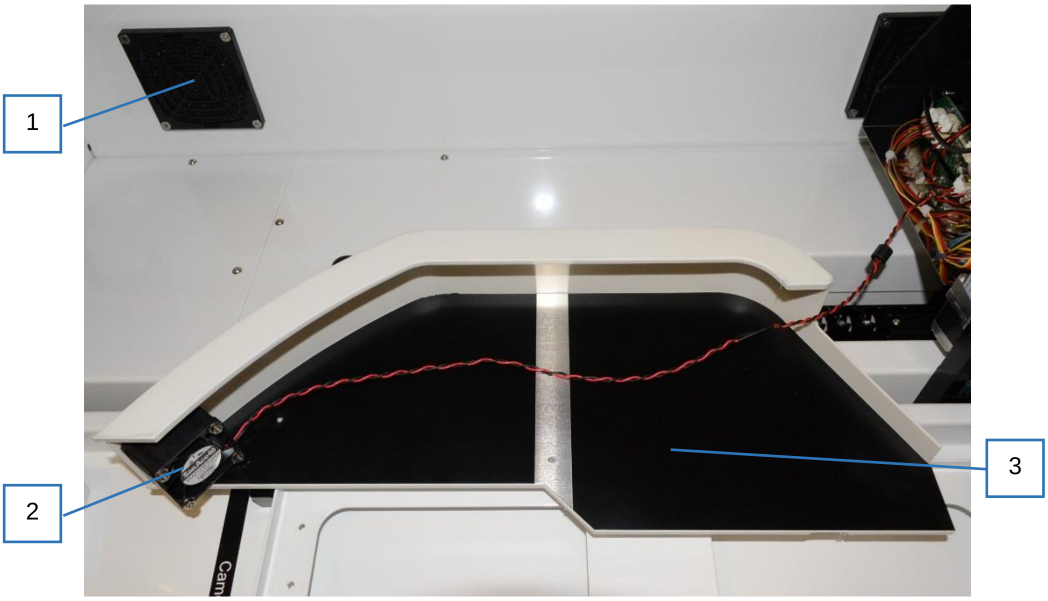
Picture 5

View after removing the cover of the working arm



Picture 6

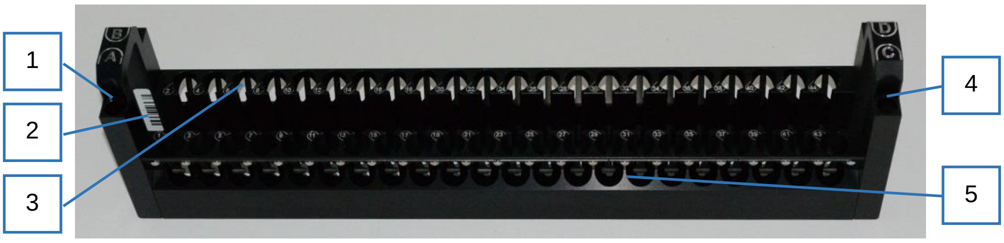
1 – camera with the objective
2 – three-way valve
3 – syringe (plunger pump)
4 – armboard
5 – LED lighting 1
6 – LED lighting 2
7 – mirror for the camera
8 – mirror for the LED lighting 1
9 – reagent dispensing arm



Picture 7

1 - right fan of the workspace
2 – fan of the strips drying
3 – disassembled cover of the working arm

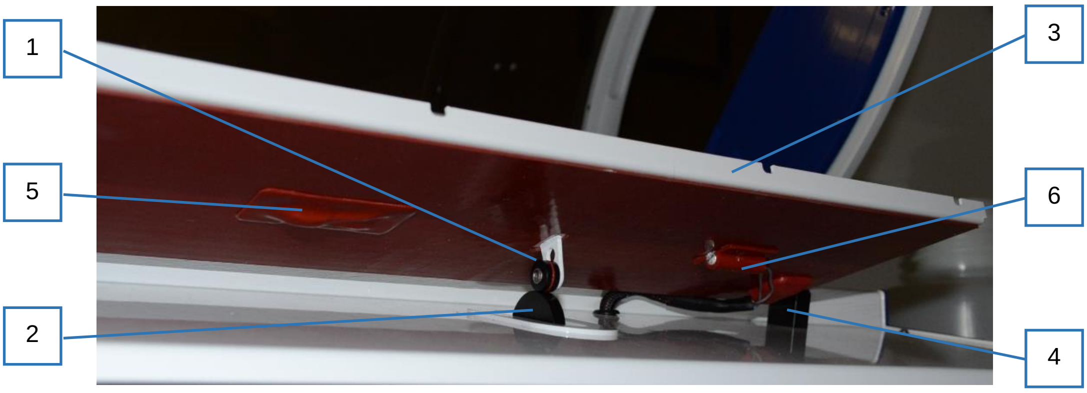
2.3.2 Sample tubes rack



Picture 8

1 – positions for the control tubes A, B
2 – control bar code for the rear row
3 – positions for the rear row of the tubes
4 – positions for the control tubes C, D
5 – positions for the front row of the tubes

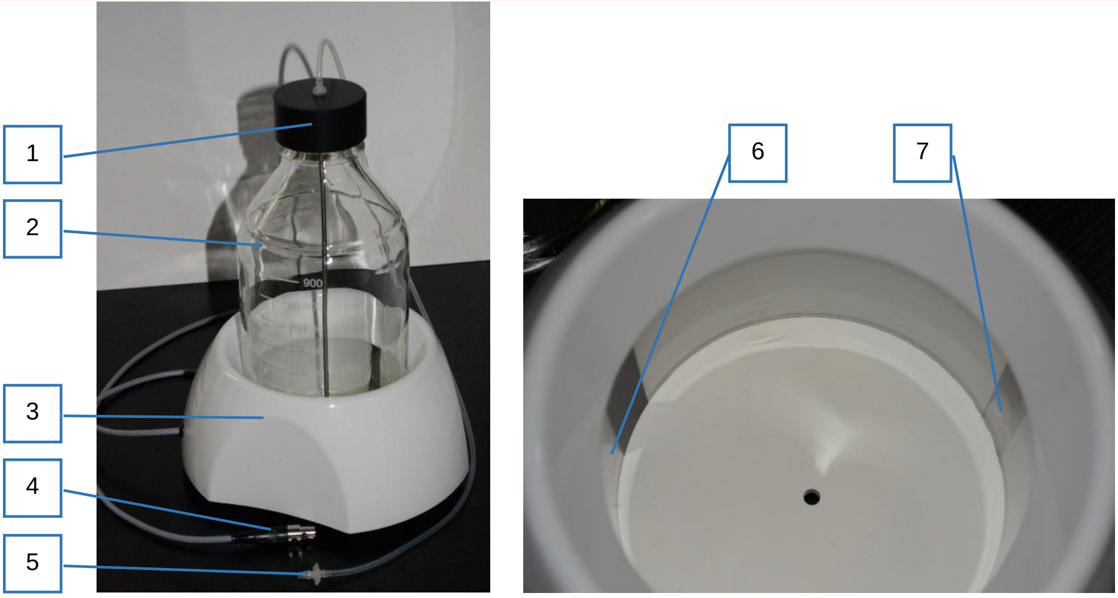
2.3.3 Strips tray holder



Picture 9

1 – pulley with the anti slip o-ring
2 – eccentric drive wheel
3 – frame to place the strips tray
4 – rotary hinge of the frame
5 - heating foil with thermostat - limiter
6 - temperature probe for the regulator

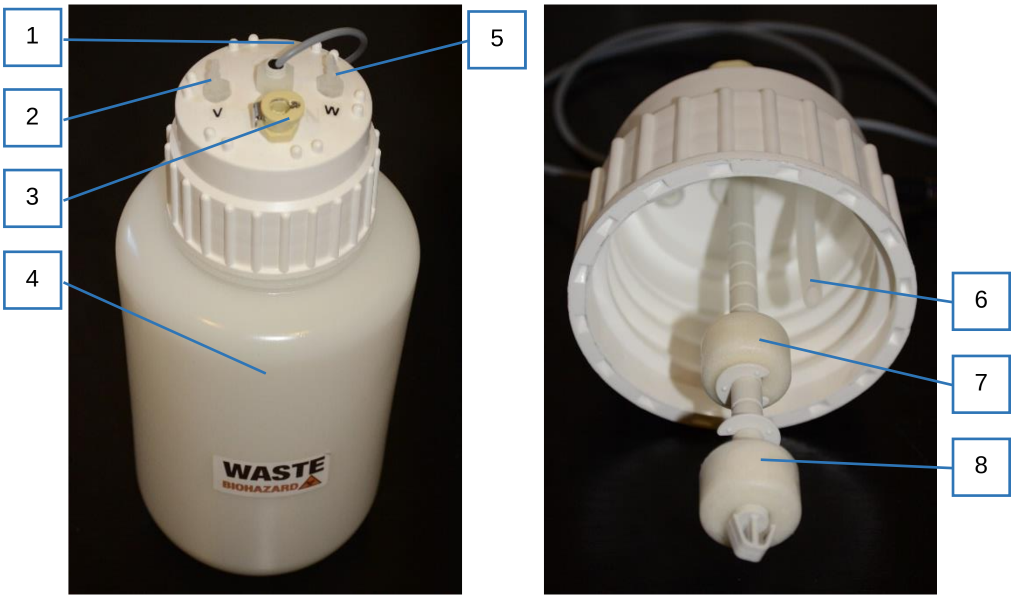
2.4 System solution bottle holder



Picture 10

1 – cap with the suction tube
2 – system solution bottle
3 – holder
4 – cable with the level sensor connector
5 – fitting to connect the system solution pump
6 – receiver of the level detection system
7 – transmitters (LED) of the level detection system

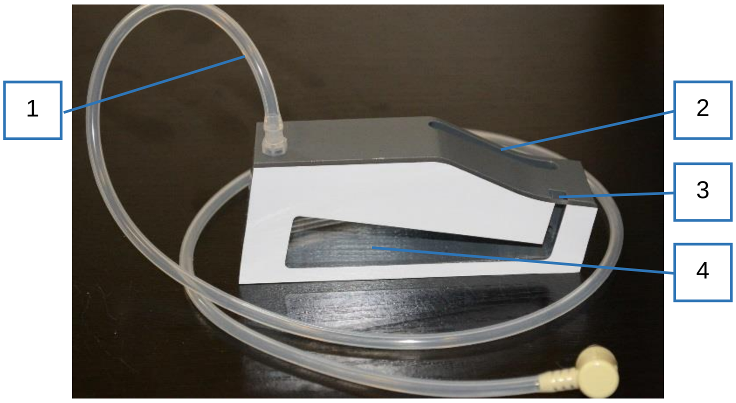
2.5 Waste bottle



Picture 11

1 – cable with the level sensor connector
2 – fitting for the vacuum tube connecting
3 – fitting for the calibration cuvette connecting
4 – waste bottle
5 – fitting for the waste tube connecting
6 – tube under the waste hose fitting
7 – float level "Error"
8 – float level “Warning”

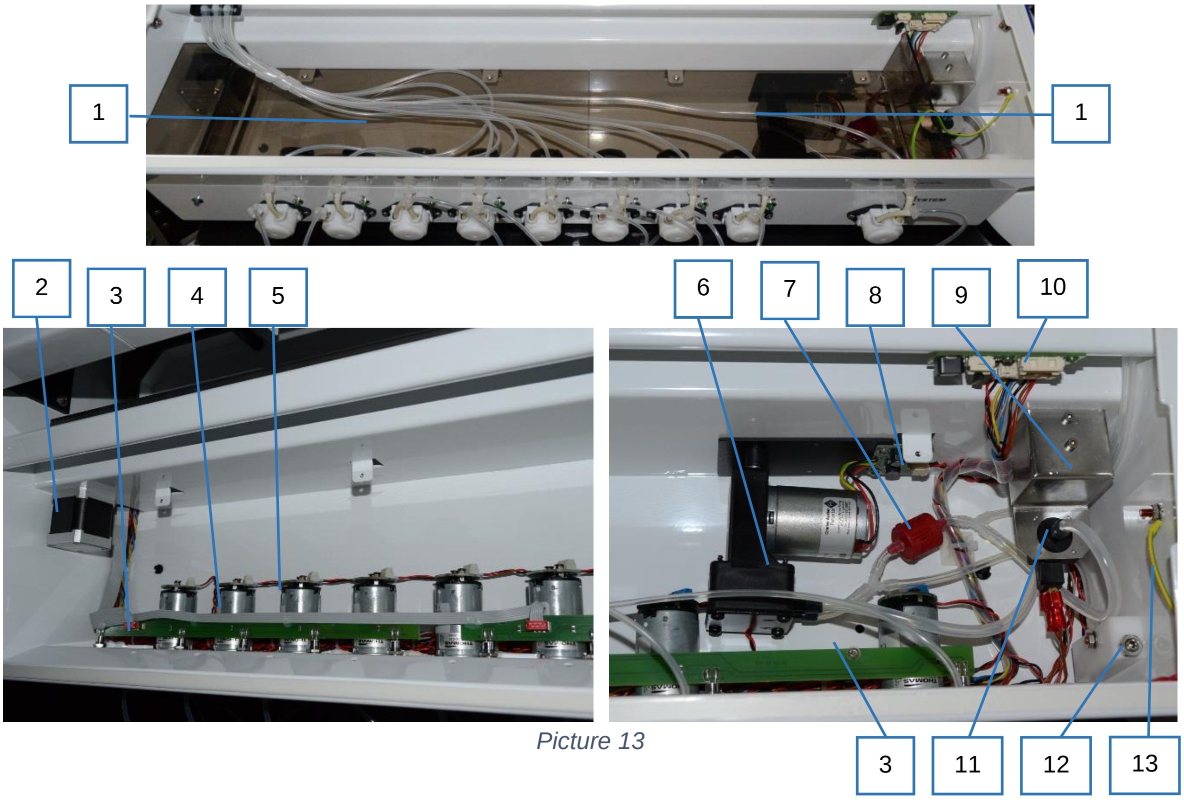
2.6 Calibration cuvette



Picture 12

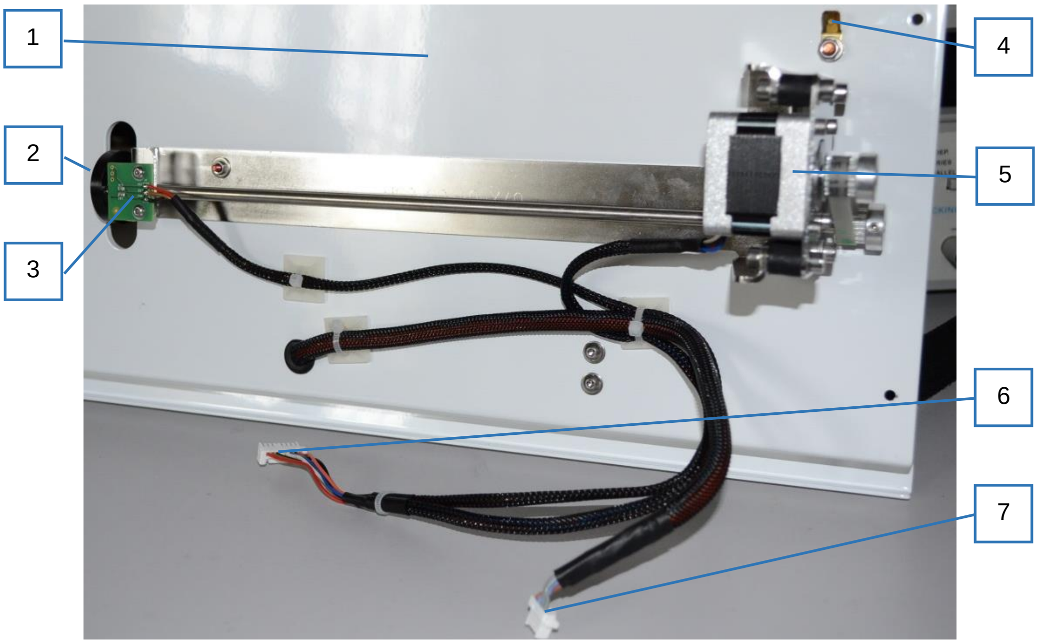
1 – tube with the connector for connection to the waste bottle
2 – filling hole
3 – hole for the level measurement by the needle
4 – vista into the calibration space

2.7 Space under the front cover



Picture 13

1 – pump motors covers
2 – stepper motor of the X motion
3 – pumps LED indicators boards
4 – reagent pump motors
5 – pump motor’s power filters
6 – vacuum pump
7 – reverse throttle valve
8 – power filter of the vacuum motor pump
9 – encoder of the X motion cover
10 – connectors of the rocking motor with its sensor and the heating foil with its temperature probe connection
11 – vacuum in the waste bottle sensor
12 – vacuum in the waste bottle regulator
13 – earthing cabel of the cover

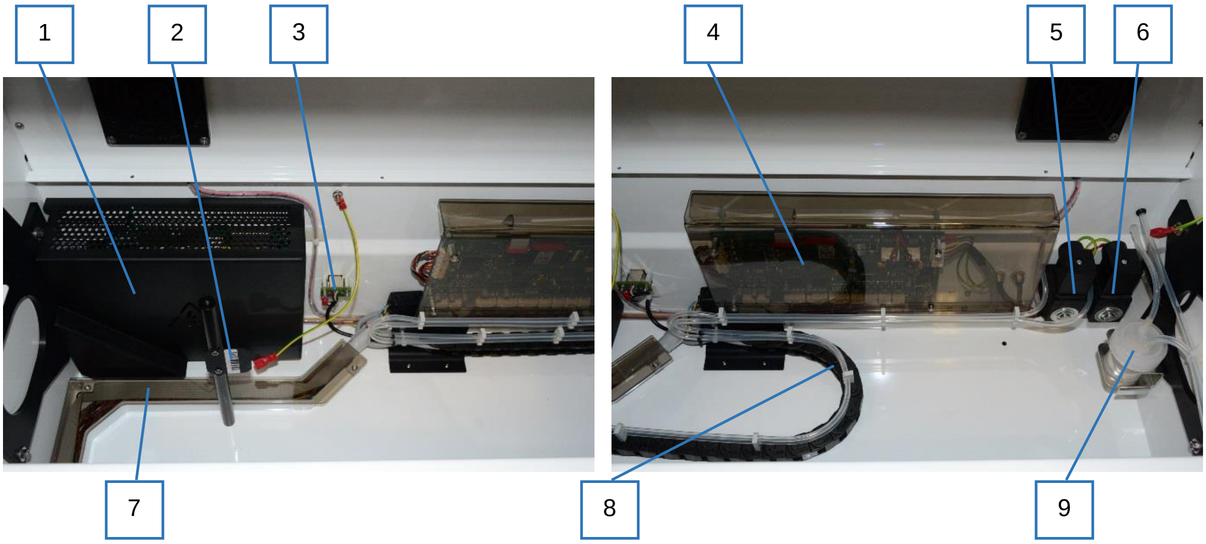


Picture 14

1 – removed front cover
2 – eccentric drive wheel
3 – rocking home sensor
4 – faston for the grounding cable
5 – rocking stepper motor
6 – stepper motor and the sensor connection cable
7 - the heating foil and the temperature probe cable

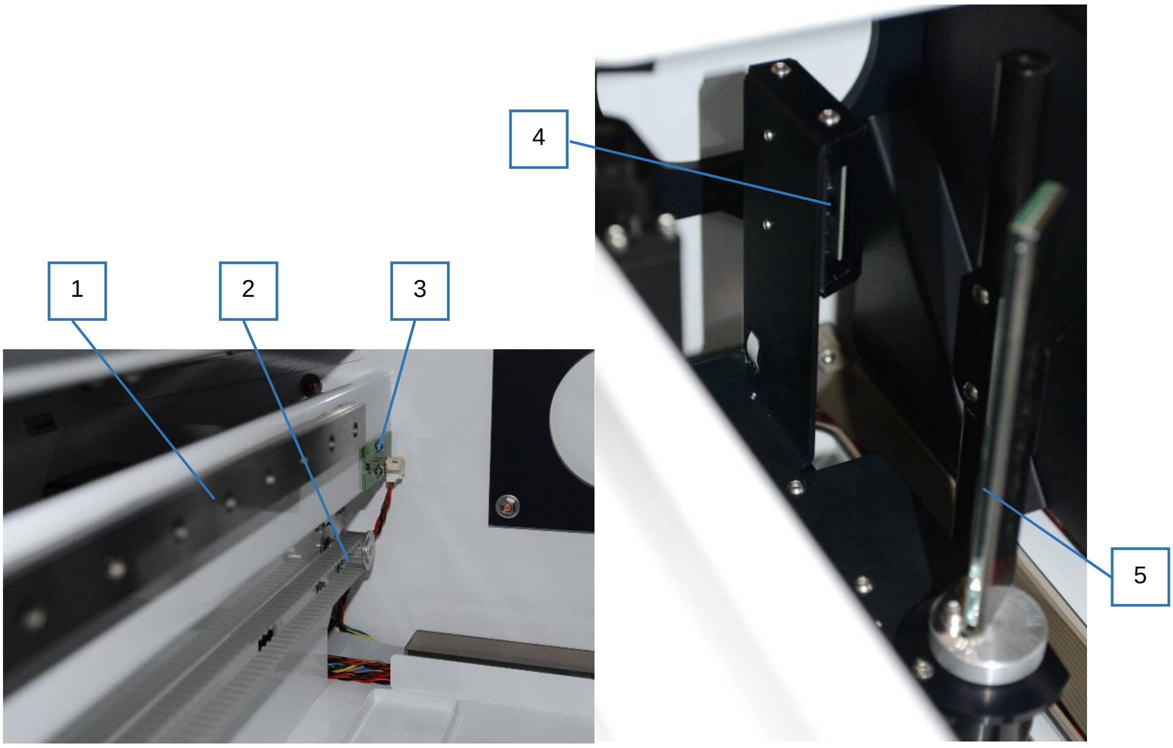
2.8 Space under rear cover

Picture 15



Picture 16

1 – power supply
2 – barcode for barcode reader checking
3 – USB camera connector board
4 – mainboard
5 – solenoid of pinch valve for cleaning needle cuvette aspiration
6 – solenoid of pinch valve for the wells aspiration arm
7 – trough for the cabling
8 – power chain with cabling and tubes to the working arm
9 – exhaust silencer of the vaccum pump



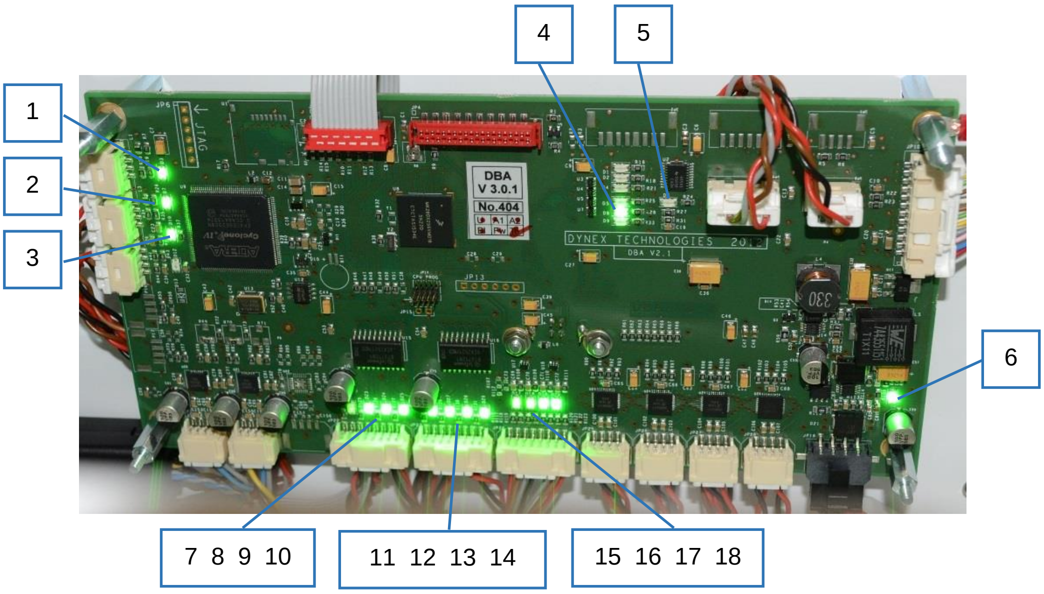
Picture 17

1 – rail of the X motion
2 – pulley and belt of the X motion stepper motor
3 – home sensor of the X motion
4 – barcode reader on the base of the working arm
5 – rotary mirror for reading the barcode

2.9 Meaning of LEDs control

There are green LEDs placed on the electronic boards – Mainboard and Armboard. These LEDs indicate input and output states. For information on the connectors on the boards and the components connected to them see 9.5 Mainboard connector map and 9.6 Armboard connector map

2.9.1 Mainboard - control LED



Picture 18

1 – encoder of the X motion, blinks while moving

2 – home sensor of the X motion, illuminates when the arm is in the home position

3 – rocking home sensor, illuminates when the eccentric wheel is on the_sensor

4 – vacuum sensor in the waste bottle, pair of LEDs – the upper LED illuminates when the under pressure is created

5 – workspace cover sensor, illuminates when the cover is closed

6 – power voltage

7 – heating foil

8 – pinch valve of the needle cleaning cuvette aspiration, illuminates when the output is switched on

9 - pinch valve of the strip wells aspiration arm, illuminates when the output is switched on

10 – vacuum pump, illuminates when the output is switched on

11 – left workspace fan, illuminates when the output is switched on

12 – right workspace fan, illuminates when the output is switched on

13 – system solution pump, illuminates when the output is switched on

14 – power supply of the system solution holder, illuminates when the output is switched on

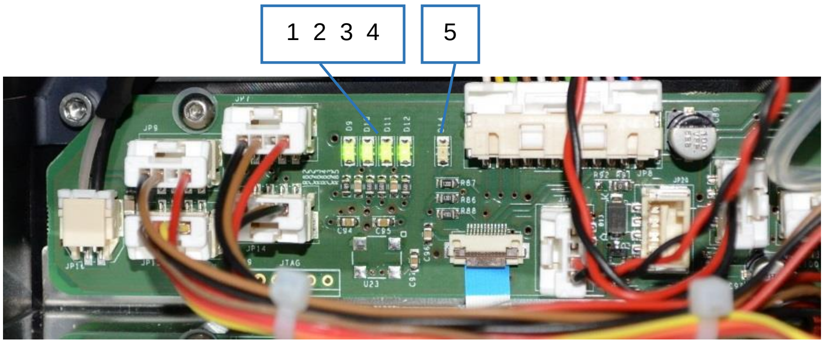
15 – level detection of the system solution bottle – warning, illuminates in the presence of the solution

16 – level detection of the system solution - error, illuminates in the presence of the solution

17 – level detection of the waste bottle - warning, illuminates in the absence of the solution

18 – level detection in the waste bottle – error, illuminates in the absence of the solution

2.9.2 Armboard - control LED



Picture 19

1 – home sensor of the Y motion, illuminates when the arm is in the home position
2 - home sensor of the Z motion, illuminates when the arm is in the home position
3 - home sensor syringe, illuminates at the home position of the syringe plunger
4 – position sensor of the aspiration arm, illuminates in the upper position of the arm
5 – barcode reader signal, flashes when the code is detected

3 DynLab software

DynLab is a service, widely-used PC software for electronic control systems used in Dynex equipment.

> **WARNING**
> Use only the DynLab software features described in this chapter if you fully understand them. Incorrect use may cause mechanical damage or decommissioning due to incorrect firmware or parameter settings.

The software has these basic functions

- Manually control of each instrument components
- Settings the device parameters (i-parameters) and store them into FLASH processor memory
- Updating the firmware in the processor memory (for example new version of the basic firmware)
- Creating and storing D-code segments (sub-programs used by the firmware to control the device) into processor memory
- Running segments or individual D-code instructions

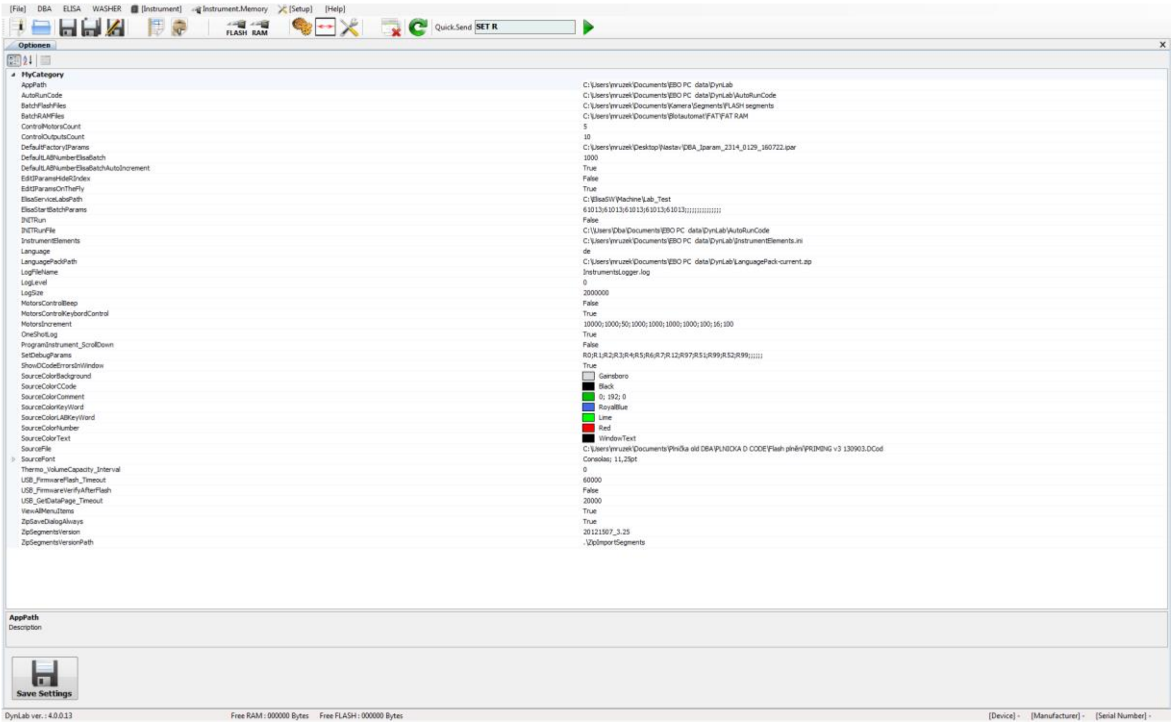
3.1 Installation, startup, settings

Installing DynLab software is done only by coping the directory with the appropriate files to your PC.

The versions of these files differ for different devices:
Constants.ini – can also have a different name, e.g. DBAConstants.ini. It describes a layout and names of the motors, system inputs and outputs.
FlashParams.ipar – always has this name. Contains a default list and basic i-parameters values. .

DynLab runs with a file DynLab.exe

After the first run, some software parameters must be set. The window *Options* opens from the *Setup / Options* or by an icon .



AppPath	C:\Users\mruzek\Documents\EBO PC data\DynLab
AutoRunCode	C:\Users\mruzek\Documents\EBO PC data\DynLab\AutoRunCode
BatchFlashFiles	C:\Users\mruzek\Documents\Kamera\Segments\FLASH segments
BatchRAMFiles	C:\Users\mruzek\Documents\Blotautomat\FAT\FAT RAM
ControlMotorsCount	5
ControlOutputsCount	10
DefaultFactoryIParams	C:\Users\mruzek\Desktop\Nastav\DBA_Iparam_2314_0129_160722.ipar
DefaultLABNumberElisaBatch	1000
DefaultLABNumberElisaBatchAutoIncrement	True
EditIParamsHideRIndex	False
EditIParamsOnTheFly	True
ElisaServiceLabsPath	C:\ElisaSW\Machine\Lab_Test
ElisaStartBatchParams	61013;61013;61013;61013;61013;;;;;;;;;;;;;;;;
INITRun	False
INITRunFile	C:\\Users\Dba\Documents\EBO PC data\DynLab\AutoRunCode
InstrumentElements	C:\Users\mruzek\Documents\EBO PC data\DynLab\InstrumentElements.ini
Language	de
LanguagePackPath	C:\Users\mruzek\Documents\EBO PC data\DynLab\LanguagePack-current.zip
LogFileName	InstrumentsLogger.log
LogLevel	0
LogSize	2000000
MotorsControlBeep	False
MotorsControlKeybordControl	True
MotorsIncrement	10000; 1000; 50; 1000; 1000; 1000; 1000; 100; 16; 100
OneShotLog	True
ProgramInstrument_ScrollDown	False
SetDebugParams	R0;R1;R2;R3;R4;R5;R6;R7;R12;R97;R51;R99;R52;R99;;;;;;
ShowDCodeErrorsInWindow	True
SourceColorBackground	⬜ Gainsboro
SourceColorCCode	⬛ Black
SourceColorComment	🟩 0; 192; 0
SourceColorKeyWord	🟦 RoyalBlue
SourceColorLABKeyWord	🟩 Lime
SourceColorNumber	🟥 Red
SourceColorText	⬛ WindowText
SourceFile	C:\Users\mruzek\Documents\Plnička old DBA\PLNICKA D CODE\Flash plnění\PRIMING v3 130903.DCod
SourceFont	Consolas; 11,25pt
Thermo_VolumeCapacity_Interval	0
USB_FirmwareFlash_Timeout	60000
USB_FirmwareVerifyAfterFlash	False
USB_GetDataPage_Timeout	20000
ViewAllMenuItems	True
ZipSaveDialogAlways	True
ZipSegmentsVersion	20121507_3.25
ZipSegmentsVersionPath	.\ZipImportSegments

AppPath
Description

DynLab ver.: 4.0.0.13   Free RAM : 000000 Bytes   Free FLASH : 000000 Bytes   [Device] -   [Manufacturer] -   [Serial Number] -

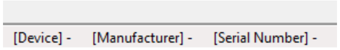
Picture 20

BatchFlashFiles – directory path for D-code segment files saving. They will be stored into FLASH instrument memory.

BatchRAMFiles – directory path for D-code segment files saving. They will be stored in RAM instrument memory. These are temporary segments used to check or service your device.

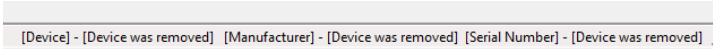
InstrumentElements - file name, e.g. Constants.ini with the layout of the motors, system inputs and outputs

The connection status of the instrument is displayed in the lower bar of the DynLab window. It is displayed before or after disconnection



[Device] -   [Manufacturer] -   [Serial Number] -

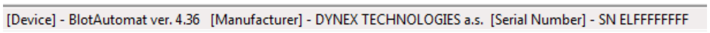
or



[Device] - [Device was removed]   [Manufacturer] - [Device was removed]   [Serial Number] - [Device was removed]

.

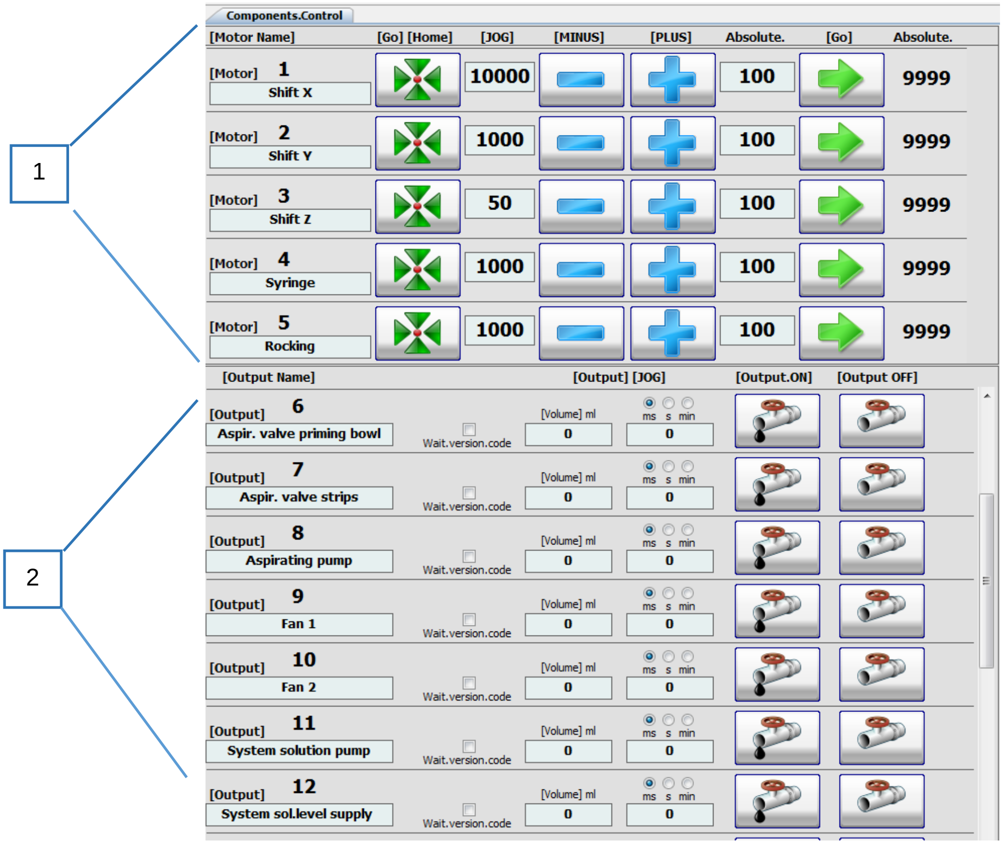
If the instrument is connected via USB to the PC, the firmware version of the mainboard is listed on the right side of the bar.



[Device] - BlotAutomat ver. 4.36   [Manufacturer] - DYNEX TECHNOLOGIES a.s.   [Serial Number] - SN ELFFFFFFFF

3.2 Manual control of individual instrument components

Manual control of the instrument components can be used to diagnose device defects or to search for movements coordinates while setting instrument parameters. The window *Components control* opens from the *Instrument / Components control* or by an icon . The left part of the window is used for control.



[Motor Name]	[Go] [Home]	[JOG]	[MINUS]	[PLUS]	Absolute.	[Go]	Absolute.
[Motor] 1 Shift X		10000			100		9999
[Motor] 2 Shift Y		1000			100		9999
[Motor] 3 Shift Z		50			100		9999
[Motor] 4 Syringe		1000			100		9999
[Motor] 5 Rocking		1000			100		9999

[Output Name]		[Output] [JOG]		[Output.ON]	[Output OFF]
[Output] 6 Aspir. valve priming bowl	☐ Wait.version.code	[Volume] ml 0	● ms ○ s ○ min 0		
[Output] 7 Aspir. valve strips	☐ Wait.version.code	[Volume] ml 0	● ms ○ s ○ min 0		
[Output] 8 Aspirating pump	☐ Wait.version.code	[Volume] ml 0	● ms ○ s ○ min 0		
[Output] 9 Fan 1	☐ Wait.version.code	[Volume] ml 0	● ms ○ s ○ min 0		
[Output] 10 Fan 2	☐ Wait.version.code	[Volume] ml 0	● ms ○ s ○ min 0		
[Output] 11 System solution pump	☐ Wait.version.code	[Volume] ml 0	● ms ○ s ○ min 0		
[Output] 12 System sol.level supply	☐ Wait.version.code	[Volume] ml 0	● ms ○ s ○ min 0		

Picture 21

Stepper motors motion control (1)

There are the names of the individual stepper motors in the rows :

X Motor	- travel of the working arm right (+) and left (-)
Y Motor	- travel of the pipette module forward (+) and backward (-)
Z Motor	- travel of the pipette needle down (+) and up (-)
Plun.pump	- travel of the piston syringe for filling (+) and dispensing (-)

Rocking Motor – rotation of the excentric wheel for rocking of the plate holder

The motors are operated with the buttons


- getting to the starting position (it starts movement towards the home sensor and stops when the signal is activated)


- relative shift of the coordinate value listed in the column *JOG*


- shift to the absolute value of the coordinate listed in the column *Absolute* (on the left from button.The current position coordinate is displayed in the column *Absolute* (on the right).

Control of binary outputs (2)

There are the names of the individual parts of the instrument connected to the outputs in the rows:

Heating	- power supply of the heating foil controler
Needle cleaning valve	- pinch valve of the needle cleaning cuvette aspiration
Aspiration arm valve	- pinch valve of the wells aspiration arm
Aspirating pump	- vacuum pump
Fan left	- left fan of the workspace
Fan right	- right fan of the workspace
System solution pump	- peristaltic pump of the system solution
System sol.level supply	- supplying the level detection circuits in the system solution bottle holder

LED 1 - LED 9	- indicating LEDs of the reagent peristaltic and system solution pumps
Pump 1 - Pump 8	- reagent peristaltic pumps
3-way valve	- 3-way valve (system solution flows into: Off – the needle cleaning cuvette, On - the syringe)
Camera light	- LED lighting1 and 2 for the camera

The outputs are controlled by buttons:

- turning the ouput ON (depending on the power-on parameters)

- turning the output OFF

Turning on can be parameterized in the fields

Volume ml – if the outputs are provided with volumetric calibration (here outputs Pump 1 - 8), it is possible to enter the volume in tenths of ml. Then the pump is triggered only in relation to its calibration constant stored in i-parameters for the time required to pump the specified volume. When the value 0 is entered, the pump is started continuously.

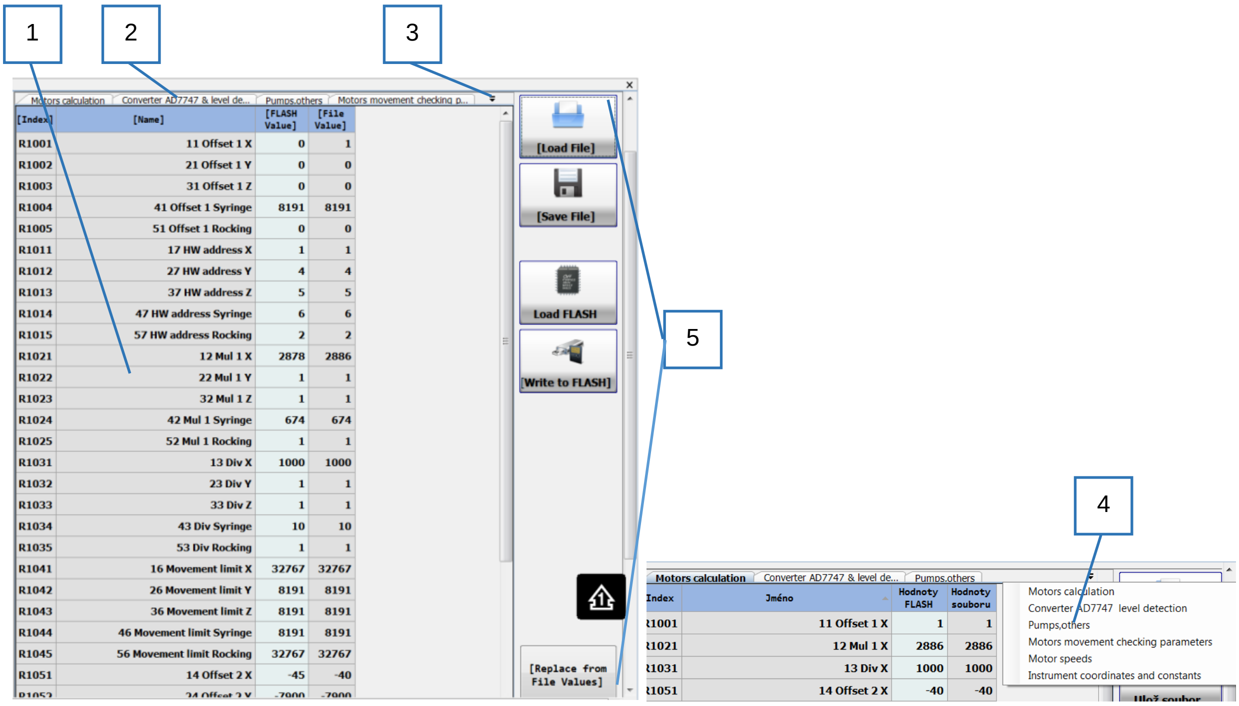
Ms s min – according to the selected unit, the output is switched only for the specified time. When the value 0 is entered, the output is started continuously.

Wait.version code – when selecting the switching output option to the specified volume or time, It blocks the possibility of simultaneously switching another output.

3.3 Setting the instrument parameters and storing in FLASH memory

The parameters (i-parameters) affecting the firmware are stored in the instrument memory. Some parameters are the same for all instruments of one type, other may vary slightly for each piece manufactured.

The left part of the window *Components Control* is used to edit and save i-parameters. It is opened by *Instrument / Components Control* or an icon .



[Index]	[Name]	[FLASH Value]	[File Value]
R1001	11 Offset 1 X	0	1
R1002	21 Offset 1 Y	0	0
R1003	31 Offset 1 Z	0	0
R1004	41 Offset 1 Syringe	8191	8191
R1005	51 Offset 1 Rocking	0	0
R1011	17 HW address X	1	1
R1012	27 HW address Y	4	4
R1013	37 HW address Z	5	5
R1014	47 HW address Syringe	6	6
R1015	57 HW address Rocking	2	2
R1021	12 Mul 1 X	2878	2886
R1022	22 Mul 1 Y	1	1
R1023	32 Mul 1 Z	1	1
R1024	42 Mul 1 Syringe	674	674
R1025	52 Mul 1 Rocking	1	1
R1031	13 Div X	1000	1000
R1032	23 Div Y	1	1
R1033	33 Div Z	1	1
R1034	43 Div Syringe	10	10
R1035	53 Div Rocking	1	1
R1041	16 Movement limit X	32767	32767
R1042	26 Movement limit Y	8191	8191
R1043	36 Movement limit Z	8191	8191
R1044	46 Movement limit Syringe	8191	8191
R1045	56 Movement limit Rocking	32767	32767
R1051	14 Offset 2 X	-45	-40
R1052	24 Offset 2 Y	-7900	-7900

Index	Jméno	Hodnoty FLASH	Hodnoty souboru
1001	11 Offset 1 X	1	1
1021	12 Mul 1 X	2886	2886
1031	13 Div X	1000	1000
1051	14 Offset 2 X	-40	-40

Picture 22

Table description (1)

I-parameters are placed in bookmarks in function groups. There are some links to bookmarks at the top of the table (2). The list of all bookmarks (4) opens by clicking the arrow (3).

The i-parameter group table contains columns:

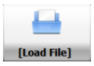
Index – the i-parameter register ID. According to this number, the i-parameters in the table are initially sorted.

Name – the name with the i-parameter function. When you click the column head, the i-parameters are alphabetically sorted by name. Names that start with a number then create a clear list of parameters, for example in order of how they are adjusted during the instrument set up.

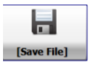
FLASH Value – i-parameter values read from the connected instrument. Values can be edited in this column.

File Value - i-parameter values retrieved from a file previously stored on a PC or from the default file FlashParams.ipar.

Description of buttons (5)



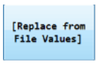
- opens a window to select a previously saved .ipar file. When you open the file, it displays its values in the column *File Values*. If the instrument is connected, it also reads the values from its memory into a column *FLASH Value*.



- opens a window to select the location and file name of the .ipar file. Subsequently, this file saves values from the *FLASH Value* column.

- reads the values from the instrument and saves them to the *FLASH Value* column. To create a table structure, the default file is FlashParams.ipar, whose values are displayed in the *File Values* column.

- writes the values from the *FLASH Value* column to the instrument memory. Before saving there is displayed an optional choice to store values into the file (see *Save File* button)



- in all tabs, the values of the *File Value* column are overwritten in the *FLASH Value* column.

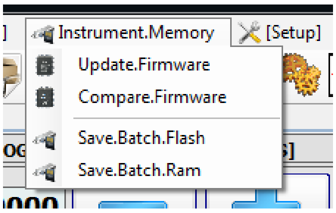
3.4 Updating firmware in processor memory

Mainboard firmware can be updated using DynLab software, via USB. Firmware updates are released fo this purpose as DBA_X_XX.S19 files.

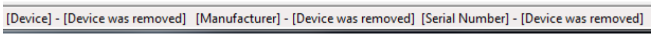
X_XX means the version number (e.g. DBA_4_38.S19 for version 4.38).

How to update firmware

When the instrument is turned on and connected, the *Instrument Memory / Update.Firmware* is selected.



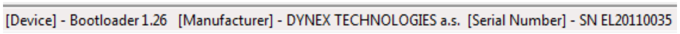
Disconnection of the instrument is shown in the lower bar for a short time.



[Device] - [Device was removed] [Manufacturer] - [Device was removed] [Serial Number] - [Device was removed]

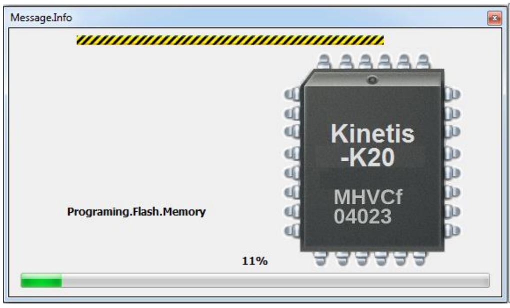
.

Then the Bootloader is connected and the .S19 file selection window is opened.



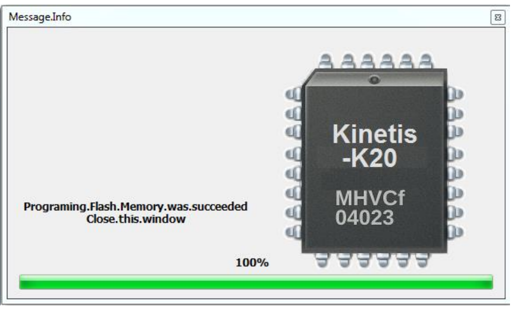
[Device] - Bootloader 1.26 [Manufacturer] - DYNEX TECHNOLOGIES a.s. [Serial Number] - SN EL20110035

Updating process and completion are shown in windows below:



Programing.Flash.Memory

11%



Programing.Flash.Memory.was.succeeded
Close.this.window

100%

Then the instrument must be turned OFF. The next time when the instrument is turned ON firmware is now up to date and running.

3.5 Saving D-code segments

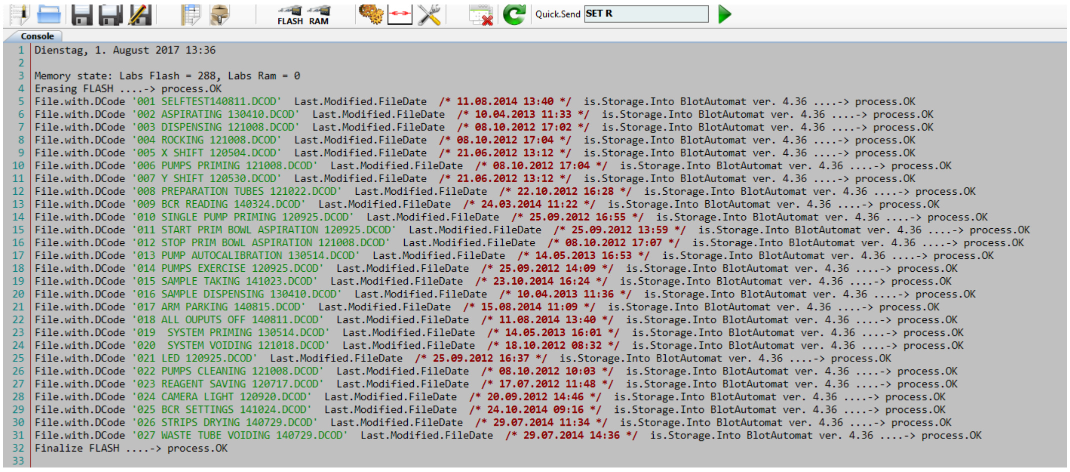
3.5.1 Saving segments to FLASH memory

Segments are short subroutines in D-code language. In the cases of update, they are released in the Segment package – File direcory. The name of this segment package is DBA_SegmentPack_X_X_X_X .
X_X_X_X means the version number (e.g. DBA_SegmentPack_1_2_0_0 for version 1.2.0.0).

NOTE
The D-code Segment package can also be saved to the instrument using application *Dynablot Automatic* for the device control. For this purpose, packages are released in one special file format (see 4 Import segments with Dynablot Automatic)

How to save D-code segments
Copy all package files to the directory that is set in the row *BatchFlashFiles*, window *Options*.
(e.g. to the directory BatchFlashFiles when set up
C:\Users\DynablotAutomatic\Documents\DynLab\BatchFlashFiles)

Storing segments in the memory starts in the menu: *Instrument Memory / Save Batch Into FLASH memory* or by the button LASH in the upper bar and confirm the check query.
A *Console* window opens in which the segments can be watched. After all segments are successfully saved, the following is displayed :



```
Dienstag, 1. August 2017 13:36

Memory state: Labs Flash = 288, Labs Ram = 0
Erasing FLASH ....-> process.OK
File.with.DCode '001 SELFTEST140811.DCOD'  Last.Modified.FileDate  /* 11.08.2014 13:40 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '002 ASPIRATING 130410.DCOD'  Last.Modified.FileDate  /* 10.04.2013 11:33 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '003 DISPENSING 121008.DCOD'  Last.Modified.FileDate  /* 08.10.2012 17:02 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '004 ROCKING 121008.DCOD'  Last.Modified.FileDate  /* 08.10.2012 17:04 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '005 X SHIFT 120504.DCOD'  Last.Modified.FileDate  /* 21.06.2012 13:12 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '006 PUMPS PRIMING 121008.DCOD'  Last.Modified.FileDate  /* 08.10.2012 17:04 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '007 Y SHIFT 120530.DCOD'  Last.Modified.FileDate  /* 21.06.2012 13:12 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '008 PREPARATION TUBES 121022.DCOD'  Last.Modified.FileDate  /* 22.10.2012 16:28 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '009 BCR READING 140324.DCOD'  Last.Modified.FileDate  /* 24.03.2014 11:22 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '010 SINGLE PUMP PRIMING 120925.DCOD'  Last.Modified.FileDate  /* 25.09.2012 16:55 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '011 START PRIM BOWL ASPIRATION 120925.DCOD'  Last.Modified.FileDate  /* 25.09.2012 13:59 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '012 STOP PRIM BOWL ASPIRATION 121008.DCOD'  Last.Modified.FileDate  /* 08.10.2012 17:07 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '013 PUMP AUTOCALIBRATION 130514.DCOD'  Last.Modified.FileDate  /* 14.05.2013 16:53 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '014 PUMPS EXERCISE 120925.DCOD'  Last.Modified.FileDate  /* 25.09.2012 14:09 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '015 SAMPLE TAKING 141023.DCOD'  Last.Modified.FileDate  /* 23.10.2014 16:24 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '016 SAMPLE DISPENSING 130410.DCOD'  Last.Modified.FileDate  /* 10.04.2013 11:36 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '017 ARM PARKING 140815.DCOD'  Last.Modified.FileDate  /* 15.08.2014 11:09 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '018 ALL OUPUTS OFF 140811.DCOD'  Last.Modified.FileDate  /* 11.08.2014 13:40 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '019  SYSTEM PRIMING 130514.DCOD'  Last.Modified.FileDate  /* 14.05.2013 16:01 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '020  SYSTEM VOIDING 121018.DCOD'  Last.Modified.FileDate  /* 18.10.2012 08:32 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '021 LED 120925.DCOD'  Last.Modified.FileDate  /* 25.09.2012 16:37 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '022 PUMPS CLEANING 121008.DCOD'  Last.Modified.FileDate  /* 08.10.2012 10:03 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '023 REAGENT SAVING 120717.DCOD'  Last.Modified.FileDate  /* 17.07.2012 11:48 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '024 CAMERA LIGHT 120920.DCOD'  Last.Modified.FileDate  /* 20.09.2012 14:46 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '025 BCR SETTINGS 141024.DCOD'  Last.Modified.FileDate  /* 24.10.2014 09:16 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '026 STRIPS DRYING 140729.DCOD'  Last.Modified.FileDate  /* 29.07.2014 11:34 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
File.with.DCode '027 WASTE TUBE VOIDING 140729.DCOD'  Last.Modified.FileDate  /* 29.07.2014 14:36 */  is.Storage.Into BlotAutomat ver. 4.36 ....-> process.OK
Finalize FLASH ....-> process.OK

```

Picture 23

3.5.2 Saving segments to RAM memory

For assembly or service activities, special segments can be temporarily stored in RAM memory. These segments can be run using DynLAb (see next chapter). After the instrument is turned off, the stored segments are deleted from the instrument memory.
The procedure for storing segments into RAM memory is similar to FLASH memory. Differences are in starting the storage and setting the path to the directory where the recording files are stored.
The path settings is in the row *BatchRAMFiles* of window *Options*.

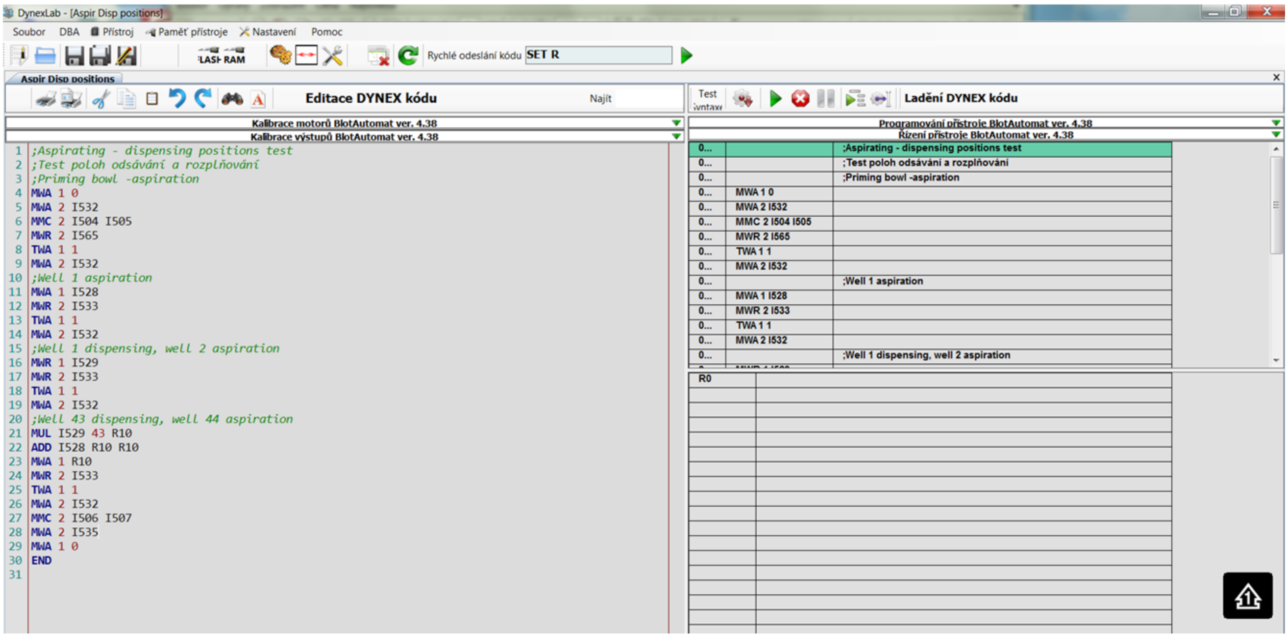
It starts up in the *Instrument memory / Save Batch Into RAM Memory* or by the button RAM in the upper bar.

3.6 Run execution of segments or individual D-code instructions

The D-code segment can be run in the DynLab software and according to its instructions, the individual activities of the Mainboard are progressively executed via USB.
If a segment contains a specific instruction, another segment stored in FLASH or RAM memory can be started. During the normal operation of the instrument, the segments of the package in FLASH memory are ran by the Dynablot Automatic application software. By running from DynLab software, the individual segments can be tested or it is possible to run segments specifically stored in RAM memory.

3.6.1 Running of the segment in DynLab SW

A segment opening is made from menu *File / Open* or by the button in the upper bar. A window with the opened segment file name appears.



Rychlé odeslání kódu: SET R

```
;Aspirating - dispensing positions test
;Test poloh odsávání a rozplňování
;Priming bowl -aspiration
MWA 1 0
MWA 2 I532
MMC 2 I504 I505
MWR 2 I565
TWA 1 1
MWA 2 I532
;Well 1 aspiration
MWA 1 I528
MWR 2 I533
TWA 1 1
MWA 2 I532
;Well 1 dispensing, well 2 aspiration
MWR 1 I529
MWR 2 I533
TWA 1 1
MWA 2 I532
;Well 43 dispensing, well 44 aspiration
MUL I529 43 R10
ADD I528 R10 R10
MWA 1 R10
MWR 2 I533
TWA 1 1
MWA 2 I532
MMC 2 I506 I507
MWA 2 I535
MWA 1 0
END
```

0...		;Aspirating - dispensing positions test
0...		;Test poloh odsávání a rozplňování
0...		;Priming bowl -aspiration
0...	MWA 1 0	
0...	MWA 2 I532	
0...	MMC 2 I504 I505	
0...	MWR 2 I565	
0...	TWA 1 1	
0...	MWA 2 I532	
0...		;Well 1 aspiration
0...	MWA 1 I528	
0...	MWR 2 I533	
0...	TWA 1 1	
0...	MWA 2 I532	
0...		;Well 1 dispensing, well 2 aspiration

R0	

Picture 24

You can edit the segment in the left part of the instruction window. However, segment creation is not the subject of this manual.
In the right part of the window there is a table with the same instruction structure and is intended to start the segment. To start, you can use these buttons above the table:

▶ - running the entire segment, the instruction line to be executed is highlighted in green. Segment run is terminated after END has been executed

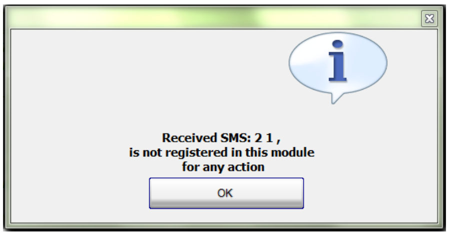
✖ - immediate stop of the executed segment

⏸ - pause of the segment runnning

- step-by-step instructions. Press the button to execute the instructions on the green line

- starting the run from the current executed line to the line that you clicked on.

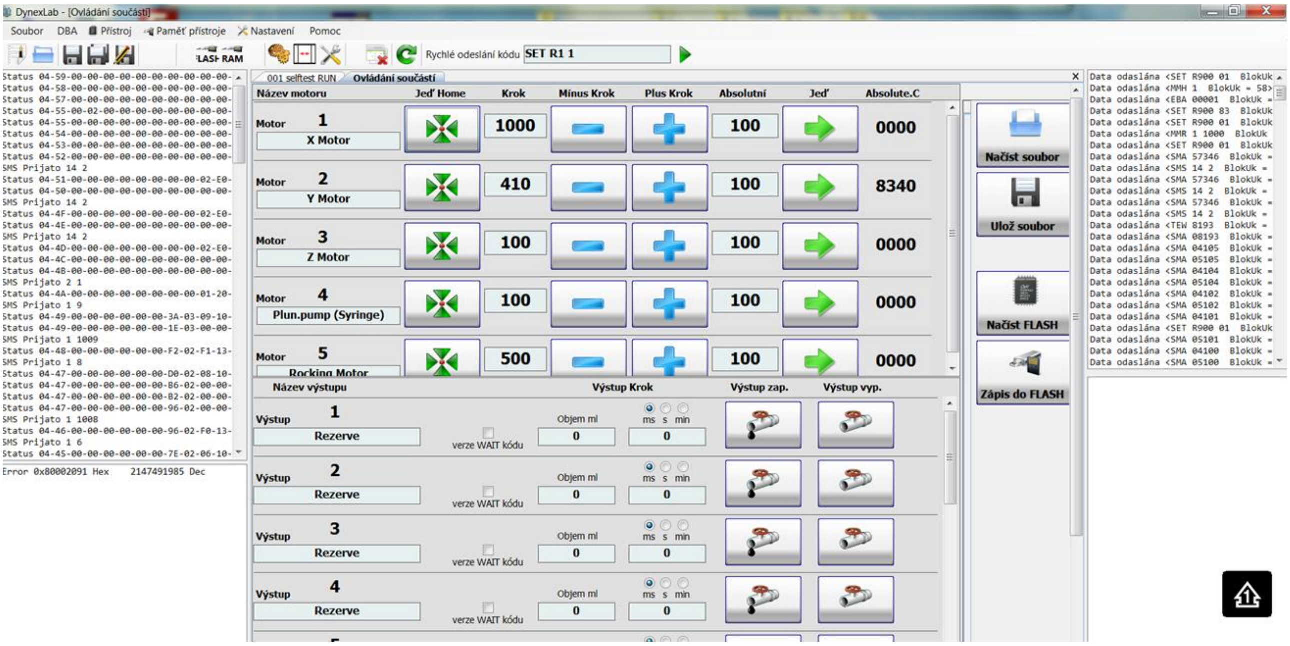
If the segment code contains instructions for sending messages (SMS X,X) the windows with information about SMS are displayed. These messages are used to communicate with the Dynablot Automatic application SW.



Received SMS: 2 1 ,
is not registered in this module
for any action

You can close individual message window by pressing the OK or all windows by button in the top bar.

Press the button in the top bar to open or close the information box on the sides of the main window where the communication between the DynLab SW and the instrument in logged.



Rychlé odeslání kódu: SET R1 1

```
Status 04-59-00-00-00-00-00-00-00-00-00-00-
Status 04-58-00-00-00-00-00-00-00-00-00-00-
Status 04-57-00-00-00-00-00-00-00-00-00-00-
Status 04-55-00-02-00-00-00-00-00-00-00-00-
Status 04-55-00-00-00-00-00-00-00-00-00-00-
Status 04-54-00-00-00-00-00-00-00-00-00-00-
Status 04-53-00-00-00-00-00-00-00-00-00-00-
Status 04-52-00-00-00-00-00-00-00-00-00-00-
SMS Prijato 14 2
Status 04-51-00-00-00-00-00-00-00-00-02-E0-
Status 04-50-00-00-00-00-00-00-00-00-00-00-
SMS Prijato 14 2
Status 04-4F-00-00-00-00-00-00-00-00-02-E0-
Status 04-4E-00-00-00-00-00-00-00-00-00-00-
SMS Prijato 14 2
Status 04-4D-00-00-00-00-00-00-00-00-02-E0-
Status 04-4C-00-00-00-00-00-00-00-00-00-00-
Status 04-4B-00-00-00-00-00-00-00-00-00-00-
SMS Prijato 2 1
Status 04-4A-00-00-00-00-00-00-00-00-01-20-
SMS Prijato 1 9
Status 04-49-00-00-00-00-00-00-3A-03-09-10-
Status 04-49-00-00-00-00-00-00-1E-03-00-00-
SMS Prijato 1 1009
Status 04-48-00-00-00-00-00-00-F2-02-F1-13-
SMS Prijato 1 8
Status 04-47-00-00-00-00-00-00-D0-02-08-10-
Status 04-47-00-00-00-00-00-00-B6-02-00-00-
Status 04-47-00-00-00-00-00-00-B2-02-00-00-
Status 04-47-00-00-00-00-00-00-96-02-00-00-
SMS Prijato 1 1008
Status 04-46-00-00-00-00-00-00-96-02-F0-13-
SMS Prijato 1 6
Status 04-45-00-00-00-00-00-00-7E-02-06-10-
```

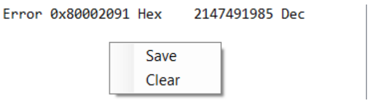
```
Error 0x80002091 Hex    2147491985 Dec
```

```
Data odaslána <SET R900 01  BlokUk
Data odaslána <MMH 1  BlokUk = 58>
Data odaslána <EBA 00001  BlokUk =
Data odaslána <SET R900 83  BlokUk
Data odaslána <SET R900 01  BlokUk
Data odaslána <MMR 1 1000  BlokUk
Data odaslána <SET R900 01  BlokUk
Data odaslána <SMA 57346  BlokUk =
Data odaslána <SMS 14 2  BlokUk =
Data odaslána <SMA 57346  BlokUk =
Data odaslána <SMS 14 2  BlokUk =
Data odaslána <SMA 57346  BlokUk =
Data odaslána <SMS 14 2  BlokUk =
Data odaslána <TEW 8193  BlokUk =
Data odaslána <SMA 08193  BlokUk =
Data odaslána <SMA 04105  BlokUk =
Data odaslána <SMA 05105  BlokUk =
Data odaslána <SMA 04104  BlokUk =
Data odaslána <SMA 05104  BlokUk =
Data odaslána <SMA 04102  BlokUk =
Data odaslána <SMA 05102  BlokUk =
Data odaslána <SMA 04101  BlokUk =
Data odaslána <SET R900 01  BlokUk
Data odaslána <SMA 05101  BlokUk =
Data odaslána <SMA 04100  BlokUk =
Data odaslána <SMA 05100  BlokUk =
```

Picture 25

In the case of a component control or running a segment, it is useful to follow the left lower field. It records errors that the instrument generates in the event of a malfunction (e.g. a motion error X is detected in the image).

The list of errors displayed in the field can be saved to a file or clear using the menu that opens by right-clicking on the area of the field .

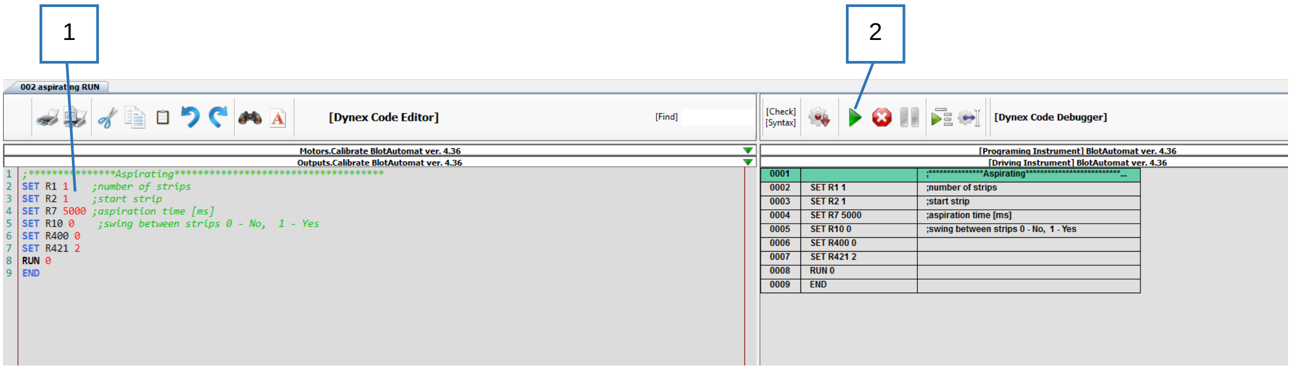


```
Error 0x80002091 Hex    2147491985 Dec
```

Use this button to reset USB communication between the PC and the instrument. It can be used in case of a problem.

3.6.2 Running of the segment stored in instrument memory

If the segment triggered by the procedure described in the previous chapter contains the instruction *RUN 0*, a segment stored in the instrument memory is executed after this instruction has been executed. Selection of this executed segment is done by the address set in the *R421* register. Before starting a segment from the instrument's memory, it is also necessary to set some registers to parametrize the segment's operation.
For example:
To perform a selftest of the instrument, you must run a segment 1 stored in the memory.
The DynLab SW opens or writes the startup segment:



```
;***************Aspirating************************************
SET R1 1    ;number of strips
SET R2 1    ;start strip
SET R7 5000 ;aspiration time [ms]
SET R10 0    ;swing between strips 0 - No,  1 - Yes
SET R400 0
SET R421 2
RUN 0
END
```

0001		;***************Aspirating**************************...
0002	SET R1 1	;number of strips
0003	SET R2 1	;start strip
0004	SET R7 5000	;aspiration time [ms]
0005	SET R10 0	;swing between strips 0 - No, 1 - Yes
0006	SET R400 0	
0007	SET R421 2	
0008	RUN 0	
0009	END	

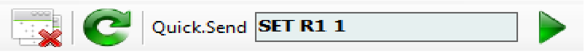
Picture 26

In the left part of the table you can overwrite some registry values as described in their rows (1).

After pressing the button (2), the boot segment is stored and its instructions are executed. The *RUN 0* instruction initiates the instrument selftest segment.

3.7 Running an individual D-code instructions

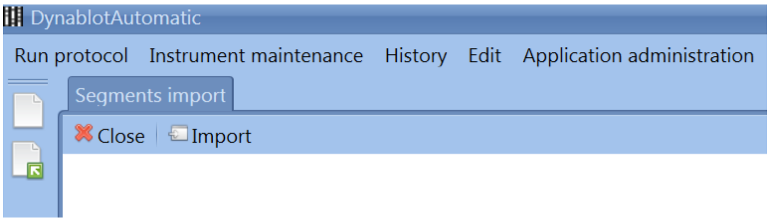
You can send a single D-code to the command line .
Intructions are written to a line and this button sends them to the instrument for execution.



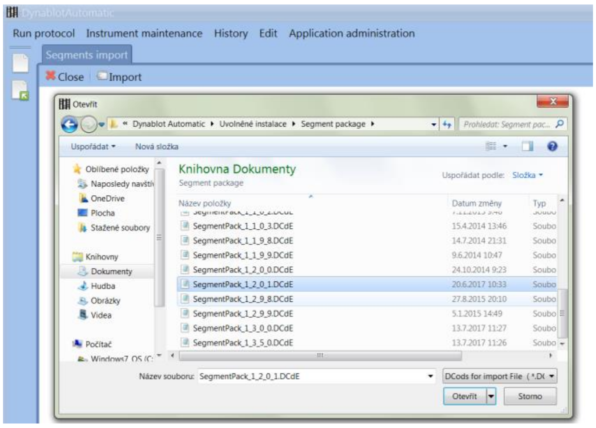
SET R1 1

4 Import segments with Dynablot Automatic application

The segment pack can also be saved to the intrument using the Dynablot Automatic application software. For this purpose, *SegmentPack_A_B_C_D.DcdE* files are issued.
The version number consists of four digits. The condition to make the saving is that the digits A and B of the package are the same as the digits in the version of the Dynablot Automatic application software. This monitors package and software compatibility.
In order to save the segment package to the instrument there must be logged a user as *Administrator* or *Service* in the application software. (see Dynablot Automatic User guide)
Use the *Application administration / Segments import* menu to open the window



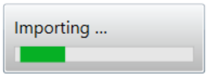
Press the button Import to open a dialog to select the segment package

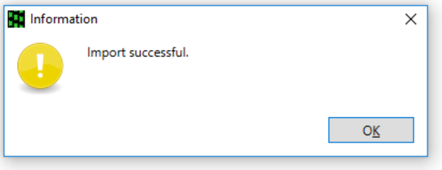


Název položky	Datum změny	Typ
SegmentPack_1_1_0_3.DCdE	15.4.2014 13:46	Soubo
SegmentPack_1_1_9_8.DCdE	14.7.2014 21:31	Soubo
SegmentPack_1_1_9_9.DCdE	9.6.2014 10:47	Soubo
SegmentPack_1_2_0_0.DCdE	24.10.2014 9:23	Soubo
SegmentPack_1_2_0_1.DCdE	20.6.2017 10:33	Soubo
SegmentPack_1_2_9_8.DCdE	27.8.2015 20:10	Soubo
SegmentPack_1_2_9_9.DCdE	5.1.2015 14:49	Soubo
SegmentPack_1_3_0_0.DCdE	13.7.2017 11:27	Soubo
SegmentPack_1_3_5_0.DCdE	13.7.2017 11:26	Soubo

Název souboru: SegmentPack_1_2_0_1.DCdE
DCods for import File (*.D(

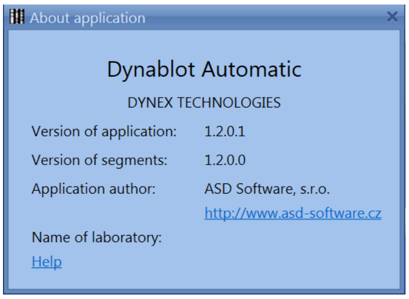
These windows below inform about the progress and completion of the import:


Importing ...



Import successful.

This import is registered in the database of the application and the package version is displayed in the *Application administration / About application*.



Dynablot Automatic
DYNEX TECHNOLOGIES
Version of application: 1.2.0.1
Version of segments: 1.2.0.0
Application author: ASD Software, s.r.o.
http://www.asd-software.cz
Name of laboratory:

5 Setting procedures

This chapter describes how to set up your instrument. The subchapters are sorted according to the order in which the new instrument is being set up.

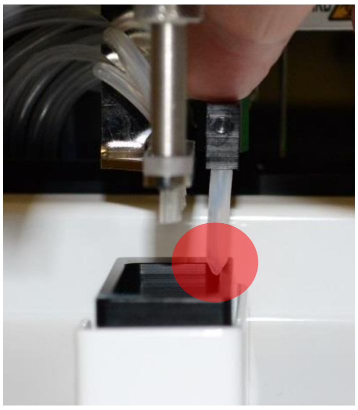
5.1 Position adjustment of home position sensors

Home sensors work on a magnetic principle. The sensor is located on a small printed circuit board, the magnet is on the moving part. As the magnet approaches the sensor, a signal is sent to the control unit. The mechanical adjustment is to fix the printed circuit board with the sensor so that the signal is sent in the desired position of the monitored moving part. The adjustment is performed when the instrument is switched on without selftesting. In this state, movable parts can be moved manually and the sensor signal can be monitored by LEDs on the electronics boards.

5.1.1 Home sensor of X motion

The location of the sensor, Picture 17 position 3. Signal indication is on the Mainboard, Picture 18 position 2.
With the correct sensor position, the fastening screws are approximately halfway through the oval hole on the board. The horizontal position of the board must be kept up.

The LED lights up when the arm moves from the right to the left when the tube of the aspiration arm is on or near the edge of the cuvette.

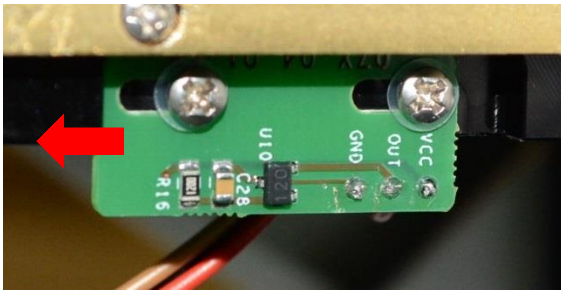


Picture 27

5.1.2 Home sensor of Y motion

The location of the sensor, Picture 5 position 3. Signal indication is on the Armboard, Picture 19 position 1.

The position of the sensor is not critical. Set the left extreme position.

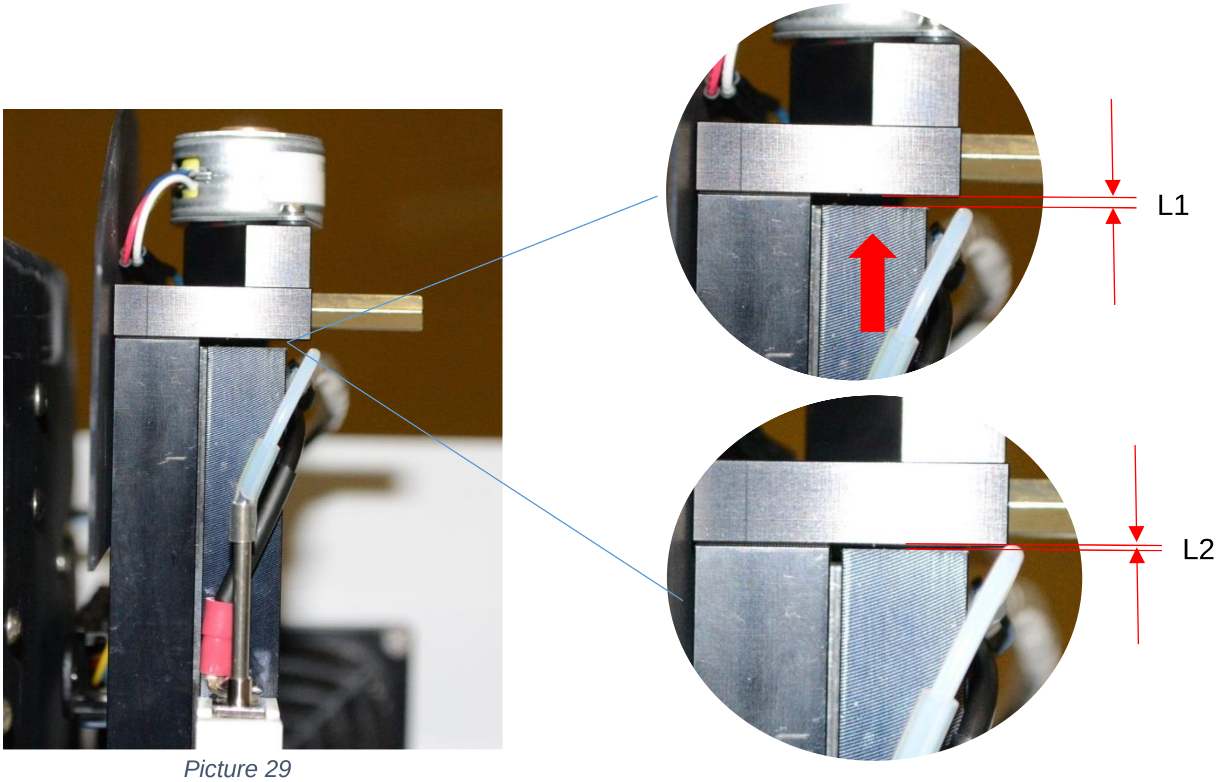


Picture 28

5.1.3 Home sensor of Z motion

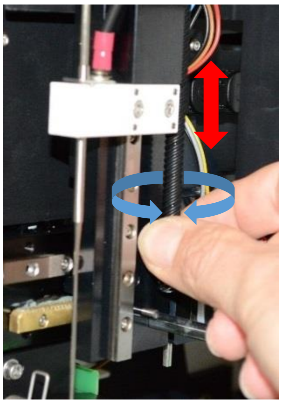
The location of the sensor, Picture 5 position 9. Signal indication is on the Armboard, Picture 19 position 2.

The LED is lit when moving from the bottom up and when the gap between the engine block and the needle block is L1 = 1.5 to 2 mm.
After the movement Z moves to the 0 coordinate, the gap is L2 = 0.5 mm. There must be no block collisions!



Picture 29

When looking for the position L1 then Z shift motion can be done manually by rotating of the bolt.



Obr. 30

Checking the movement to the coordinate 0 can be done by DynLab SW:
First use the instruction *MMC 3 1 1* to set the movement speed (see 3.7 Running an individual D-code). Next use the relative movement (-200) to exit the starting position, then the movement to *Home* position, then the relative movement (-200) to exit the starting position again and then the absolute movement to coordinate 0 (see 3.2 Manual control of individual instrument components).

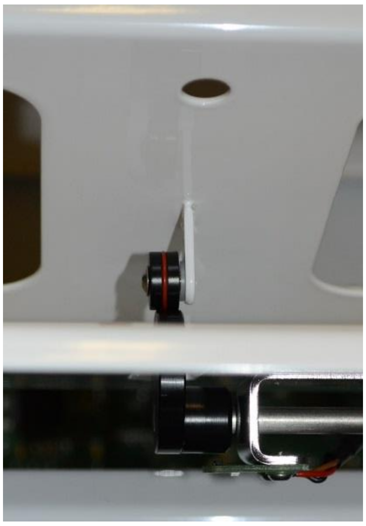
5.1.4 Home senzor syringe

The home sensor of the original piston syringe position is an integral part of this component and does not need to be set.

5.1.5 Home sensor of rocking

The location of the sensor, Picture 14 position 3. Signal indication is on main board, Picture 18 position 3.

Precise sensor position adjustment is not required. The LED is on when the eccentric wheel is in the upper position.

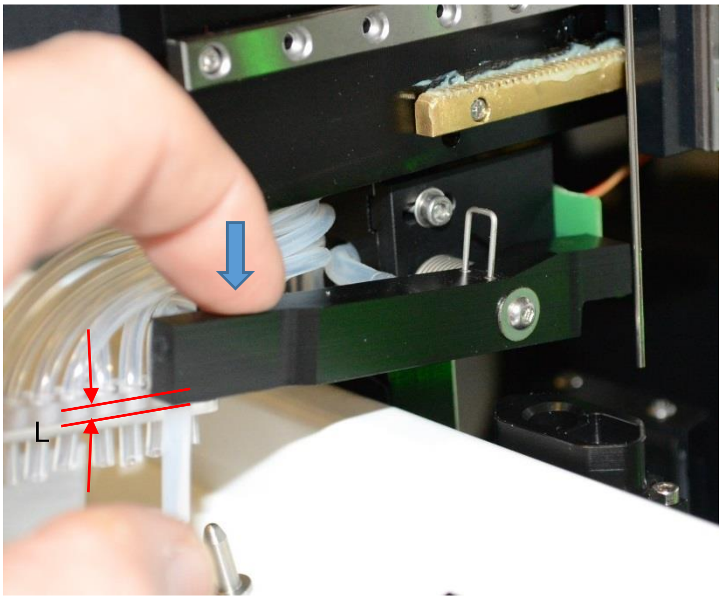


Picture 31

5.1.6 Aspiration arm

The location of the sensor, Picture 5 position 10. Signal indication is on the Armboard, Picture 19 position 4.
The aspiration arm does not have ist own drive. Y shift is used to control it. The aspiration arm sensor is used only to indicate that the arm is in the upper position by means of a the spring action.

The position of the sensor is set so that the LED in the upper position of the arm lights up and goes out by pushing the arm about L = 2mm.

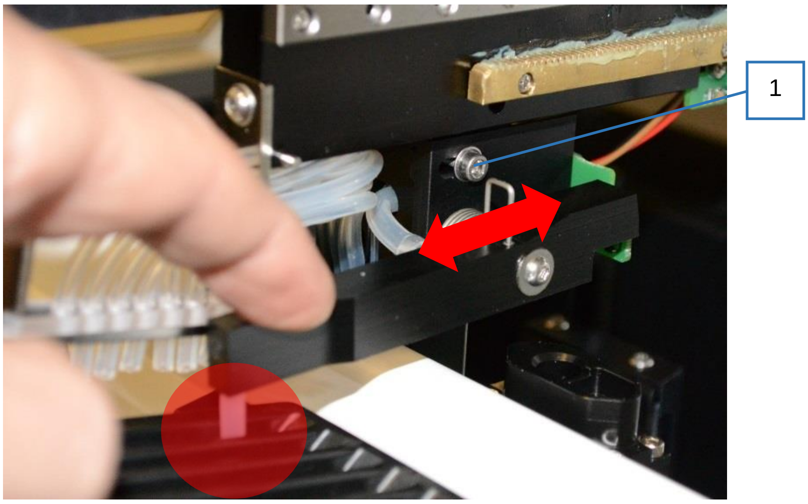


Picture 32

5.2 Setting aspiration and filling arms of reagents

The arms are adjusted so that their position corresponds to the spacing between the adjacent strip wells in the tray inserted in the holder. The holder is in the top position when setting up.

The position of the aspiration arm is set first.
In the correct position, the aspiration tube touches the bottom of the well at the point of its rear corner to achieve as complete aspiration of the well content as possible.

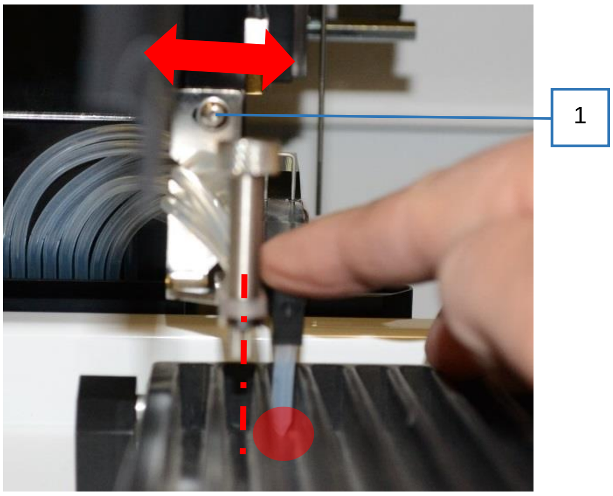


Picture 33

Once the fixing screw (1) is released, the arm assembly together with the sensor can be moved to the correct position. Then the screw is secured again.

Subsequently, the mutual position of the filling arm and the aspiration arm is adjusted.

The aspiration arm tube is places in the center of the well plate by moving the entire working arm. The filling arm is adjusted so that the ends of the tubes are above the center of the adjacent well on the left.

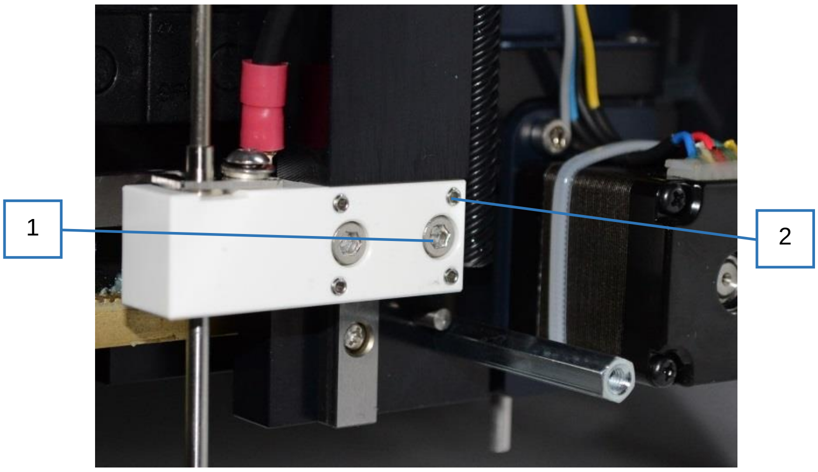


Picture 34

Once the fixing screw (1) is released, the arm can be moved to the correct position. Then the screw is secured again.

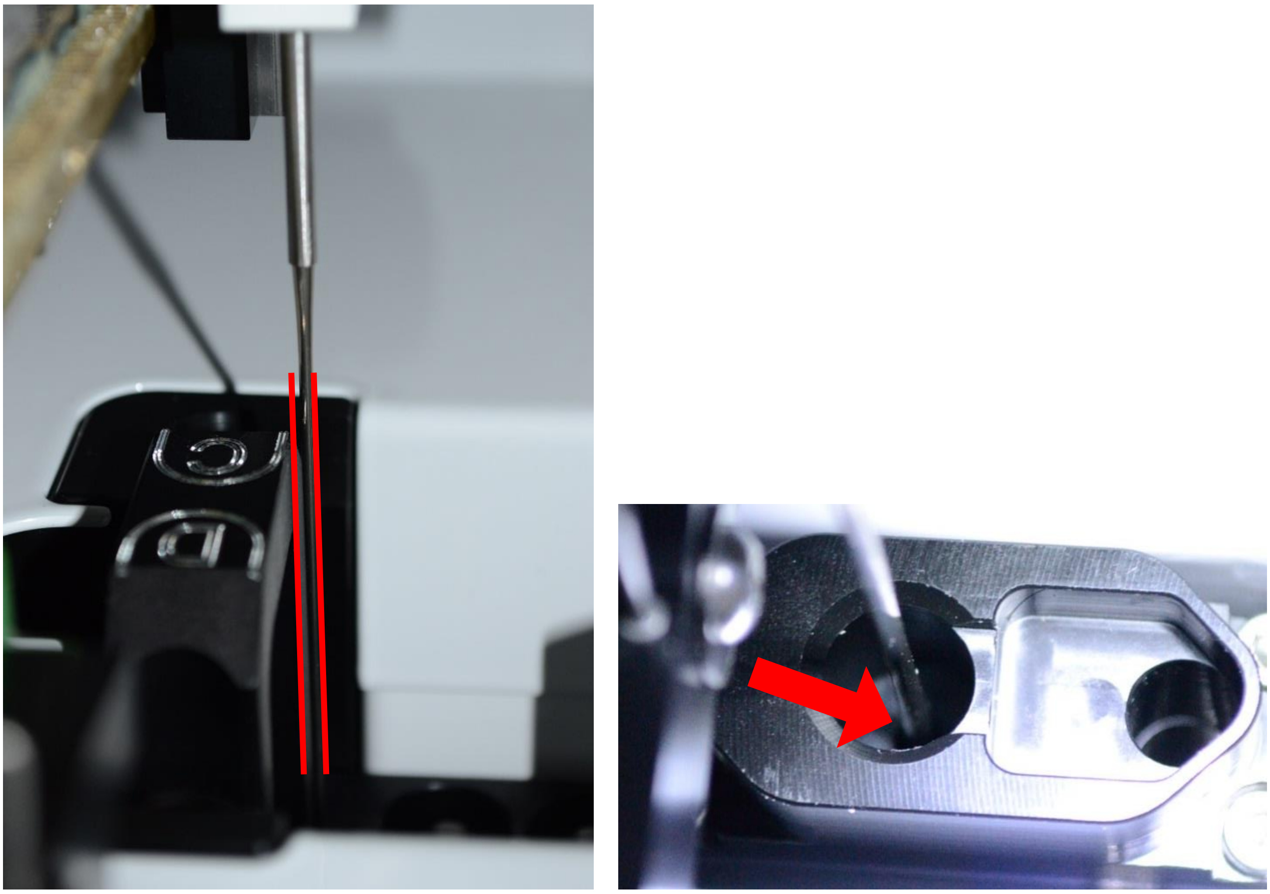
5.3 Setting mechanical positions of needle

The mechanical setting of the needle position is influenced by the overall position of the working arm. To fine-tighten the needle position, use 4 screws on the needle holder.



Picture 35

After the two fastening screws (1) are slightly released, the needle parallelism with the tube rack (Picture 36 on the left) and the needle position in the center of the hole in the bottom of the cleaning cuvette (Picture 36 on the right) can be adjusted by manipulating the four adjustment screws (2). Then tighten the fixing screws carefully and check the position again.



Picture 36

5.4 Vacuum in the waste bottle adjustment

To set the vacuum level, a tube with a connector can be used to connect the pressure gauge to the waste bottle, which is disconnected from the cuvette for calibration of the pumps (2.6 Calibration cuvette).

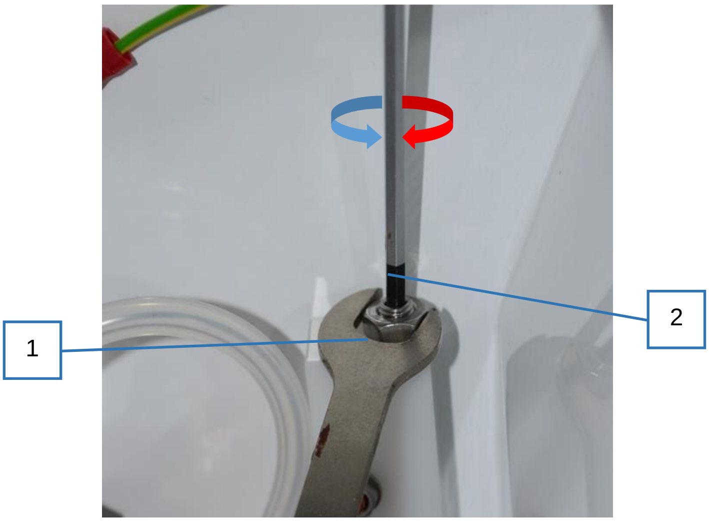
Picture 37

5.4.1 The maximum vacuum value adjustment

The maximum vacuum value in the waste bottle is set by the vacuum regulator (see Picture 13 position 12).

Before setting, make sure that the waste tubes are properly inserted in the pinch valves (see Picture 2 positions 9 and 10) and the waste bottle lid is tightly tightened.

Switch the instrument ON and using the DynLab SW start the vacuum pump (see Picture 21 output 8 Aspirating pump). The vacuum value must be stabilize at about 200 mBar, at least at 160 mBar.



Picture 38

Before manipulation with the adjusting screw (2), it is necessary to release the fixing nut (1) and tighten it after adjustment. By tightening the adjustment screw, the negative pressure increases.

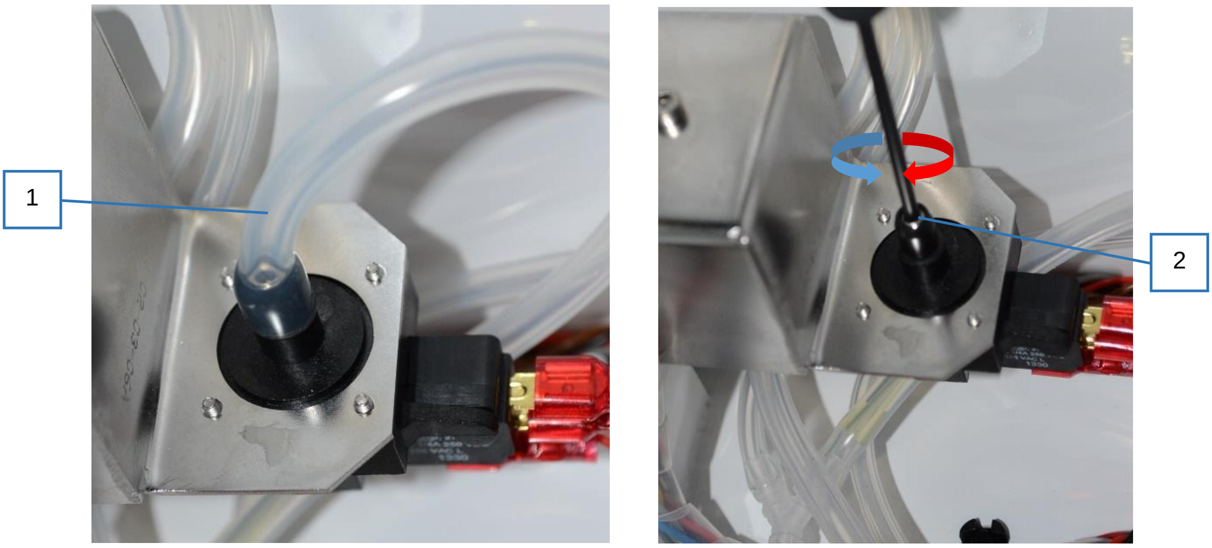
If the vacuum is stabilized at a higher value than needed, by enabling the adjusting screw the vacuum will not decrease immediately as this prevents the non-return valve. If pressure is to be lowered, it is necessary first to loosen the adjusting screw, then lower the vacuum in the bottle by releasing its lid. After the lid is tightened, the vacuum will stabilize after a while.

5.4.2 The vacuum in waste bottle sensor adjustment

Sensor adjustment is to set the vacuum value at which contacts are switched (see picture 13 position 11).

Switching the contacts can be monitored by the control LEDs on the mainboard (see PicturePicture 18 position 4). Switch the instrument ON and start the vacuum pump by DynLab (see Picture 21

Output 8 Aspirating pump). When the sensor is correctly set the control LEDs switch at about 60 mBar of the vaccum value. After the vacuum pump is stopped, the vacuum pressure can be reduced by hand by pressing one of the pinch valves manually. LEDs back switching occurs at about 70 mBar.



Picture 39

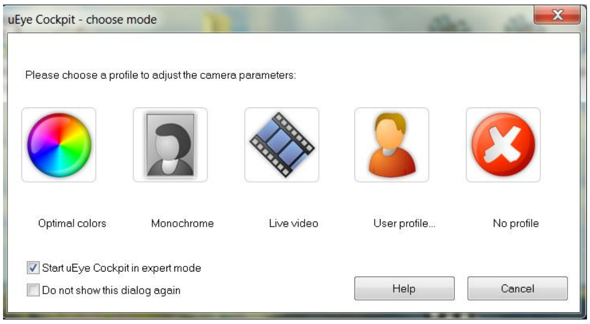
In the case of the sensor adjustment change, the inlet tube (1) must be disconnected. A new value can be set by turning the adjusting screw (2) at the sensor input. Then put the tube back and re-check the negative pressure for switching. By tightening, the underpressure value at which the switching occurs increases.

5.5 The camera system adjustment

5.5.1 The camera control software

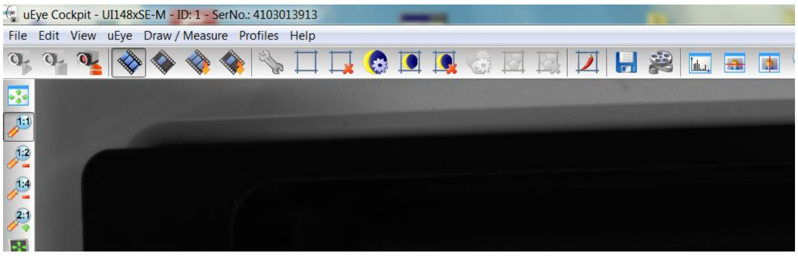
For service purposes, you can control the camera using the *uEye Cockpit* software that is installed along with the Dynablot Automatic application software.

Software is started using the icon uEye Cockpit, and selecting the parameters *No profile* ✗. If the cable is connected from the instrument camera's connector to the PC (see Picture 2 position 6), the camera is connected by pressing the button at the top bar. The live view of the camera is displayed in the window and the camera type and serial number in the top bar.


uEye Cockpit - choose mode

Please choose a profile to adjust the camera parameters:

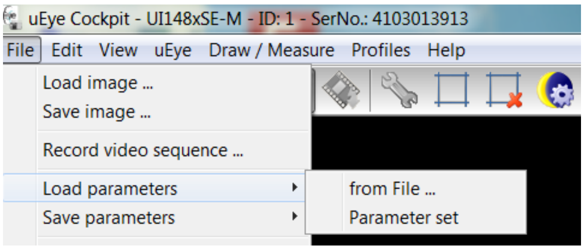
☑ Start uEye Cockpit in expert mode
☐ Do not show this dialog again

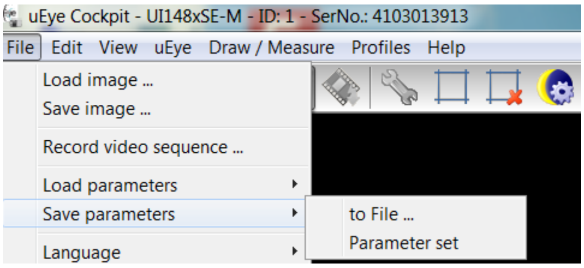


The subject of this manual is not a description of all the *uEye Cockpit* features. Described are only the functions used to set up Dynablot Automatic.

File of parameters

The camera setting is stored in the parameter file. Besides the file includes AOI, baud rate and shutter speed. The file is stored in the memory of each camera. For archiving, the file can be saved in a PC. These archive files are stored by manufacturer for each manufactured intrument under the name *Camera ini xxxx_xxxx_YYMMDD.ini*. During service change, new camera setting can be restored. The menu *File / Load parameters a Save parameters* is used to manipulate the file of parameters.





Load parameters / from File ... - the dialog for selecting the *.ini* file opens. Once the selection is confirmed, the live preview will begin to appear according to the new settings.

Load parameters / Parameter set – it retrieves the previously saved setting from the camera's memory and the live preview starts displaying according to the new setting

Save parameters / to File ... – the current setting is saved to the *.ini* file

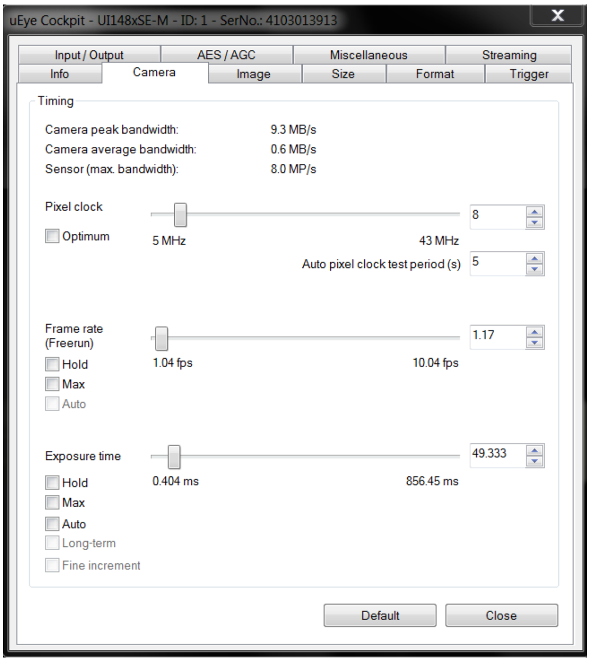
Save parameters / Parameter set – the current setting is stored into the camera's memory

Function of some other buttons

- live viewing closing and disconnecting the camera

1:1
1:2
1:4
2:1 - scaling the live view of the PC screen. Scale 1:2 shows the entire shot.

🔧 - Opens a window to view and set camera display parameters. The parameter groups are divided into individual bookmarks.



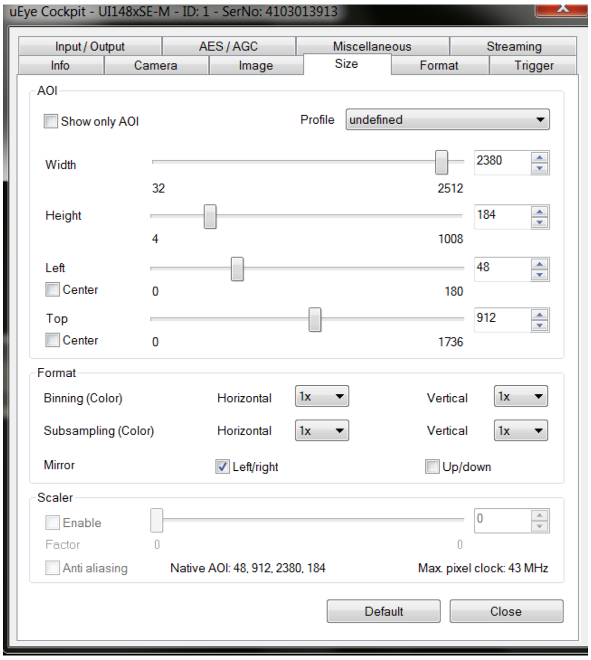
Timing

Camera peak bandwidth: 9.3 MB/s
Camera average bandwidth: 0.6 MB/s
Sensor (max. bandwidth): 8.0 MP/s

Pixel clock 8 (5 MHz – 43 MHz)
☐ Optimum
Auto pixel clock test period (s) 5

Frame rate (Freerun) 1.17 (1.04 fps – 10.04 fps)
☐ Hold
☐ Max
☐ Auto

Exposure time 49.333 (0.404 ms – 856.45 ms)
☐ Hold
☐ Max
☐ Auto
☐ Long-term
☐ Fine increment



AOI

☐ Show only AOI
Profile: undefined

Width 2380 (32 – 2512)
Height 184 (4 – 1008)
Left 48 (0 – 180)
☐ Center
Top 912 (0 – 1736)
☐ Center

Format

Binning (Color) Horizontal 1x Vertical 1x
Subsampling (Color) Horizontal 1x Vertical 1x
Mirror ☑ Left/right ☐ Up/down

Scaler

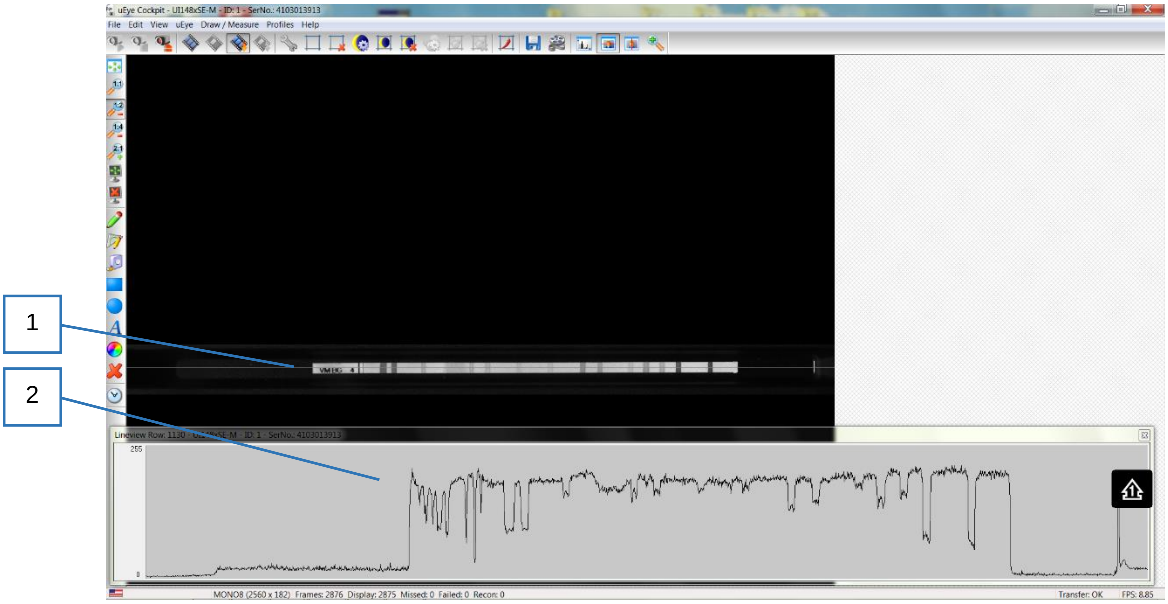
☐ Enable 0
Factor 0 0
☐ Anti aliasing
Native AOI: 48, 912, 2380, 184
Max. pixel clock: 43 MHz

For service activities are mainly used these parameters:

Camera / Exposure time – setting the shutter speed changes the brightness of the live preview

Size / AOI Width,Height,Left,Top - parameters changing the size and position of the area of interest from the overall camera view. These parameters are set so that the shot taken by camera contains just one well with a strip. In the instrument’s overall setting, these parameters are related to the setting of the position coordinates of the arm to capture strip images.

- opens / closes the window showing the signal level from the selected line of the camera shot.

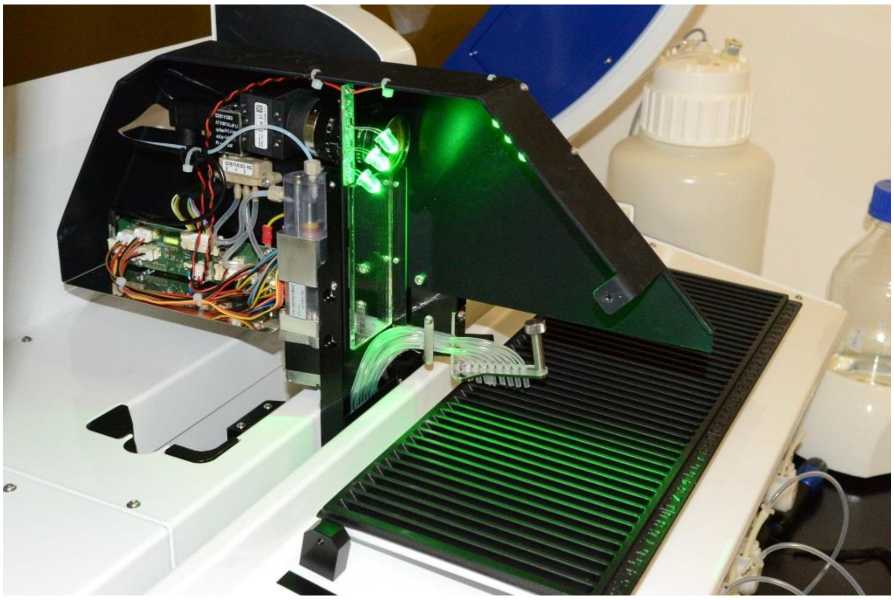


Picture 40

A live preview is displayed in the main part of the window (in this case, the AOI is already limited for the size of the well). When you turn on the signal display function, the line will appear in the preview (1). Its position is changing by dragging the mouse and is fixed with the left mouse button. You can change the position again by clicking on the cursor on the line. The window (2) with a brightness value graph on the row selected by the line is also displayed. The X axis shows the position of the points in the image, the Y axis is a brightness value in the range of 0 – 255 (0 = no light, 255 = maximum brightness or overexposed).

5.5.2 Mechanical position of camera adjustment

The mechanical adjustment of the camera is performed with the removed cover of the working arm (see Picture 6). A tray is inserted into the holder. Using DynLab software, the holder is set to a horizontal position and the light illuminates – 33 Camera light output.



Picture 41

Using the *uEye Cockpit*, the camera will be connected and a full view will be displayed in the live view. The exposure time is set so that the shape of the wells is clearly visible in the picture.

uEye Cockpit - UI148xSE-M - ID: 1 - SerNo.: 4103013913

MONO8 (2560 x 1920 Frames: 4353 Display: 4353 Missed: 0 Failed: 97 Recon: 0

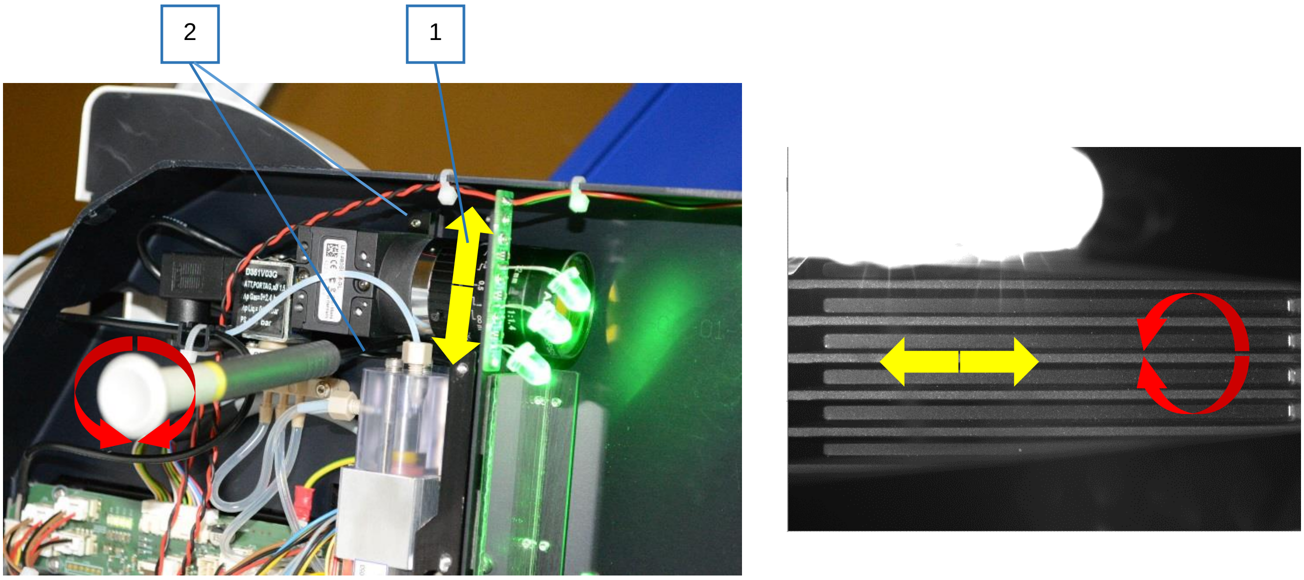
Picture 42

You can see the LED lighting 1 – trinity next to the mirror (1) and the tray image in the mirror (2). The position of the camera is not still adjusted in this case.

The position must be adjusted so that the wells are in the center of the shot in the longitudinal direction and parallel to the edge of the frame.

The position of the camera can be changed when two fixing screws (1) are partially released. To be accessible, the pipette module must be moved to the rear position.

Picture 43

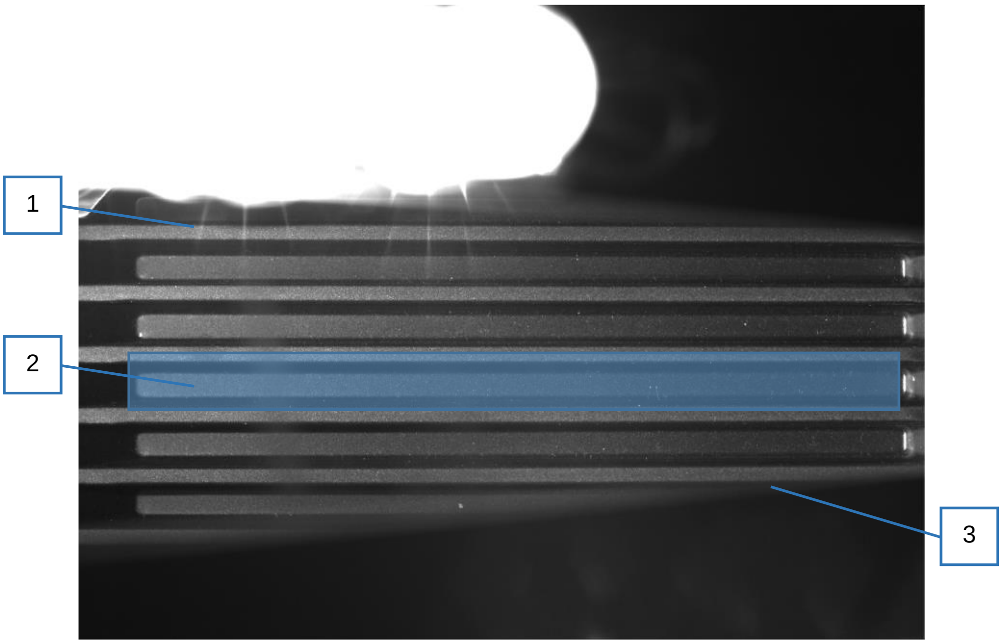


Picture. 44

Adjusting the well image to the center of the shot is done by manually rotating the camera in the direction (1). Parallelism is adjusted by tightnening the screw that is below or above the camera as required (2). After setting the camera position, both fixing screws must be tightened.

5.5.3 Area of Interest (AOI) adjustment

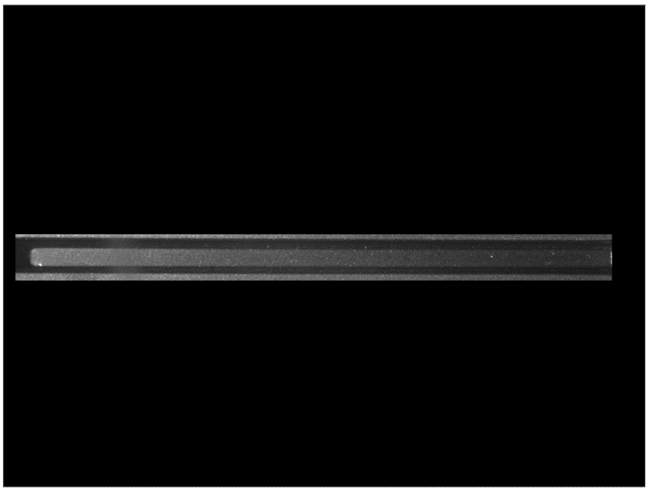
The area of interest of the camera is set so that the shot contains one well.



Picture 45

The area of interest (2) is set at about half the height of the shot. Care must be taken not to interfere with the glare (1) caused by the LED on the lens. The area of interest must be safely distant from the edge of the mirror (3).

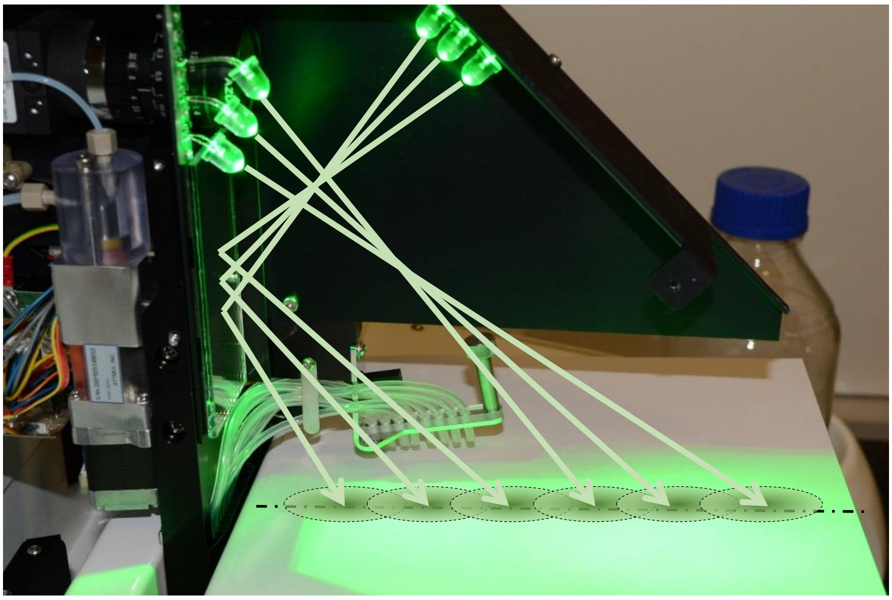
Once the AOI is set, the live preview is limited to the selected area.



Picture 46

5.5.4 Illumination, camera aperture and focus adjustment

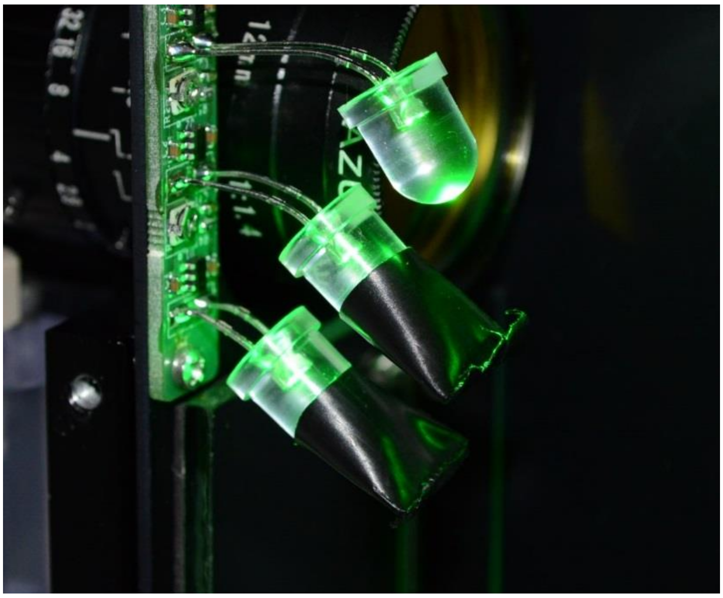
The illumination of the scanned strip is realized by means of two triplets of LEDs (see 8.9 Capturing strip images). Adjusting the illumination is to set the position of an individual LEDs so that the area of interest (AOI) captured by the camera is illuminated uniformly. Sharp changes of brightness are inadmissible in view of the correct evaluation of strip images.
The lighting lights up with the DynLab SW before adjusting, and a sheet of paper is placed on the plate holder.



Picture 47

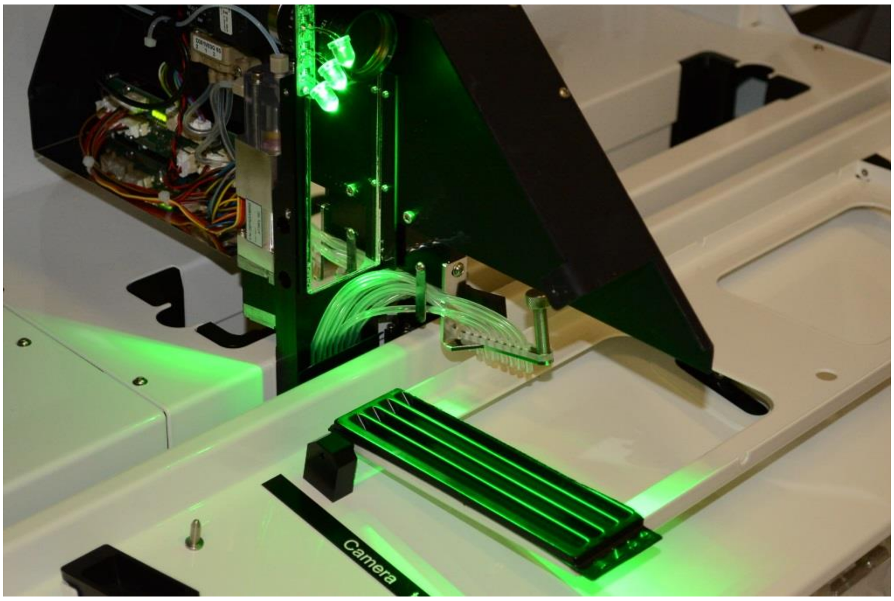
By changing the position of the individual LEDs by bending their leads, the presetting is done so that their light traces are in the lens axis and the order see Picture 47.

Tracking the light trail of one LED can be achieved by shading the other five LEDs using the sleeves.



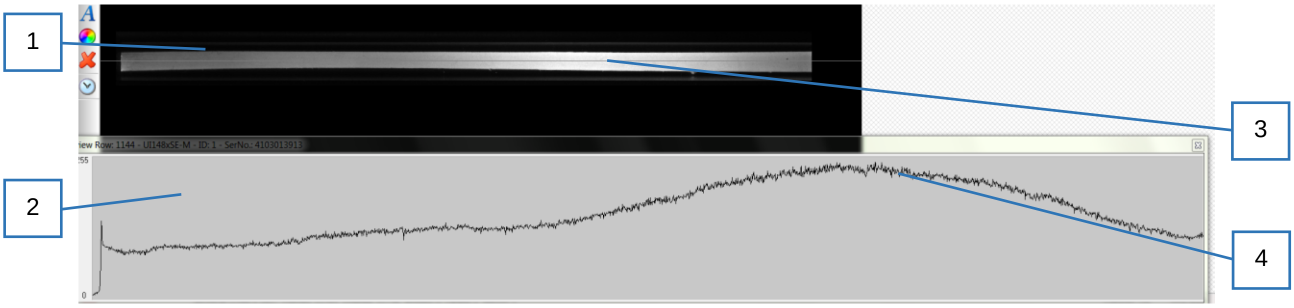
Picture 48

The next step is to balance the intensity of the light in the AOI of the camera. A calibration plate is inserted into the plate holder.



Picture 49

Use the *uEye Cockpit* to show live view of the camera. By downloading parameters from the camera (*File / Load parameters / Parameter set*) , only the AOI is displayed. The exposure time is set to 32 ms.

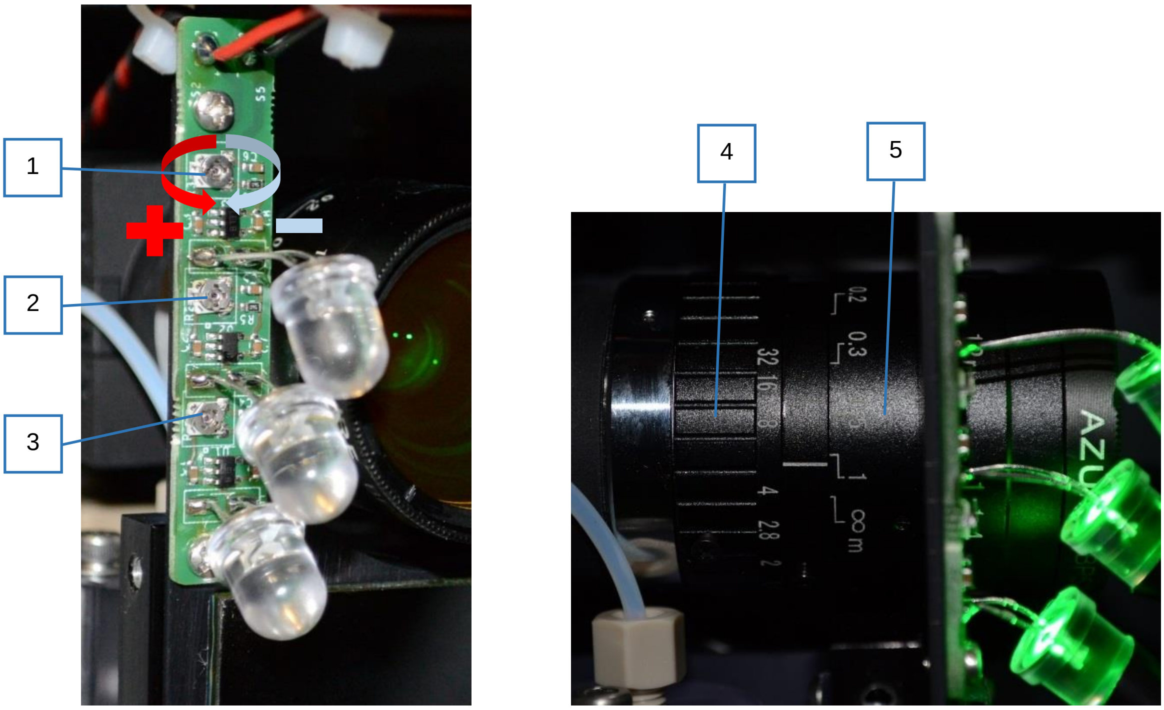


Picture 50

The white strip (1) from the calibration plate (fourth well) is displayed in the preview by changing the X position of the arm. Next, a window showing the signal level from the selected camera line opens (2) and the line of the tracked row (3) is set to the center of the well.

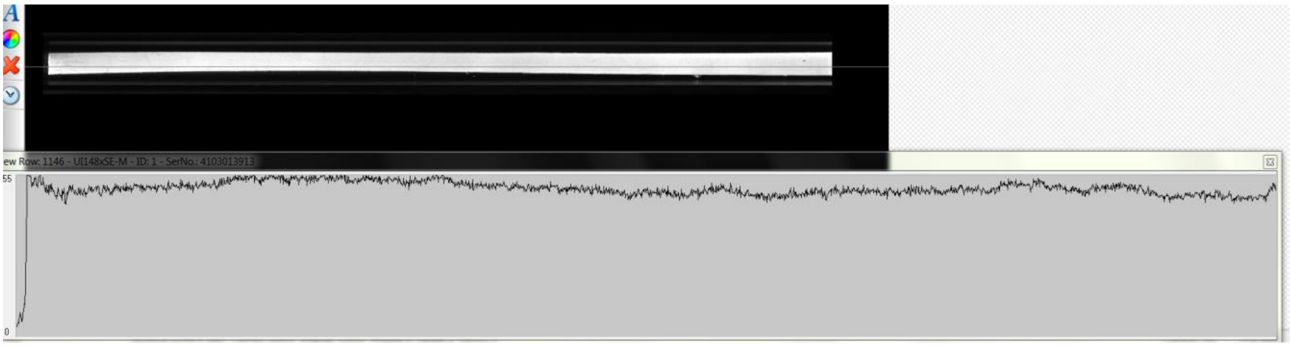
Subsequent alignment requires that the brightness curve (4) should be uniform and near the top of the window (the intensity of the brightest part of the strip will be a maximum of 255).

Uniformity adjustment is first achieved by gentle changes in the position of the LEDs and subsequently by adjusting the intensity of the individual LEDs. To achieve overall brightness, the camera lens aperture is used.



Picture 51

Change of the LED intensity is made by adjusting the potentiometers 1, 2 and 3.
The aperture is adjusted by turning the ring (4) on the camera lens. Caution – ring position is fixed by screw. It must be released before manipulation. The lens also has a focusing ring (5).



Picture 52

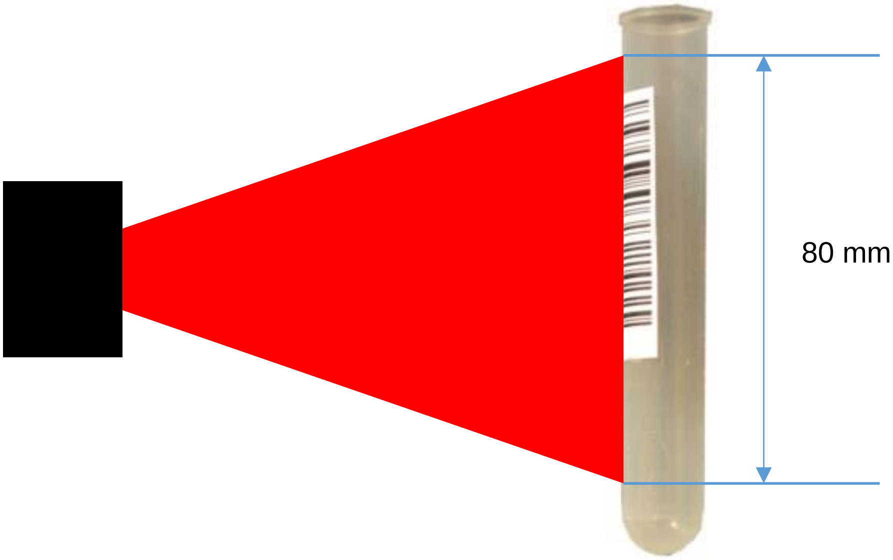
After adjustment, an example of the brightness curve is shown in Picture 52.

NOTE

When adjusting the LED position, the mirror surface may become dirty by touching the hand. This results in unevenness in brightness. Therefore, clean the mirrors if necessary.

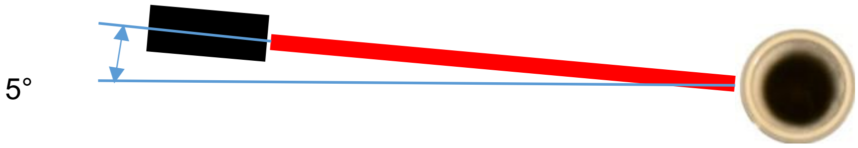
5.6 Setting barcode reader

The reader mechanical adjustment must meet two basic conditions to achieve reliable reading of the barcodes.



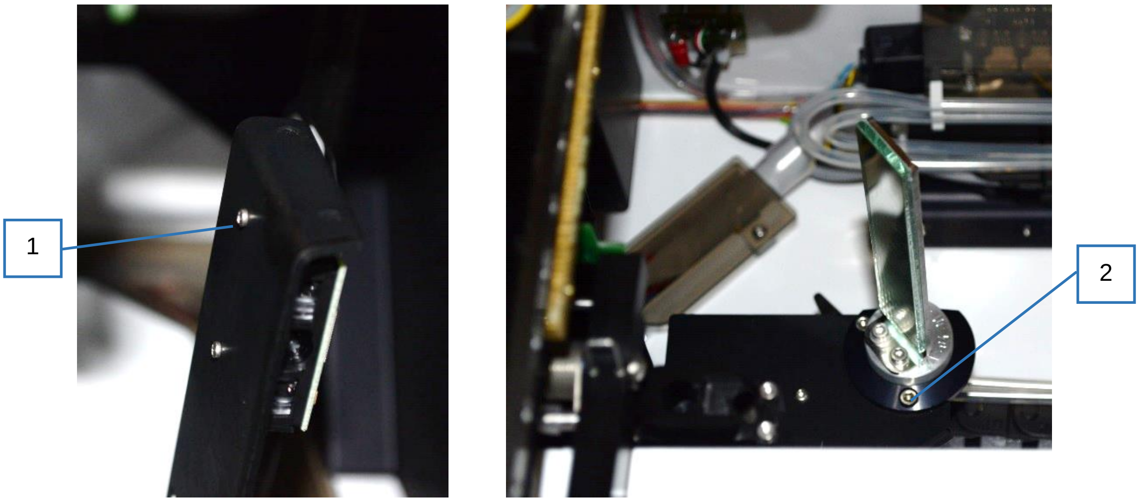
Picture 53

The viewing angle of the reader must cover the length of the largest sample tube inserted into the rack in the vertical direction. The lower limit is given by the size of the cutout in the tube rack, the upper by the tube height.



Picture 54

From the top view, the reader beam must deviate from the perpendicular direction by about 5° to suppress glare that prevents reliable code reading.



Picture 55

The entire reader mechanism is adjusted during instrument production.However, the position of the viewing angle can be gently adjusted by rotating the reader body after releasing the two screws (1).

Deviation from the perpendicular direction can be slightly adjusted by rotating of the entire mirror assembly after releasing the two screws (2).

Position of the reader check with the DynLab SW

A tube measuring 100 x 16 mm (maximum size for the rack) with a code at a height of 15 mm from the bottom (corresponding to the lower edge of the cutout in the rack) is used for testing.
After switching on the instrument and DynLab connection, the reader is initialized by sending the D-code: *BCR* 9 and BCR *12*.
Subsequently, by sending the *BCR 2* instruction, the reader is initialized. The red light switches on the reader. The light switches OFF immediately if the code is successfully scanned or after 5 seconds of light.

Picture 56

The tube is inserted into some position in the rack. The reading is initialized and the arm is moved by the hand to the reading position. Once the location is found, the reader is switched OFF almost immediately after every initialization. Subsequently, the tube is ejected so that the position of the code matches the maximum upper limit and the reading check is repeated.

5.7 Coordinate settings using i-parameters

The fine adjustment of the instrument is achieved by setting the coordinates with i-parameters. This corrects the mechanical differences between the instruments and the settings of the home sensors. The DynLab SW is used to find the correct coordinate values and store them into the i-parameters (see 3.3 Setting the instrument parameters and storing in FLASH memory)

5.7.1 Setting i-parameter of position X above the priming cuvette

In the correct position, the aspiration tube of the aspiration arm is near the right inner wall of the cuvette.

Picture 57

The position is set by changing the parameter *R1051 14 Offset 2 X* in the *Motors Calculation* tab as follows:

- Set the low movement speed X by sending the instruction *MMC 1 10 10*.
- Move the X arm with the relative feed in the *Component Control* window by about 10 cm to the right of the left edge position.
- The X arm is sent by motor to the home position
- The X arm is sent by motor to the absolute position 0.
- Subsequently, using a small relative shift (5 steps), the correct arm position is found (see PicturePicture 57).
- The value of the Absolute C. column (the last column in the motors control table) is added to the existing values of i-parameter R1051 and the parameters are written to the FLASH memory. R1051 typically ranges from -10 to -100.

You can check this setting by repeatedly moving to the home position and sending it to the absolute position 0.

5.7.2 Setting i-parameter of rocking control

The correct value is set by changing the *R1205 51 Check point Rocking* in the tab *Motors movement checking* as follows:

- Set the low rocking speed by sending the instruction *MMC 5 50 50*.
- By using the relative movement of the *Rocking Motor* the home position must be left. Indicating LED (see Picture 18 position 3) must be switched OFF.
- Rocking is sent to the home position with *Rocking Motor*.
- Continuous rocking operation is started by sending the absolute coordinate 6000.

- The home sensor LED is monitored and when it is OFF, the absolute position 20 is sent. The rocking should stop and the LED should light up
- Using a relative shift + with 5 steps value, a position is searched for when the LED switches OFF.
- The value from the *Absolute C*. column is written to the i-parameter R1205 and the parameters are written to the FLASH memory

5.7.3 Setting i-parameter coordinates and constants (Instrument coordinates and constants)

The manual control is used to set the instrument components to the correct positions when searching for coordinate values (see 3.2 Manual control of individual instrument components). After setting the correct position, the coordinate value (*Absolute C.* column) is written in *FLASH Value* column in the appropriate row of the parameter table. During setup the parameters values can be stored at any time into FLASH instrument memory, but at latest before closing DynLab SW.

Prior to coordinates setup, you need to initialize all movement by searching for the home position and setting the correct feed rate parameters. It can be accomplished by running the selftest segment (see 9.1.1 001 selftest RUN.Dcod). Prior to starting, *SET R1 0* is set, so only a part of the selftest is set to set the home positions.

Overview of parameters:

Index	**Name**	**Typical value**
R1566	001 X BCR selftest control code	150
R1551	002 X BCR mirror right side turn	6300
R1547	003 X BCR rear row control code	1000
R1548	004 X BCR rear row 1. tube	1230
R1549	005 X BCR front row control code	5800
R1550	006 X BCR front row 1. tube	5500
R1544	011 Rocking - down position	1200
R1543	012 Rocking - horizontal position	2050
R1542	013 Rocking - up position	2950
R1535	020 Y needle cleaning bowl	8340
R1532	021 Y aspiration ready	13450
R1565	022 Y aspiration down - priming bowl	400
R1528	023 X 1. well - aspiration	1500
R1533	024 Y aspiration down - strip well	300
R1530	025 X pipettor offset	-130
R1534	026 Y needle - well pipetting	13400
R1538	027 Z well start of level detection for dispensing	150
R1539	028 Z well stop of level detection for dispensing	1000
R1531	035 X camera offset	540
R1540	036 X Camera test label offset	1695
R1545	041 X - needle - 1. tube	1790
R1536	042 Y needle - center front tube row	4175
R1537	043 Y needle - center rear tube row	275
R1574	051 X Control tube A	1526
R1578	052 Y Control tube A	4445

R1575	053 X Control tube B	1526
R1579	054 Y Control tube B	-45
R1576	055 X Control tube C	6250
R1580	056 Y Control tube C	4475
R1577	057 X Control tube D	6250
R1581	058 Y Control tube D	-25
R1567	061 X pump autocalibration bowl	545
R1568	062 Y pump autocalibration bowl	12710
R1570	063 Z autocalibration bowl top	450
R1569	064Z needle position for watching of a-cal. filling	1300

001 X BCR selftest control code
X shift position for reading of the control barcode (see Picture 16 position 2) during selftest.

The barcode reader must be initialized after switching on the instrument by sending these instructons
BCR 9
BCR 12
Sending the *BCR 2* instruction starts reading. The reader switches ON the red light. The light turns OFF immediately if the code is successfully scanned or after 5 seconds.
At the correct coordinate, the reader only briefly flashes after initialization. Coordinate is searching in the direction from the home position. About 20 steps must be added to the value of coordinate at which the reading starts to be succesful.

002 X BCR mirror right side turn
Position on the right side of the X shift to rotate the mirror of the barcode reader.
Adjustment is done by moving X between the coordinate 0 and the desired coordinate. At the correct value, the mirror realibly flips. At the same time, the X shift must not hit the right edge of the travel range.

003 X BCR rear row control code
X shift position to read the control barcode of the back row in the tube rack (see Picture 8 position 2).
The setup procedure is similar to the parameter *001 X BCR selftest control code*.

004 X BCR rear row 1. tube
X shift position for reading the barcode of the first row tube in the tube rack (position number 2).

The setup procedure is similar to the *001 X BCR selftest control code* parameter. A 5-step relative shift is used for stepping. The correct value of the parameter is the coordinate from the left direction when the reading starts to be successful and this value is incremented by 5.

005 X BCR front row control code
X shift position for reading front line control code in the tube rack.

Prior to setting, the X motor is sent to the *002 X BCR mirror right side turn* to turn the mirror to the reading position of the front row of test tubes. The procedure is similar to *001 X BCR selftest control code*, with the difference that the search direction is from right to left and the value 20 is subtracted.

006 X BCR front row 1. tube
X shift position for reading the barcode of the first tube in the tube rack (position number 43).

The setup procedure is similar to the *001 X BCR selftest control code* parameter. A 5-step relative shift is used for stepping. The correct value of the parameter is the coordinate from the right direction when the reading starts to be successful and this value is reduced by 5.

011 Rocking - down position
Bottom dead center position of the tray holder.

The coordinate value is found out by stepping with the Rocking Motor from the starting position.

012 Rocking - horizontal position
Horizontal position of the tray holder.

The coordinate values is found out by stepping from the starting position through the bottom dead center to the horizontal position.

You can use a small water-level for more accurate horizontal positioning.

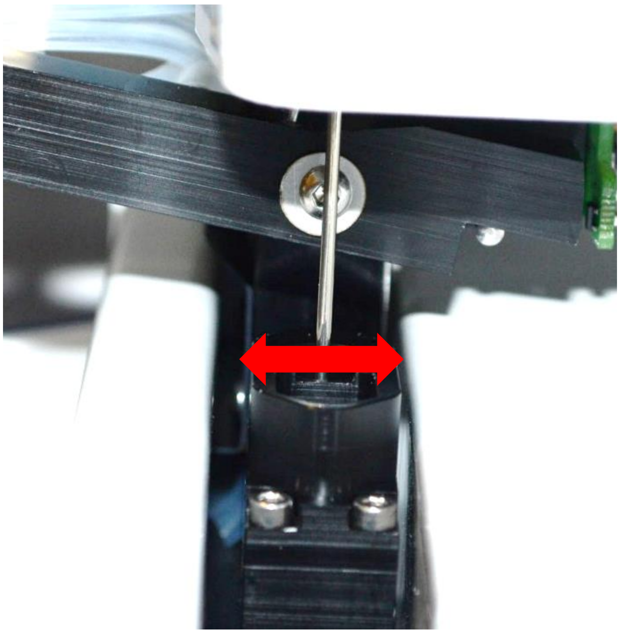
Picture 58

013 Rocking - up position
Position of the upper dead center of the plate holder.

The coordinate values is found out by stepping from the starting position through the bottom dead center to the upper dead center.

020 Y needle cleaning bowl
Position of the pipette module (Y Motor) so that the needle is above the center of the cleaning cuvette.

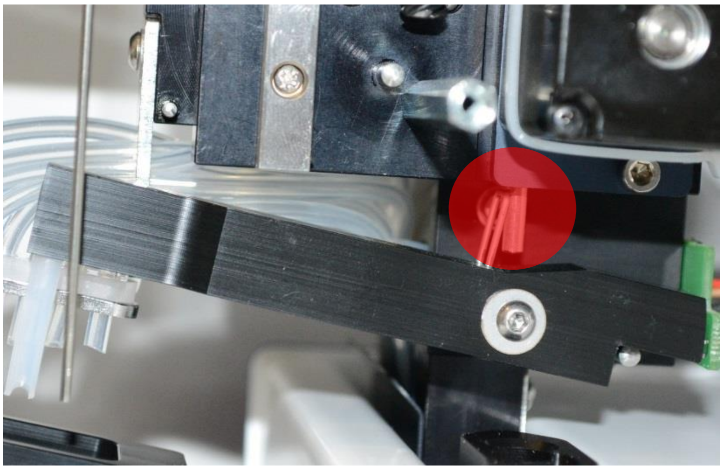
For a more accurate positioning, it is advisable to lower the needle position by moving the Z shift.
It is important that the needle should be routed to the hole in the bottom of the cleaning cuvette (see Picture 36).



Picture 59

CAUTION
If the needle is inserted into the cleaning cuvette, change the Y motor position obliquely to avoid collision of the needle with the cuvette to damage them.

021 Y aspiration ready
Position of the pipette module (Y motor) so that the control pin just touches the caliper on the aspiration arm.



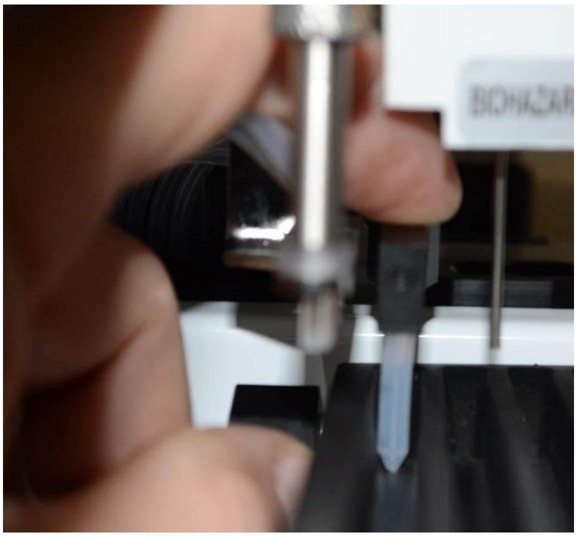
Picture 60

022 Y aspiration down - priming bowl
Relative shift of the pipette module (Y Motor) from position *021 Y aspiration ready* to get the aspiration arm down into the priming bowl.

When setting, the Y motor is sent to the absolute coordinate *021 Y aspiration ready*. Then, by relative shift, the value, at which the arm is moved down so that the aspirating tube lightly touches the bottom of the bowl or just above it, is found.

023 X 1. well - aspiration
X shift position for the tube of the aspiration arm above the center of the first well of the tray.

When setting up, the tray holder is in the upper position. The position can be better monitored by manually moving the arm down.



Picture 61

024 Y aspiration down - strip well
Relative shift of the pipette module (Y Motor) from position *021 Y aspiration ready* to get the aspiration arm down into the well of the tray.

When setting, the Y motor is sent to the absolute coordinate *021 Y aspiration ready*. Then, by relative shift, the value, at which the arm is moved down so that the aspirating tube lightly touches the bottom of the well or just above it, is found.

025 X pipettor offset
Relative shift of X motor from the position *023 X 1. well - aspiration* so that the needle is above the center of the first well of the tray.

When setting up, X motor is sent to the absolute coordinate *023 X 1. well - aspiration*. Then, using a relative shift, the value, at which the needle is above the center of the first well (because it is a shift toward the home position, the coordinate will have a negative value), is found.

026 Y needle - well pipetting
Position of the pipette module (Y Motor) in which sample pipetting is perfomed into the wells.

In the correct position, the needle is above the flat part of the bottom of the well where the sample is pipetted. The coordinate value must not be greater than the *021 Y aspiration ready* value to avoid unwanted movement of the aspiration arm.

027 Z well start of level detection for dispensing
When pipetting the sample into the well, the needle searches for the reagent level in the well. Therefore, pipetting occurs when the needle touches the level of the reagent in the well, leaving the reminder of the sample not dropping at the end of the needle.

With the correct coordinate position, the needle is about 3 mm above the top edge of the tray.

028 Z well stop of level detection for dispensing
It is related to the previous parameter. If the level is not found, the Z motion is terminated at this coordinate.

With the correct coordinate position, the needle is about 1 mm above the bottom of the well. The needle must not touch the bottom of the well.

035 X camera offset

Relative shift of X Motor from the position *023 X 1. well - aspiration* so that the first well of the plate is in the camera's shot.

Before setting this parameter, the camera settings must be done according to chapter 5.5 Setting the camera system.

Adjusting is done using live camera preview (SW uEye Cockpit). The arm moves to the absolute coordinate *023 X 1. well - aspiration*. The holder with the inserted tray is in the horizontal position. Then relative coordinate, at which the first well is in the center of the camera shot, is found.

036 X Camera test label offset

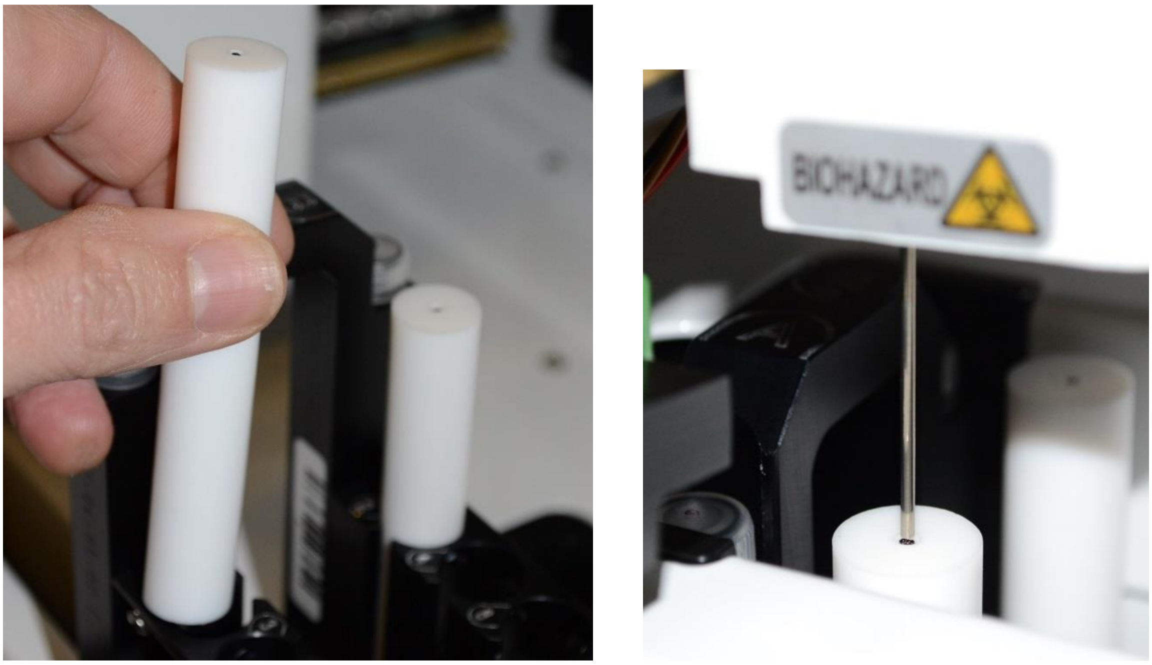
X shift position to display the *Camera test* label at the center of the camera shot.

This is the absolute coordinate of the X motor when the label fills the entire camera shot.

041 X - needle - 1. tube and 042 Y needle - center front tube row

X and Y shift positions for the needle above the center of theposition 1 in the tube rack.

For setting up, it is preferable to use auxiliary cylinders that have the dimensions as the maximum tube and the center indicated. The needle is positioned in the center of the cylinder with X, Y and Z shifts. Absolute values of X and Y coordinates of the motors are written into parameters.



Picture 62

043 Y needle - center rear tube row

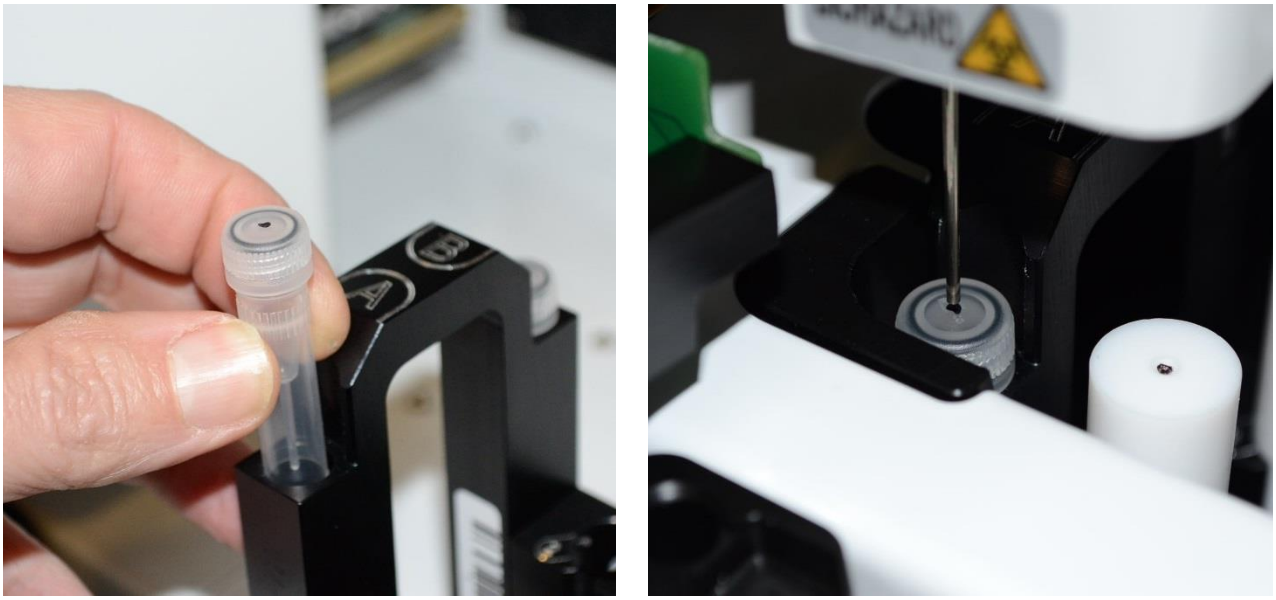
Y shift position for the needle above the center of position 2, the rear row in the tube rack.

Setting similar to previous parameters. Coordinate *041 X - needle - 1. tube* is common for the front and rear row of tube positions.

051 X Contol tube A and 052 X Contol tube A

X and Y shift positons for the needle above the center of the position for the control tube A in the tube rack.

For setting up, it is preferable to use tubes with a lid and centerline. The needle moves X, Y and Z feed onto the lids. Absolute values of X and Y coordinates of the motors are written into parameters.



Picture 63

053 X Contol tube B and 054 X Contol tube B

055 X Contol tube C and 056 X Contol tube C

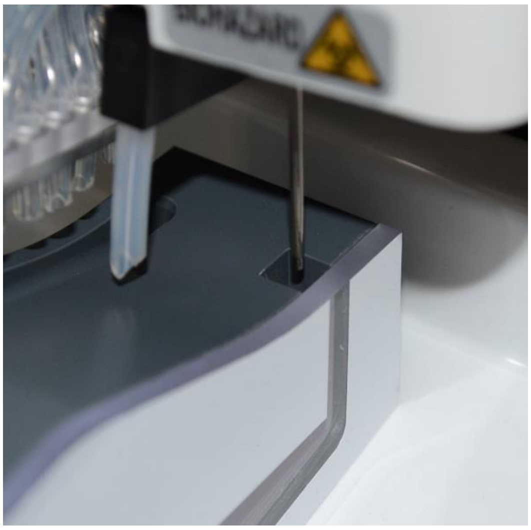
057 X Contol tube D and 058 X Contol tube D

X and Y shift positions for the control tubes B, C and D similar as to position A.

061 X pump autocalibration bowl and 062 Y pump autocalibration bowl

X and Y shift positions for the needle above the center of the square hole in the cuvette for the peristaltic pumps calibration.

The needle is positioned in the center of the hole by X, Y and Z shifts. Absolute values of X and Y coordinates of the motors are written into parameters.

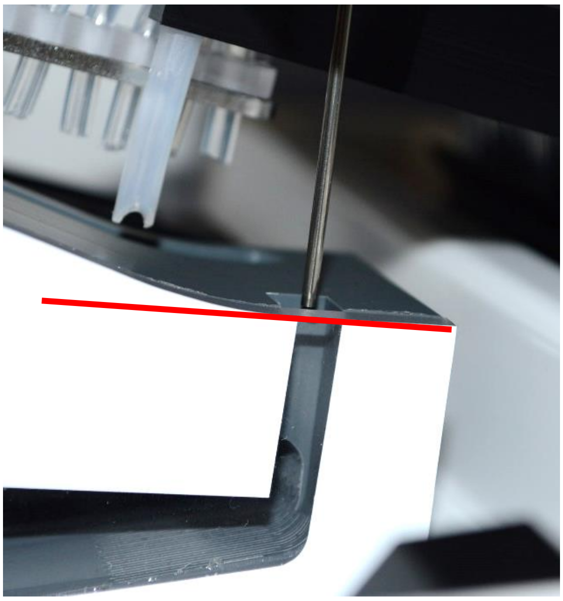


Picture 64

063 Z autocalibration bowl top

Z shift position for the needle at the top edge of the square hole.

Setting the correct position is important for proper calculation when the pumps are calibrated.

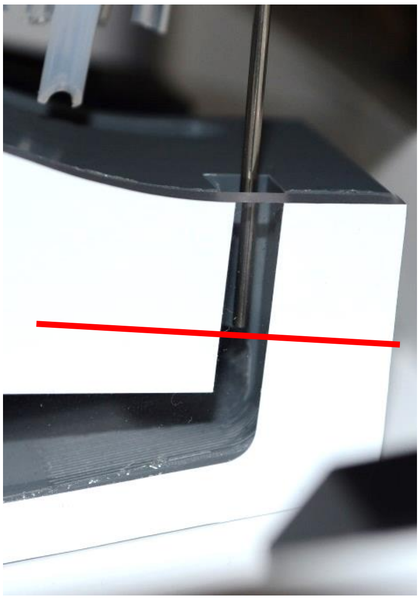


Picture 65

064 Z needle position for watching of a-cal. filling

The position Z, in which the needle waits for the touch of the liquid during the filling of the calibration cuvette by the pump.
The correct position is about 3 mm above the square hole lower orifice into the main cavity of the calibration cuvettes.

When calibrating the pump, the last batch must partially fill space of the aperture hole, where the water level is detected by by the needle.
If the needle was too low, the pumped water would only remain in the main cavity of the cuvette.
If the needle was too high, the cuvette would be overflowed.



Picture 66

6 Instrument maintenance

The individual chapters describe the assembly procedures used for routine maintenance. Some of these procedures are used to perform a check and preventative maintenance of the intrument.

6.1 The instrument checking and preventive maintenance operations list

Checking and preventive maintenance of the instrument should be carried out at annual intervals, in the normal operation of the instrument.

Step	Operation	Note / Link
1	The cassettes of peristaltic pumps replacement	6.3.1 Pump cassette - replacement
2	The reagent tubing replacement	6.3.2 Filling tubes - replacement 6.3.3 Tubes for reagent bottles - replacement
3	Pumps calibration	see Service manual, kap. 4.4 Pump calibration
4	X shift control and maintenance	6.7 Shift maintenance / 6.7.1 X - shift
5	Y shift control and maintenance	6.7 Shift maintenance / 6.7.2 Y - shift
6	X shift control and maintenance	6.7 Shift maintenance / 6.7.3 Z - shift
7	Rocking motion control and maintenance	6.7 Shift maintenance / 6.7.4 Rocking
8	Checking and maintenance of the vacuum in the waste bottle system	Check vacuum and adjust if necessary - 5.4 Vacuum in the waste bottle adjustment Cleaing the reverse throttle valve - 6.8 Maintenance of exhaust silencer and reverse throttle valve
9	Checking of system solution pump	6.6.1 Status test and replacement of the system solution pump
10	Maintenance of barcode reader system	6.9 Maintenance of barcode reader
11	Camera system maintenance	6.10 Camera system maintenance
12	Calibration of camera system	Calibration (see SW for strip evaluation - LabImage)
13	Checking of the instrument functionality checking	Running the protocol *Instrument Check* (see 6.15 Checking of the instrument functionality)

List of spare parts

Name	Catalog no.	Pcs.
Tubing replacement maintenance kit - Reagent part	DA21-09010	1

6.2 Disassembly the instrument covers

6.2.1 Front cover - disassembly

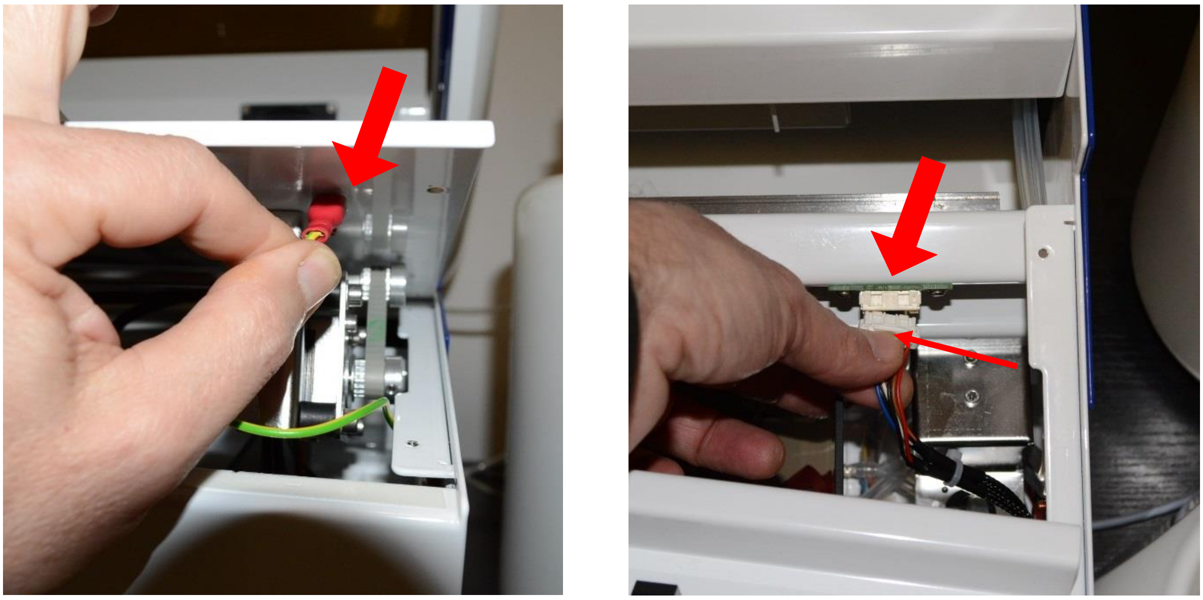
CAUTION

The instrument must be turned OFF when the cover is removed and replaced. Otherwise, damage of the electronic parts may be caused by manipulation with the stepper motor connector.

The cover is released by unscrewing the four screws (see Picture 67).

Picture 67

After lifting the front of the lid, disconnect the faston ground wire and, after partially removing the left side of the cover, disconnect the power connectors of the rocking stepping motor with its home sensor and the heating foil with temperature sensor. When disconnecting the connectors, the ratched on the top of the connectors must be pressed (see Picture 68).

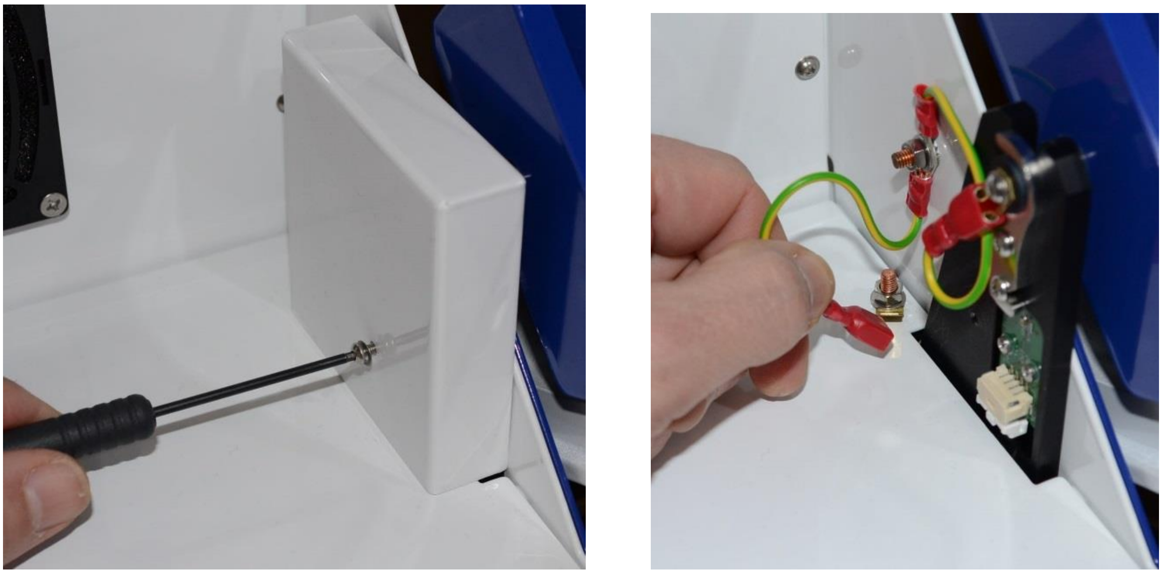


Picture 68

Subsequently, the cover can be removed from the instrument.

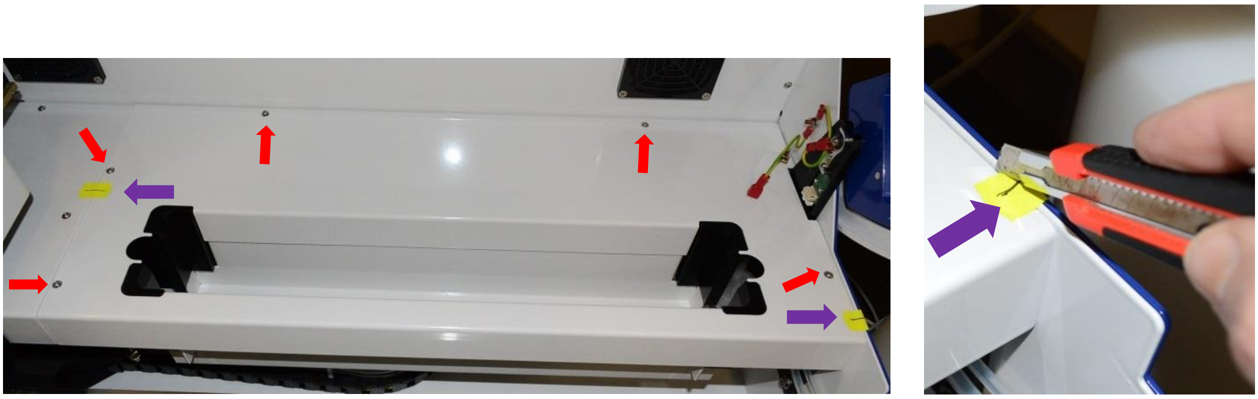
6.2.2 Rear cover - disassembly

Before disassembling the rear cover, remove the cap and disconnect the ground wire faston (see Picture 69).



Picture 69

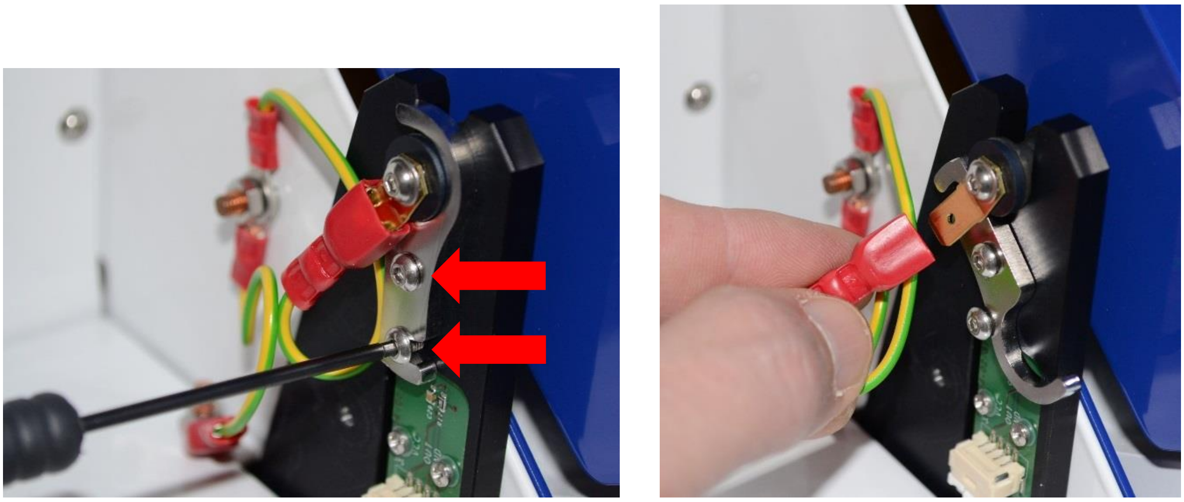
Because the tube rack is inserted into the cover, the position of the cover affects the setting of some movements coordinate in i-parameters. In order to mount the cover to the same position later, it is fitted at the opposite ends with an adhesive tape with a dashed line for later alignment. The tape is cut at the place of the covers gap. Release the cover by unscrewing the five screws (see Picture 70).



Picture 70

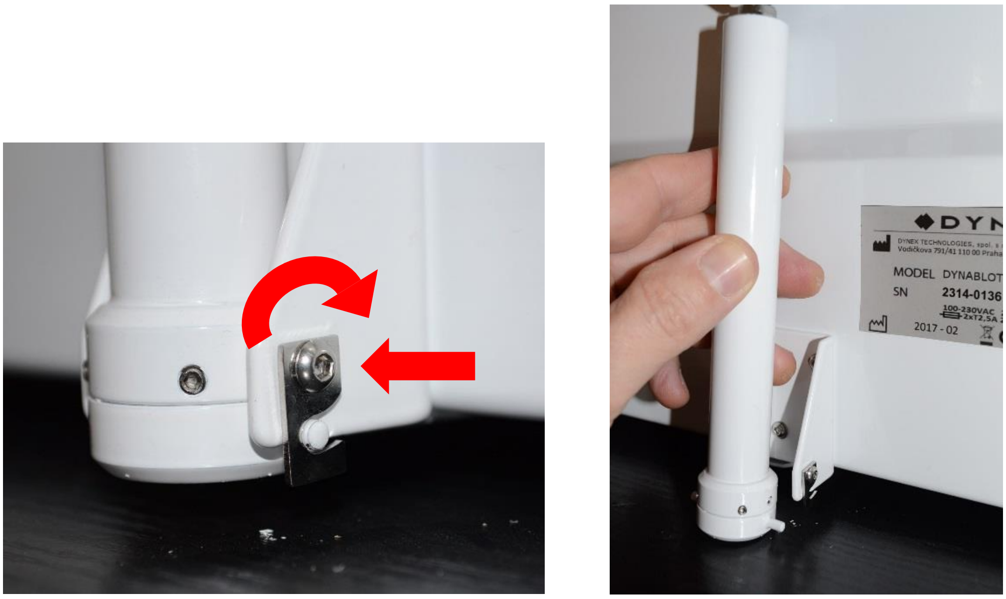
Subsequently, the cover can be removed from the instrument.

6.2.3 Workspace cover - disassembly



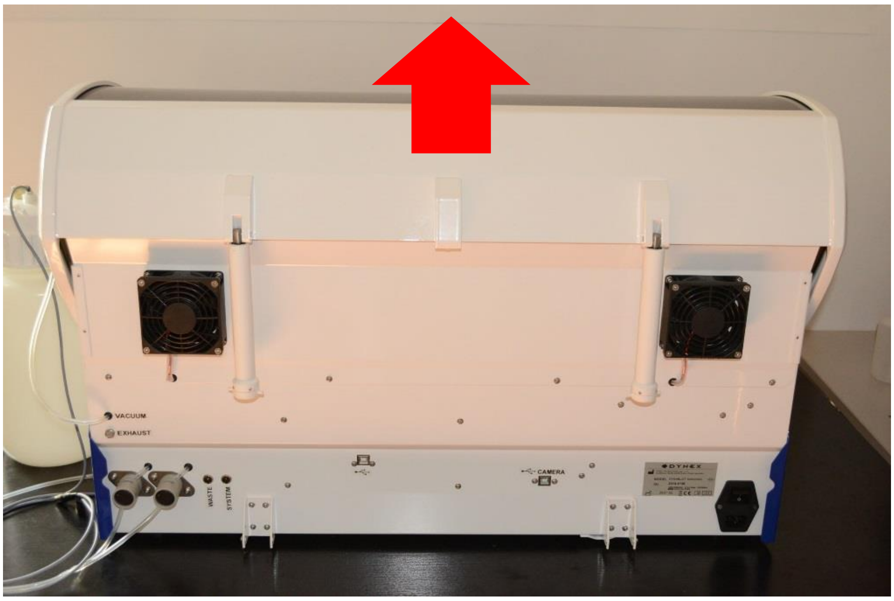
Picture 71

On the hinges of the workspace area cover, the bolts are released and the fuses are opened. On the left side, the faston ground conductor must be disconnected.



Picture 72

On the rear wall of the device, the bolts are loosened and the spring struts are flipped. The struts are removed from the brackets. CAUTION - After removing the struts, the cover must be held in place to prevent it from falling to the closed position.



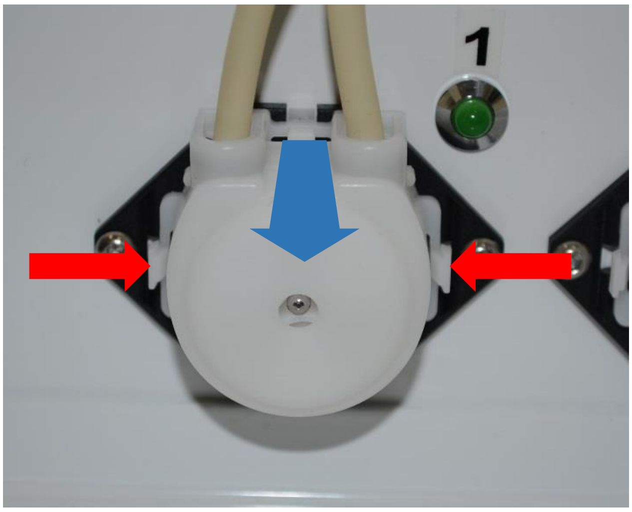
Picture 73

Subsequently, the cover can be lifted and positioned next to the instrument.

6.3 Replacement of pump cassettes and reagent tubes

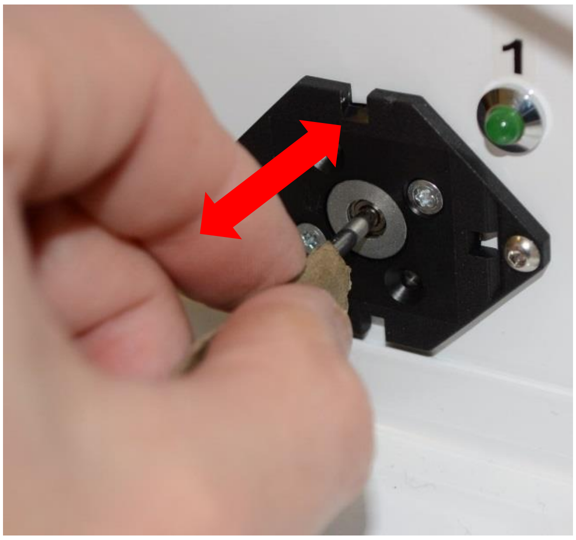
6.3.1 Pump cassette - replacement

Remove the two pipe connectors from the old pump cassette. The ratchets are pressed at the sides and the cassette is pulled down from the engine axes.



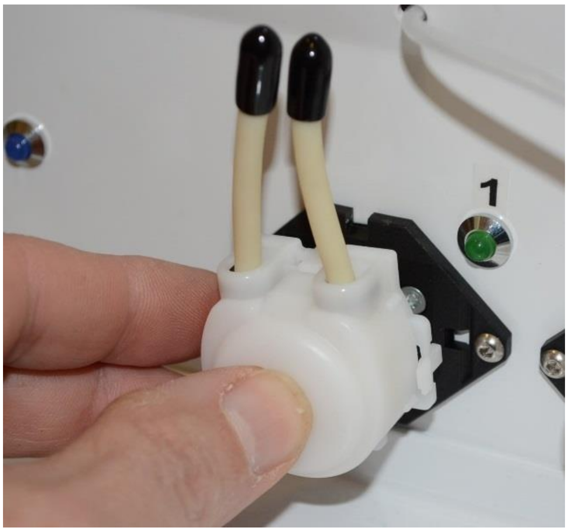
Picture 74

Before installing the new cassette, it is advisable to roughen the motor axis longitudinally with fine sandpaper and clean with alcohol.



Picture 75

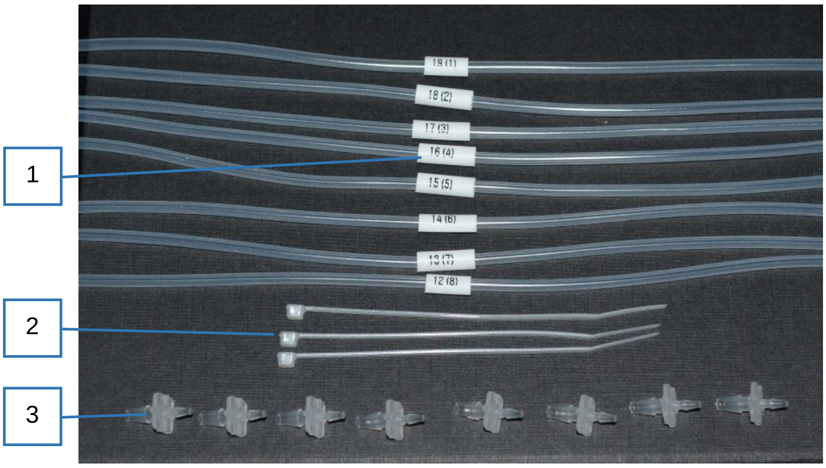
The new cartridge is put on the motor axis and pressed to snap the ratchets.



Picture 76

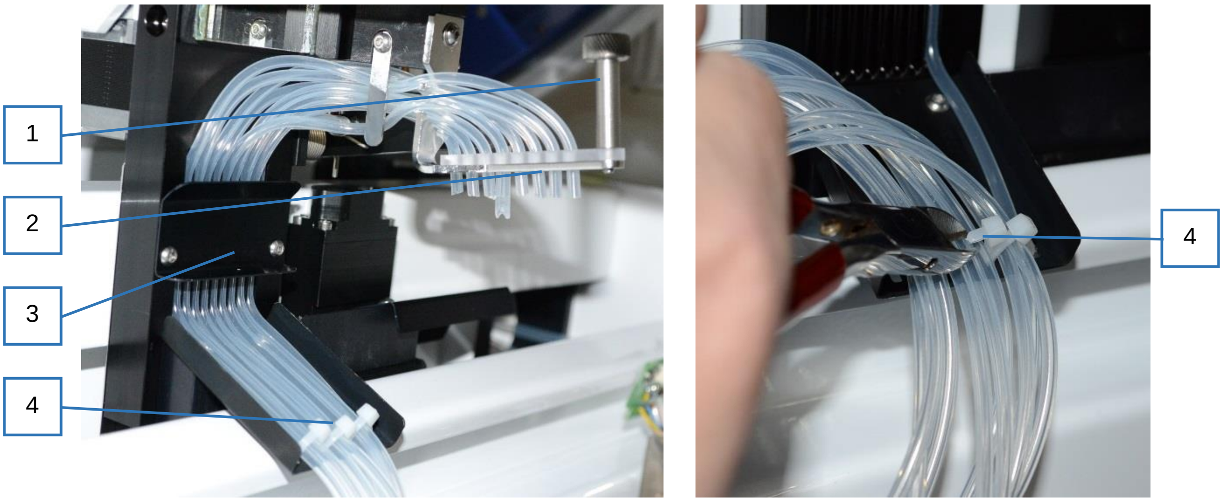
6.3.2 Filling tubes - replacement

The front cover of the instrument must be removed to replace the filling tubes (see 6.2.1 Front cover - disassembly) and a set *Dispensing tube set DA21 – 08116* is needed.



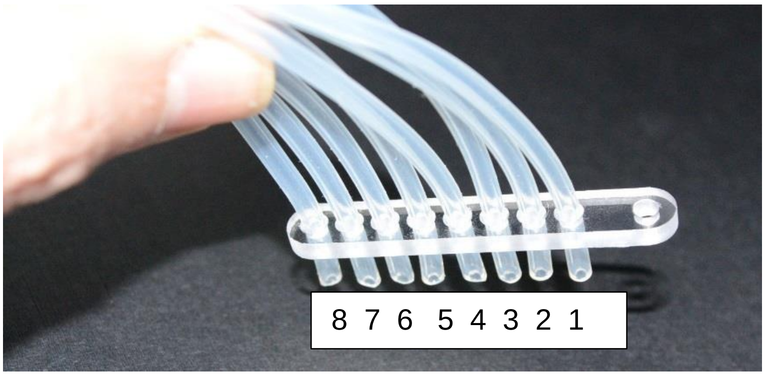
Picture 77

1 - 8 pieces of tubes marked with sleeves. The first number is the number of the tube position on the drawing of Appendix 9.4 Hydraulic scheme. The number in brackets (1 - 8) is the name of the channel to which the tube belongs.
2 - 3 pieces of cable ties
3 - 8 pieces of connector for connecting the tubes to the cassette of the peristaltic pump



Picture 78

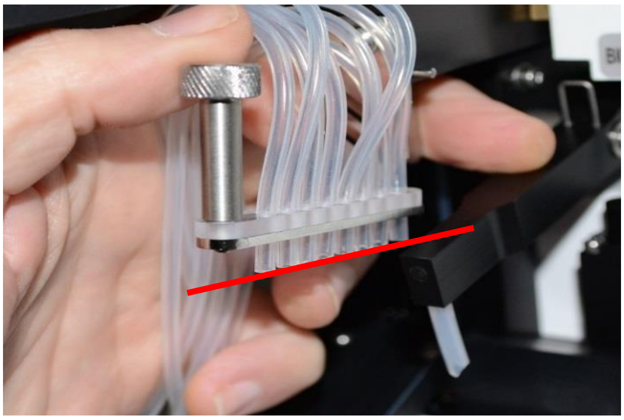
The bolt (1) is unscrewed and the plastic tube holder (2) is pulled out of the filling arm. Remove the tube cover (3) and cut off the cable ties (4). Then the old tubes are disconnected from the pump cassette connectors and removed from the unit. The plastic holder is removed from the tubing for further use.



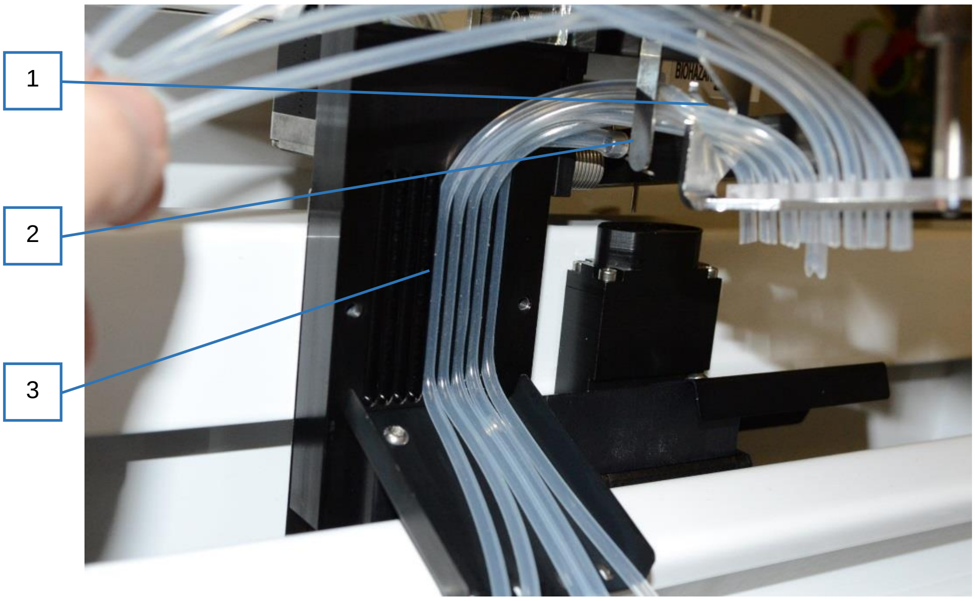
Picture 79

The new tubes from the kit are inserted into the plastic holder in the order of channels (number in bracket on the sleeve) according to Picture 79 .

The plastic tube holder is inserted into the filling arm and secured with a screw. The ends of the tubes are aligned to protrude about 5 mm below the arm.



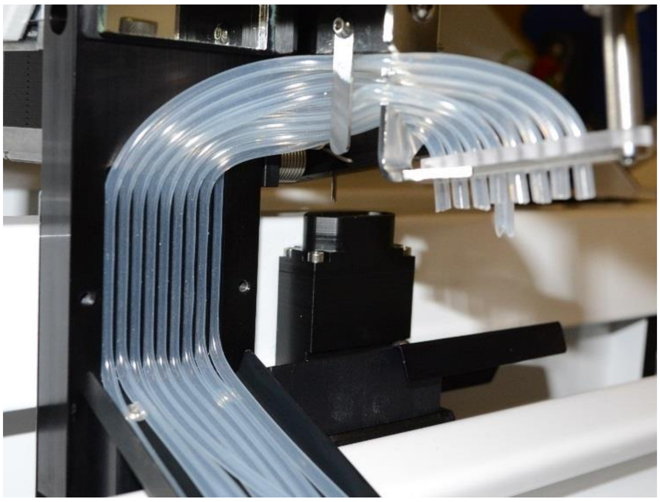
Picture 80



Picture 81

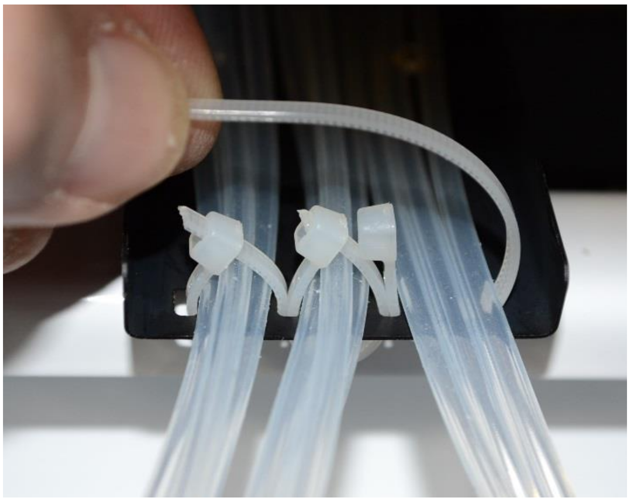
The tubes are successively inserted in the notches (1) behind the stop (2) from the 8th to the first channel and pushed into the grooves (3) in the arm.

The result is a regular distribution of the tubes so that they do not interfere with the lower edge of the lighting mirror and do not cause the shadow on the strips during their scanning.



Picture 82

Using cable ties, the trinity of the tubes (in the right three, one tube belonging to the system solution pump) is attached to the lower part of the arm. WARNING - Do not tighten the ties too much to avoid flow reduction due to tightening of the tubing.



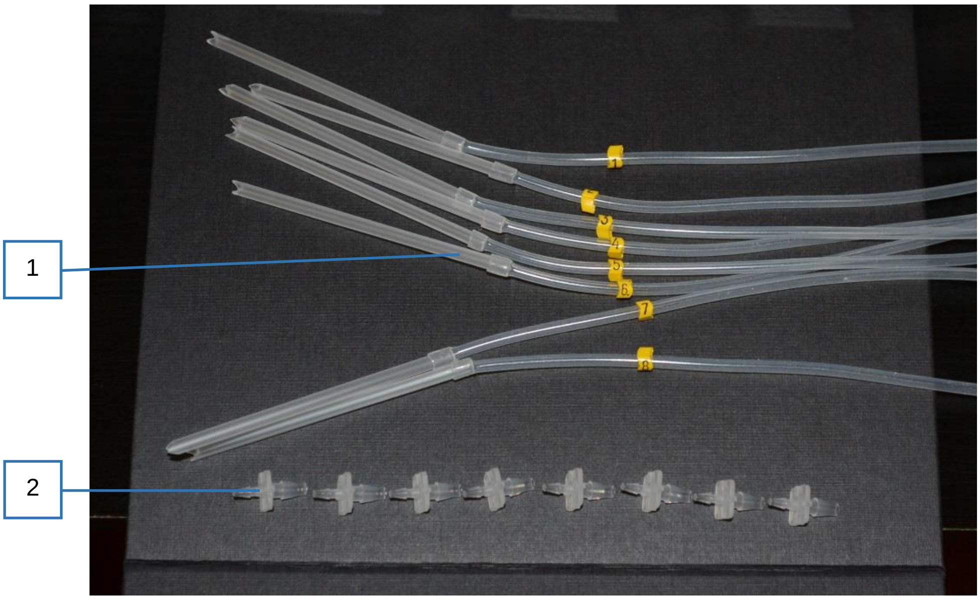
Picture 83

Picture 84

The tubes are pushed through the holes in the front of the instrument to the respective pumps, and connects through the connectors to the right tubes of the cassettes and the tubes are drawn into the device. Care should be taken to regularly arrange the tubes under the front cover, without unnecessary crossing, so that they do not lift too much when the arm is moving and do not engage with the rocking mechanism.

6.3.3 Tubes for reagent bottles - replacement

The *Bottle tubing set DA21 – 08121* is required to replace the filling tubes.

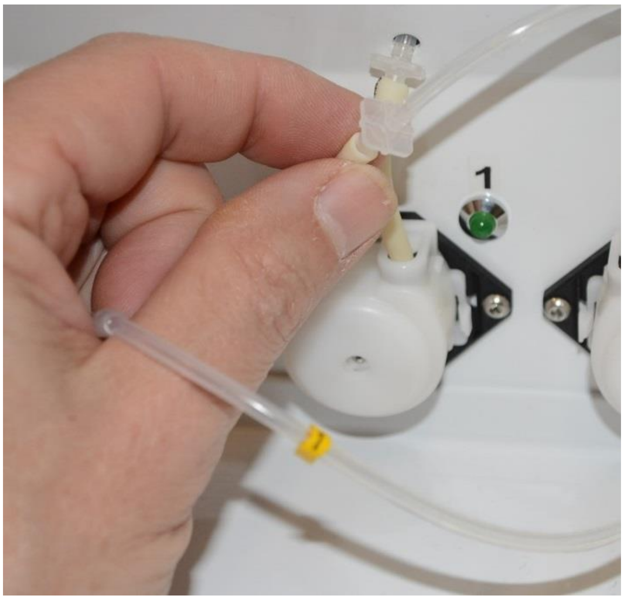


Picture 85

1 - 8 pieces of tubes marked with sleeves. The number on the sleeve indicates the channel that the tube belongs to

2 - 8 pieces of connector for connecting the tubes to the cassettes of the peristaltic pump

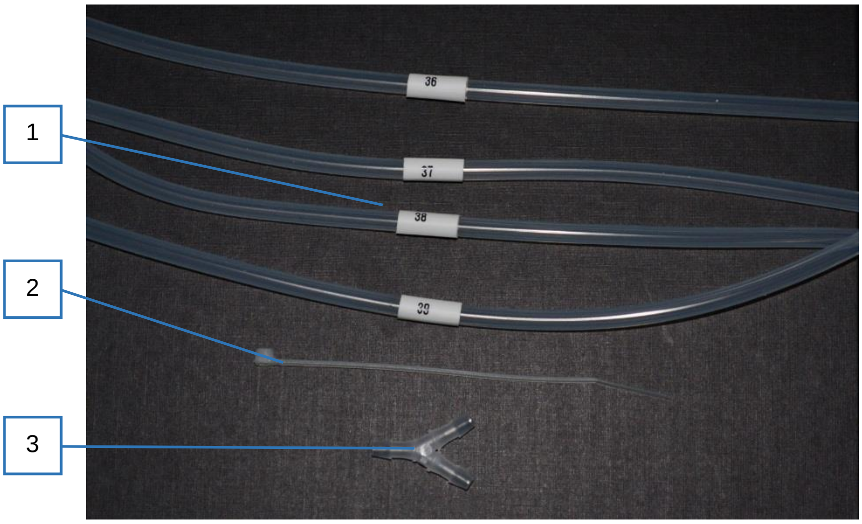
A new tube with a connector connects to the left tube of the appropriate peristaltic pump.



Picture 86

6.4 Exchange of aspiration tubes

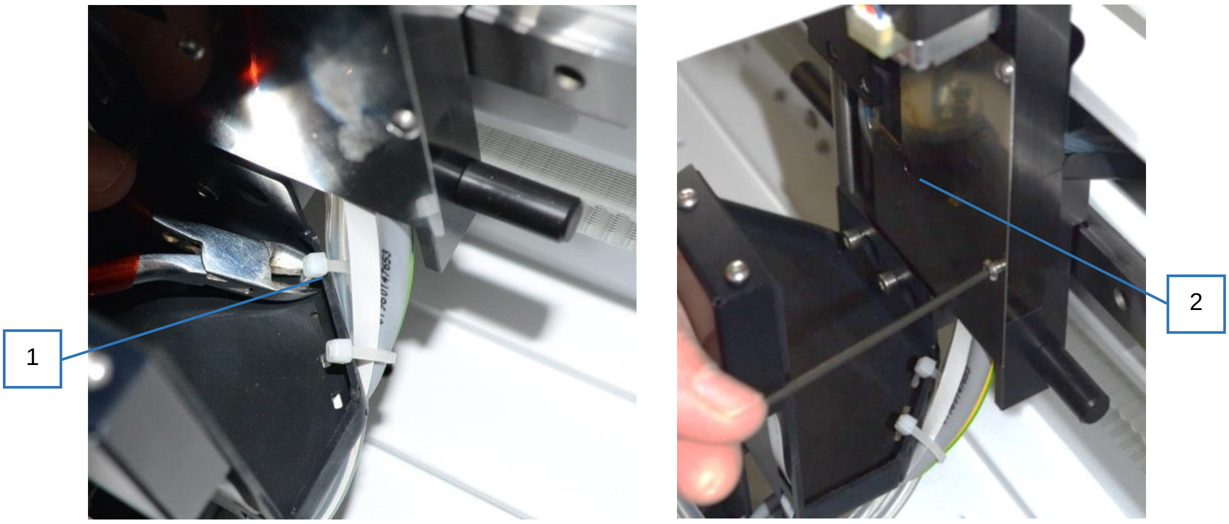
The *DA21 – 08122* set is required to replace the tubes aspirating the waste from the wells of the tray and from the needle cleaning cuvette.



Picture 87

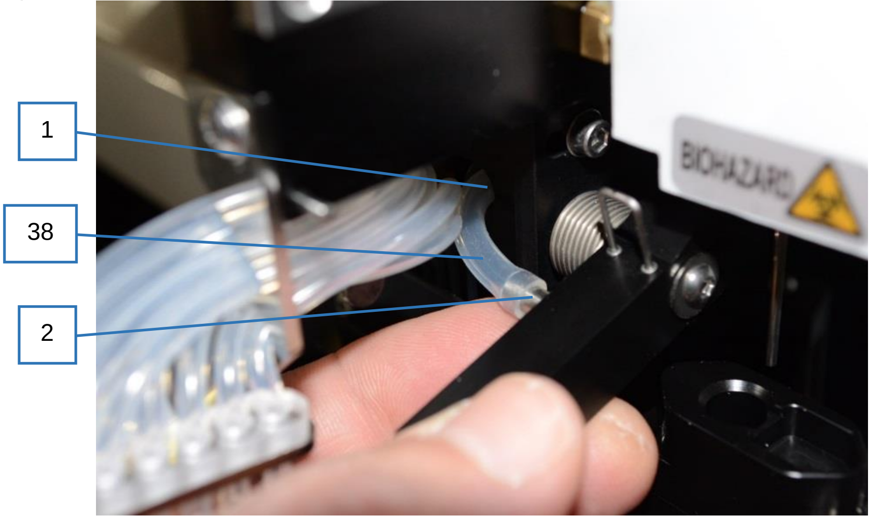
1 - 4 pieces of tubes marked with sleeves. The number indicates the position of the tube in the drawing of Appendix 9.4 Hydraulic
2 – cable tie
3 - Y-connector for connecting the tubes in front the waste bottle

Before replacing the tubes, remove the rear cover (see 6.2.2 Rear cover - disassembly). For a more comfortable access from the rear to the bottom of the working arm, it is recommended to remove the workspace cover (see 6.2.3 Workspace cover - disassembly).



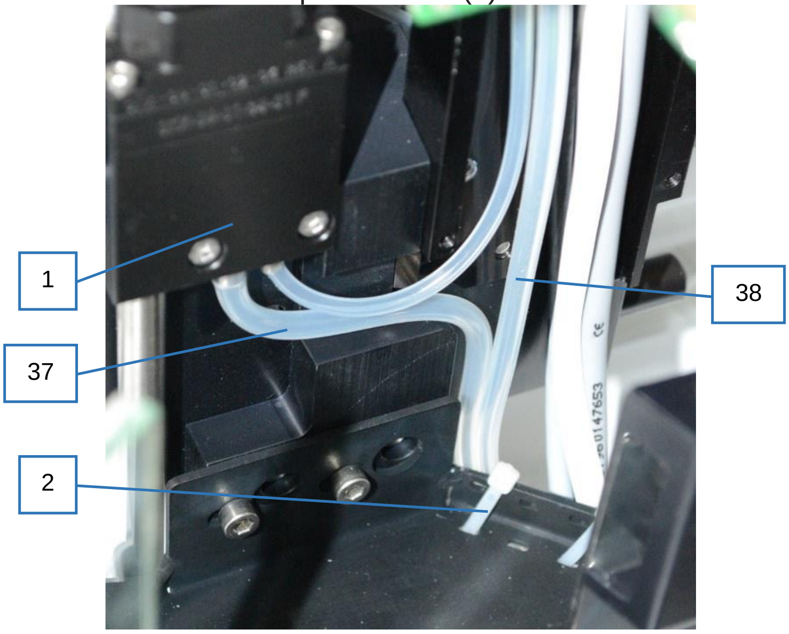
Picture 88

At the bottom of the working arm, cut the tie (1) to release the old tubes. Remove the cover (2) from the rear of the arm by unscrewing four screws.
After removing the old tubes, proceed to install new ones.



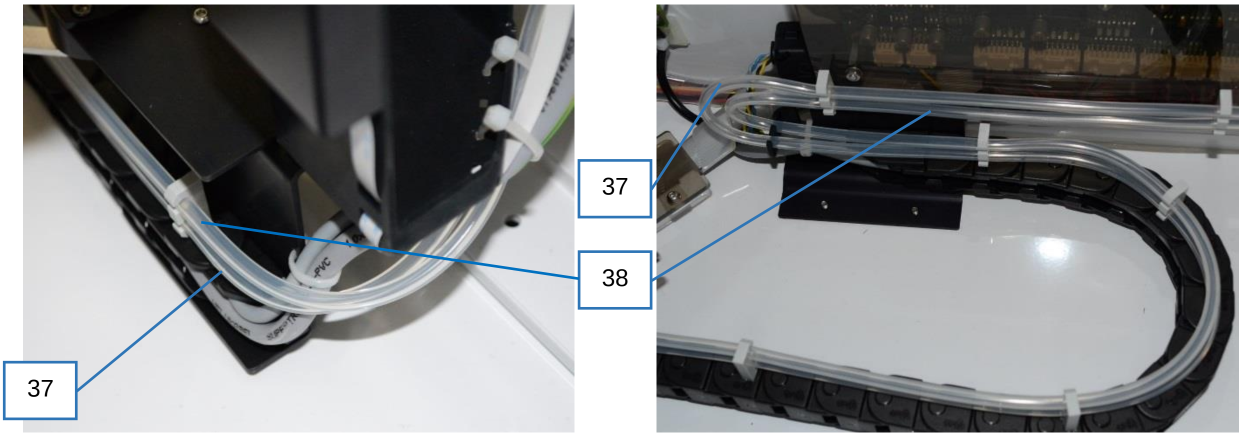
Picture 89

The tube marked by a sleeve with the number 38 is pushed through the opening (1) in the working arm from behind and is attached to the aspiration arm (2).



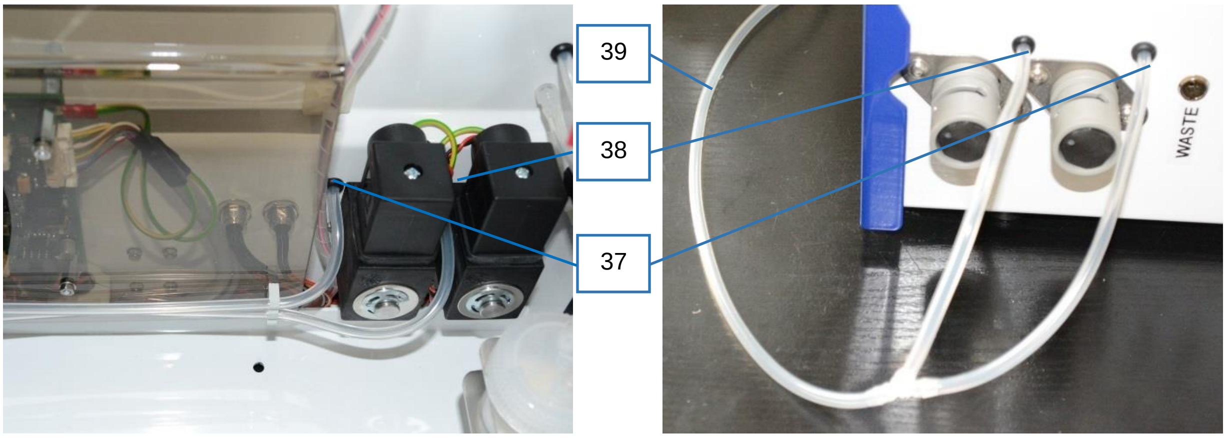
Picture 90

The tube marked by a sleeve with the number 37 is attached to the needle cleaning cuvette (1). The two tubes are fastened with the cable tie (2). CAUTION - The tie must not be tightened too much to avoid flow reduction due to tightening of the tubing.



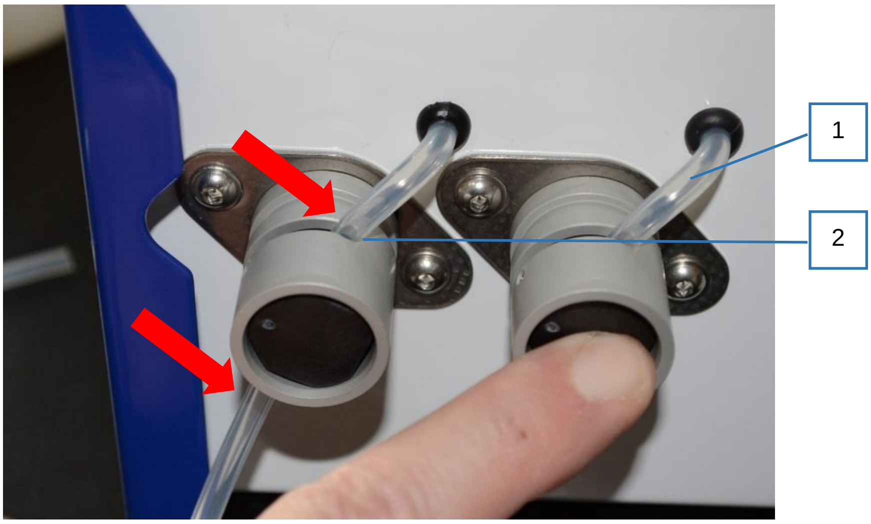
Picture 91

Next, the two tubes are inserted into the holders on the movable chain and on the mainboard cover (see Picture 91). The tube 37 (from the aspiration arm) is at the bottom cutout and the tube 38 (from the needle cleaning cuvette) is in the upper cut out of the chain. On the mainboard, this is the opposite (see Picture 91).



Picture 92

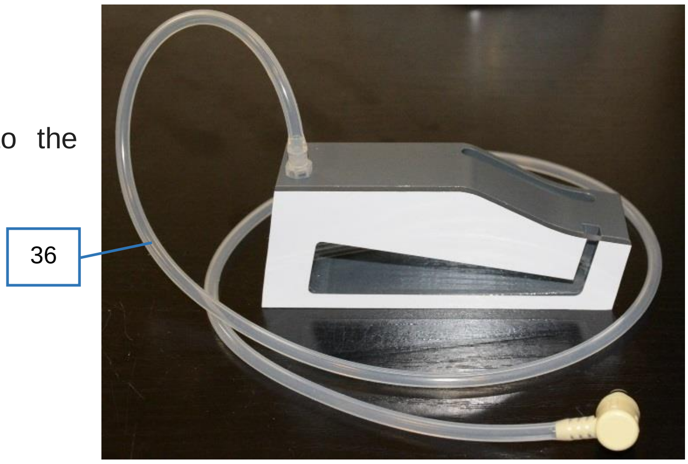
The tubes are inserted through the grommets in the back of the instrument. It is important that the respective tubes come to the correct pinch valve. The tubes are coupled using a Y-connector and a tube sleeve number 39 with a *W* output of the waste bottle (see Picture 92).



Picture 93

The tubes are inserted into the notch in the pinch valves. CAUTION - Between the bushing and the valve, the tubes must form a regular arc (1) to avoid flow reduction due to tightening of the tubes. For the correct operation of the valves, the tubes must be carefully up and down inserted into the rear of the notch (2). (see Picture 93).

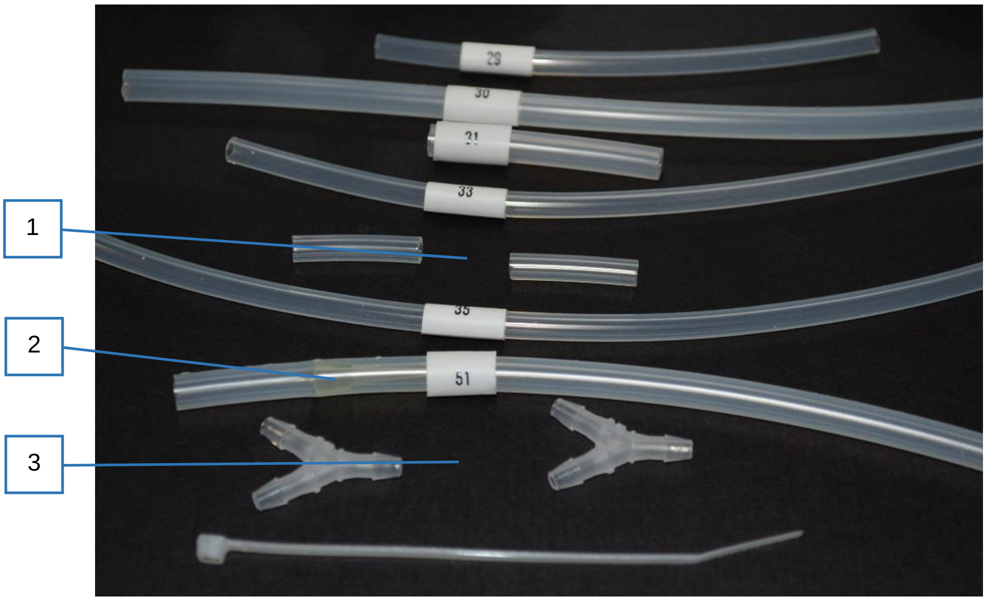
The tube with sleeve No. 36 belongs to the aspiration of the pumps calibration cuvette.



Picture 94

6.5 Replacing the vacuum system tubing

To replace the vacuum system tubing, the front cover (see 6.2.1 Front cover - disassembly), rear (see 6.2.2 Rear cover - disassembly) and the right cover above the motors of the peristaltic pumps must be removed. You need a set *Vacuum tube set DA21 - 08123*.



Picture 95

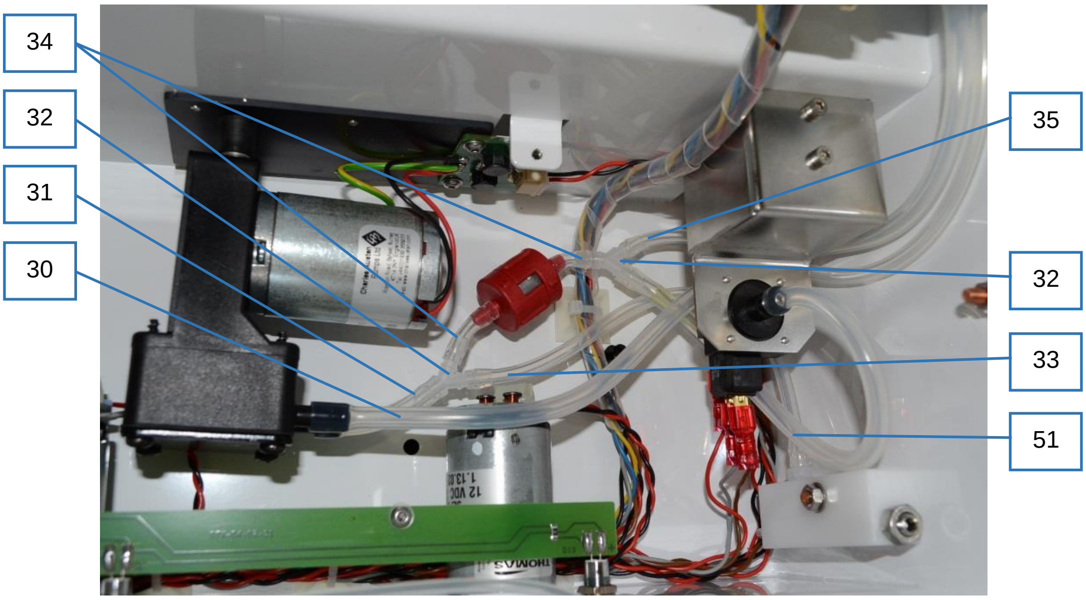
The drawing in the Appendix 9.4 Hydraulic is used to determine the purpose of the set items. Some tubes are marked with a sleeve with the position number in the drawing (29, 30, 31, 33 and 35). Unlabeled items in drawing are:

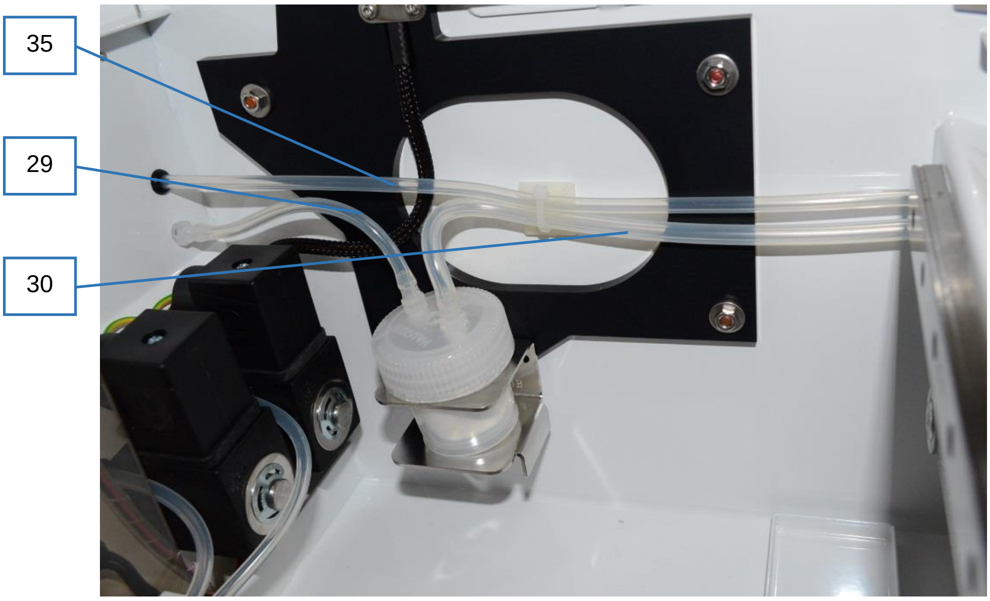
1 - position 34

2 - position 53 - inserted silencer

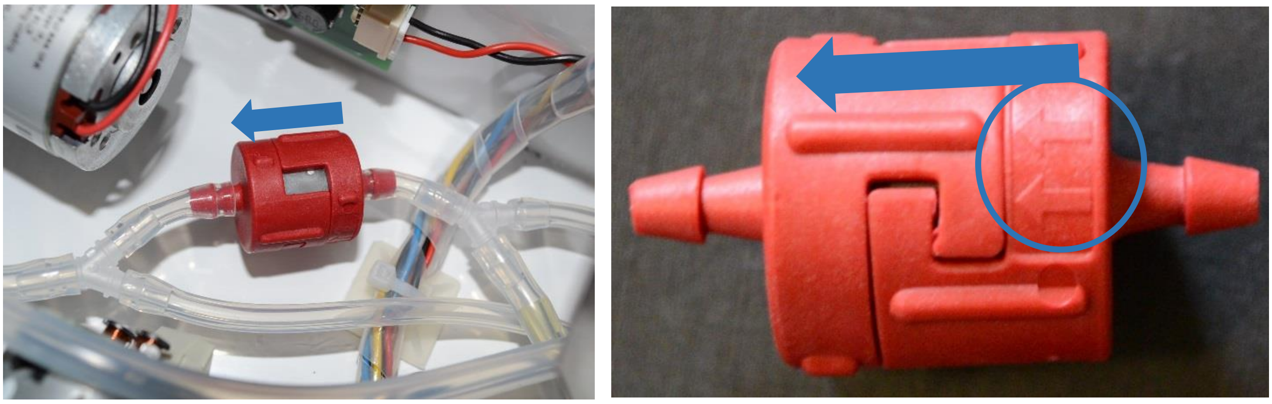
3 - position 32

The old tubes are dismantled. The vacuum system is again assembled from the new set according to Picture 96. The individual parts are shown in the picture with the position shown on the Hydraulic scheme. The position tube 35 is connected to the output *V* in the waste bottle.





Picture 96



Picture 97

It is necessary to orientate according to Picture 97 when mounting the reverse throttle valve.

6.6 Replacing the pipette system components

6.6.1 Status test and replacement of the system solution pump

In order to clean the needle between pipetting of individual samples, the peristaltic pump of the system solution must be in a satisfactory condition. Pump status can be verified by a simple test using the pipetting system purge function:

The instrument turns on and connects to the DynLab SW.

First, the initialization is required for all moves by searching for the home positions and setting the correct shift parameters. This can be accomplished by running the selftest segment (see 9.1.1 001 selftest RUN.Dcod).

Prior to starting, *SET R1 0* is set, so only a part of the selftest is set to set the starting positions.

The measuring cylinder is filled with 40 ml of distilled water and the cap with a suction tube is put to it (see Picture 98). The segment *020 System voiding RUN* (see 9.1.2 020 System voiding RUN) is ran.

The needle goes into the cleaning cuvette and the system solution pump draws up. After the segment runs, the water loss in the cylinder is checked.

Typical water consumption for one run of the segment is 19-20 ml. If the consumption is less than 17 ml (e.g. more than 23 ml remained in the cylinder), replace the pump cassette (see 6.3.1 Pump cassette - replacement).

Picture 98

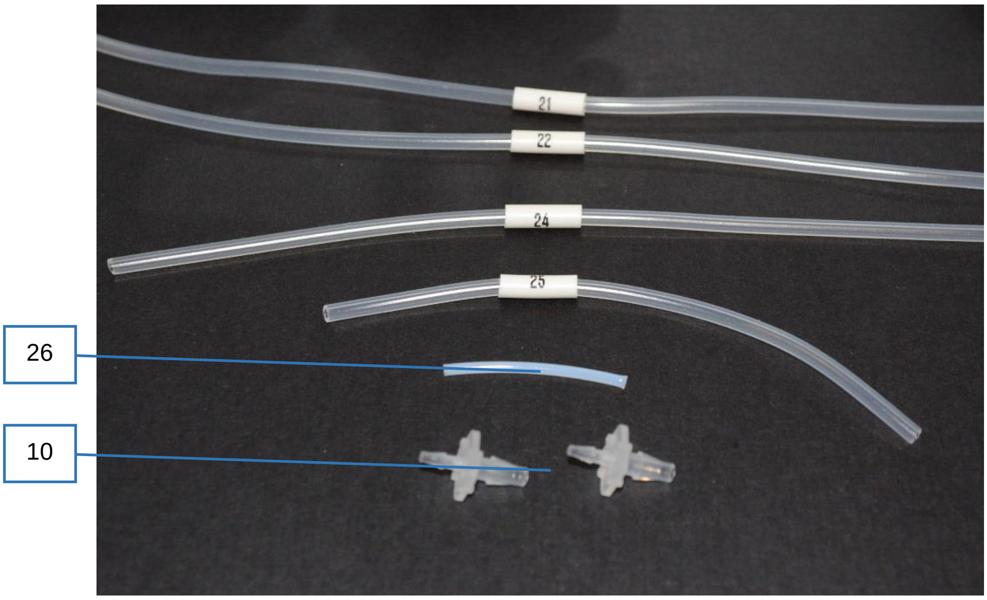
NOTE

The system solution pump can also be run from the Dynblot Automatic application SW using the *Instrument maintenance / system solution / Empty.*

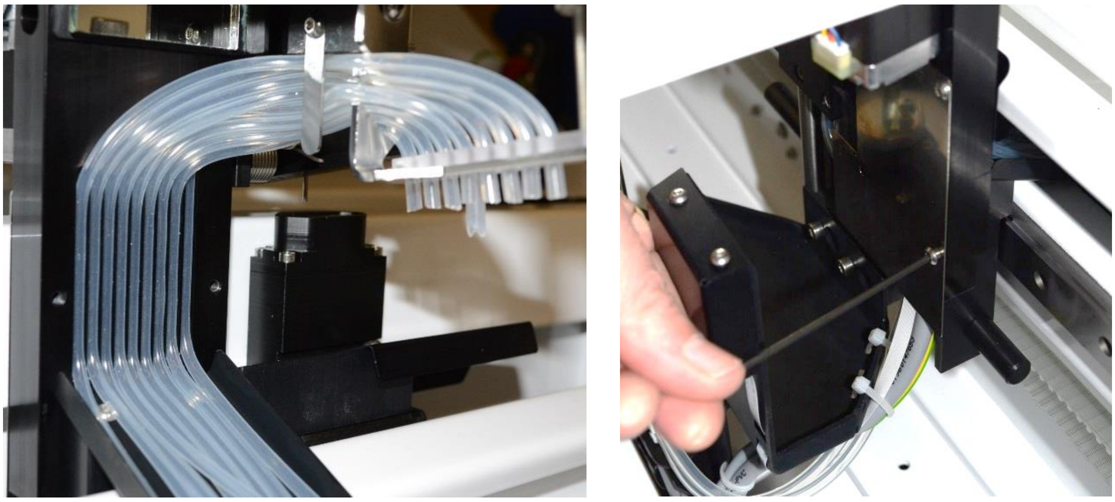
6.6.2 Replacing the system solution tubes

To replace the system solution tubes, the front cover of the instrument must be removed (see 6.2.1 Front cover - disassembly), the rear cover (see 6.2.2 Rear cover - disassembly) and the working arm cover. For a more comfortable access from the rear to the bottom of the working arm, it is also recommended to dismantle the workspace cover (see 6.2.3 Workspace cover - disassembly).

The set *Dispensing tube set - system liquid DA21 – 08124* is required.



Picture 99

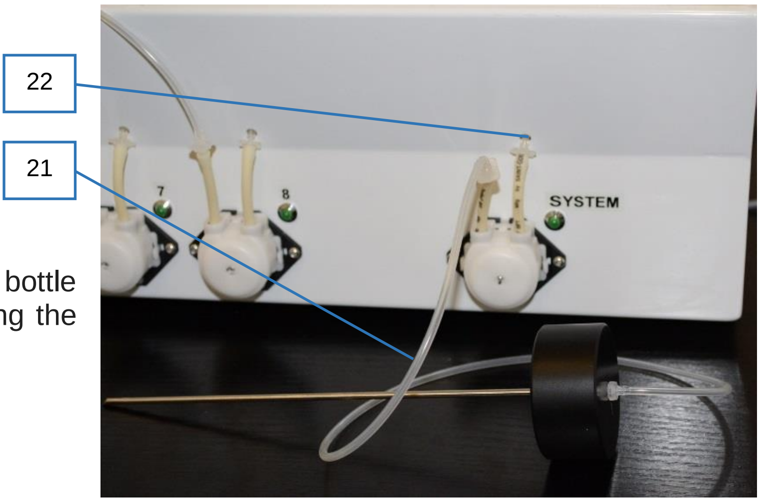


Picture 100

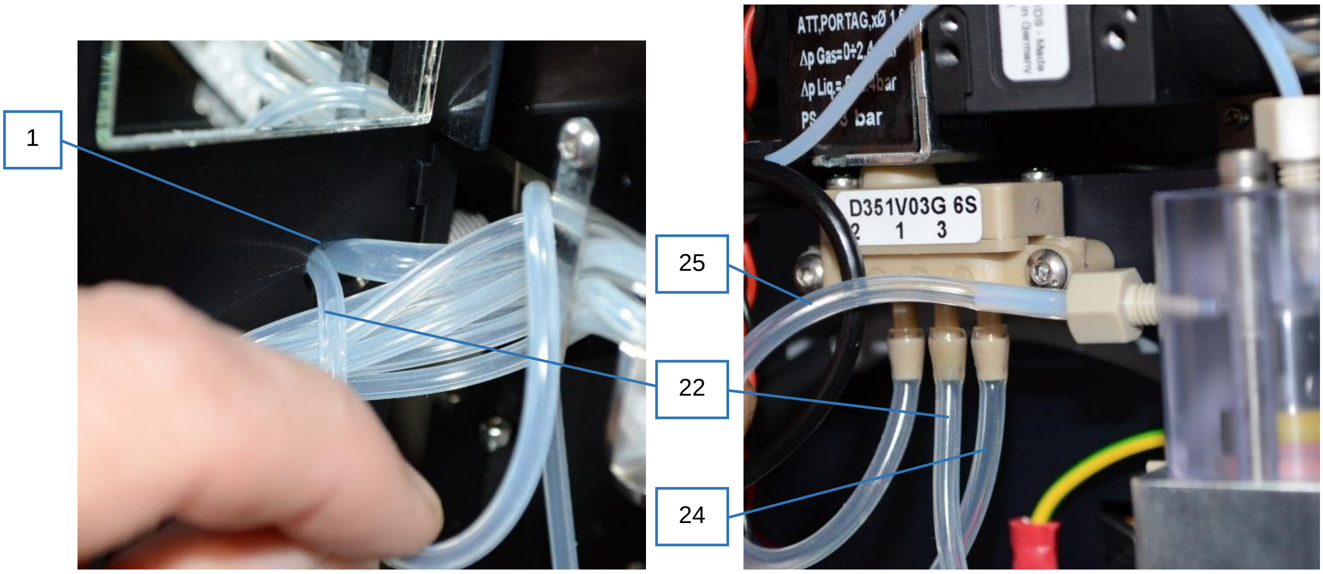
To obtain access to the tubes, remove the caps from the front and rear parts of the working arm (Picture 100).

Old tubes are replaced according to the pictures. The individual parts are indicated in the pictures by the position shown in Appendix 9.4 Hydraulic .

Connection between the pump and the bottle cap of the system solution (21) including the pump tube connector.

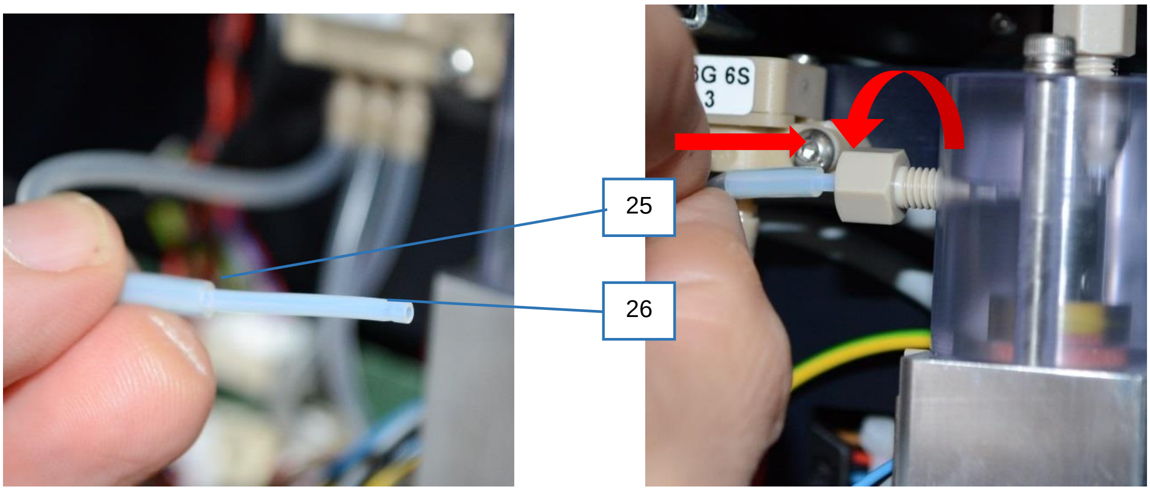


Picture 101



Picture 102

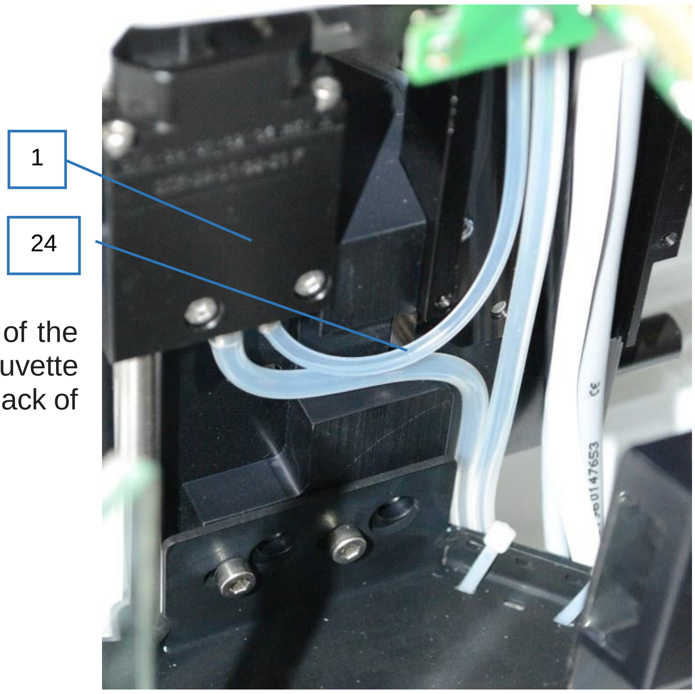
When connecting the pump and the three-way valve, the tube (22) passes through the opening (1) in the working arm. The front is connected by a connector to the right tube of the peristaltic pump. In the working arm area, it is connected to the three-way valve input 1 (COM).



Picture 103

The tubes (25) and (26) are used for the connection between the output 2 (NC) of three-way valve and the syringe. The assembly of the tubing to the syringe is shown in Picture 103. When handling the tube, the connector on the syringe head must be loosen. The new tube is inserted into the connector and then it is tightened.

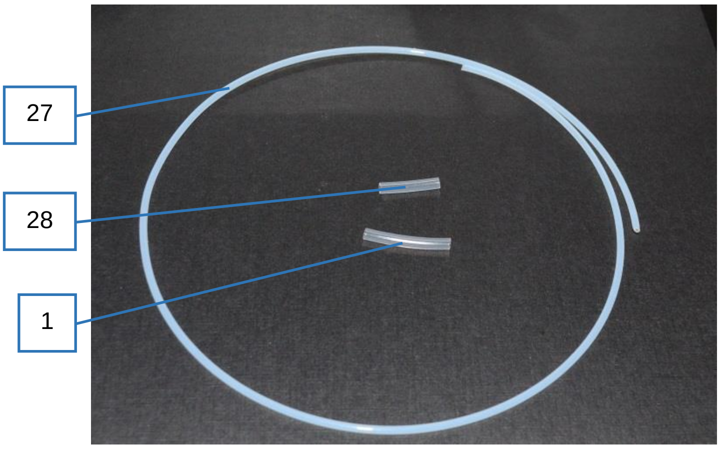
The connection between the output 3 (NO) of the three-way valve and the needle cleaning cuvette (1) is done by a tube (24) guided along the back of the working arm.



Picture 104

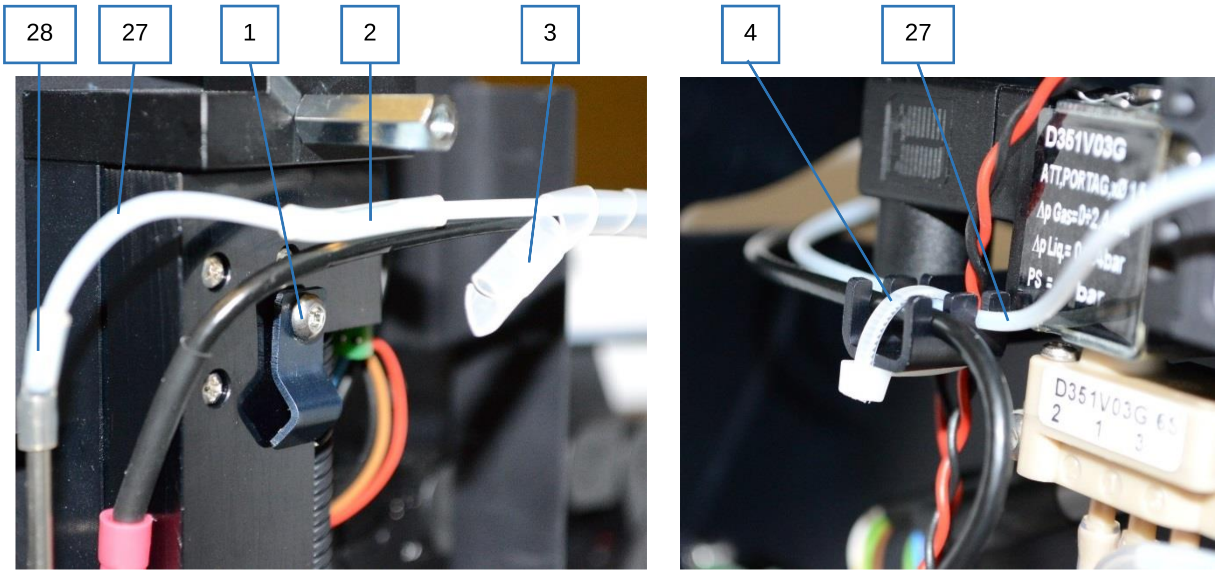
6.6.3 Replacement of needle and tubes

To replace the needle and its tubes, the cover of the working arm and the pipette cover must be removed. The tubes are in the *Dispensing tube set - pipetting DA21 - 08125*.



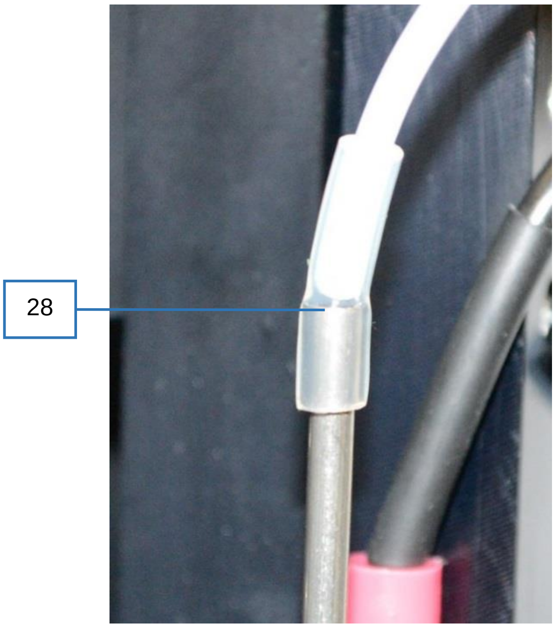
Picture 105

9.4 Hydraulic is used to determine the purpose of the set items. The silicon tube (1) is designed to be threaded onto a tube (27) for fastening to the holder (see next text).



Picture 106

To release the pipette tube, loosen and unclip the holder (1) on the pipette module, remove the protective spiral (3), and cut off the cable tie (4) in the working arm area. Remove the tube from the needle with a silicone junction. From the head of the syringe, the tube can be pulled out after the connector is released.

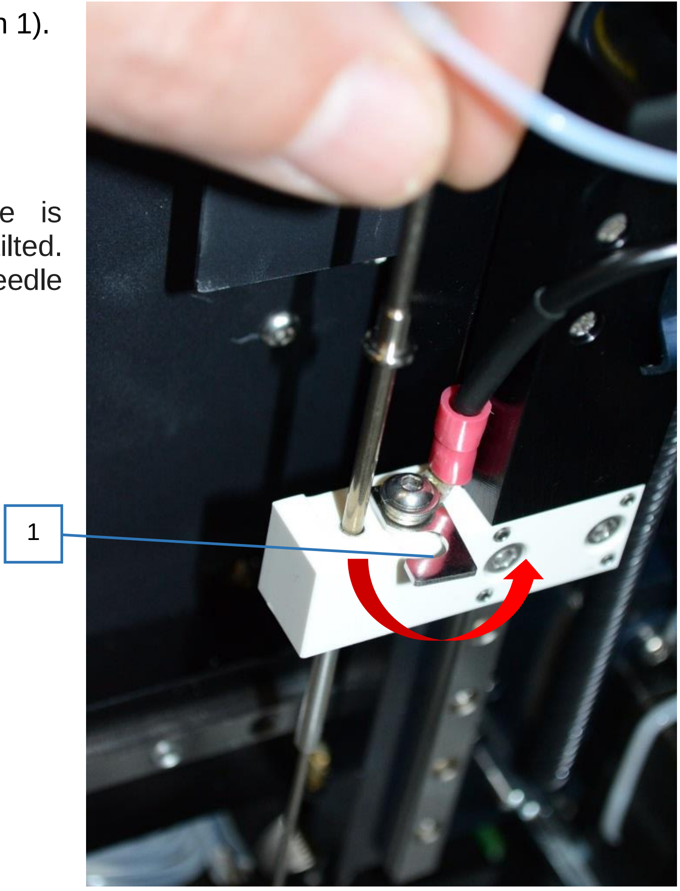


Picture 107

When fitting a new tube, when attaching the junction (28) to the needle, careful caution is required so that the edge of the needle does not cut off the junction wall. Even a very small hole would cause inaccuracies in pipetting. When the connector on the syringe head is loosen, the tube (27) is inserted in it and the connector is tightened.

The newly mounted tube is fastened with a strap to the holder, together with the level detection cable with a protective spiral and fixed by the holder on the pipette module. For correct fixation, a piece of silicone tubing must be fitted at the teflon tube in the place of the holder (27) (see Picture 106 position 1).

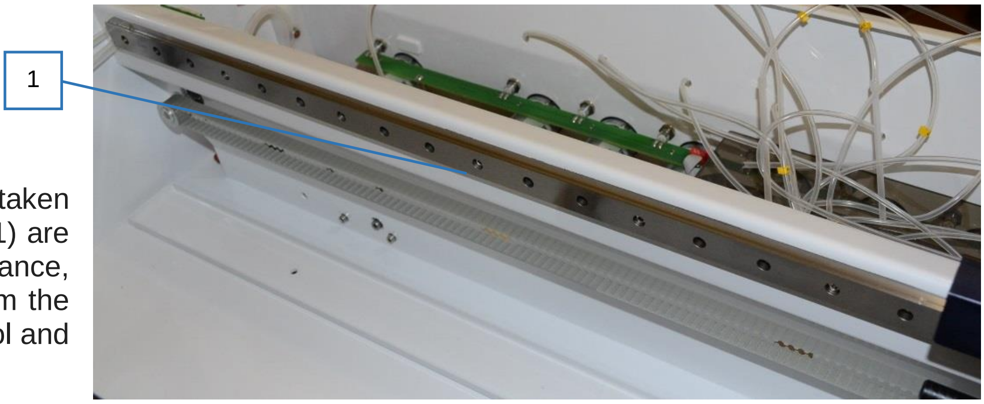
When removing the needle, the inlet tube is disconnected. The needle lock (1) is loose and tilted. The needle can be pulled out of the tube in the needle holder and replaced with a new one.



Picture 108

6.7 Shift maintenance

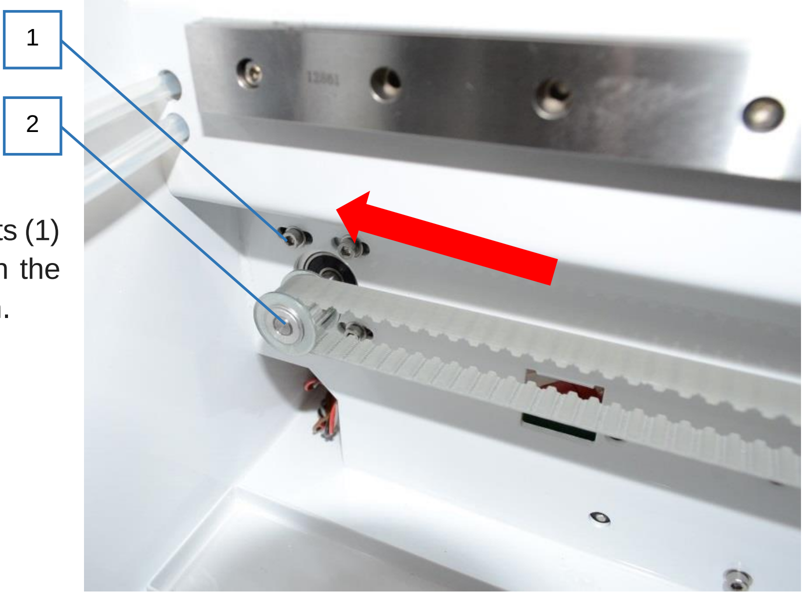
6.7.1 X - shift



For X shift, care must be taken to ensure that the rails (1) are clean. During maintenance, the rails are cleaned from the top and bottom by alcohol and gently lubricated with oil.

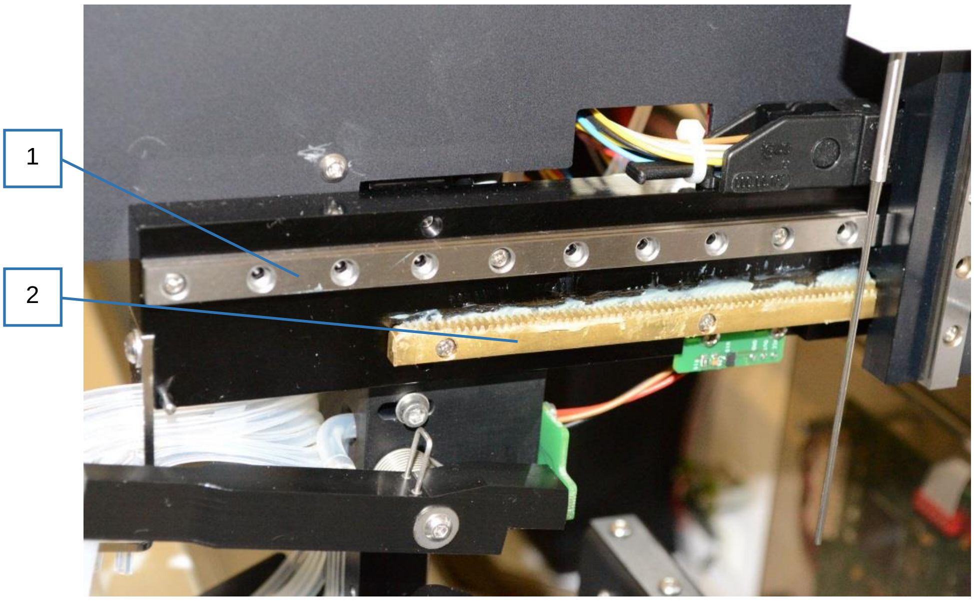
Picture 109

If the belt is to be tensioned, four bolts (1) are released, tensioning the belt on the pulley and tightening the bolts again.



Picture 110

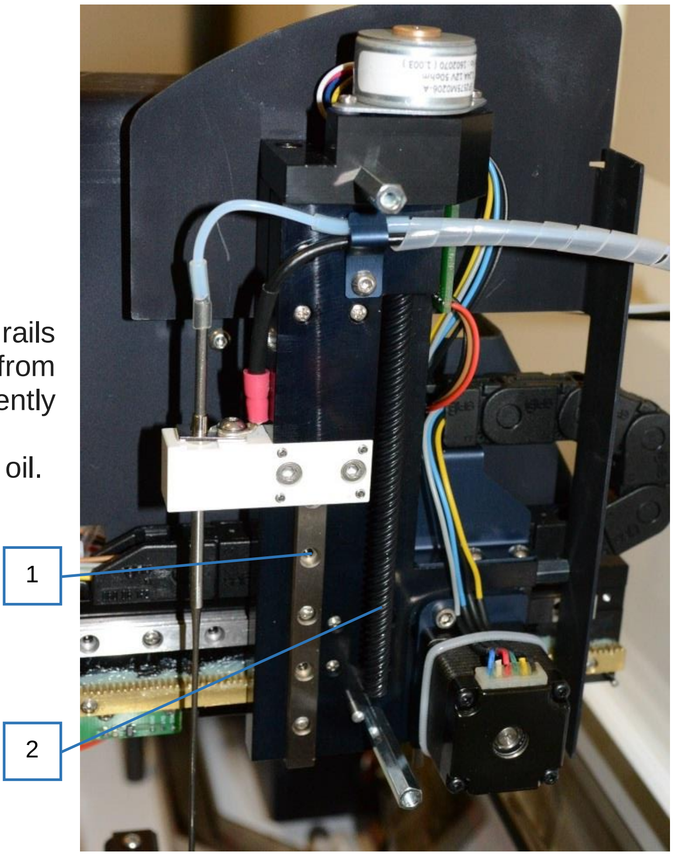
6.7.2 Y - shift



For Y shift , care must be taken to ensure that the rails (1) are clean. During maintenance, the rails are cleaned from the top and bottom by alcohol and gently lubricated with oil.
The toothed ridge (2) must be sufficiently greased with vaseline.

6.7.3 Z – shift

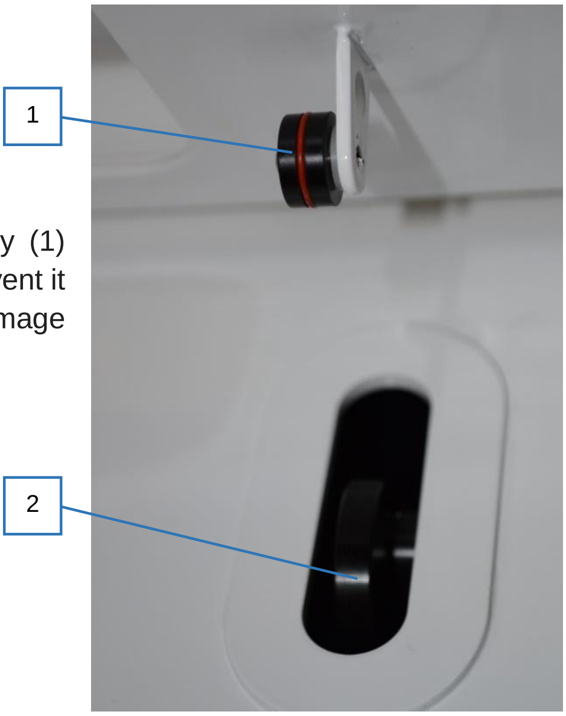
For Z shift, care must be taken to ensure that the rails (1) are clean. During maintenance, the rails from both sides are cleaned with alcohol and gently lubricated with oil.
Also the drive screw (2) is gently lubricated with oil.



Picture 111

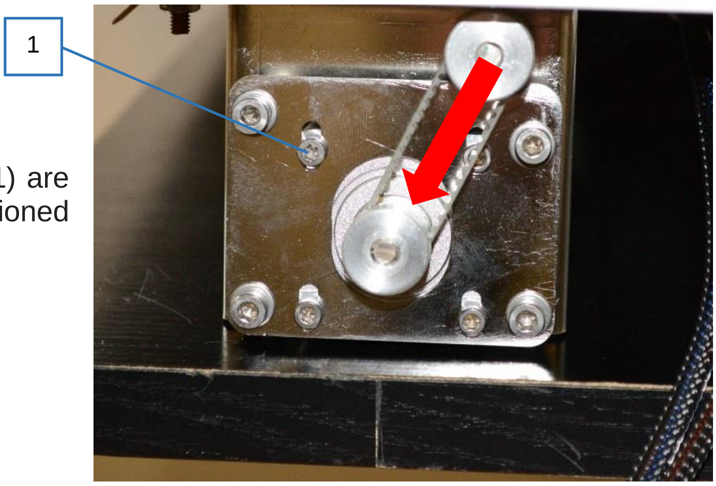
6.7.4 Rocking

For proper operation of the mechanism, the pulley (1) must rotate freely and contain a rubber o-ring to prevent it from sliding on the eccentric wheel (2). In case of damage to a part, it is necessary to replace it.



Picture 112

If the belt tension is required, four bolts (1) are released, pressure on the pulley is tensioned and the bolts are secured again.



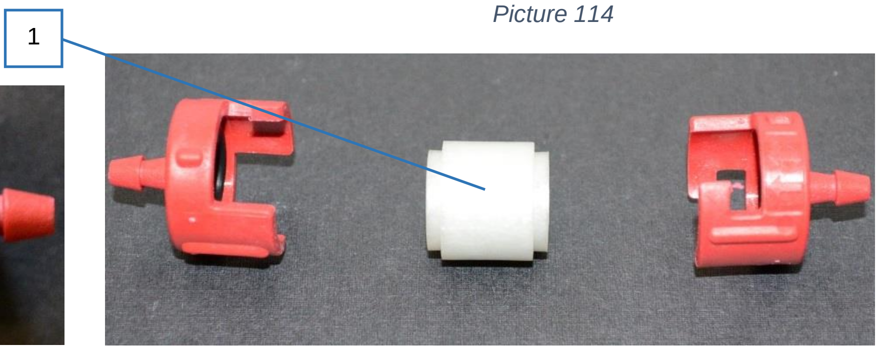
Obr. 113

6.8 Maintenance of exhaust silencer and reverse throttle valve

The exhaust silencer (see Picture 16 position 9) and reverse throttle valve (see Picture 13 position 7) may be contaminated with residual fluids. The reverse throttle valve may even be glued, resulting in insufficient vacuum creation in the waste bottle.

The container of the silencer is removed from the holder and it can be cleaned after the unscrewing the lid.

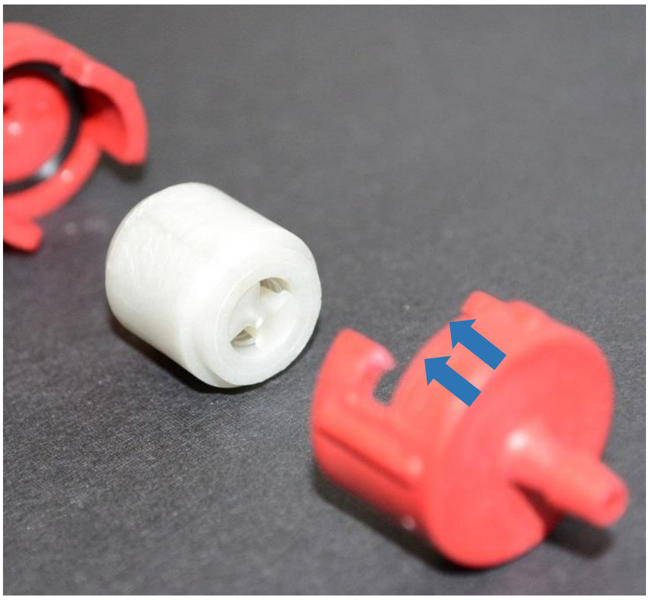
Picture 114



Picture 115

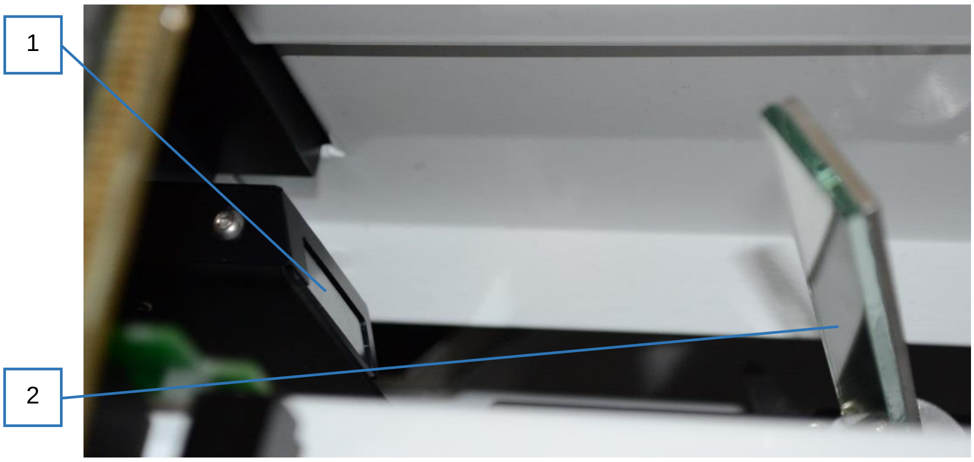
After turning the valve body halves, the insert (1) is removed, which is thoroughly washed with water and checked if its spring loaded piston moves freely.

When reassembling, care must be taken to ensure that the insert is correctly positioned so that the valve is permeable in the direction indicated by the arrows.
The direction of arrows from the waste bottle to the vacuum pump must also be observed when connecting the valve to the tubes.



Picture 116

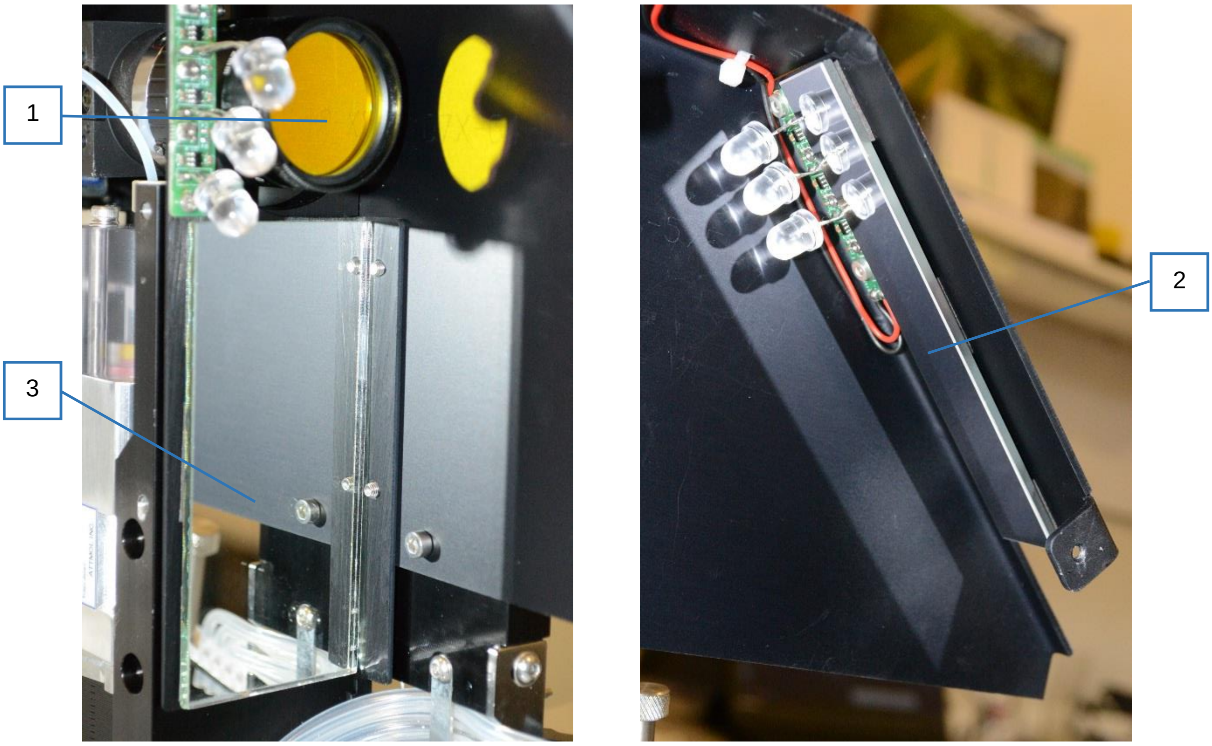
6.9 Maintenance of barcode reader



Picture 117

To ensure that the barcode reader functions correctly, make sure that the visor cap (1) and the mirror (2) are clean. A fine cloth intended for maintenance of the optics is used for cleaning. Alcohol may be used on the mirror when it is contaminated. Caution - the visor cap is made of plastic, and if chemicals are used for cleaning, it could be damaged.

6.10 Camera system maintenance



Picture 118

For proper operation of the camera system, the lens filter (1), the camera mirror (2), and the mirror for LED lighting (3) must be clean.
A fine cloth intended for maintenance of the optics is used for cleaning. Alcohol may be used on mirrors when the dirt is heavier.

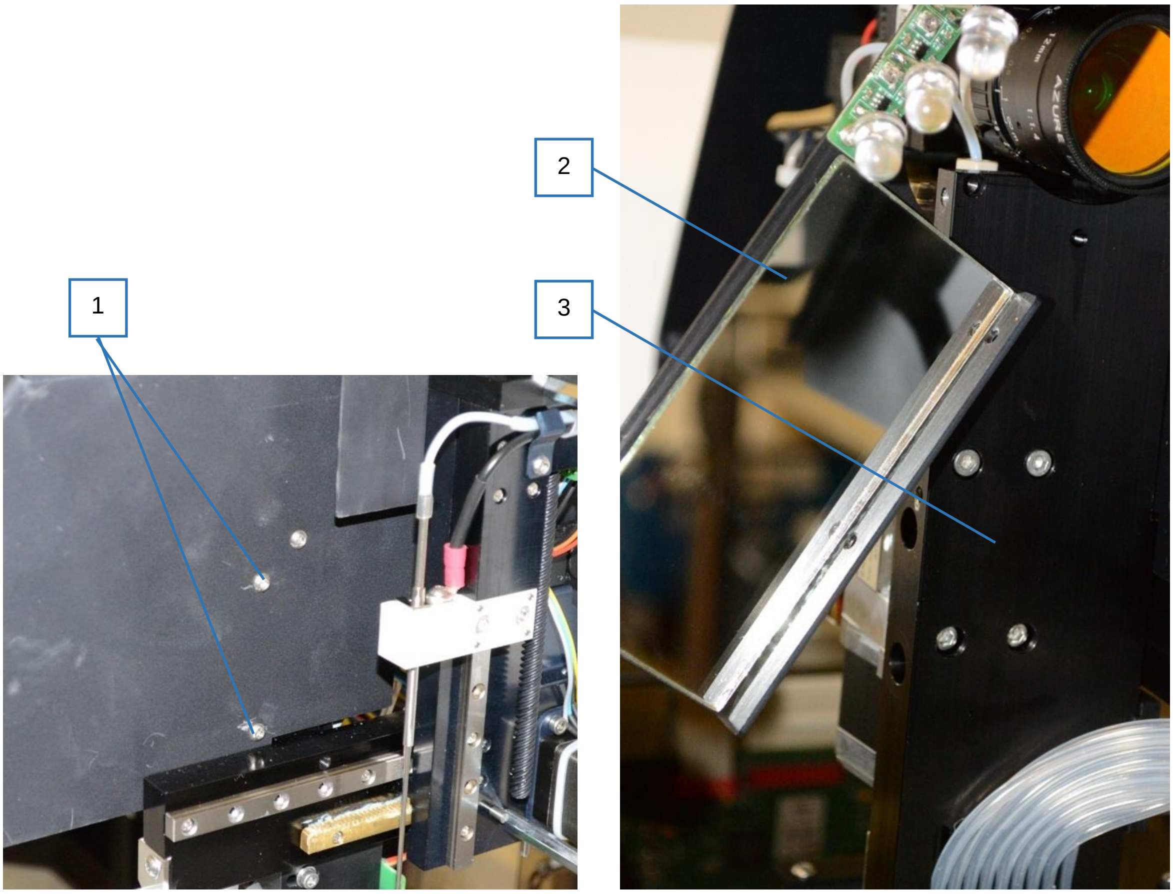
CAUTION

An optical mirror with a reflective layer applied to the surface is used for camera to reduce dupplication of the image. Therefore, it is not protected by glass. It is very important to use a very soft material for cleaning. The paper towel can cause scratches on the mirror surface.

NOTE

The lens filter and the camera mirror are well protected against dirt by their position under the cover of the working arm, in a normal operation. If there is no suspicion of their contamination, it is sufficient to clean the LED mirror for normal maintenance and the working arm cover must not be removed.

6.11 Dismantling the syringe



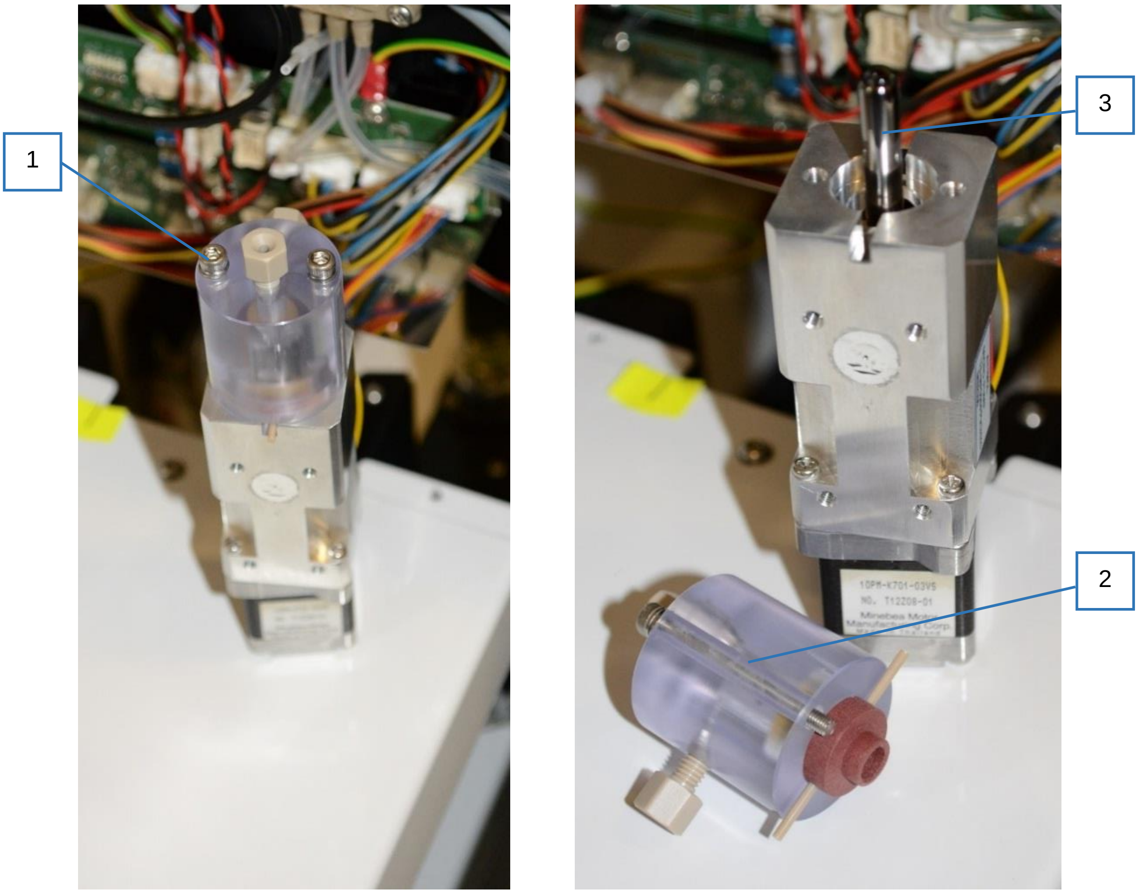
Picture 119

The cover of the working arm is removed first. To access the four syringe screws (3), the mirror holder lighting and the LED lighting 2 are diverted after the two screws are released.

The holder remains hanging on the power lines. After the screws (3) are released and the two connectors are disconnected, the syringe can be removed from the arm.

CAUTION

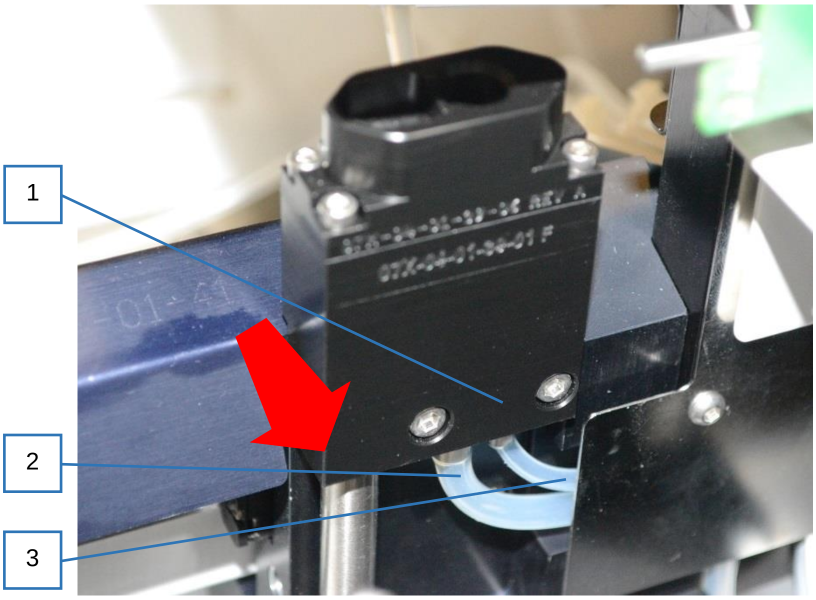
When manipulating with the holder, the shape of LEDs must not be changed so the strip lighting settings are not changed.



Picture 120

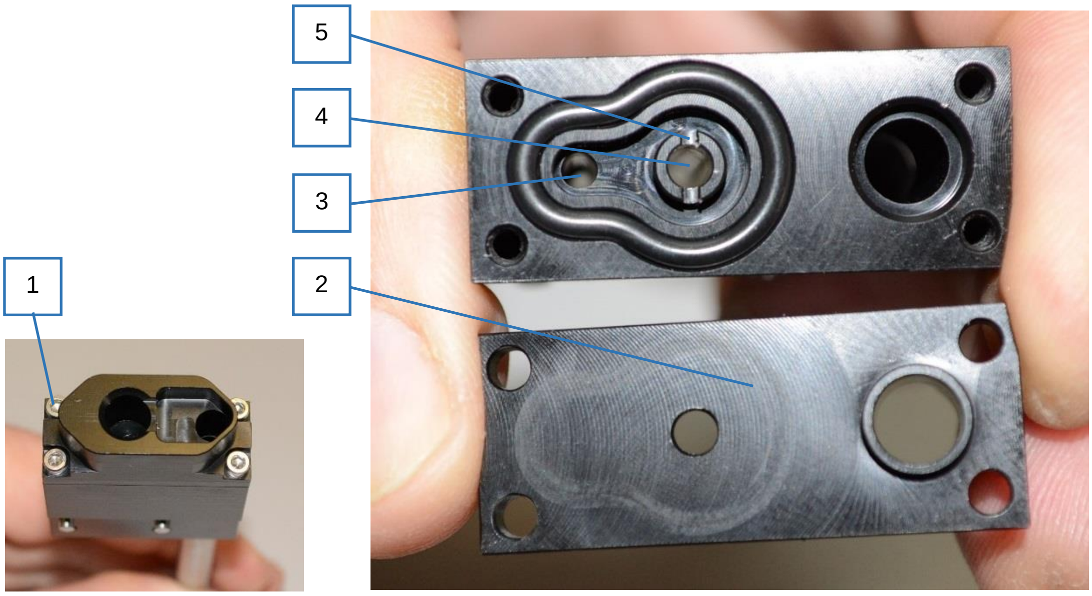
In case of a damage, only the syringe head (2) can be replaced. Two bolts (1) are released and the head retracts from the piston (3).

6.12 Dismantling of needle cleaning cuvette



Picture 121

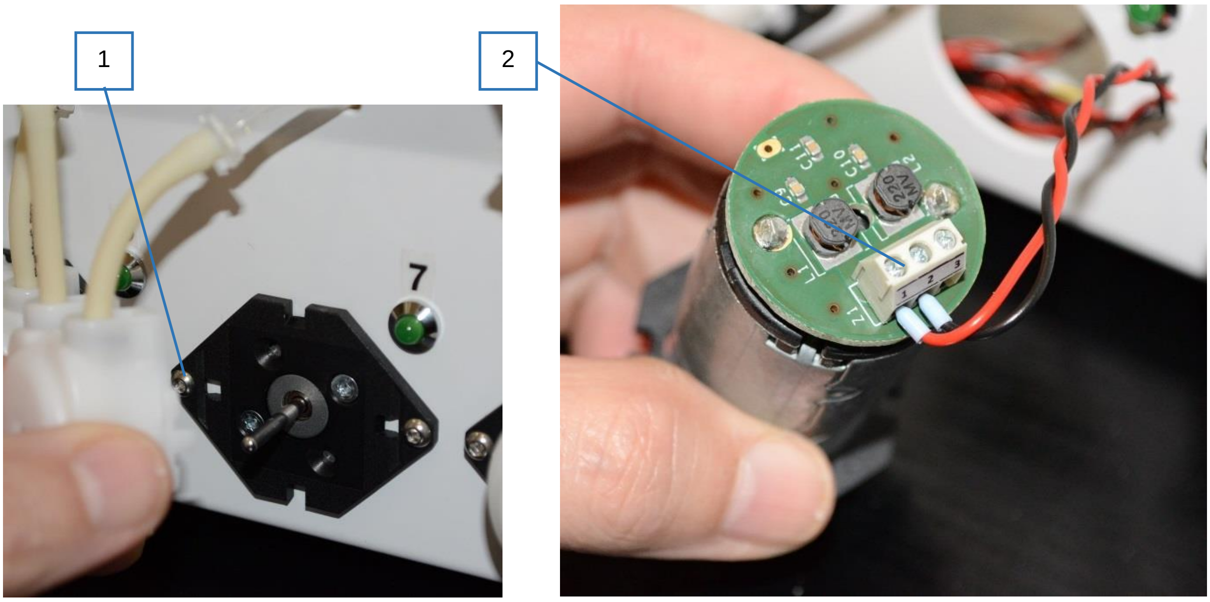
After removing the two screws (1), remove the cuvette in the direction of the arrow from its position and disconnect the waste tube (2) and tube of the system solution (3).



Picture 122

To clean the inner part of the cuvette, remove the cap (2) after loosening the four screws (1). For proper functioning of the cuvette, the inlet port of the system solution (3), the waste hole (4) and the needle rinse nozzles (5) must be well through and clean.

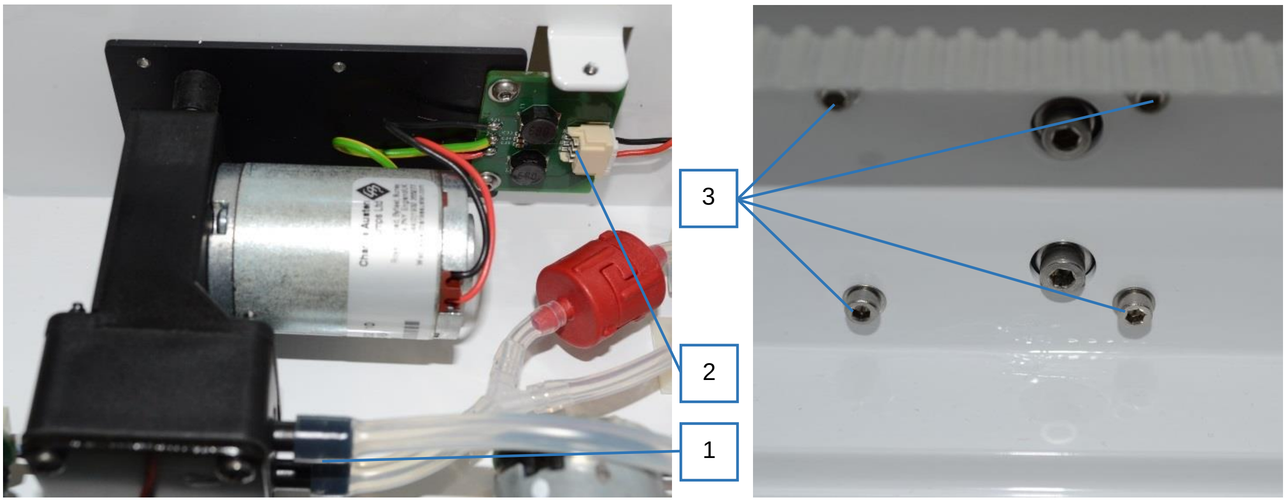
6.13 Dismantling the peristaltic pump motor



Picture 123

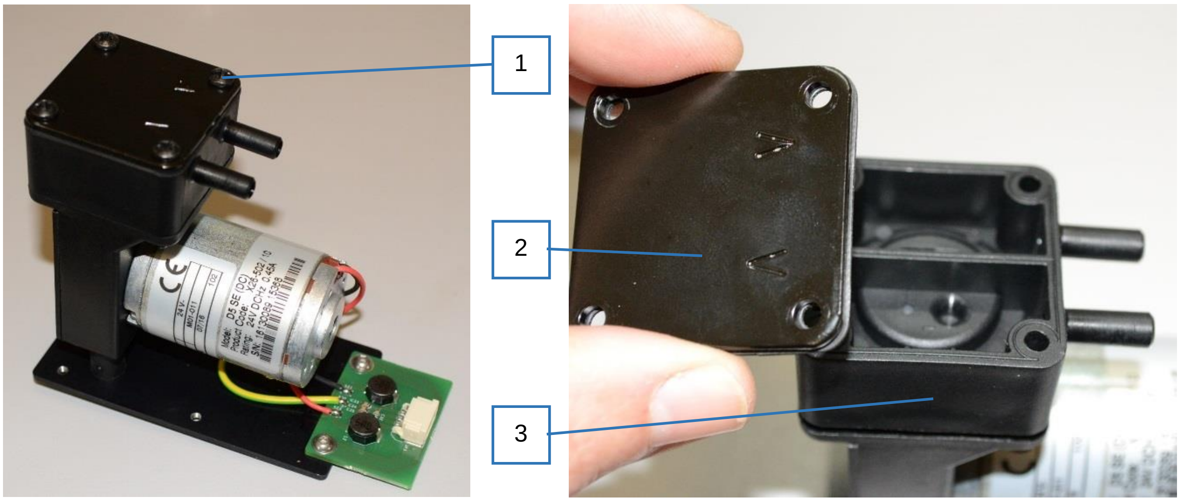
Remove the peristaltic pump cassette and loosen the two screws (1). The pump motor is ejected and the power wires are released from the terminal block (2).
WARNING for the correct polarity of the supply wires when reassembling.

6.14 Dismantling pump of vacuum in waste bottle

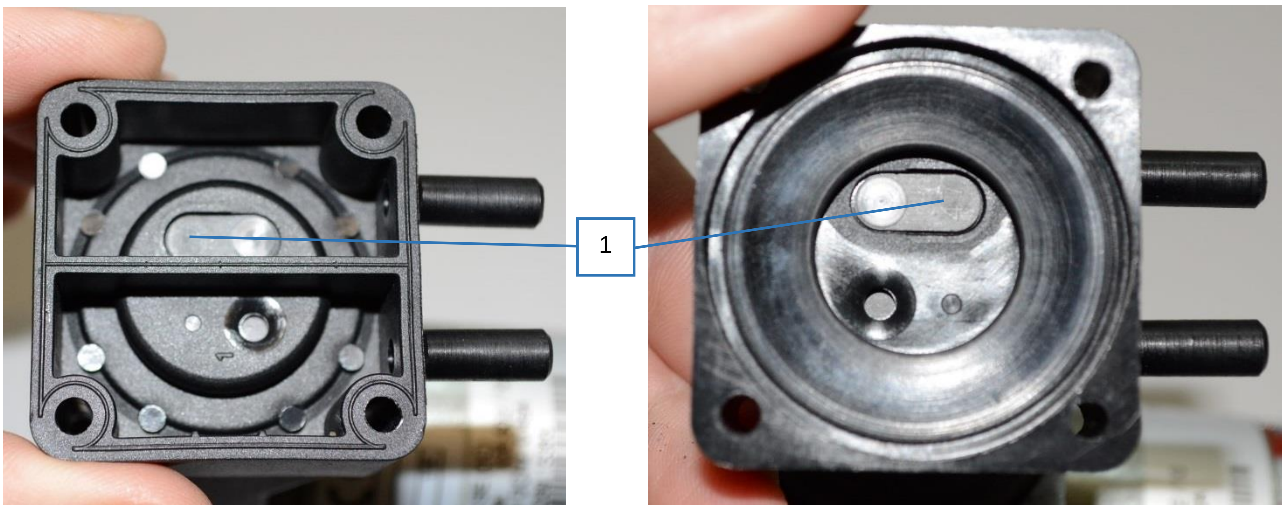


Picture 124

Remove the tubes (1) and the connector (2) from the motor assembly. The four screws (3) are released from the back.



Picture 125



Picture 126

The body of the head can be washed with water so that the contact surfaces of the two valves (1) are clean.

6.15 Checking of the instrument functionality

The instrument functionality is verified by running the *Instrument Check* protocol. This test is assigned to an assay of the same name (see 9.2 Assay listing of *Instrument check*).

At least 4 samples are selected when creating a worklist. The barcode reader function is verified by reading the code from the inserted tubes with a barcode. The type of tubes must be the same as the type selected in the worklist table, and the tubes are filled with the system solution in the same volume as the usual volume of samples in routine operation.
Reagent preparation will require distilled water at pump number 8.
In the assay steps, the correct execution of each activity is checked. The confirmation is required, as with manual activity, before performing any other activity.
In the first step of the assay, 100 µl of the system solution is pipetted from the tubes to the empty wells. Check for pipetting in each well (100 µl) does the pipettor function (orientative checking for pipetting can be done by aspiration of 100 µl using a pipette).
In the second step, 2 ml of distilled water is filled into the wells and incubation is then started - rocking for 30 seconds.
In the third step, the contents of the wells is aspirated.
In the fourth step, one strip drying cycle is run.
In the fifth and the final step, the plate can be replaced by a calibration plate and scanned for strip images.
Then the protocol run is completed.
Images of the calibration plate can be checked in the detail of the completed protocol in the menu *History / Protocols*.

7 History of instruments running- log files

The Dynablot Automatic PC application creates and stores files with the history of the instrument running. *Communication.log* files contain a detailed record of the instrument operation, and their analysis can help to correct the malfunctions. Files with error status records can be sent to service centers supporting Dynablot Automatic instrument to help resolve technical issues.

The files are stored in the *C:\Dynex\DynablotAutomatic\Logs*.
The file that is currently being recorded is called *communication.log*.
Files from previous days are added to the date they were recorded, for example, *communication.log.2017-02-16*. If a file size exceeds 1 MB, a new file is created for that day. The original file is renamed by adding the name to the name with the sequence number *.1*. If the current file exceeds the limit size again, a new file is created and all older files of that day are renumbered as one.
This creates a chronological series of log files ranging from the latest records to older ones. For example:
communication.log
communication.log.1
communication.log.2017-02-20
communication.log.2017-02-16
communication.log.2017-02-16.1

8 Principles of operation

8.1 Communication

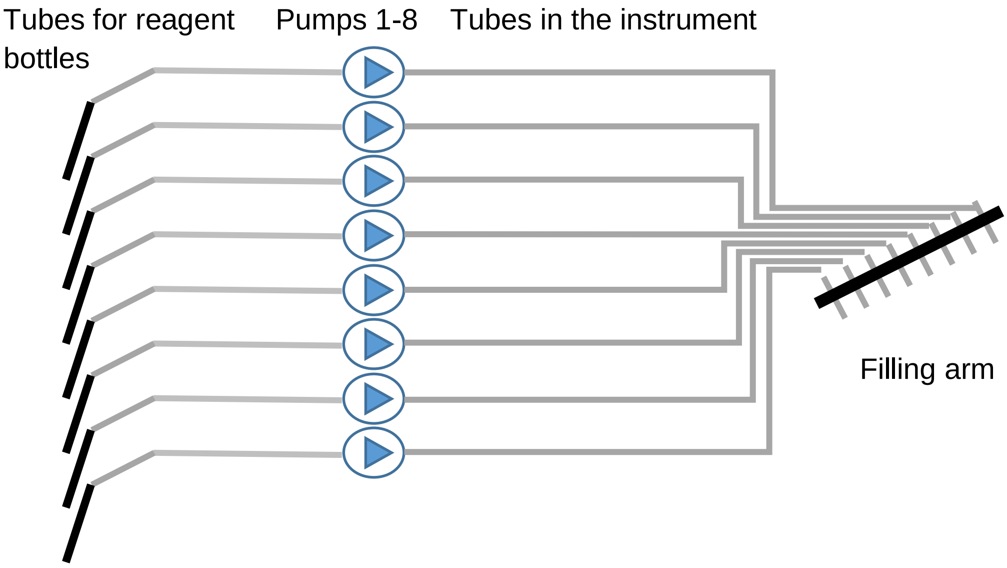
External communication between the PC and the instrument:
This communication is realized via two USB ports.
One communication channel is connected to the mainboard of the intrument and passes data of commands and information related to the control of the intrument operation.
The second channel directly connects PC and camera and provides camera control and image data transfer. This USB connection also provides power to the camera, which is therefore independent of the power supply of the instrument.

Internal communication:
Communication between individual functional units within the instrument

- Mainboard – armboard, is realized via a cable stored in the energy chain between the instrument chassis and the movable working arm, has its own communication protocol
- Barcode reader – mainboard, is realized via a flat cable between the reader and the armboard and also by the cable stored in the power chain between the chassis of the instrument and the movable working arm, the serial communication at the TTL level
- Level detection circuit – mainboard, is realized via a cable stored in the energy chain between the chassis of the device and the movable working arm, the I2C communication protocol

8.2 Hydraulic scheme of reagent filling system

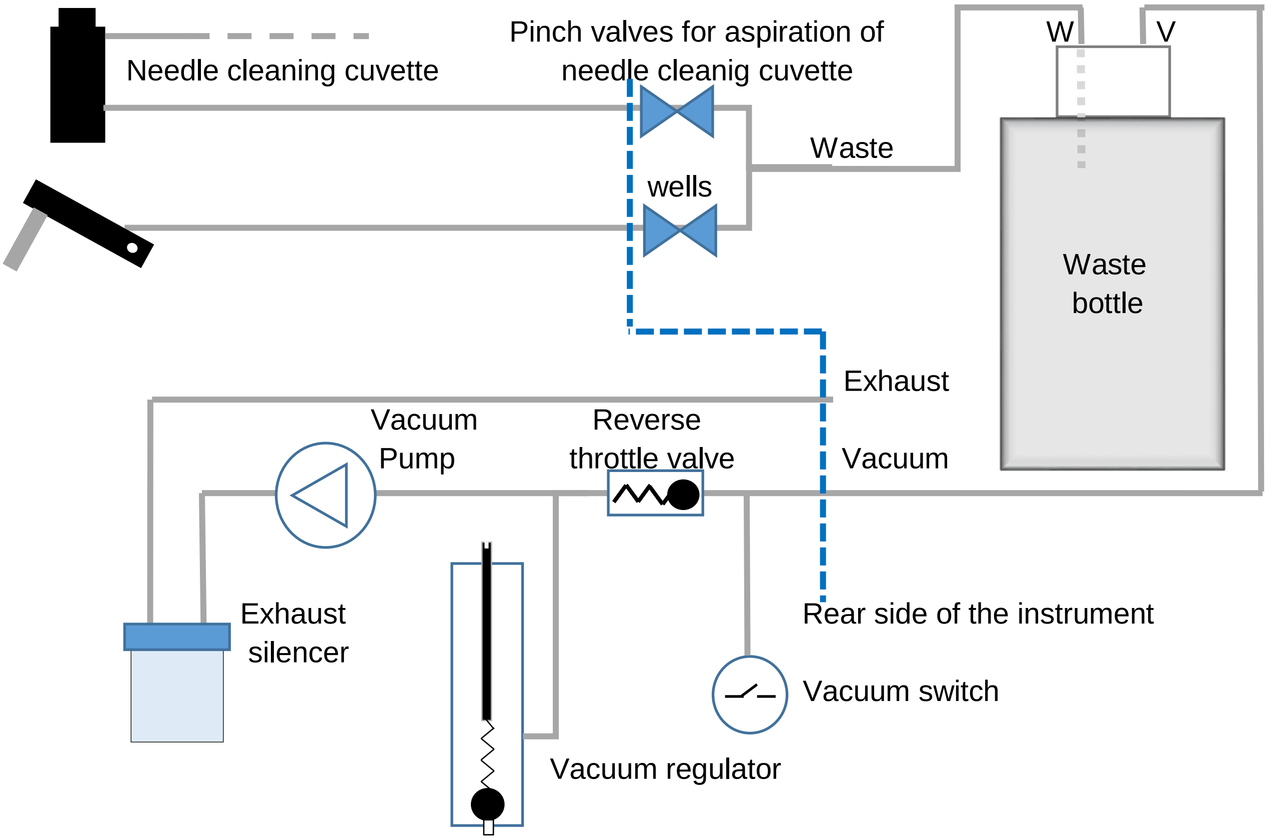
The instrument has 8 channels to fill the reagents. Each channel is composed of a peristaltic pump. The inlet tube ending with a plastic tube for insertion into a reagent vial and an outlet tube leading to the filling arm are connected to it. Simple design of the channel enables easy replacement of parts during preventive maintenance.



Picture 127

8.3 Hydraulic scheme of exhaust system

The aspirating system is based on vacuum in the waste bottle. It ensures that the used system solution is aspirated out of the needle cleaning cuvette and aspirates the contents of the wells while replacing the reagents during the protocol run.

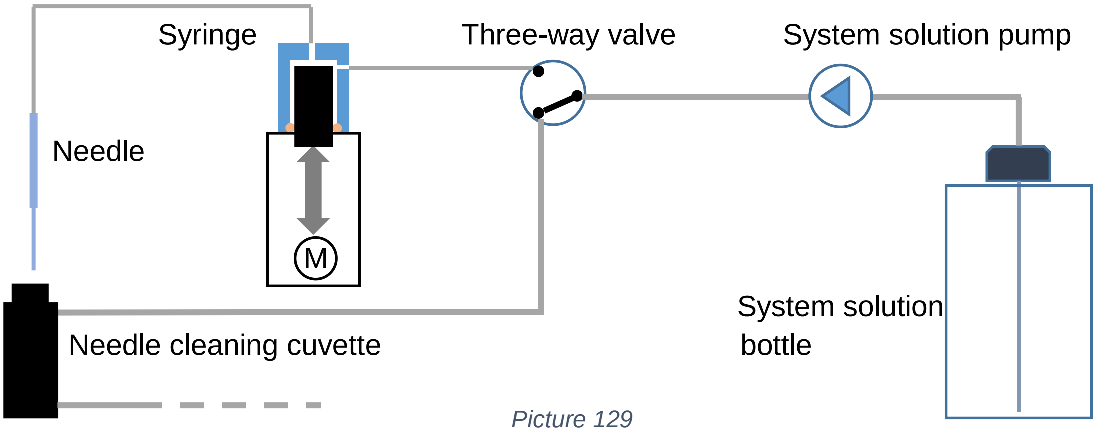


Picture 128

A diaphragm pump is used to create a vacuum in the waste bottle, the outlet of which is fed through the muffler into the exhaust in the rear wall of the instrument. The silencer reduces the noise of the instrument and separates any residual liquid that is sucked from the waste bottle. By the vacuum regulator, the vacuum is set in the waste bottle when both aspiration valves are closed. Depending on the pressure value on the regulator inlet valve, air is pumped into the pump. Pressure is adjusted by turning the screw on the top of the regulator. By tightening of the screw, the air suction is limited, which increases the bottle under pressure. The reverse throttle valve maintains the vacuum in the waste bottle after the pump has been switched off. This speeds up the system's readiness to run the next aspiration cycle. By means of a vacuum sensor, the instrument control system receives a signal whether sufficient aspiration pressure is achieved. By opening the exhaust valves of aspiration for cleaning cuvette or wells, the aspiration from the appropriate location is activated.

8.4 Hydraulic scheme of pipetting system

The pipetting system performs the sample transfer between the sample tubes in the rack and the wells in the tray. It is filled by the system solution during its operation. The solution makes the pipetting more accurate (if the air fills the system its compressibility is problematic) and it is used for the needle cleaning.



Picture 129

The needle serves to manipulate the sample itself. The surface of the inner walls and the lower part of the outer wall of the needle are provided with ceramic "nanocoating" technology, which greatly facilitates its cleaning. The cleaning is done by the peristaltic pump with the flow of the system solution. Depending on the location of the three-way valve, the solution is passed through the syringe into the interior of the needle or into the top of the cleaning cuvette. During cleaning, the needle is partially inserted into the cuvette and the outer part that comes into contact with the sample is washed.

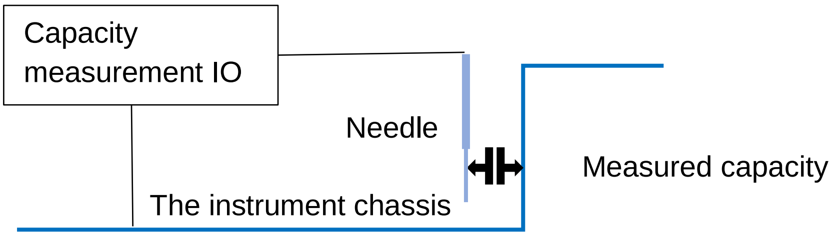
Accurate measurement of the volume of the pipetted sample is performed in the syringe by piston movements. The piston is sealed at the bottom of the head of the syringe, the inside diameter of which is larger than the diameter of the piston. This allows free flow of system solution at any piston position. When pipetting, the three-way valve outlet leading into the syringe is closed and the syringe with the needle forms a closed space. The movement of the piston is then accurately transferred to the system solution in the needle and thus to the pipetted sample. Before taking a sample, a small amount of air is drawn into the needle tip and this creates a bubble, which separates the sample from the system solution.

8.5 Fluid level detection with pipettor needle

Liquid level detection using a pipetting needle is used to detect:

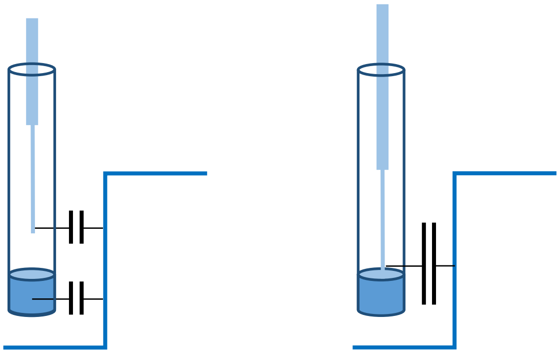
- the sample levels in primary tubes before aspirating
- the reagent level in the wells of strip plate before pipetting samples (pipetting below the level of the well content eliminates the drop of sample on the tip of the needle)
- the presence of a system solution in a needle cleaning cuvette during the system solution priming
- the presence of a system solution in a needle cleaning cuvette while filling the cuvette during extra needle cleaning
- the water level in the calibration cuvette during the calibration of peristaltic pumps

For detecting the touch of a pipette needle with a liquid, the principle of the electrical capacity measuring between the needle and the chassis of the apparatus is used, where the needle forms one electrode and the chassis of the instrument the second electrode of the measured capacitor. The capacity measuring circuit is located on the armboard and is connected to the needle by a shielded cable.



Picture 130

When looking for a liquid level, the parasitic capacity of the needle against the chassis is first recorded. Then, the required process is triggered (for example, moving the needle down when searching for the sample level or starting the system solution pump when filling the cleaning cuvette). As soon as the needle touches the fluid which is looked for, the fluid capacity is added to the parasitic needle capacity and the measuring circuit records an increase of the value. If the increase exceeds the required limit, the level detection is considered to be successful.



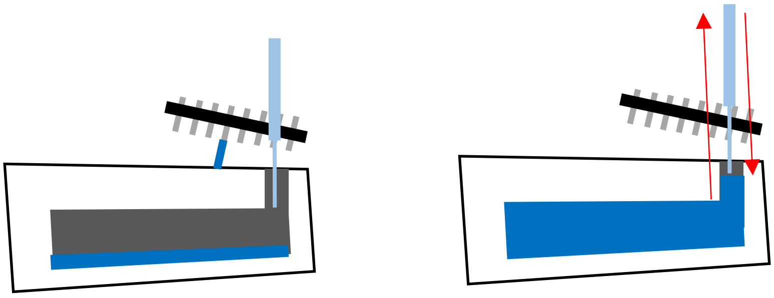
Picture 131

INSTRUCTION

The capacity of the liquid to be searched against the chassis of the instrument is dependent in the electrical conductivity of the liquid. For this reason, it is important to add a preparation named *Setup Clean* to the distilled water in the prescribed concentration when preparing the system solution. Low concentration decreases the conductivity of the system solution and causes errors during the preparation of the system solution and during the filling of the cleaning cuvette during extra needle cleaning.

8.6 Automatic calibration of peristaltic pumps

In the automatic calibration process, the peristaltic pump performs short, time-defined batches that fill the calibration cuvette. Calibration constant is calculated as the ratio of pumping time to filled volume.



Picture 132

In the first calibration phase, the needle is at the lower edge of the measuring hole and the calibrated pump performs filling doses. Once the needle detects fluid contact, the dosage is interrupted. The fill time is calculated from the number of batches. The level is stabilized in the measuring hole after the last dose.

Subsequently, the needle goes to the upper position and returns to the measuring hole to measure the height of the level. The volume is calculated from the known volume of the cuvette main cavity and the level of the level in the measuring hole.

Then, the liquid from the calibration cuvette is aspirated into the waste bottle and the cuvette is prepared to calibrate the next pump.

8.7 Level detection in system solution bottle

The level detection in the system solution bottle is carried out in the holder by contactless measurement using light beams. The presence of the solution is detected in two levels - Warning and Alarm. A different beam refraction passing through an empty or filled bottle is used for detection.

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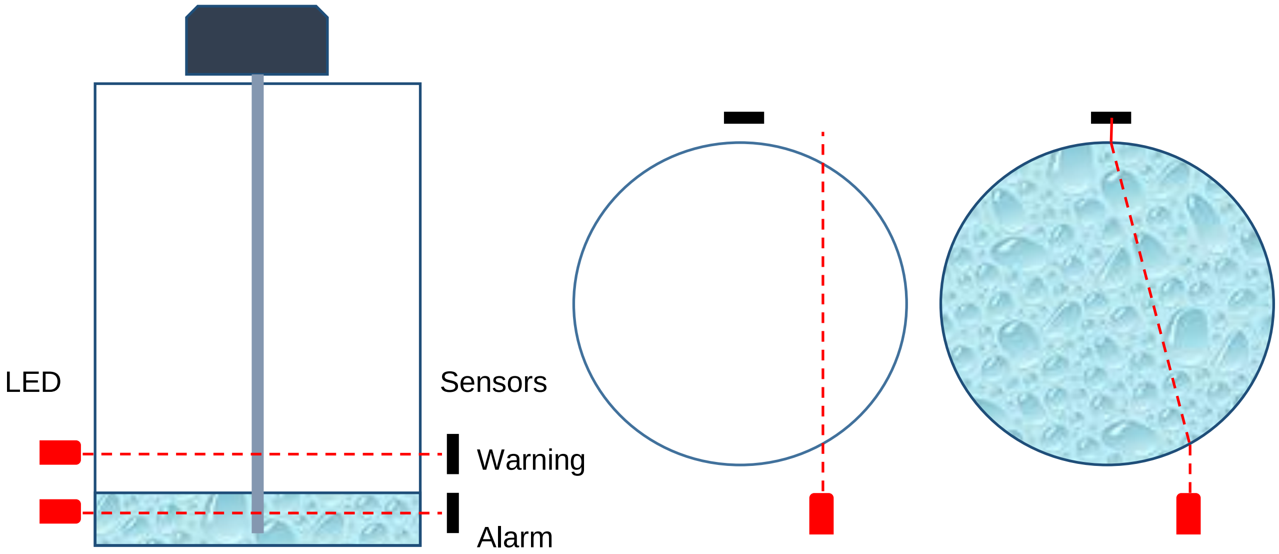


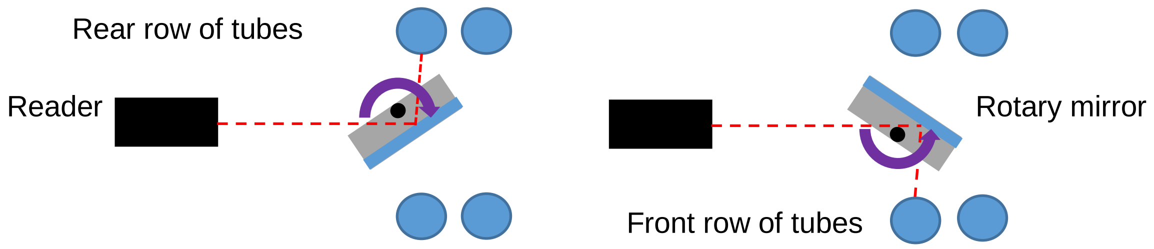
The level detection is activated only when the system solution is in the *Ready state* and the measurement is done once every 10 seconds with a brief LED illumination.

INSTRUCTION

Do not place labels or self-adhesive labels on the system solution bottle at the measurement level to prevent beam passage.

8.8 Barcode reader

The bar code reader scans the sample identification codes from the primary tubes inserted into the rack that is inserted into the instrument. In order to save space, reading is performed via the swivel mirror.



Picture 133

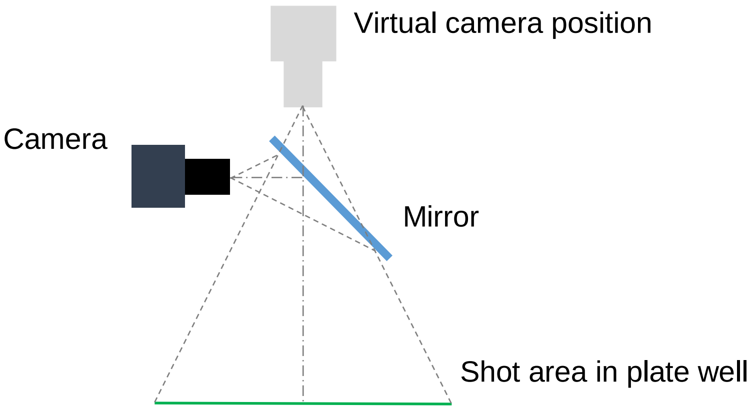
The swivel mirror allows you to read the codes from the opposite rows of tubes in the rack. The tilting of the mirror is performed mechanically when the working arm reaches the utmost right and left X shifts.

INSTRUCTION

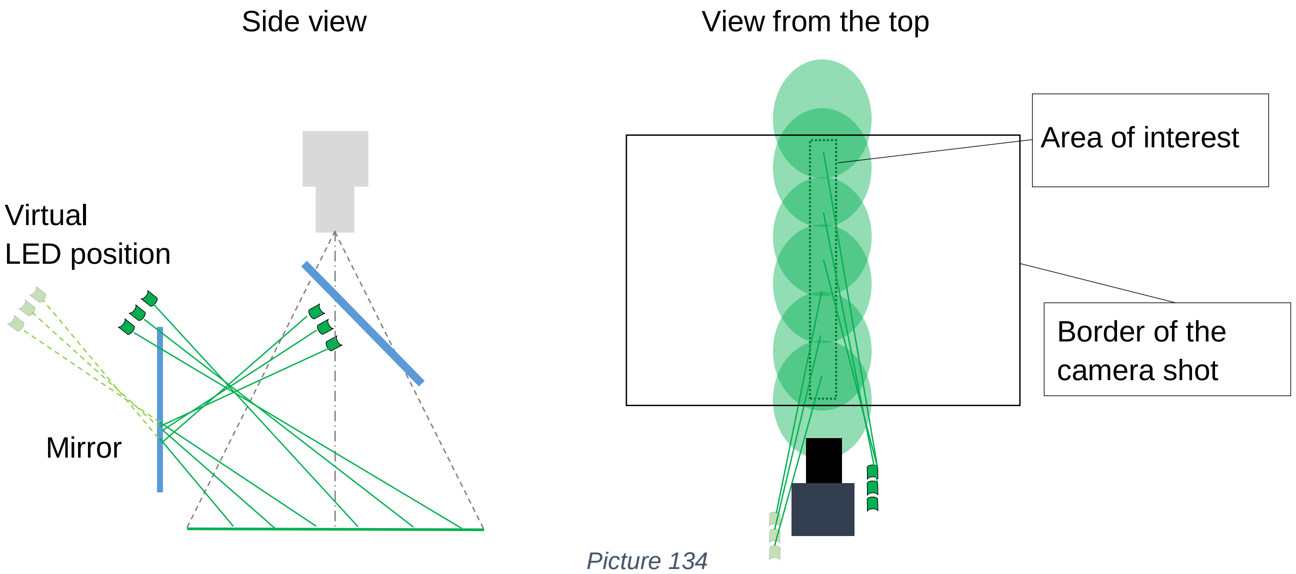
The types of codes, that are recognized during reading, can be selected in the instrument settings. In terms of reliability of recognition and read speeds, it is advisable to select only the types that are actually used on the tubes.

8.9 Capturing strip images

The strip image capture is performed with a 5 MPixel monochrome CCD camera. To achieve the required distance between the camera lens and the scanned area, the shot is performed over the sloping mirror. This made it possible to reduce the height of the instrument.



Green LEDs are used to illuminate the area being scanned. In order to suppress the influence of ambient light penetrating into the workspace, the camera lens is equipped with a green filter that only passes light of the wavelength corresponding to the LED light. Lighting LEDs with a radiation angle of about 20 ° are placed in two triplets to achieve bottom illumination of the wells without undesirable shadows from the walls of the wells. At the same time, the LEDs are positioned so that their direct reflections on the wet surface of the strips are out of the camera view.
By setting the camera parameters, the AOI is selected, which is part of the camera overall shot. Only this part of the image is then transmitted by the camera when creating a snapshot of a well with a strip. An appropriate combination of arm and camera position, choice of area of interest, and lighting adjustment will give a picture of the bottom of the well with a stripe without undesirable shadows and glare.



Picture 134

9 Appendix

9.1 D-code segments

The chapter contains D-code segments that are run from DynLab software for some service activities.

9.1.1 001 selftest RUN.Dcod

```
;****Self tests and home positions after the instrument switch ON****
SET R1 0    ; 0=only home positions, 1=all tests
SET R2 1    ;BarCodeReader 0=No 1=Yes
SET R3 0    ;Camera 0=No 1=Yes
SET R400 0
SET R421 1
RUN 0
END
```

9.1.2 020 System voiding RUN

```
;***************System voiding (syringe, needle, needle cleaning bowl)**************
SET R400 0
SET R421 20
RUN 0
END
```

9.2 Assay listing of *Instrument check*

Group	Instrument check
Assay	Instrument check

Step	Operation	Parameter	Value
Pipettting	Pipetting samples	Volume	100,00 µl
		Disable multiple pipetting	No
		Extra needle cleaning	No
		Clot detection	No
Dispensing Incubation	Manual operation	Message	Dispensing start
Dispensing Incubation	Filling	Volume	20,00 * 0.1 ml
		Reagents	Dist. Water
Dispensing Incubation	Manual operation	Message	Incubation start
Dispensing Incubation	Incubation	Speed rocking	2
		Incubation time	00:00:30
		After stopping the incubation, stop the rocking	Yes
Aspiration	Manual operation	Message	Aspiration start
Aspiration	Aspiration	Thorough Aspiration	No
Drying	Manual operation	Message	Drying start
Drying	Drying	Drying cycles	1
Images	Manual operation	Message	Insert the calibration plate - Images taking start
Images	Capturing		

9.3 Preventive maintenance protokol

Preventive maintenance protokol

Instrument : Dynablot Automatic

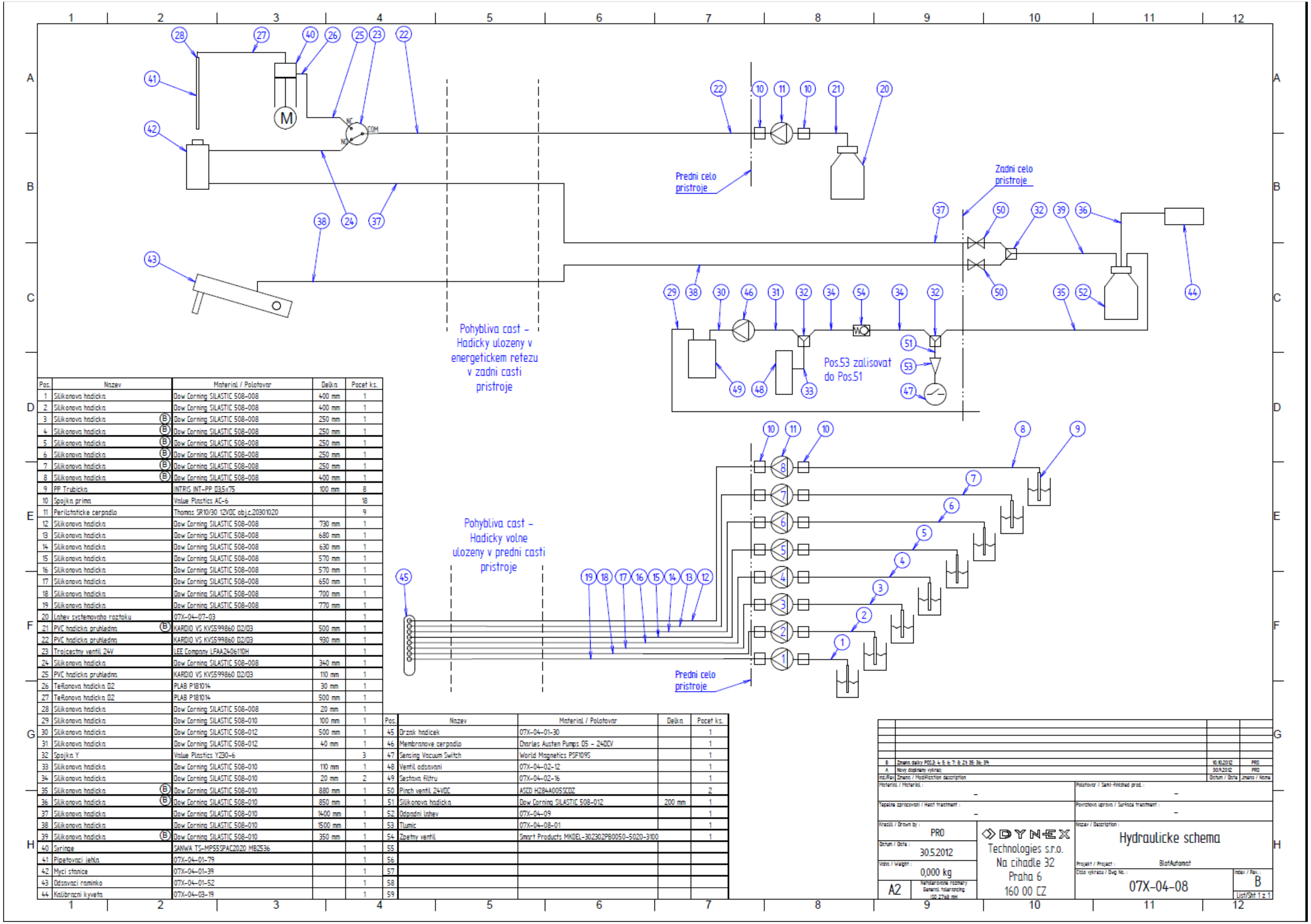
Serial number : ___________ - ____________

Checklist of operations

Step	Operation	done
1	The cassettes of peristaltic pumps replacement	
2	The reagent tubing replacement	
3	Pumps calibration	
4	X shift control and maintenance	
5	Y shift control and maintenance	
6	X shift control and maintenance	
7	Rocking motion control and maintenance	
8	Checking and maintenance of the vacuum in the waste bottle system	
9	Checking of system solution pump	
10	Maintenance of barcode reader system	
11	Camera system maintenance	
12	Calibration of camera system	
13	Checking of the instrument functionality checking	

Date		
Service technician	Name	
	Signature	

9.4 Hydraulic diagram



Pos.	Nazev		Material / Polotovar	Delka	Pocet ks.
1	Silikonova hadicka		Dow Corning SILASTIC 508-008	400 mm	1
2	Silikonova hadicka		Dow Corning SILASTIC 508-008	400 mm	1
3	Silikonova hadicka	Ⓑ	Dow Corning SILASTIC 508-008	250 mm	1
4	Silikonova hadicka	Ⓑ	Dow Corning SILASTIC 508-008	250 mm	1
5	Silikonova hadicka	Ⓑ	Dow Corning SILASTIC 508-008	250 mm	1
6	Silikonova hadicka	Ⓑ	Dow Corning SILASTIC 508-008	250 mm	1
7	Silikonova hadicka	Ⓑ	Dow Corning SILASTIC 508-008	250 mm	1
8	Silikonova hadicka	Ⓑ	Dow Corning SILASTIC 508-008	400 mm	1
9	PP Trubicka		INTRIS INT-PP D3,5x75	100 mm	8
10	Spojka prima		Value Plastics AC-6		18
11	Perilstaticke cerpadlo		Thomas SR10/30 12VDC obj.c.20301020		9
12	Silikonova hadicka		Dow Corning SILASTIC 508-008	730 mm	1
13	Silikonova hadicka		Dow Corning SILASTIC 508-008	680 mm	1
14	Silikonova hadicka		Dow Corning SILASTIC 508-008	630 mm	1
15	Silikonova hadicka		Dow Corning SILASTIC 508-008	570 mm	1
16	Silikonova hadicka		Dow Corning SILASTIC 508-008	570 mm	1
17	Silikonova hadicka		Dow Corning SILASTIC 508-008	650 mm	1
18	Silikonova hadicka		Dow Corning SILASTIC 508-008	700 mm	1
19	Silikonova hadicka		Dow Corning SILASTIC 508-008	770 mm	1
20	Lahev systemovaho roztoku		07X-04-07-03		1
21	PVC hadicka pruhledna	Ⓑ	KARDIO VS KVS599860 D2/D3	500 mm	1
22	PVC hadicka pruhledna		KARDIO VS KVS599860 D2/D3	930 mm	1
23	Trojcestny ventil 24V		LEE Company LFAA2406110H		1
24	Silikonova hadicka		Dow Corning SILASTIC 508-008	340 mm	1
25	PVC hadicka pruhledna		KARDIO VS KVS599860 D2/D3	110 mm	1
26	Teflonova hadicka D2		PLAB P181014	30 mm	1
27	Teflonova hadicka D2		PLAB P181014	500 mm	1
28	Silikonova hadicka		Dow Corning SILASTIC 508-008	20 mm	1
29	Silikonova hadicka		Dow Corning SILASTIC 508-010	100 mm	1
30	Silikonova hadicka		Dow Corning SILASTIC 508-012	500 mm	1
31	Silikonova hadicka		Dow Corning SILASTIC 508-012	40 mm	1
32	Spojka Y		Value Plastics Y230-6		3
33	Silikonova hadicka		Dow Corning SILASTIC 508-010	110 mm	1
34	Silikonova hadicka		Dow Corning SILASTIC 508-010	20 mm	2
35	Silikonova hadicka	Ⓑ	Dow Corning SILASTIC 508-010	880 mm	1
36	Silikonova hadicka	Ⓑ	Dow Corning SILASTIC 508-010	850 mm	1
37	Silikonova hadicka		Dow Corning SILASTIC 508-010	1400 mm	1
38	Silikonova hadicka		Dow Corning SILASTIC 508-010	1500 mm	1
39	Silikonova hadicka	Ⓑ	Dow Corning SILASTIC 508-010	350 mm	1
40	Syringe		SANWA TS-MP55SPAC2020 MB2536		1
41	Pipetovaci jehla		07X-04-01-79		1
42	Myci stanice		07X-04-01-39		1
43	Odsavaci raminko		07X-04-01-52		1
44	Kalibracni kyveta		07X-04-03-19		1

Pos.	Nazev	Material / Polotovar	Delka	Pocet ks.
45	Drzak hadicek	07X-04-01-30		1
46	Membranove cerpadlo	Charles Austen Pumps D5 - 240DV		1
47	Sensing Vacuum Switch	World Magnetics PSF109S		1
48	Ventil odsavani	07X-04-02-12		1
49	Sestava filtru	07X-04-02-16		1
50	Pinch ventil 24VDC	ASCO H284A005SCDZ		2
51	Silikonova hadicka	Dow Corning SILASTIC 508-012	200 mm	1
52	Odpadni lahev	07X-04-09		1
53	Tlumic	07X-04-08-01		1
54	Zpetny ventil	Smart Products MKDEL-302302PB0050-5020-3100		1
55				
56				
57				
58				
59				

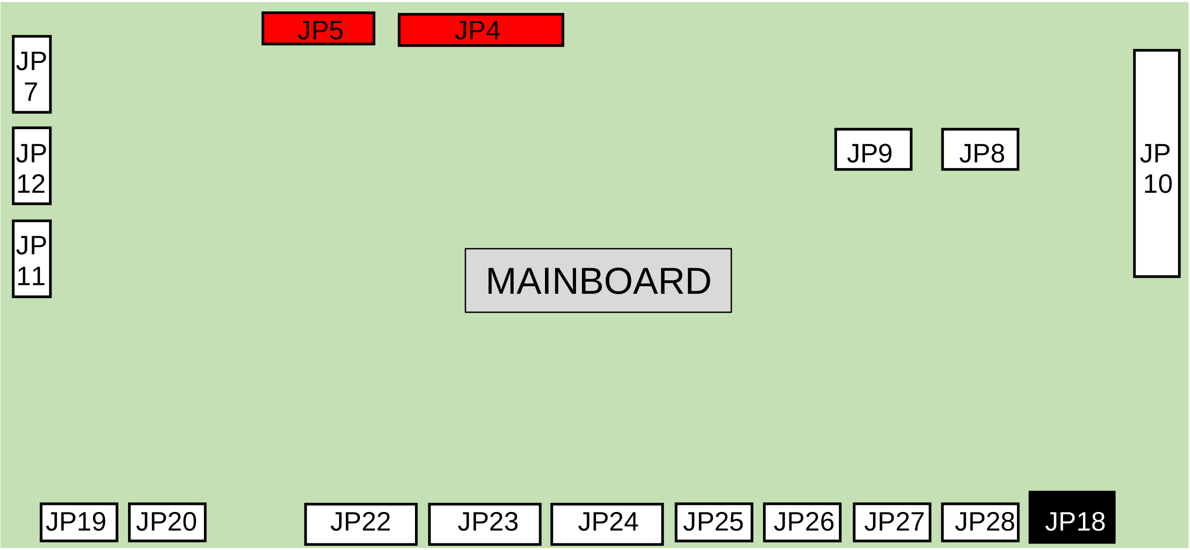
Ind./Rev.	Zmena / Modification description	Datum / Date	Jmeno / Name
B	Zmena delky POS.3; 4; 5; 6; 7; 8; 21; 35; 36; 39;	10.10.2012	PRO
A	Novy doplneny vykres;	30.9.2012	PRO

Material / Material : –
Polotovar / Semi-finished prod. : –
Tepelne zpracovani / Heat treatment : –
Povrchova uprava / Surface treatment : –
Kreslil / Drawn by : PRO
Datum / Date : 30.5.2012
Vaha / Weight : 0,000 kg
A2
Netolerovane rozmery
General tolerancing
ISO 2768 mH

DYNEX
Technologies s.r.o.
Na cihadle 32
Praha 6
160 00 CZ

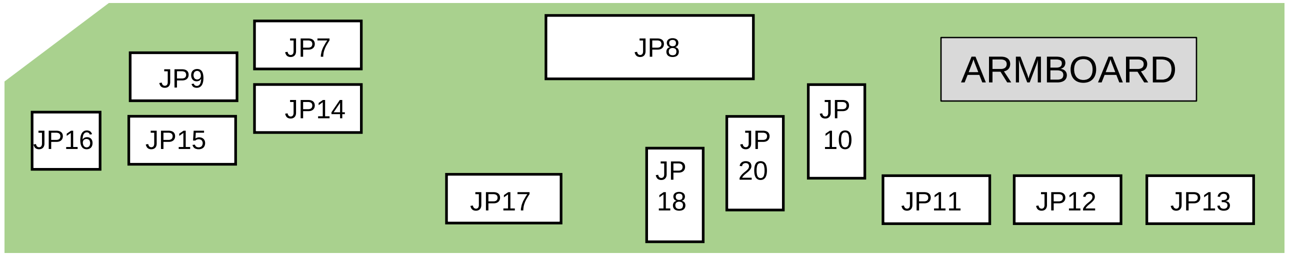
Nazev / Description : Hydraulicke schema
Projekt / Project : BlotAutomat
Cislo vykresu / Dwg No. : 07X-04-08
Index / Rev. : B
List/Sht 1 z 1

9.5 Mainboard connector map



JP4 - auxiliary service connector for LCD display
JP5 - pumps LED indicators boards
JP 7 - encoder of X shift
JP8 - sensor of the closed position of the workspace cover
JP9 - vacuum in the waste bottle sensor
JP10 - main cable for connection to the armboard
JP11 - rocking home sensor
JP12 - home sensor of X shift
JP18 - power supply 24 V
JP19 - stepper motor of X shift
JP20 - stepper motor of rocking
JP22 - outputs : power supply of the heating foil regulator
pinch valve of asp. cleaning needle cuvette
pinch valve of asp. arm of the wells
vacuum pump
JP23 - outputs : left fan of workspace area
right fan of workspace area
peristaltic pump of system solution
power supply of the system solution holder
JP24 - level detection in syst. solution bottle and waste bottle
JP25 - peristaltic pumps channel 1 and 2
JP26 - peristaltic pumps channel 3 and 4
JP27 - peristaltic pumps channel 5 and 6
JP28 - peristaltic pumps channel 7 and 8

9.6 Armboard connector map



JP 7	- home sensor of Z shift
JP 8	- main cable for connection to mainboard
JP 9	- position sensor of the aspiration arm
JP10	- three-way valve
JP11	- stepper motor of Y shift
JP12	- stepper motor of Z shift
JP13	- stepper motor of syringe
JP14	- home sensor of Y shift
JP15	- home senzor of syringe
JP16	- level detection circuit
JP17	- barcode reader
JP18	- LED lighting 1 and 2
JP20	- fan of strip drying