Antec Scientific
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The Netherlands

AS110 autosampler

Service manual

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CE Declaration of Conformity

We Antec Leyden B.V., Zoeterwoude, The Netherlands, declare that the product:

AS 110 & AS 110 micro auto sampler **type 191**

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to which this declaration relates, is in conformity with the following CE directives:

Machinery Directive (2006/42/EC)

Low Voltage Directive (2014/35/EU) applied with the following standards:

Safety requirements for electrical equipment for measurement, control, and laboratory use:

- Part 1: General Requirements	**EN 61010-1:2010**
- Part 2-081: Particular requirements for automatic and semi-automatic laboratory equipment for analysis and other purposes	**EN 61010-2-081:2002 + A1:2003**

EMC Directive (2014/30/EU) applied with the following standards:

Electrical equipment for measurement, control and laboratory use - EMC requirements

- Part 1: General Requirements	**EN 61326-1:2006**

RoHS directive (2011/65/EU) Restriction of Hazardous Substances
WEEE directive (2012/19/EC) Waste Electrical and Electronic Equipment

Use manufacturer-supplied cable(s) only to connect all I/O's with other devices. Thoroughly connect the shielding to common. Manufacturer will not accept any liability for damage, direct or indirect, caused by connecting/integration this instrument to devices or systems, which do not meet the essential requirements or relevant safety standards.

Zoeterwoude, The Netherlands, April 20th, 2016
Dr. N.J. Reinhoud (managing Director)

Intended use

For research purposes only. While examples of clinical applications may be shown, this instrument is not tested by the manufacturer to comply with the In Vitro Diagnostics Directive.

WEEE directive

Antec is a Business-to-Business producer of analytical analysis equipment which fall under WEEE Annex IA categories 8 and 9 (includes medical devices and monitoring and control instruments). All equipment of Antec Leyden which are subjected to the WEEE directive (shipped after August 13, 2005) are labelled with the “crossed out wheelie”.

The symbol on the product indicates that the product must not be disposed as unsorted municipality waste. When taking the instrument out of service, the different materials must be separated and recycled according to national and local environmental regulations.

Collection & recycling information (business-to-business)
Antec Leyden offers the possibility for disposal and recycling of their instrument at an appropriate recycling facility if requested (there may be costs involved with this service). Please contact Antec for more information about this service and to register the return and disposal of end-of-life instruments. To assure hygienic & personal safety all instrument should be returned with a signed decontamination form which is available on the website.

Shipping address for end-of-life products:

Antec
Industrieweg 12
2382NV Zoeterwoude, The Netherlands

In case of questions, or if further information is required about the collection & recycling procedure, please contact Antec or your local distributor.

ROHS directive

The AS 110 is ROHS compliant and in conformity with Directive 2011/65/EC Restricted use of Hazardous Substances in electrical and electronic Equipment (ROHS).

Antec Leyden is an ISO 9001:2008 certified company.

About this manual

This service manual is written for trained and qualified service engineers who service the AS 110 autosampler. End-users and untrained people should not service the instrument.

This service manual offers the following information:

- Chapter 1 Introduction to AS 110 and injection principles
- Chapter 2 Service manager control software
- Chapter 3 Maintenance
- Chapter 4 Troubleshooting
- Chapter 5 Disassembling
- Chapter 6 Installation
- Chapter 7 Adjustments
- Chapter 8 Testprocedure analytical performance

- Appendix A specifications of the AS 110
- Appendix B lists the accessories and spares

.

An index has been provided to allow the user to find required information quickly.

Symbols

The following symbols are used in this guide:

The danger sign warns about a hazard. It calls attention to a procedure or practice which, if not adhered to, could result in injury or loss of life.
Do not proceed beyond a danger sign until the indicated conditions are fully understood and met.

The warning sign denotes a hazard. It calls attention to a procedure or practice which, if not adhered to, could result in severe injury or damage or destruction of parts or all of the equipment. Do not proceed beyond a warning sign until the indicated conditions are fully understood and met.

The caution sign denotes a hazard. It calls attention to a procedure or practice which, if not adhered to, could result in damage or destruction of parts or all of the equipment. Do not proceed beyond a cautions sign until the indicated conditions are fully understood and met.

The attention sign signals relevant information. Read this information, as it might be helpful.

The note sign signals additional information. It provides advice or a suggestion that may support you in using the equipment.

Safety practices

The following safety practices will ensure safe operation of the auto sampler and should only be executed by authorized personnel:

- Removal of some panels exposes potentially dangerous voltages. Disconnect the instrument from all power sources before removing protective panels.
- Replace blown fuses with size and rating indicated on the fuse panel or holder and as listed in the list of accessories and spares (appendix D) in this manual.
- Replace or repair faulty or frayed insulation of power cords.
- Check actual line voltage to confirm it is the value for which this instrument is wired. Make sure power cords are plugged into the correct voltage sources.

- Perform periodic leak checks on supply lines.
- Do not allow flammable and/or toxic solvents to accumulate. Follow a regulated, approved waste disposal program. Never dispose of such products through the municipal sewage system.

Using the AS 110 in other ways than indicated in the instructions given in this manual may cause unsafe conditions.

Table of contents

C H A P T E R 1

Introduction

The AS 110 autosampler is a high throughput autosampler of robust design, developed to meet the challenge of the modern analytical laboratory. It is a very complete autosampler that needs little bench space; the AS 110 is designed for indoor use. The AS 110 autosampler features among other things:

- PASA™ injection concept (see "Injection principles" on page 12).
- High-resolution syringe control; this ensures very high precision for injection and reagent addition.
- Internal standard addition, sample dilution or derivatization can simply be programmed.
- PC control ensures easy-to-understand operation; context-sensitive online help is available with every window and dialog.
- Special attention has been paid to ensure a service-friendly design.
- To enhance safety, speed of operation of the AS 110 will decrease when the door is opened.
- Optional sample cooling ensures consistent results.
- Read this chapter to help identify parts of the AS 110 auto sampler, and to learn more about injection principles.

Instrument description

The AS 110 is a autosampler that requires very little bench space. Standard high or low well plates or vial trays can be used. The sampling compartment of the AS 110 can accommodate two different well plates. Any combination of well plates is allowed, except for 384 Low on the left and 96 High on the right.

The AS 110 autosampler is standard fitted with:

- 15 µL injection needle
- 500 µL syringe
- 1000 µL buffer tubing
- 100 µL sample loop.

All replaceable parts are easily accessible. Refer to the List of accessories and spares (see "List of accessories and spares" on page 58) for more information.

To open the door, execute the following steps:

1. Get hold of the door handle

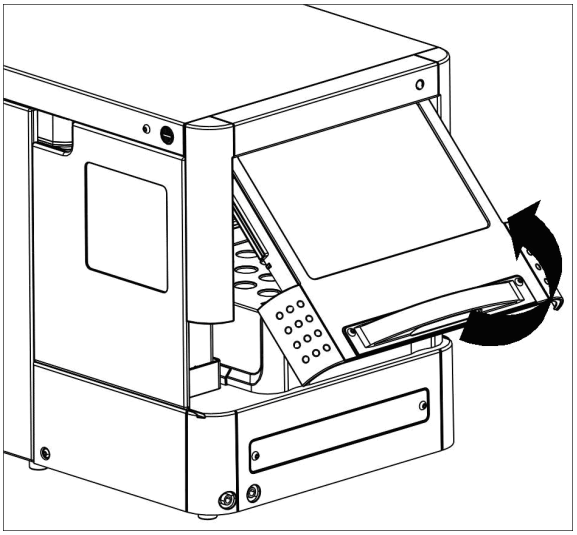


Figure 1: Open the door.

2. Gently pull it towards you and push it upward until it is in horizontal position.

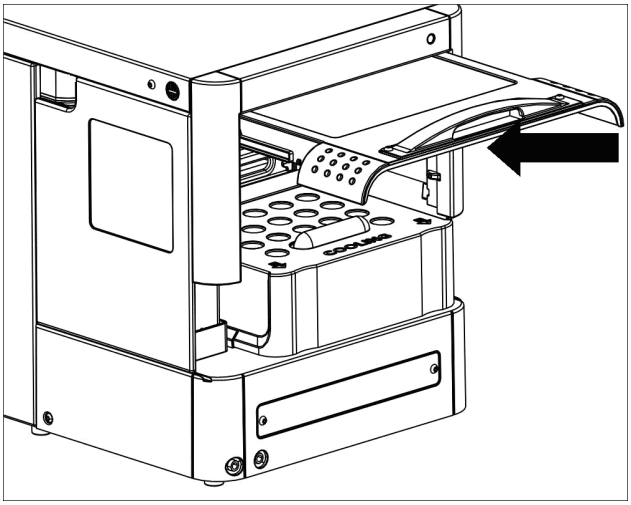


Figure 2: Push the door upward.

3. Slide the door into the autosampler.

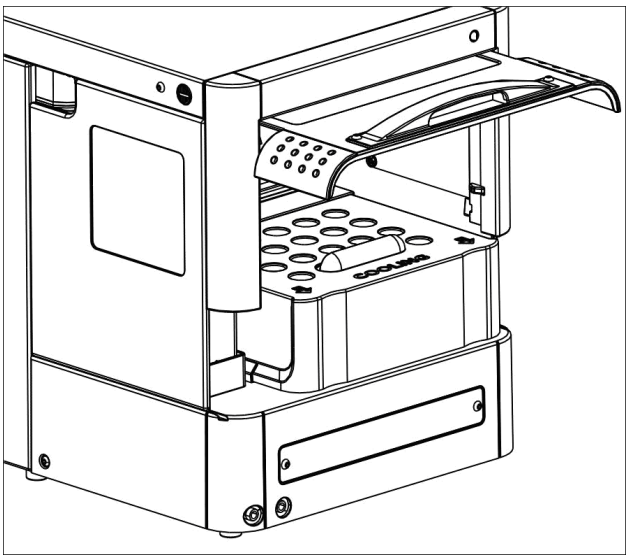


Figure 3: Slide the door into the auto sampler.

For easier access, you can remove the cover of the AS 110 (see figure 4). To remove the cover:

1. Press the two black buttons on either side (top) of the autosampler simultaneously.
2. Gently pull the cover towards you.

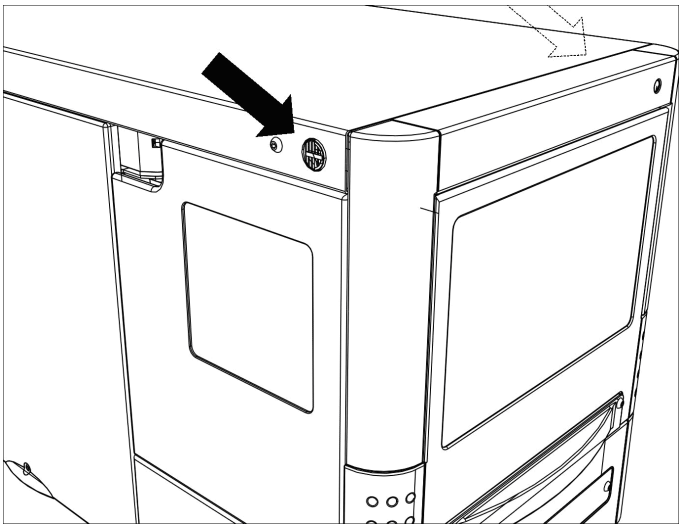


Figure 4: Location of Black push buttons.

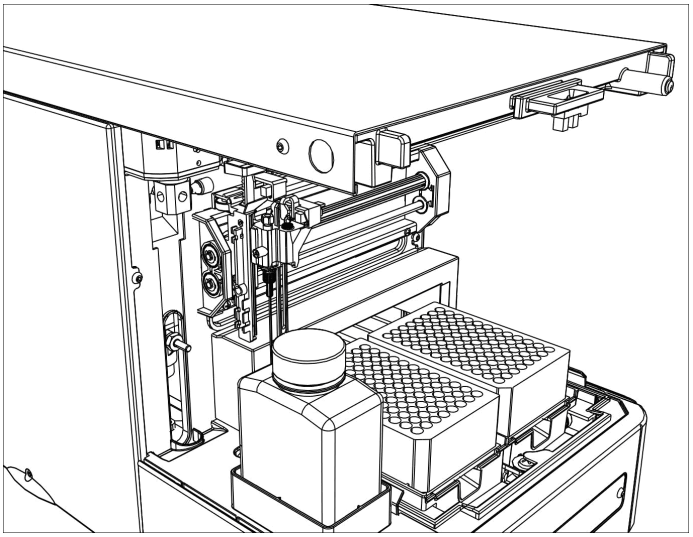


Figure 5: AS 110 without cover.

If the cooling option is installed: slide out the cooling cover by pulling it gently towards you. You can now place well plates.

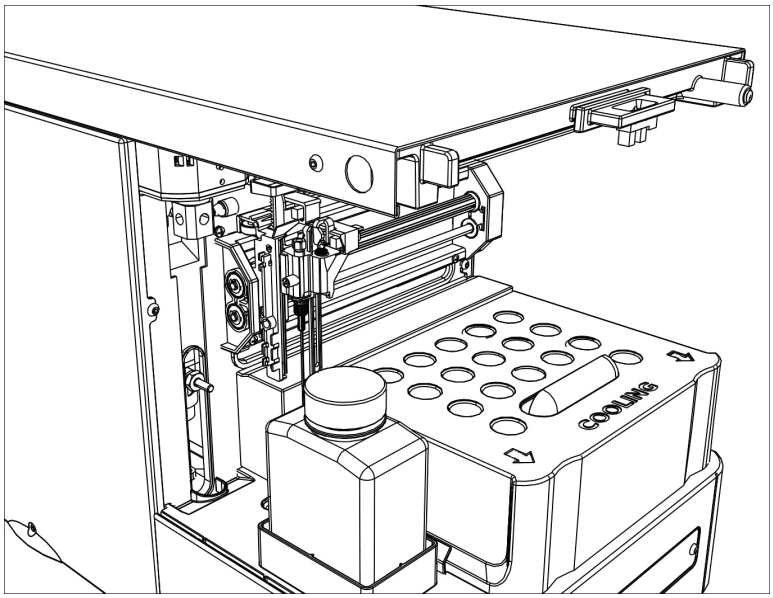


Figure 6: AS 110 with cooling cover

AS 110 autosampler – front

The AS 110 sampling compartment houses the following parts:

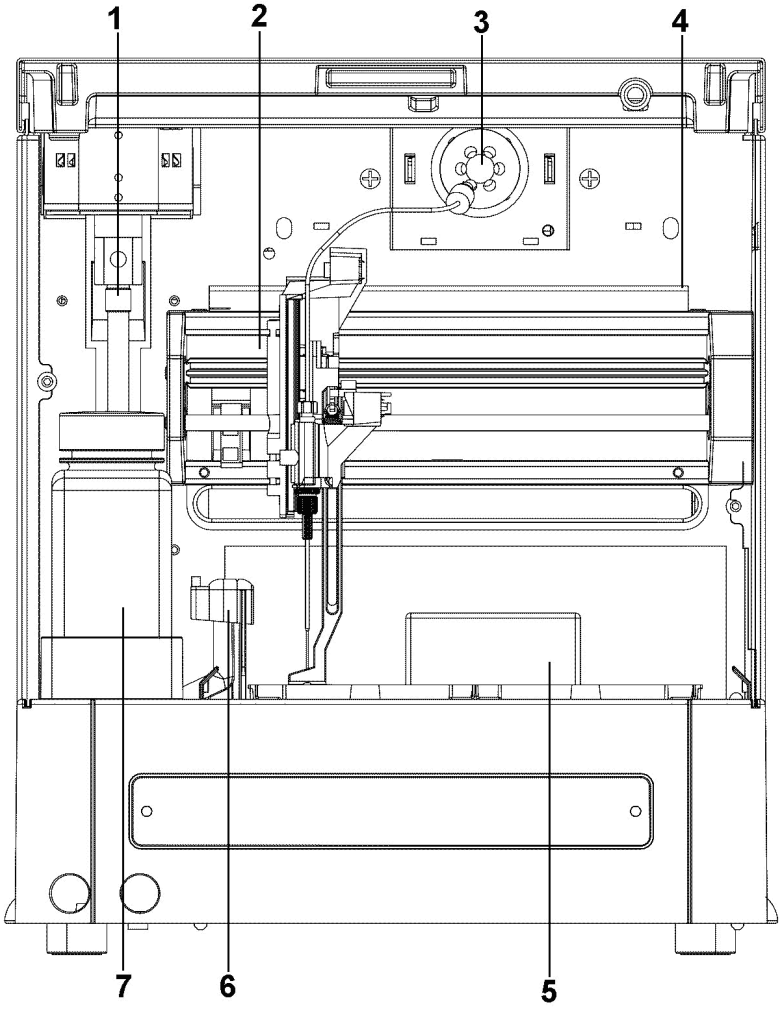


Figure 7: AS 110 sampling compartment.

1. Syringe
2. Needle arm
3. Injection valve
4. Valve leak bin
5. Sample compartment
6. Needle wash position
7. Wash liquid bottle

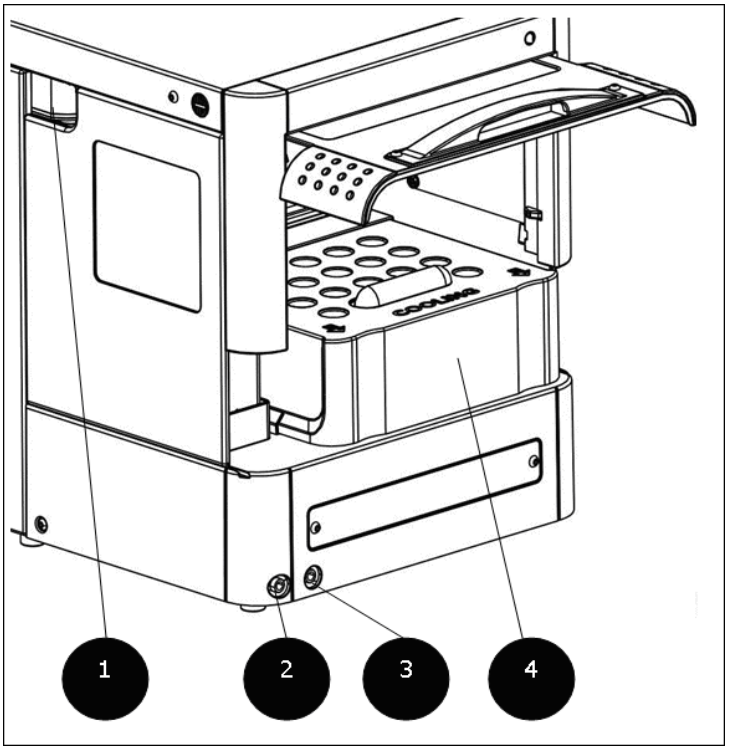


Figure 8: AS 110 with cooling, front-side..

1. Tubing guide
2. Wash/waste
3. Condensed water/leakage
4. Cooling cover

AS 110 autosampler – back

The back of the autosampler has the following items:

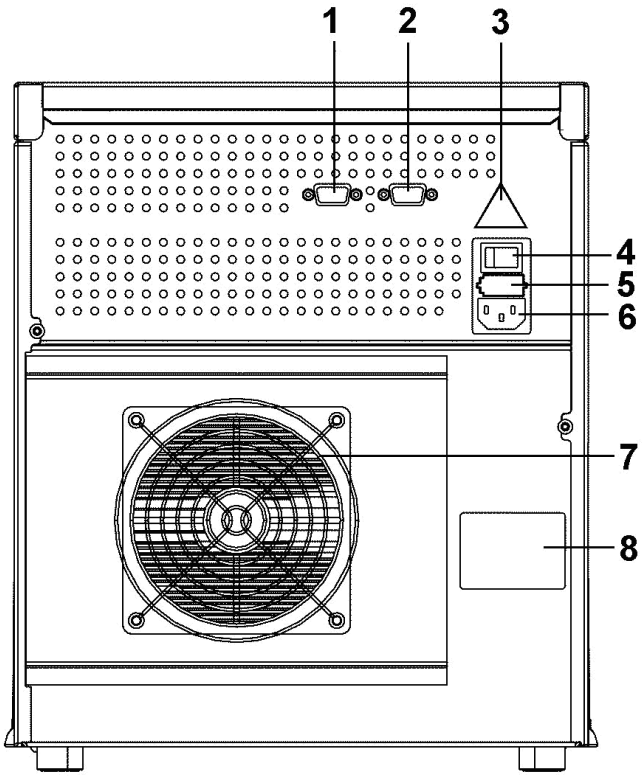


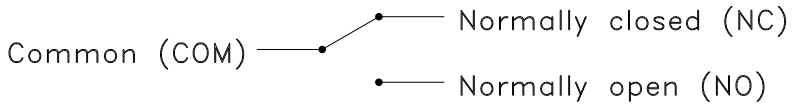
Figure 9: AS 110 with cooling, back-side.

1. 9-pin male connector (inputs/output)
2. 9-pin female connector (serial interface)
3. warning label (see "Control I/O connections" on page 54)
4. on/off switch
5. fuse box
6. power connector
7. cooling fan (if cooling option is installed; do not obstruct!)
8. type label

On the mainboard are also 2 fused placed; one of 2A slow en
one of 6.3 A slow.

Pin description of 9 pins male connector P1 (inputs/outputs):

Pin #	Description	Color of wiring set
1	Output 1 Common	Red of 3 wiring cable
2	Output 1 Normally Open (Contact closure)	Black of 3 wiring cable
3	Programmable Input 1 (TTL)	Red of 4 wiring cable
4	Programmable Input 2 (TTL)	Black of 4 wiring cable
5	Ground	
6	Output 1 Normally Closed (Contact closure)	Brown of 3 wiring set
7	Ground	
8	Ground	Orange of 4 wiring set
9	Ground	Brown of 4 wiring set



Pin description of 9 pins female connector P2 (RS 232):

Pin #	Description
2	Tx (Transmitted data to the computer)
3	Rx (Received data from the computer
5	SG Signal Ground

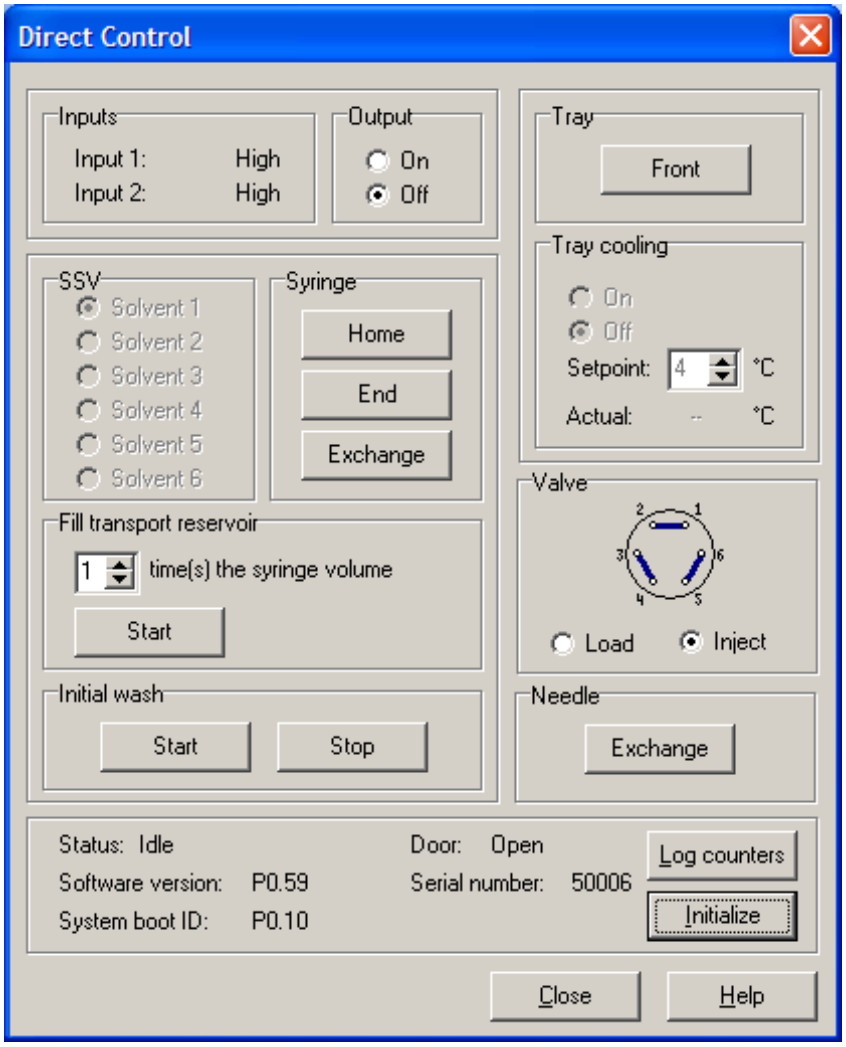
C H A P T E R 2

AS 110 Service manager (ASM) control software

How to use ASM Direct Control

The Direct Control function is available to allow:

- Control of isolated parts of the autosampler
- Easy maintenance



The Direct Control dialog allows you to:

- view input settings
- switch output on or off
- move the sample trays to the front of the autosampler
- select a solvent port for the SSV
- move the Syringe to Home position (standard position before aspiration), or to move the syringe to end position and to exchange position (to exchange the syringe).
- switch tray cooling on or off, and to enter a setpoint; the actual temperature is also displayed
- fill the transport reservoir
- switch the valve to load or inject
- perform an initial wash
- place the needle in exchange position
- The dialog also displays status information, and you can access the Log counters.

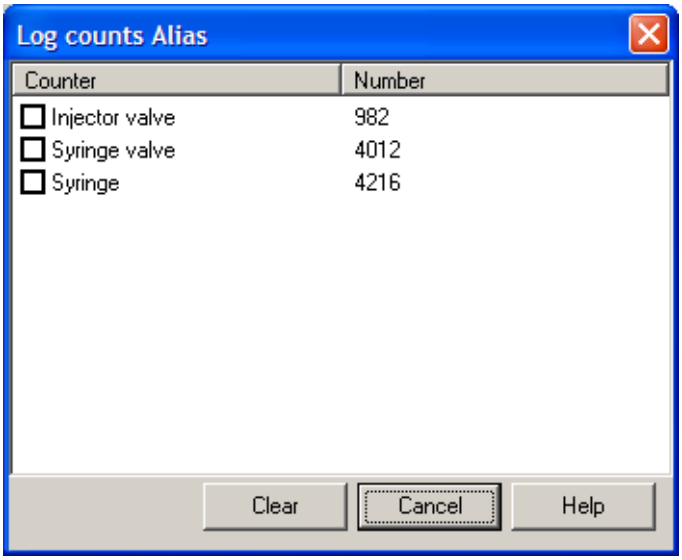
Click Initialize to reset all parts of the AS 110 for normal use.

How to use Log counters

Log counters displays a list of moving parts in the autosampler that need periodic maintenance. Log counters keeps count of the number of movements of each part. Whenever you have replaced a part:

1 Open Log counters.
2 In your AS 110 log: enter the number of movements counted for the part concerned. Fill in whatever other information is required by the log.
3 In the log counters dialog: tick the checkbox for the part you have replaced.
4 Click Clear. The counter is now set to 0 for the part concerned.

Exit log counters.



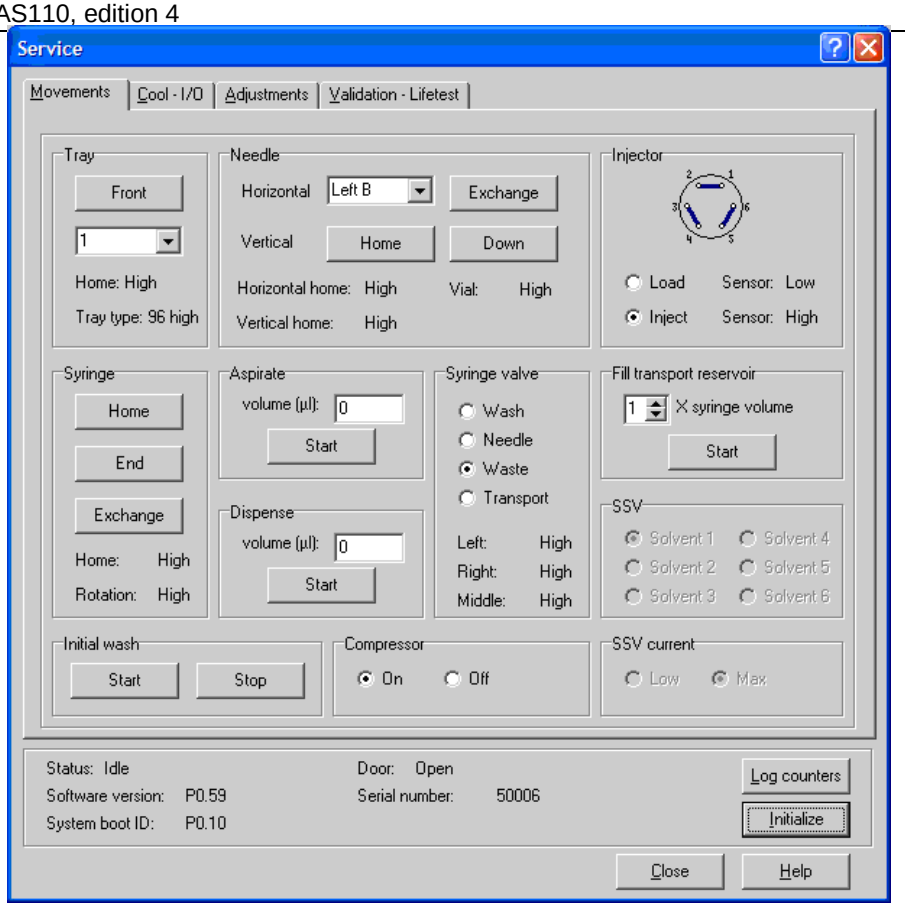
Service Mode

A Service Mode Control function is available to allow:

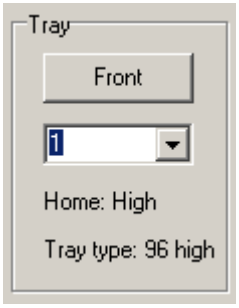
- control of isolated parts of the autosampler
- read out of optical sensors

In Instrument setup, select AS 110/ Service Mode to open the Service Mode Control dialog. The Password dialog box will be displayed.

Enter the password: **101163** and click on the OK button. The Service Mode control dialog will be opened.



By clicking on the tabs on the top of the screen, other screens on the service mode dialog box; Cool - I/O, Adjustments and Validation – Lifetest will become available.

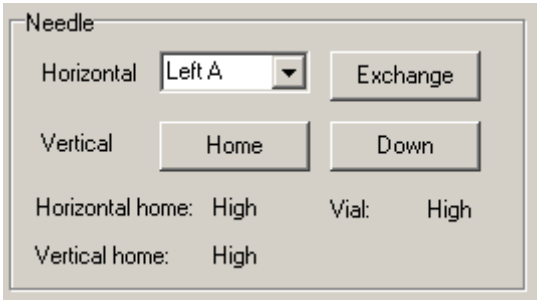


The tray control box controls:

- Tray movement to the [Front] or back to the [Home]
- Movement to the row 1-12 in case of a 96 well plate

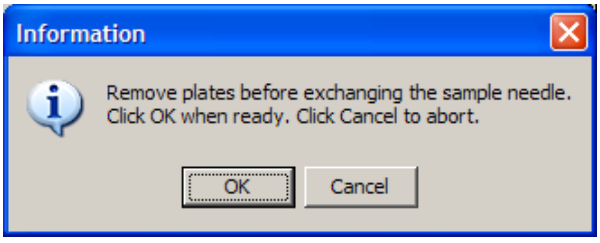
The tray control box displays:

- The status of the tray home sensor. (High = tray home; sensorflag of tray is inside optical sensor)
- The programmed type of tray



The needle control box controls:

- Needle movement Horizontal to the programmed plate and column
- Needle movement Vertical [Home] or [Down]
- By pressing the [Exchange] button, the needle will be moved into a position where the sample needle easily can be exchanged



Make sure the well plates or vial racks are removed from the plate as the needle arm will be lowered.

The needle control box displays:

Horizontal home sensor:

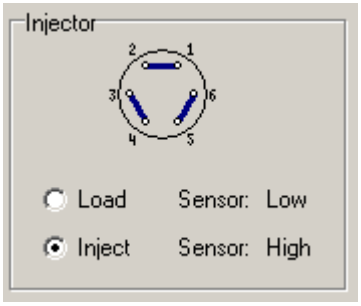
- High - Home sensor activated; needle arm is in home position, which is the total left position.
- Low - Home sensor not activated; needle arm not in horizontal home position.

Vertical home sensor:

- High - Needle arm is up
- Low - Needle arm is not up

Vial sensor:

- High - No vial or plate detected
- Low - Vial or plate detected



The injector valve control box controls:

- Load; switches the injector valve into the Load position
- Inject; switches the injector valve into the Inject position

The injector valve control box shows:

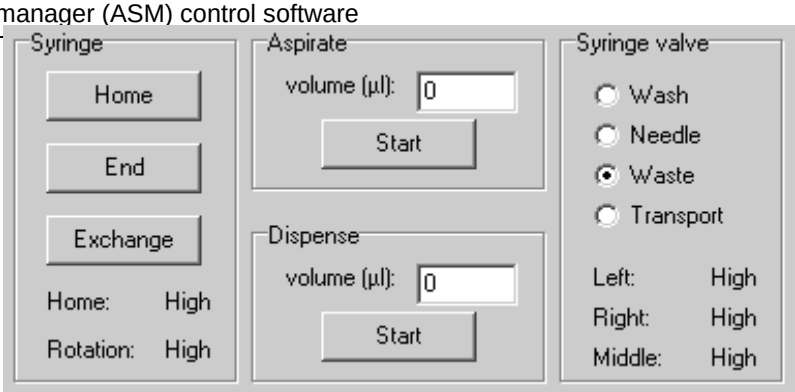
Load sensor:

- Low: sensor not activated, valve not in the load position
- High: senor activated, valve in the inject position.

Inject sensor:

- Low: sensor not activated, valve not in the inject position
- High: senor activated, valve in the inject position.

The diagram shows the position of the rotor seal



The Syringe control control box controls:

- [Home]; Moves the syringe into the home position (up)
- [End]; Moves the syringe into the end position (down)
- [Exchange]; Moves the syringe into the exchange position on where the syringe can easily be replaced.

The syringe control control box shows:

Home sensor

- Low: Home sensor not activated, sensor flag not inside sensor, syringe not in the home position
- High: Home sensor activated, sensor flag inside sensor, syringe is in the home (up) position

Rotation sensor

- Low: Rotation sensor not activated, lightbeam of sensor goes through slot of spindle.
- High: Rotation sensor activated lightbeam of sensor blocked by spindle.
- Note: The rotation sensor is checking the correct rotation of the syringe spindle, during up and downmovement of the syringe. Whenever the movement is obstructed, the steppermotor might loosen steps. These missing steps will be displayed as an error code 335

The syringe aspirate-dispense control box controls:

- Aspirate: Program the volume for asprirating and press the [Start] button.

- The total aspirated volume should not exceed the total volume of the syringe.
- Dispense: Program the volume for dispensing and press the [Start] button
- The total dispensed volume should not exceed the total aspirated volume.

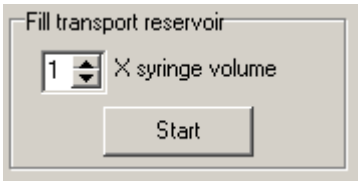
The syringe valve control box controls:

- [Wash] Sets the syringe valve in the wash position
- [Needle] Sets the syringe valve in the needle position
- [Waste] Sets the syringe valve in the waste position
- [Transport] Sets the syringe valve in the transport position

The syringe valve control box shows:

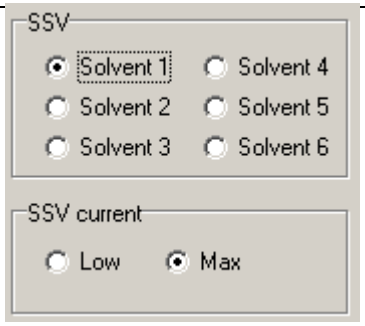
- Left, Right and Middle sensor
- Low: Light beam of sensor is not interrupted by the code disc
- Hight: Light beam of sensor is interrupted by the code disc

Position	**Status of left sensor**	**Status of right sensor**	**Status of middle sensor**
Wash	Low	High	Low
Needle	Low	Low	Low
Waste	High	High	High
Transport	High	Low	Low



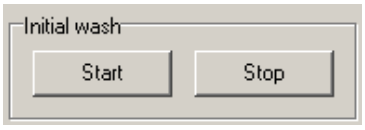
The Fill transport reservoir control box controls:

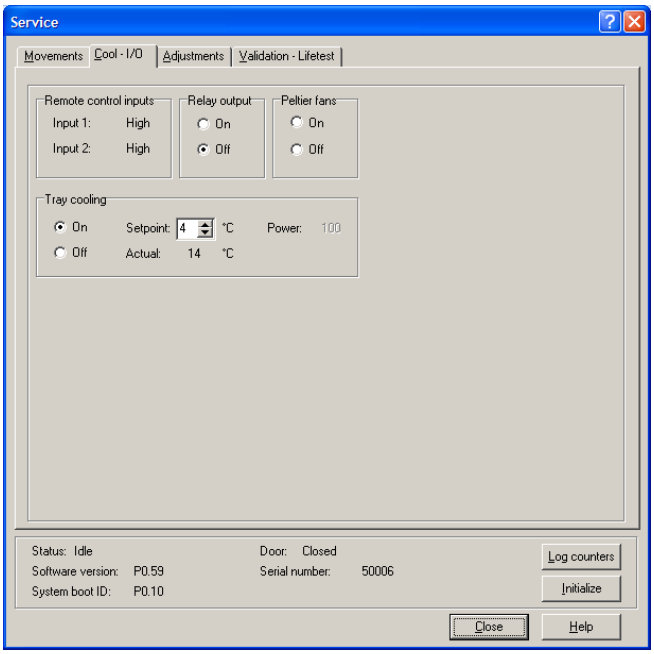
- Number of syringe volumes selectable from 1-9
- [Start]; Autosampler starts to fill the transport reservoir



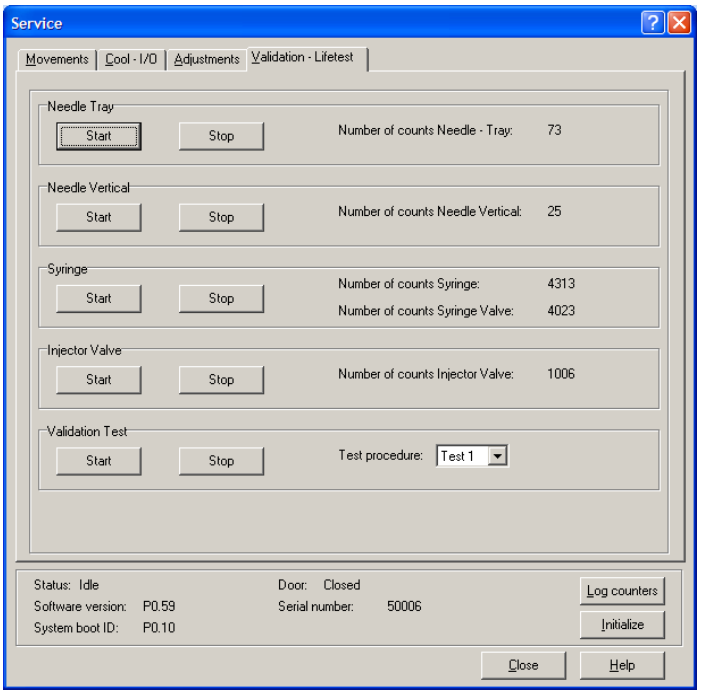
The solvent selection control box controls:

- Solvent port 1-6 of the optional solvent selection valve.
- SSV current
- Low: Lowers the current to the solenoid of the solvent selection valve. (hold condition of the solenoid is lower, to prevent heating the solvents)
- High: Highers the current to the solenoid of the solvent selection valve (select condition of the solenoid is high to activate the solenoid).





the Service Mode Cool – I/O screen, the remote in and outputs as well as the cooling can be controlled.



With the validation and lifetest screen, the AS 110 can be functional tested on a separate module, such as injector valve, syringe, needle or a needle and tray combination. A counter will be started to indicate the numbers of movements. With the Validation test a pre-programmed test procedure can be started within seconds.

There are 4 test procedures available:

- Test #1 is a µL pick up test on position A1-A5 on a 96 deepwell plate
- Test #2 is a partiall loopfill test on position A6-A12 on a 96 deepwell plate
- Test #3 is a full loop test on position A1-A5 on a 96 deepwell plate
- Test #4 is a partial loopfill test in the PREP mode with a plate holder for 10ml vials.

See section Analytical test procedures for details on the analytical test procedure for the AS 110 Autosampler.

C H A P T E R 3

Maintenance

For all maintenance procedures:

- Open the door of the AS 110.
- Remove the cooling cover by sliding it towards you.
- Press the two buttons at the top sides of the AS 110 simultaneously.
- Remove the cover by pulling it towards you.

You need not disconnect the AS 110 from the power source for any of the maintenance procedures. In this way software control will still be possible. Use the Direct Control function in the control software to check operation of the various parts of the auto sampler.

Cleaning

In general, the AS 110 autosampler needs very little maintenance. You can clean the outside with a damp cloth with non-aggressive cleaning liquid. Other items that may need periodic cleaning:

- ***valve leak bin*** (see "AS 110 autosampler - front" in the introduction section): a special leak bin is installed underneath the injection valve. You can clean this bin with a damp cloth with non-aggressive cleaning liquid.
- sample tray: if sample has been spilled on the sample tray, clean the tray with a damp cloth with non-aggressive cleaning liquid.
- drain tubing: regularly flush the drain tubing with solvent to prevent clogging and to ensure that liquids and condensate are disposed of.

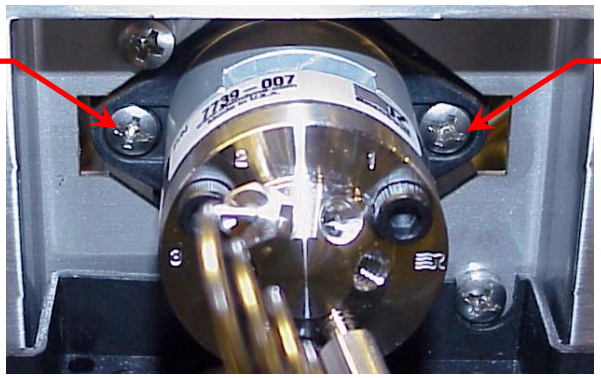
Injection valve and rotor seal

The AS 110 is equipped with an injection valve with fixed mounting (see figure below).

Execute the following steps to remove the injection valve:

- Disconnect all tubing from the valve. Only the sample loop can stay in place.
- Remove the 2 marked philips screws and slide the valve forwards out of the unit.

Valve screw 1



Valve screw 2

Figure 10:Removal of valve.

Maintenance on the Valco injection valve

Cleaning a valve can often be accomplished by flushing all lines with appropriate solvents.

NOTE:

Do not disassemble the valve unless system malfunction is definitely isolated to the valve.

Disassembly:

- Use a 9/16 hex driver to remove the socket head screws which secure the cap on the valve.
- To insure that the sealing surface of the cap is not damaged, rest it on the outer face. Or, if the tubing is still connected, leave it suspended by the tubing.
- With your fingers or small tool, gently pry the rotor away from the driver.

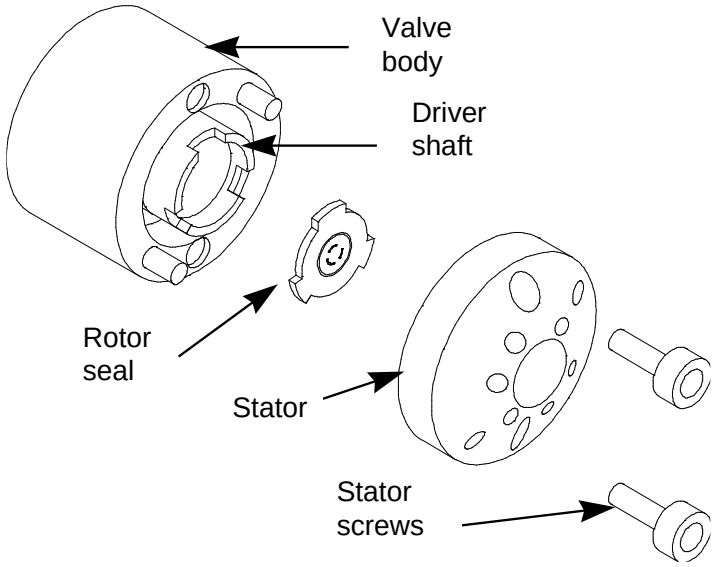


Figure 11: Exploded view of Valco valve.

- Examine the rotor sealing surface for scratches. If scratches are visible to the naked eye, the rotor must be replaced. If no scratches are visible, clean all the parts thoroughly with an appropriate solvent, taking care that no surfaces get scratched. (The most common problem in HPLC is the formation of buffer crystals, which are usually water-soluble) It is not necessary to dry the rotor.

Reassembly:

- Replace the rotor in the driver, making sure that the rotor sealing surface with its engraved flow passages is facing out. The pattern is asymmetrical to prevent improper placement.

- Replace the cap. Insert the two socket head screws and tighten them gently until both are snug. Do not over-tighten them - the screws simply hold the assembly together and do not affect sealing force, which is automatically set as the screws close the cap against the valve body.

- Test the valve by pressurising the system. If it doesn’t hold pressure, the valve should be returned to Valco for repair.

Sample loop

The AS 110 is standard fitted with a 100 µL sample loop. A different sample loop size can be installed, but note that you will need the proper combination of *syringe and tubing* Take the following into account when you have installed a sample loop:

- Connect the loop between ports 2 and 5 of the injection valve
- Go to the configuration settings and adapt settings in the flowpath group box if you have installed a loop with a different volume.

Remember that the maximum injection volumes are calculated with the following formulas:

- **Full loop: injection volume = loop volume**
- **Partial loopfill: maximum injection volume = 50% of the loop volume**
- **µL pickup: maximum injection volume = 50% of loop volume - 1.5 times the needle volume**

Sample needle

The sample needle is one complete replacement assembly and will be shipped including the tubing, nuts and ferrules. Keep in mind there are different needle assemblies available for different applications and different type of injection valves. Basiccallly you can select the needle on the internal diameters, needle material (with of without inert coatings) and valve connections. See the list of accessories for the correct type of needle.

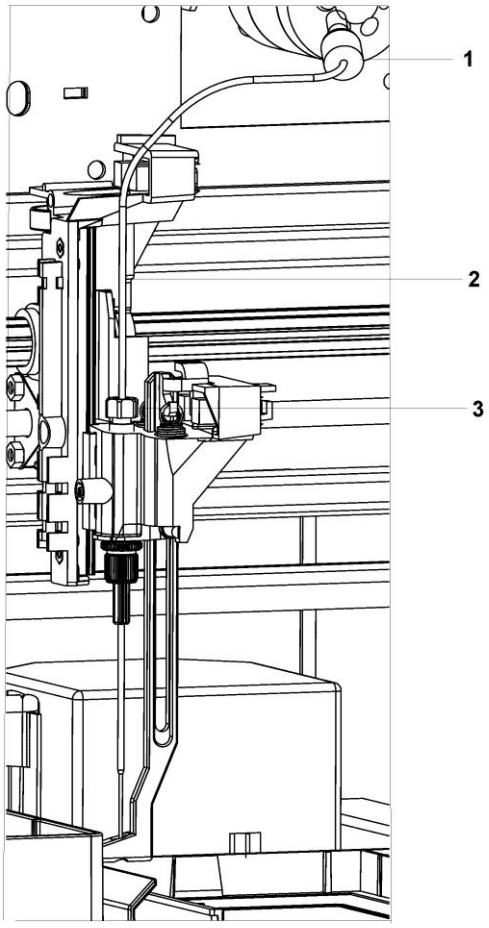


Figure 12: Sample needle assembly.

Execute the following steps to replace the sample needle:

- Open Direct control.
- Click **Exchange** in the Needle group box. The needle moves to exchange position.
- Loosen the needle connection nut (number 3).
- Loosen the nut (number 1) that connects the tubing (number 2) to port 4 of the injection valve.
- Remove the sample needle by pulling it out of its fitting by the tubing.
- Install a new needle assembly; make sure that the air seal is around the needle.
- Tighten the needle assembly with the needle connection nut.
- Connect the other end of the needle connection tubing to port 4 of the injection valve. Do not tighten too much as this may block the tubing.
- Click **Initialize** in Direct control. The sample needle moves back to home position.
- Perform a wash routine to clean the new needle by clicking **Start** in the Initial wash group box of Direct Control. Click **Stop** to end the wash routine.
- Use the AS 110 / Adjustments option to adapt ***Needle - Tray settings*** (see "How to use Needle - Tray adjustment").

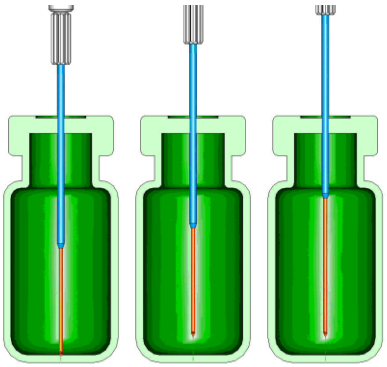
If you use trays with 12 vials or 48 vials, make sure that the needle height settings is > 2mm to prevent the needle from touching the bottom of the vials.

Air needles for AS 110

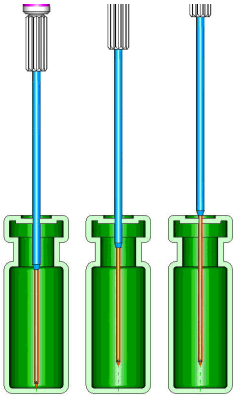
Six types of air needles are available for the AS 110 autosampler, all different in length (difference of 6 mm). These air needles are required to accommodate use of different plate heights in the AS 110. For every well/vial plate the correct air needle is available. Apart from the 6 mm difference in length between the air needle types, the needle holder allows for an extra 6 mm variation in needle height.

Standard air Needle

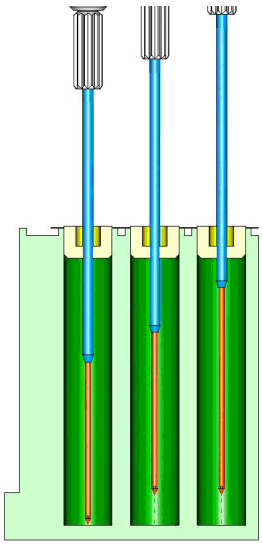
The standard air needle is a 62 mm needle (no. 0045.505). This air needle accommodates use of a wide range of high and low plates. See the illustrations below for the puncturing depth of the needle:



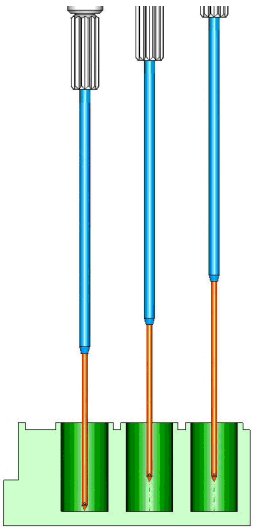
10 mL vial



2 mL vial



Greiner deep well with capmat



Greiner low well

Note that no PASA™ should be used for low wells: as the sample needle sufficiently punctures the seal to prevent vacuum, the function of the air needle will be insignificant for the low well plates.

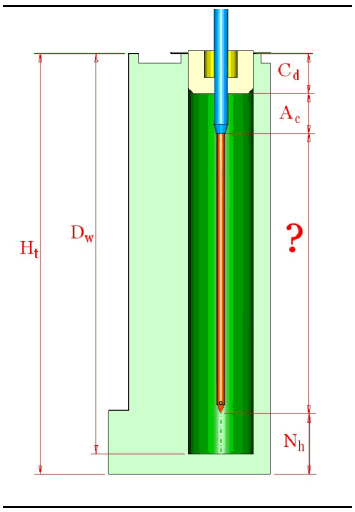
If the 10 mL vials are used, the air needle is lowered pretty far into the vial. If the vial is not filled for more than 60%, the air needle can be applied as usual. The same applies for the deep wells.

If you need to deviate from these standard settings, use one of the optional needle types.

Which air needle for which titre plate or vial

To determine which air needle to use, the following dimensions need to be considered:

- the height of the titre plate in mm: Ht
- well depth in mm: Dw
- thickness of capmat or seal in mm: Cd
- set needle height in mm: Nh
- distance air needle point through the capmat or seal in mm, min. 2 mm: Ac



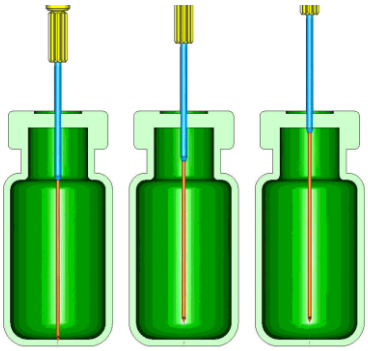
The following must be true:

Ht - Dw must be between 2 and 6 mm
If this is true, the protrusion length of the sample needle can be calculated; this is the distance between the point of the sample needle and the point of the air needle. It can be calculated as as follows:

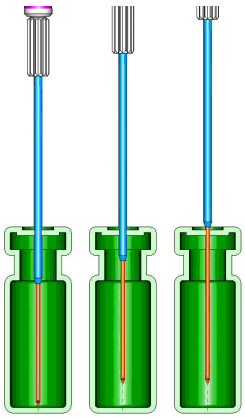
Protrusion length = Ht - Cd - Nh - Ac

You can select the most suitable air needle on the basis of the protrusion length:

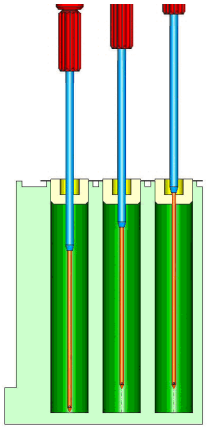
	Protrusion length	
Air needle type	from	to
50 mm, yellow	34	40
56 mm , red	28	34
62 mm, white (std needle)	22	28
68 mm, blue	16	22
74 mm, green	10	16
80 mm black	4	10



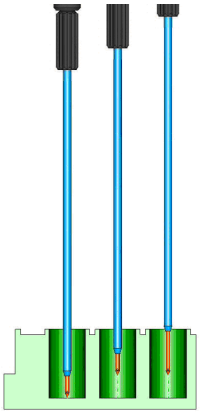
10 mL vial - 50 mm air needle



2 mL vial - 62 mm air needle



Greiner deep well M53000, needle with capmat
- 56 mm air needle



Greiner low well - 80 mm air

Example

You have a Greiner deep well with Micronic capmat M53000; the AS 110 has a standard needle height setting. Calculations will be as follows:

Ht = 41.4 mm	The following is true:
Dw = 37.8 mm	41.4 - 37.8 = 3.6 (is between 2 and 6 mm)
Cd = 3.8 mm	Protrusion length = 41.4 - 3.8 - 6.0 - 2.0 = 29.6
Nh = 6.0 mm (standard)	
Ac = 2.0 mm (minimum)	

An air needle of 56 mm is required.

Air needle replacement

Execute the following steps to replace the air needle:

1. Remove (see "Replacing the sample needle" on page 29) the sample needle.
2. Unscrew the chrome locking nut to remove the air needle.
3. Unscrew the chrome locking nut from the adjustment nut.
4. Get the new air needle.
5. Screw the height adjustment nut to the chrome locking nut (thread of the height adjustment nut must be level with the lower part of the locking nut). Make sure the O-ring seal is in the locking nut.
6. Install the air needle.
7. Install the sample needle.
8. Program the proper needle height for the new needle in the ASM settings window. Go to Adjustments to adapt Needle - Tray settings, if necessary.

If you use trays with 12 vials or 48 vials, make sure that the needle height settings is > 2mm to prevent the needle from touching the bottom of the vials.

9. Do an initial wash from Direct control to rinse the needle.

Sample needle penetration depth

To keep rest volume small, the sample needle tip should stop close to the bottom of the sample vial. With the ASM adjustment wizard, the needle depth can easily adjusted to the depth dome of the plate holders. See section Needle-Tray adjustments. In the run mode method builder, the needle depth can be set to a needed depth.

AS 110 tubing

The AS 110 is standard fitted with the following tubing:

Tubing	Materials/Dimensions
Standard sample needle and tubing (label 15 µL)	SS: 97 mm x 0.8 mm OD x 0.25 mm ID ETFE (Tefzel): 200 mm x 1/16” OD x 0.25 mm ID
Buffer tubing from high-pressure valve to syringe valve (label 1000 µL)	ETFE (Tefzel): 1275 mm x 1/16” OD x 1.0 mm ID
Tubing syringe valve to wash solvent bottle	PTFE: 400 mm x 1/8” OD x 1.6 mm ID
Tubing syringe valve to waste	PTFE: 400 mm x 1/8” OD x 1.6 mm ID

Note the following if you need to install new tubing:

- insert tube ends always flush with ferrule ends
- do not over-tighten nuts, as this may cause blockage in the flow path
- make sure that you always use tubing volumes that are suitable for use with the other items in the flow path.

Syringe dispenser

The AS 110 is standard supplied with a 500 µL syringe, but a 2500 µL syringe can also be installed for the Prep version.

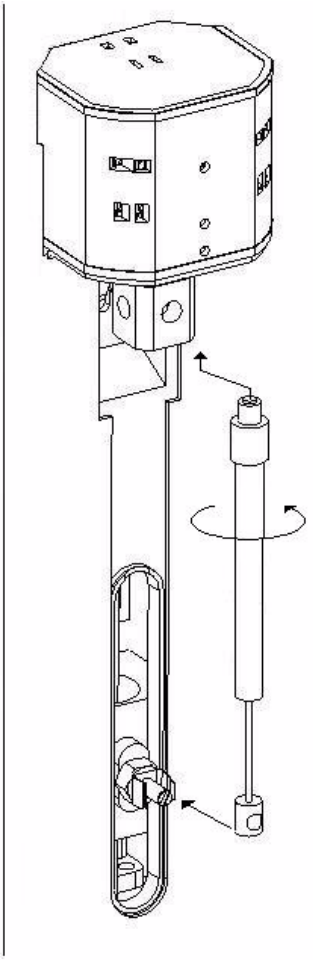


Figure 13: Removal of Syringe.

Execute the following steps to install a different syringe:

- In Direct Control, click Exhange in the Syringe group box. The Syringe moves to the position where the syringe easily can be exchanged.
- Unscrew the syringe from syringe valve.
- Pull the syringe forward by using the Disconnect the plunger from the syringe drive.

- Fill the new syringe with wash solvent, preferably IPA. Make sure that most air bubbles are removed from the syringe.
- Connect the plunger of the filled syringe to the syringe drive and connect the syringe with the connector at the syringe valve.
- Screw the syringe firmly into the connector.
- In Direct control, click Home in Syringe group box. The syringe moves to home position and its content will be dispensed to syringe waste.
- If there is still some air in the syringe, click End again in Direct control. The syringe is filled with wash solvent. Use IPA.
- Click Home again to dispense the wash solvent to waste.
- If there is still air in the syringe, repeat the previous steps and gently tap the syringe as the wash solvent is dispensed to syringe waste.
- Perform a standard wash routine (Direct control: click Start/Stop in the Initial wash group box). All tubing connected to the syringe valve will be refilled and flushed.

Syringe dispenser valve connections

The syringe valve is a 4-port selection valve. Ports are assigned as follows:

Waste	Use this port as a drain for the syringe dispenser. The waste outlet is positioned on the rear side of the valve
Wash	Use this port to aspirate wash liquid from the wash bottle (or in case of multiple wash liquids: connect it to the solvent selection valve) The wash inlet is positioned at the right side of the valve
Needle	Connect the buffer tubing, which connects the injection valve to the syringe dispenser valve to this port. The needle inlet is positioned at the front side of the valve.

All connections to the syringe valve must be made using fingertight fittings. An exception can be made for the waste outlet (the port on the rear of the valve).

Replacing the Syringe dispenser valve

Execute the following steps to replace the syringe dispenser valve:

Place the syringe valve in waste position before you replace the syringe valve. In this position, the lower mounting screw is opposite/in line with the hole.

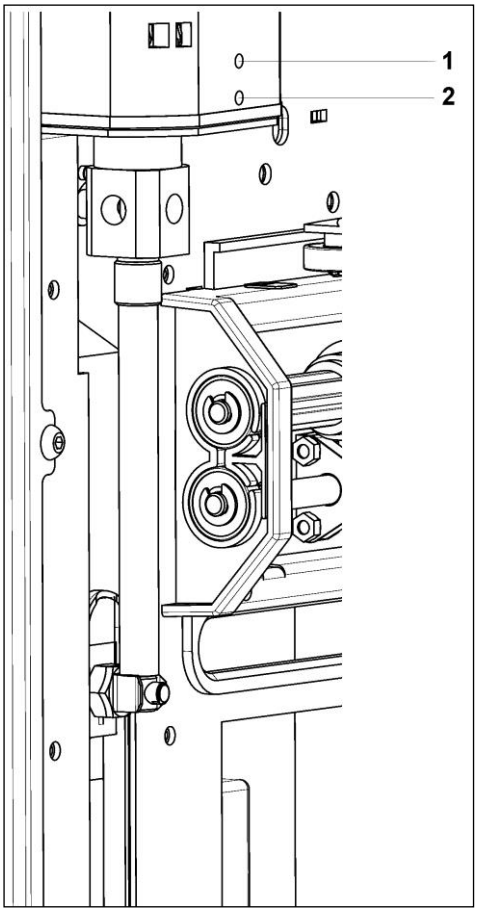


Figure 14: Replacing the syringe dispenser valve.

- In Direct Control, click Exhange in the Syringe group box. The Syringe moves to the position where the syringe easily can be exchanged.
- Loosen the lower socket-head screw (number 2).
- Remove the top cover of the AS 110 and turn the geared belt of the syringe valve manually until the upper socket-head screw (number 1) is positioned in front of the hole.

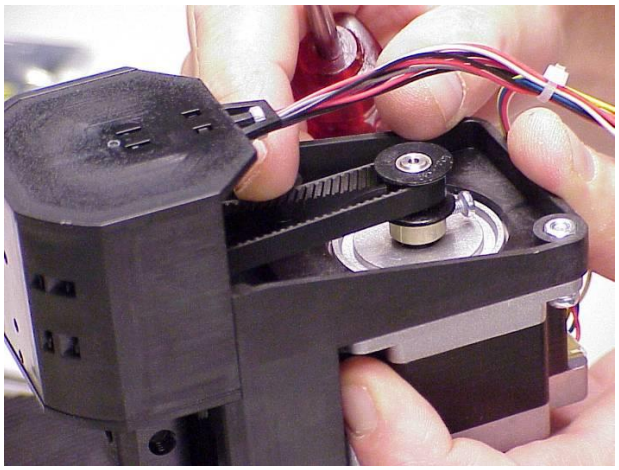


Figure 15: Belt of the syringe dispenser valve.

- Loosen the upper socket head screw (number 1).
- Remove the syringe: pull out the top of the syringe first.
- Remove the syringe valve and install a new one.
- Re-install the syringe.
- Fasten the two socket-head screws again (fingertight + 1/4 turn).

Fuses

Fuses of the following types are installed in the AS 110:

- 2 x 2.5A in the mains inlet / power switch fusebox
- 2 Fuses on the mainboard a 2A and a 6.3A

Disconnect the AS 110 from its power source if you need to replace fuses.

If you need to replace the fuses, make sure that you install fuses of the same type and rating. See appendix B for part numbers of the fuses.

C H A P T E R 4

Trouble shooting

Even though great care was taken in the design of the AS 110, problems may occur:

- *instrument errors:* these can be caused by a variety of reasons.
- *software errors*: usually caused by faulty communication between instruments, or by faulty installation of the software.
- *analytical problems* (see "Analytical trouble shooting"): these may occur e.g. as a result of wear of parts, errors in injection settings and methods, or a wrong combination of sample loop, buffer tubing and syringe.

AS 110 Service Manager contains a Service option (select AS 110/Service). Note that an access code is required for this option, and that the service option is intended for service engineers only.

Contact your supplier if a problem occurs that you cannot solve.

Instrument errors

Incidental fault conditions may occur in any instrument. The AS 110 will generate an instrument error message with an error number, a short description of the error and instructions on how to proceed.
In most cases, you will be asked to either initialize the system, or to switch the system off and then on again. Always click OK and follow the instructions to resolve the error status. Use AS 110/Direct control in AS 110 Service Manager to monitor the error. Initialize the system in the AS 110/Direct control window.

Make sure AS 110 is connected to a grounded power source.
If the LED is not lighted, a fuse may have blown.

Checking a valve implies that you remove the valve and check all parts for wear and dirt. Execute the following steps after any problem with a valve has been resolved:

1. Select AS 110/Direct control. The Direct control window appears.
2. Click **Initialize**.
3. In the Initial wash group box, click **Start** to start the wash.
4. Click **Stop** to end the wash.
5. Click **Close** to exit the Direct control window.

Execute the following steps if you are asked to initialize the system:

1. Select AS 110/Direct control. The Direct control window appears. From this window you can control separate parts of the autosampler to check whether they function as intended.
2. Click **Initialize** to reset the system and prepare it for normal use.

Execute the following steps if you are asked to switch the system off, and then on again:

1. Check that the communication cable between AS 110 and PC is properly installed.
2. Turn the instrument off with the on/off switch at the back of the autosampler.
3. Turn the system on again with the on/off switch. The system is initialized and is now ready for use.

Error code list

Tray unit		
Error	Cause	Action
294	Home sensor not reached.	Check for any obstructions on the tray movement, by sliding the tray forward and backwards
295	Deviation of more than +/- 2mm towards home.	Check for any visible obstructions in the tray area. Check belt on tension or visible damage. In case of weak belt tension, check belt tension mechanism at bottom side of tray.
296	Home sensor not de-activated.	Check home sensor in service mode. Check for any obstruction of tray movement. Check function of stepper motor.
297	Home sensor activated when not expected.	Check home sensor in service mode
298	Tray position is unknown.	Initialize instrument in direct control screen

Needle unit		
Error	Cause	Action
303	Horizontal: needle position is unknown.	Initialize instrument in direct control
304	Horizontal: home sensor not reached.	Check movement for any obstruction. Check function of sensor in service mode
306	Horizontal: home sensor not de-activated.	Check movement for any obstruction Check function of sensor in service mode
307	Horizontal: home sensor activated when not expected.	Check function of sensor in service mode
312	Vertical: needle position is unknown.	Initialize instrument in direct control
313	Vertical: home sensor not reached.	Check movement for any obstruction Check function of sensor in service mode Check steppermotor for vertical needle movement Check belt and pulleys
315	Vertical: home sensor not de-activated.	Check movement for any obstruction Check function of sensor in service mode Check steppermotor for vertical needle movement Check belt and pulleys
316	Vertical: home sensor activated when not expected.	Check function of sensor and wiring set
317	Vertical: stripper didn't detect plate (or wash/waste).	Check if plates of vials are installed
318	Vertical: stripper stuck.	Check if stripper is in total down position Check spring mechanism for stripper Make sure adjustment tool for penetration point check is removed from needle arm Check stripper for any obstruction/dirt Check sensor and wiring set
319	Vertical: The sample needle arm is at an invalid position.	

Syringe dispenser unit		
Error	Cause	Action
324	Syringe valve didn't find wanted position.	Check optical sensors of syringe valve in service mode Check function of steppermotor Check belt and pulleys
330	Syringe home sensor not reached	Check optical sensor of syringe home in service mode Check function of steppermotor Check belt and pulleys Check spindle and transportblock on rotating torque. Check flowpath on restriction by performing a wash with direct control
331	Syringe home sensor not de-activated	Check optical sensor of syringe home in service mode Check function of steppermotor Check belt and pulleys Check spindle and transportblock on rotating torque. Check flowpath on restriction by performing a wash with direct control
332	Asked syringe load volume is too high.	Check program and system settings on correct syringe volume
333	Ask syringe unload volume is too high.	Check program and system settings on correct syringe volume
334	Syringe position is unknown.	Initialize syringe in direct control
335	Syringe rotation error.	Check optical sensor of syringe rotation in service mode Check function of steppermotor Check belt and pulleys Check spindle and transportblock on rotating torque. Check flowpath on restriction by performing a wash with direct control

Injection valve unit		
Error	Cause	Action
340	Wanted position not reached	Check optical sensors in service mode Check for high switching torque on injection valve (might indicate extensive wear or leakage)
341	Wear-out limit reached	Check injection valve thorougly on wear and tear/leakage. Reset wear out limit
342	Illegal sensor readout.	Check optical sensors in service mode

Cooling unit		
Error	Cause	Action
347	Temperature above 48˚C at cooling ON.	Check temperature sensor Check if peltier elements are correct installed (reversed?).

Electronics		
Error	Cause	Action
280	EEPROM write error.	Check if upload procedure is followed.
282	EEPROM error in settings	During power ON, the settings values are not correct readed from EEPROM. Restart instrument, if problem remains, reprogram EEPROM
283	EEPROM error in adjustments	During power ON, the adjutment values are not correct readed from EEPROM. Restart instrument, if problem remains, reprogram EEPROM
284	EEPROM error in log counter	During power ON, the Log counter values are not correct readed from EEPROM. Restart instrument, if problem remains, reprogram EEPROM
290	Error occurred during initialization, Autosampler can not start	During power ON, the instrument came up with an error. By ignoring this error, the Autosampler can continue to program. However an essential function of the Autosampler is not properly working and the Autosampler cannot start to inject samples. Turn mains power OFF/ON and check for the error code

Software errors

Software errors usually are caused by faulty installation of the software, or by faulty communication between instruments; you will be asked to re-install the software on the PC that controls the system.
If a software error message appears, first check if it may be caused by faulty communication between instruments:

1. Check all cable connections between instruments.
2. Open AS 110 Service Manager.
3. Select AS 110/Direct Control.
4. Click **Initialize**.

Analytical trouble shooting

Analytical problems like bad reproducibility or carry-over may occur in any HPLC system. It may be hard to find the cause; you may have to try out several procedures. The first thing to do is to determine whether the problem is caused by the autosampler or by the rest of the system:

1. Replace the valve by a manual injection valve to discriminate between valve problems and other problems.
2. Do a number of Full loop injections. If the results are fine, the fault is in the autosampler; if not, check the rest of the HPLC system.

Please bear in mind that analytical problems may also be caused by external influences like temperature or light-sensitive samples. Make sure that the application was running trouble-free before and that no changes have been made to the system.

A number of causes and possible solutions for analytical problems is listed below. Contact service if you need further help.

If *reproducibility* is not according to specifications, check the following possible causes:

Causes	Solutions
Air in flow path.	Do an initial wash (select AS 110/Direct Control in AS 110 Service Manager)
Leaking syringe.	If leakage occurs at the top of the syringe, check whether it has been properly mounted. If leakage occurs at the bottom of the syringe, replace plunger tip or syringe.
Leaking syringe valve.	Check or replace valve.
Rotor seal worn out.	Replace seal. Check stator.
Dead volumes in tubing connections.	Redo connections with new ferrules and nuts.

If a *blank gives a peak that is too high* for your criteria:

Causes	Solutions
Solubility problem.	You can either modify your sample, or accept carry-over.
Bad match between sample characteristics and hardware.	Check hardware: Needle: either use an extra wash (to wash the inside and outside needle), or install a different type of needle (Steel or Silica-coated) Valve: replace rotor in valve by Valco E or H type. Tubing: install different tubing (Steel, Peek) between autosampler and column, or use different wash solvents
The blank you use has been soiled.	Use a new blank.
Cause not clear.	Check if you can solve the problem by using more variation in solvents.

If *no injection* takes place:

Causes:	**Solutions:**
Blockage in flow path	1. Disconnect needle from valve. 2. Start a manual wash. 3. If solvent flows from the injection port, check the needle; if no solvent flows from the injection port, disconnect buffer tubing from valve. 4. Start a manual wash. 5. If solvent flows from open end: check rotor seal; if not: disconnect buffer tubing from syringe valve. 6. Start a manual wash. 7. If solvent flows from syringe valve: check buffer tubing; if not, check for over-tightened connections in the entire flow path and check the syringe valve.
Leakage in the injection valve	1. Disconnect the needle tubing and buffer tubing. 2. Connect port 1 to an HPLC pump. 3. Block port 6. 4. Start the pump at a low flow. 5. Observe ports 3 and 4 for leakage. 6. If leakage occurs at ports 3 and 4: check rotor seal; if not: recheck with manual valve.

Observe the maximum allowed pressure of 350 bar to prevent leakage in the valve!

C H A P T E R 5

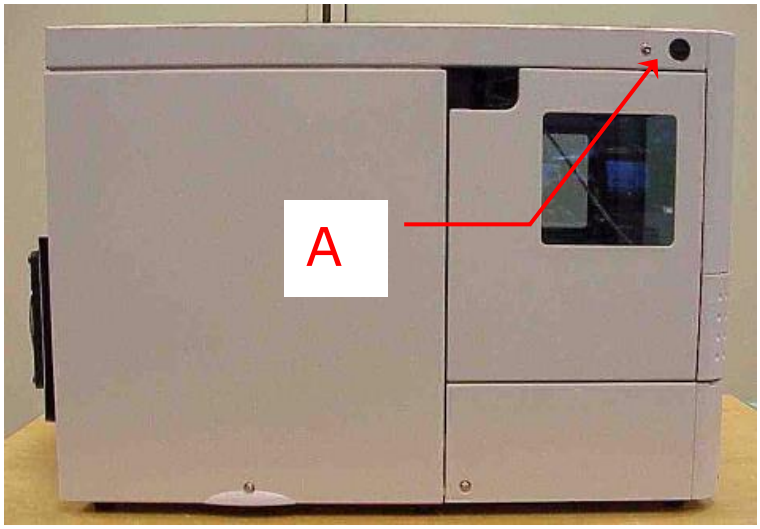
Disassembling

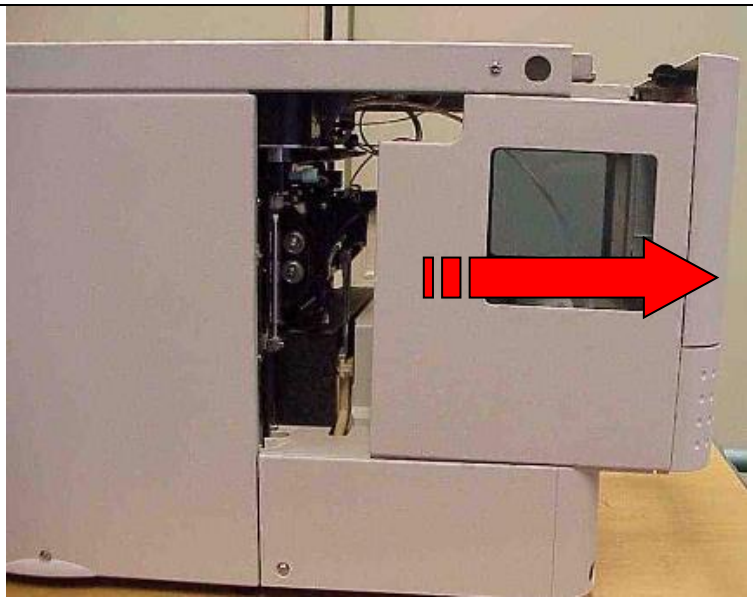
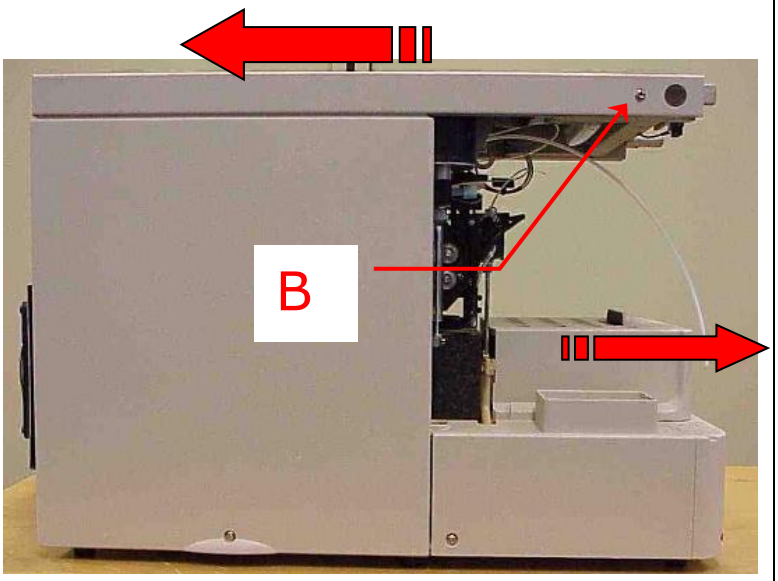
The modular design of the AS 110 simplifies replacements, reducing repair time and minimize downtime. This chapter describes how the different assemblies of the AS 110 can be removed, repaired or adjusted.

Disconnect the instrument from AC power source to prevent danger of electrical shock

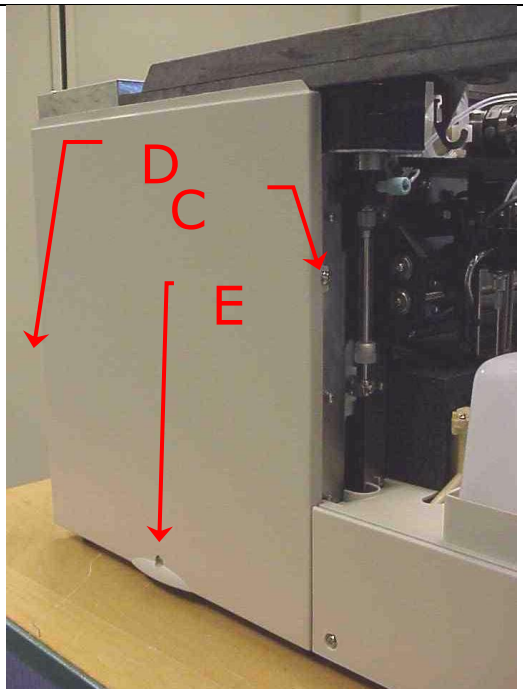
Removing the top cover

To get access to the assemblies the top cover needs to be removed. To remove the top cover, proceed as follows:

Remove the front cover, by pressing on both sides the black notches, marked A and sliding simultaneously the front cover forwards.	 *Figure 16: Removing the front cover*

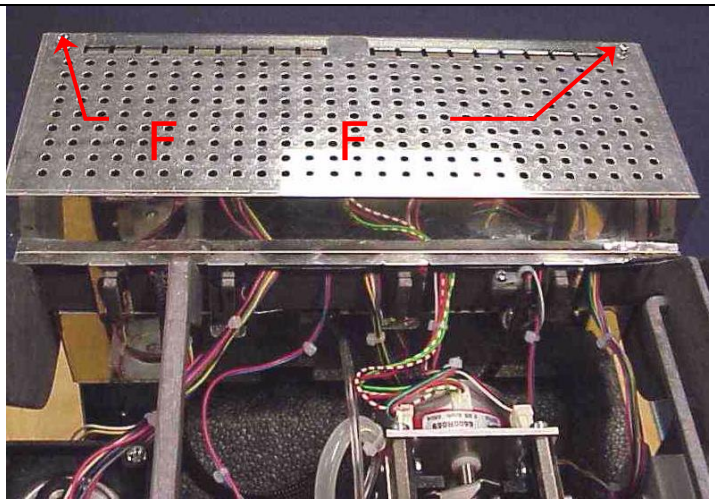
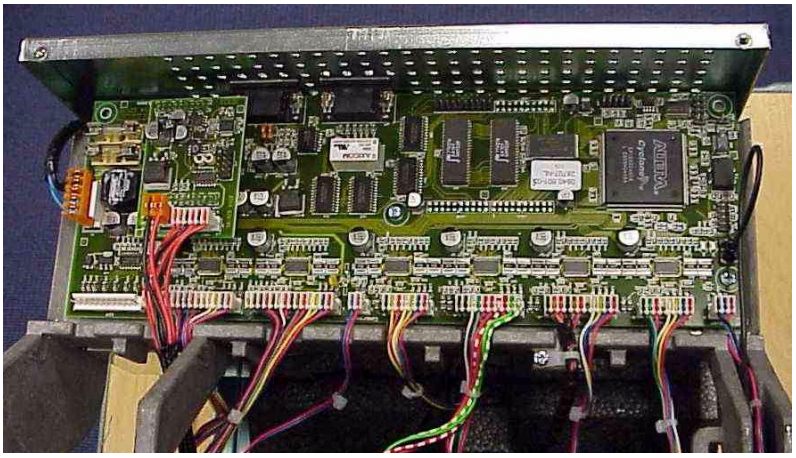
Slide the front cover forwards out of the Autosampler and place it on a safe place	 *Figure 17: Front cover removing*
Remove the cooling cover, by sliding if forwards. Undo the 2 screws from the top cover, marked B, and slide the top cover backwards for at least 2cm and lift it up for further removing.	 *Figure 18: Removing cooling cover and top cover*

Removing side panels

Loosen the screws marked C and D both 1 turn Remove the screw marked C for removing the left side panel of the Autosampler Repeat this procedure for the right side panel	 *Figure 19: Removing the side panels.*

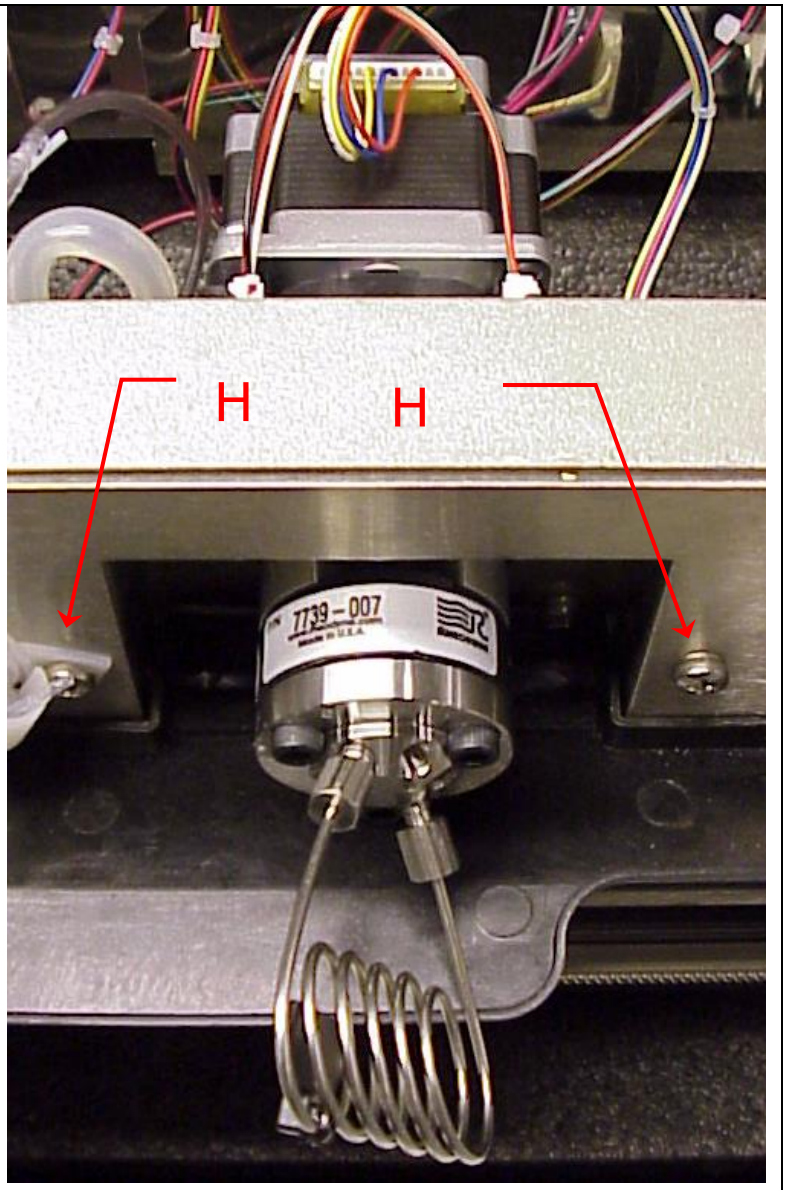
Removing the main board

To remove the main board, start with the section “remove the top cover and continue with the procedure below.

Top view of Autosampler with shielding cover at main board Remove the 2 marked screws E for removing the shielding cover.	 *Figure 20: Removing the shielded mainboard cover*
Top view of mainboard with additional cooling board. Disconnect all connectors and remove the philips screws and sub-D connectors screws, to remove the mainboard.	 *Figure 21: Top view of mainboard*

Removing the injection valve assembly

To remove the injection valve, start with the section removing the top cover and continue with the procedure below

T For removing the complete valve assembly, remove the 2 marked screws H and unplug the connector from the motor and the 2 optical sensors	 *Figure 22: Removing the new style injection valve assembly*

Removing the syringe dispenser

To remove the syringe dispenser, start with section removing the top cover, side cover and continue with the procedure below
Remove the 6 marked screws for removing the syringe dispenser assembly
Remove the shielding cover of the mainboard and unplug the 2 connectors from the mainboard.

Slide the syringe dispenser backwards out of the mainframe and take note for the syringe waste tubing.

For reinstalling the syringe dispenser, remove the tray cover first for correct installing of the waste tubing.

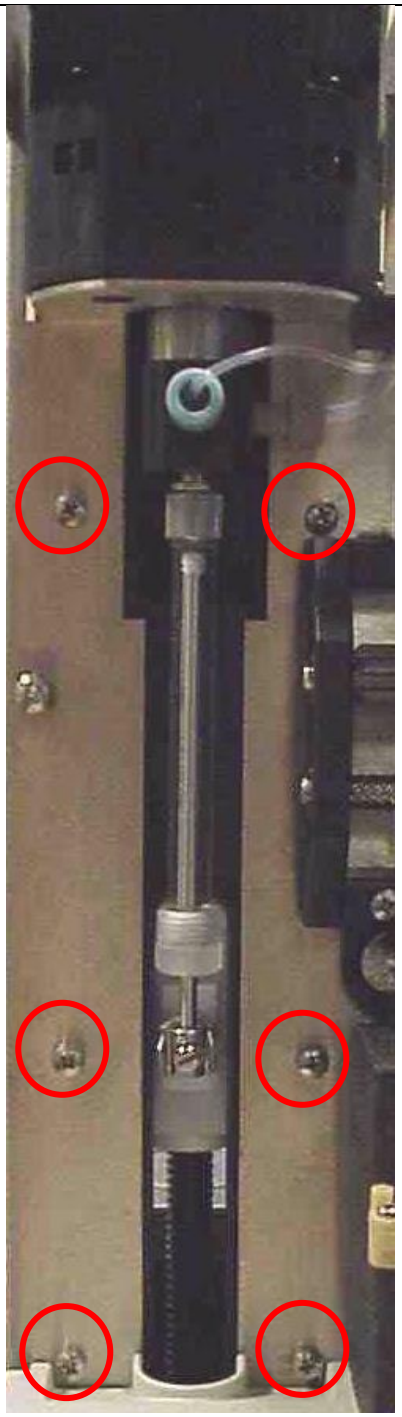


Figure 23: Removing the syringe dispenser

C H A P T E R 6

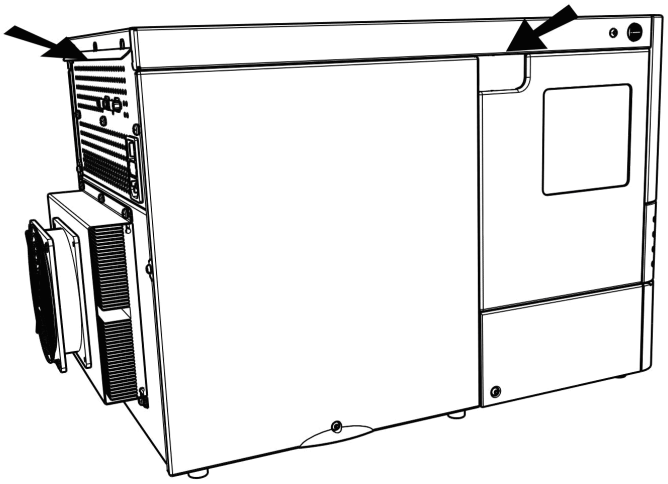
Installation

Unpacking

Inspect the *transport box* for possible damage as it arrives. Immediately inform the transport company in case of damage, otherwise she may not accept any responsibility. Keep the transport box as it is designed for optimum protection during transport and it may be needed again. Carefully unpack the autosampler and inspect it for completeness and for possible damage. Contact your supplier in case of damage or if not all marked items on the checklist are included.
Prior to shipment, your autosampler has been thoroughly inspected and tested to meet the highest possible demands.

Execute the following steps for initial installation of the AS 110 autosampler:

1. Lift the AS 110 from its packaging using both hands at the marked position.



2. With both hands under the instrument, lift the AS 110 to its operating location. Keep the instrument upright.

Make sure that the ventilation holes at the back of the autosampler are not blocked. Note that if the ventilation holes are blocked, this may influence performance and cooling capabilities of the autosampler.

If objects are placed on top of the AS 110, this may also influence the cooling capabilities.

Objects can be placed on any side of the AS 110; however, make sure these objects are placed at a distance of:

- 5 cm from the AS 110, if objects are placed at only **one** side of the AS 110
- 10 cm from the AS 110, if objects are placed on **more than one side** of the AS 110

Do not place the AS 110 in an area subject to excessive dust or shocks. Use the AS 110 indoors only. Do not place it near a source of heat or in direct sunlight, as this may influence the cooling capabilities of the system.

1. Leave the AS 110 to adopt ambient temperature for at least one hour.
2. Install AS 110 Service Manager (see "ASM software" on page 45) on your PC.
3. Check that fuses and voltage range on the rear side of the instrument match that for the power outlet to be used.
4. Connect the AS 110 to the PC COM-port with the cable provided with the AS 110.
5. Connect the power cable between the AS 110 and the power outlet.
6. Switch on the AS 110.
7. On your PC, open AS 110 Service Manager and enter the required settings.
8. Connect the drain tubing to the waste outlet.
9. Fill the wash solvent bottle inside the sampling compartment of the AS 110 with distilled water and propanol (80/20 v/v%) or mobile phase. Only water or organic solvents should be used. Do not use crystalline or buffer solutions, as these may block the system and

cause severe damage. Degas the wash solvent to prevent air bubbles from forming in the syringe.

10. Fill the wash solvent tubing, syringe and buffer tubing by washing the system two or three times.

Use 100% IPA for better degassing or removing of air bubbles.

11. Check if air bubbles are trapped in the syringe; remove them by gently tapping the syringe.
12. Connect your HPLC pump to port 1 of the injection valve and the column (or the capillary) to port 6 of the injection valve. Check for leakage and let the system stabilize for at least 5 minutes.

Go to Instrument setup see user manual to start using the software for control of the AS 110 autosampler.

AS 110 fluid connections

When all items have been installed, the following fluid connections are in place:

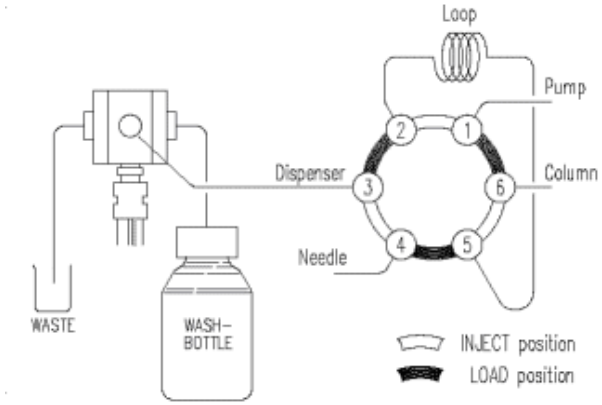


Figure 24: AS 110 fluid connections.

The AS 110 is factory-installed with:

- 500 µL syringe
- 100 µL sample loop
- 1000 µL buffer tubing
- 15 µL stainless steel sample needle.

Make sure that the following are correctly connected:

- HPLC pump to port 1 of the injection valve.
- HPLC column to port 6 of the injection valve.

AS 110 tubing

The AS 110 is standard fitted with the following tubing:

Tubing	**Materials/Dimensions**
Standard sample needle and tubing (label 15 µL)	SS: 97 mm x 0.8 mm OD x 0.25 mm ID ETFE (Tefzel): 200 mm x 1/16” OD x 0.25 mm ID
Buffer tubing from high-pressure valve to syringe valve (label 1000 µL)	ETFE (Tefzel): 1275 mm x 1/16” OD x 1.0 mm ID
Tubing syringe valve to wash solvent bottle	PTFE: 400 mm x 1/8” OD x 1.6 mm ID
Tubing syringe valve to waste	PTFE: 400 mm x 1/8” OD x 1.6 mm ID

Note the following if you need to install new tubing:

- insert tube ends always flush with ferrule ends
- do not overtighten nuts, as this may cause blockage in the flow path
- make sure that you always use tubing volumes that are suitable for use with the other items in the flow path.

Tubing guide

To prevent that the wash tubing obstructs the horizontal movement of the needle unit, use the tubing guide integrated in the leakage drain:

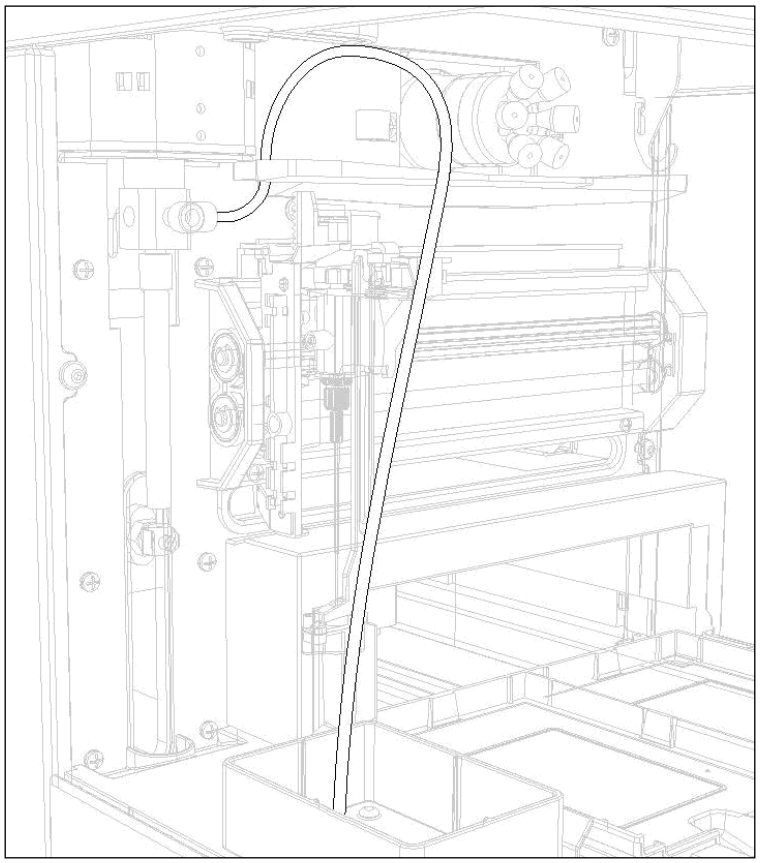


Figure 25: Tubing guide.

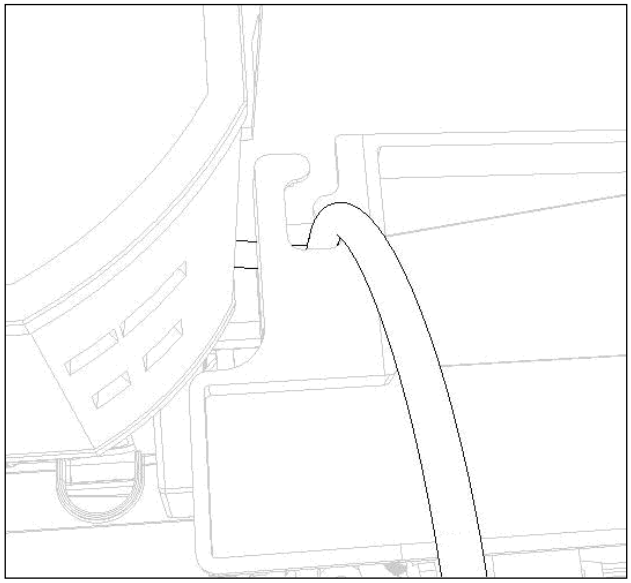


Figure 26: Top view of tubing guide.

Waste tubing

Make the following connections for disposal of waste liquids:

- General waste: connect the drain tubing (in the shipkit of the AS 110) to the right-hand drain hose connector (see figure 8, number 2). Place the other end in a bottle for waste (on the floor). Through this drain all the liquid dispensed to the wash position is removed. Sample liquid that is not injected is also removed through this tubing.
- Condensation water and leakage drain: through the left-hand hose connector (see figure 8, number 3) all leaked solvents and condensation (from cooling) are drained. If the cooling is used, you are advised to connect this hose connector (in the shipkit of the AS 110) to a waste container on the floor.
- Make sure that none of the drain or waste tubes is twisted; this might obstruct the flow path.

Wash solvent and syringe rinse

Use a clean bottle for the wash solvent and place it on the left-hand side of the AS 110. You are recommended to use a mixture of distilled water and isopropanol (80 /20%) or mobile phase as wash solvent. Before using the wash solvent, degas the solvent with helium or an ultrasonic bath. Do not use salts or buffer solutions; crystals may block or damage the system.

1. To fill the wash solvent tubing execute the following steps:
2. Place the end of the wash solvent tubing in the filled wash solvent bottle.
3. Open Direct Control in AS 110 Service Manager.
4. In the Syringe group box, click End. A syringe volume of wash solvent is aspirated from the wash solvent bottle and the wash solvent tubing is filled.
5. Click Home. The syringe contents is dispensed to syringe waste.
6. Repeat steps 3 and 4 until the wash solvent tubing and the syringe are completely filled.
7. When wash solvent tubing and syringe are completely filled, click Start in the Initial wash group box to perform a standard wash routine. All tubing connected to the syringe valve will be rinsed with wash solvent.
8. Click Close to leave the Direct control screen. The AS 110 is initialized.

Syringe

A 500 µL syringe is standard installed in the AS 110. However, it is also possible to install a 2500 µL syringe. Refer to Syringe dispenser (on page 34) for more information on how to replace the syringe.
Note that the AS 110 will give the best results if all air is removed from the syringe. Execute an extra wash to remove air from the syringe.

Sample handling

Take the following into account when handling samples:

- Standard vials can best be filled by means of a narrow-end pipette to allow air to escape when filling the vial.
- Do not fill vials/wells to the edge. If you do, sample will be forced into the air needle, risking cross-contamination of samples and soiling the needles.
- It is important that seals and capmats are airtight to prevent air bubbles from forming and to block evaporation of volatile samples. We recommend use of the following seal types:
- for standard (low) well plates: sealing tape
- for deep well plates: pierce-able capmats (Pre-slit or silicon) or sealing tape
- for vials: standard septa (thin types); do not use vials with hard caps that are not designed for being pierced by an injection needle (do not use e.g. Eppendorf SafeLock micro test tubes).
- When you use uncapped vials/wells, injection performance may not be to specification.

C H A P T E R 7

Adjustments

Frame

The overall frame consists of three main parts: Bottom plate, mainframe and top frame

Alignment mainframe

The order of mounting the parts of the frame is important to achieve good alignment of the different modules.

When mounting the mainframe to the bottom, make sure that the notches of the mainframe fit trough the holes of the bottom. This can only be seen from below, since the insulation parts obstruct direct view.

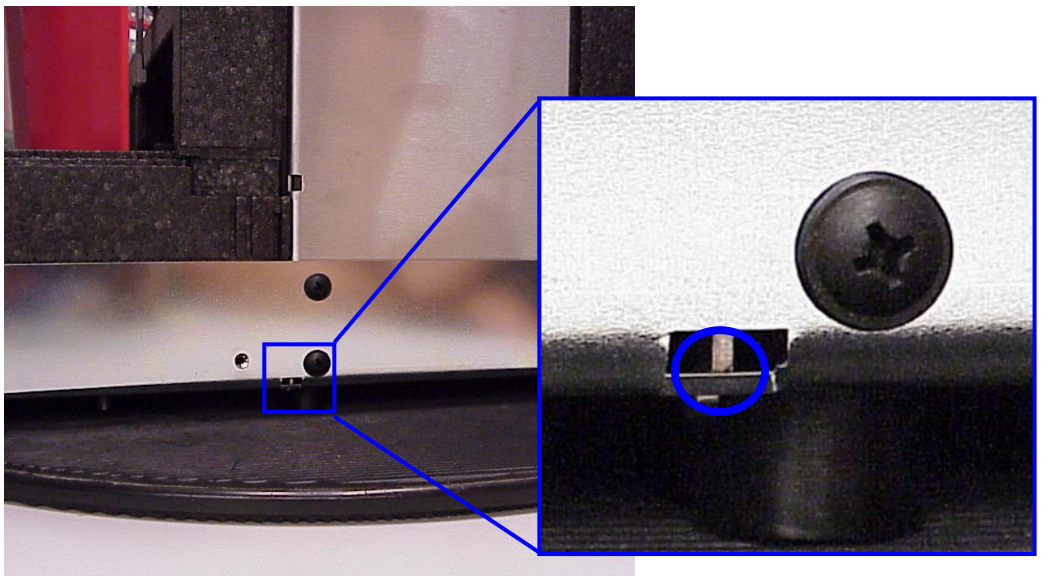


Figure 27: Alignment notches of mainframe.

The mainframe is mounted with one screw directly to the bottom, and six screws on the sides. Make sure not to tighten the screws on the sides prematurely.

Alignment top frame

The top frame aligns the mainframe perpendicular to the bottom. The screws must be mounted in the correct order, while pressing the top frame down.

The correct order is:

- two screws M4 top frame on the front side
- 2 self-tapping screws top frame
- 6 self-tapping screws bottom plate

Check afterwards the mainframe to bottom plate connection and make sure that there is no gap between mainframe and bottom plate.

Needle module

Linear guiding rail

The miniature linear rail requires delicate handling, since the carriage is not fixed to the rail.

The linear rail should be installed with the markings in the direction as shown below.

First install the linear rail to the needle holder. Push the needle holder with its notches to the carriage while tightening the mounting screws.

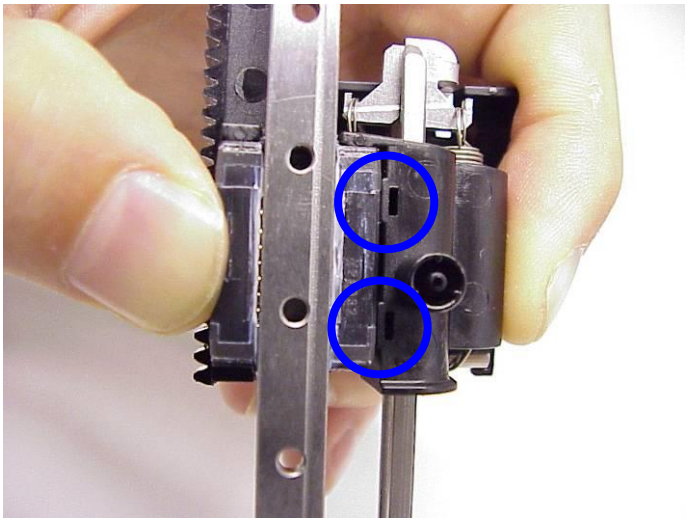


Figure 28: Detail view of linear guiding rail.

Then place the X-train. Push the rails to the notches while tightening the three mounting screws.

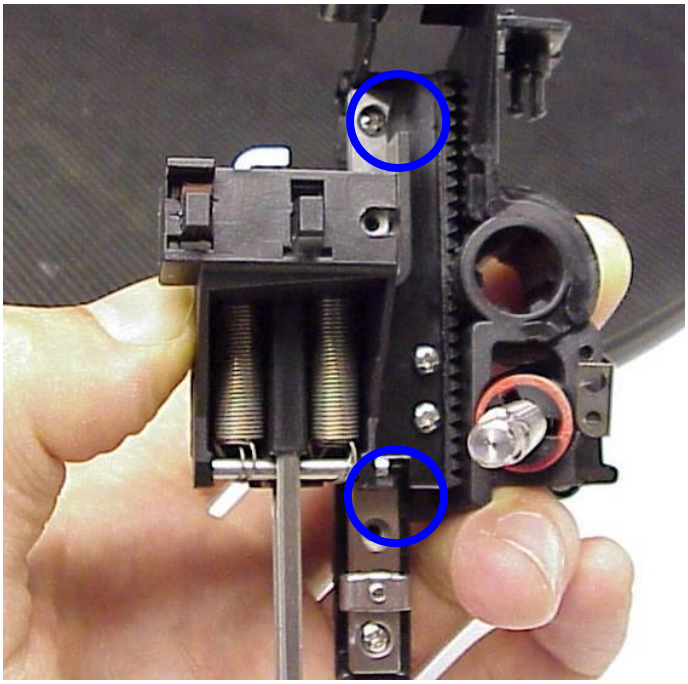


Figure 29: Needle up down adjustment notches

Spindle play

The aluminium pulley on the lead screw must be installed free of axial play to achieve zero backlash. To achieve this, push the pulley, bearing and lead screw together, while tightening the mounting screw of the pulley.

Make sure after installation that the lead screw does not move when pushing or pulling on the pulley

Installing the needle assembly

To assure the accuracy specifications of the AS 110 autosampler, it is important to mount the needle module correctly into the frame.

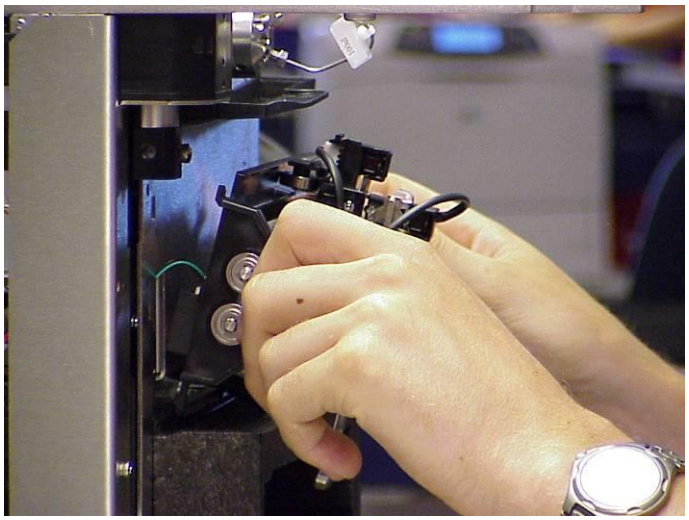


Figure 30: Needle unit in angle positioned for installing

Place the needle unit at a slight angle onto the insulation cover of the tray drive.

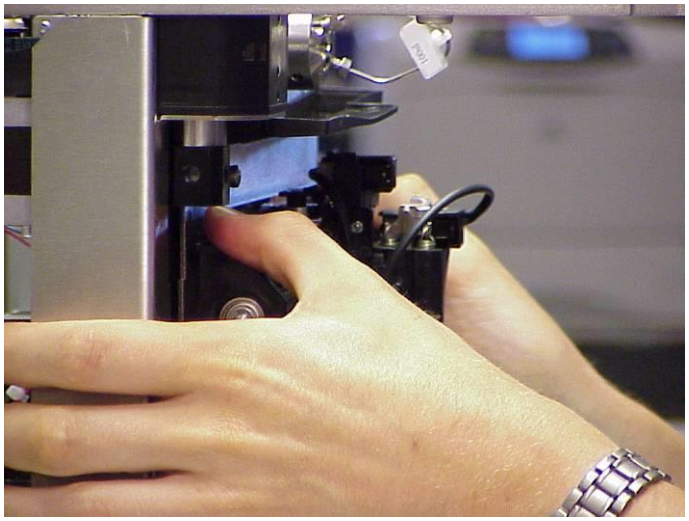
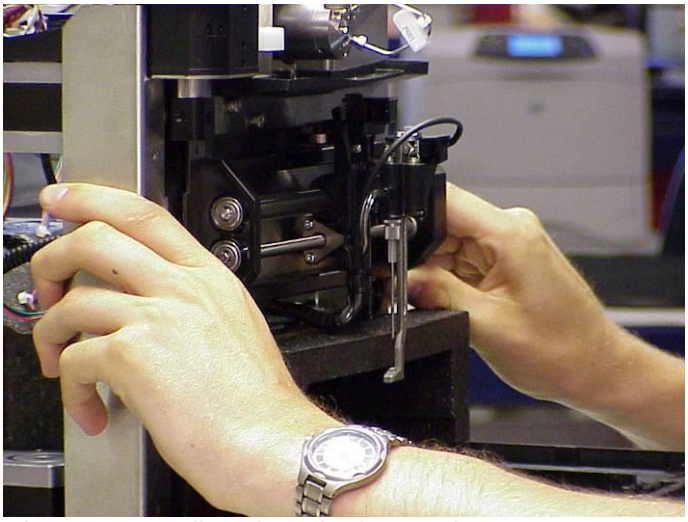


Figure 31: Needle unit pressed donw for installing

Press the needle unit down on the left and right hand side into the insulation material and rotate the needle unit with the alignment catchers into the frame.

The catchers should snap in place when the pressure is relieved.



Push the needle unit up to the end stops. Make sure that both the left and right end stops are reached.

Figure 32: Needle unit pushed upwards

Finally, secure the unit with two Phillips head screws on the bottom of the bearing frame.

Figure 33: Installing of the 2 screws

Geared belts

The motor frame should be moved to the right hand side to tension both belts. The belts should preferably be tensioned with the corresponding tool (no…).

When this tool is not present, make sure that the belts are just free of play and not too tight. The motor plate should be pressed to the right by finger pressure only while tensioning the mounting screws.

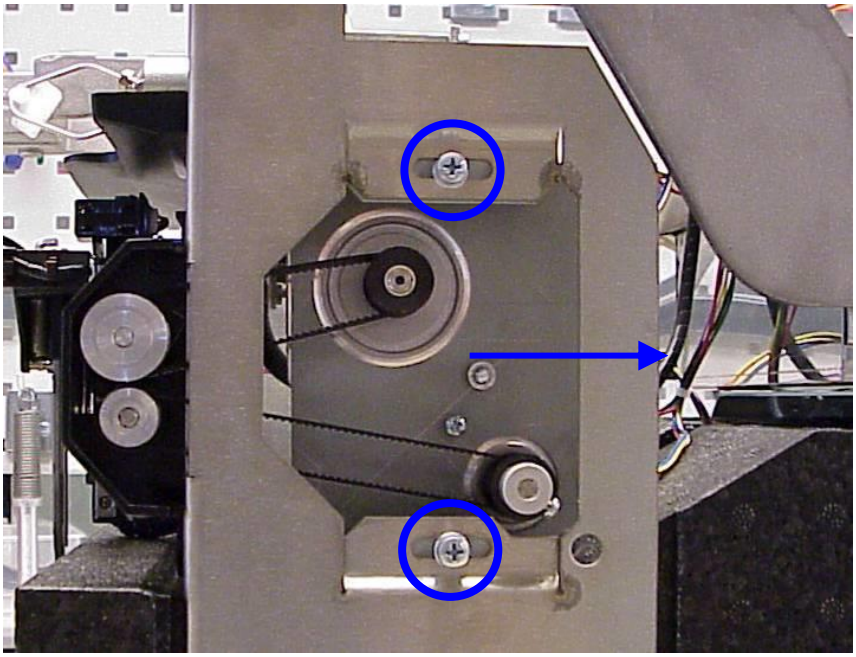


Figure 34: Adjustment of the needle unit geared belts

Dispenser Module

This section describes the adjustments and installation notes for the syringe dispenser module.

Geared belts

The motors should be moved to the back to tension the belts. Make sure that the belts are just free of play and not too tight. The motor should be pressed to the right by finger pressure only while tensioning the mounting screws.

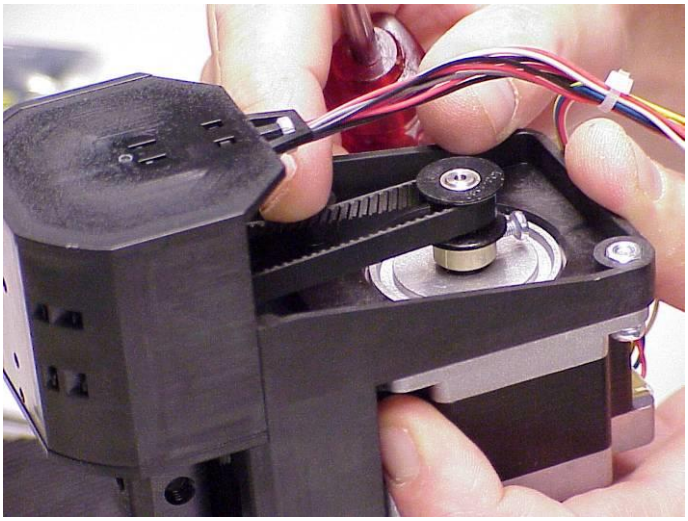
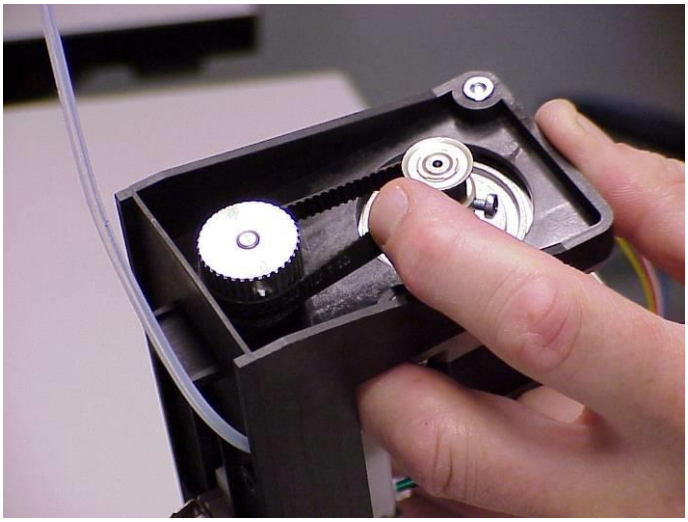


Figure 35: Adjustment of syringe valve belt.

The belt can be twisted to about 45 degrees when the belt has been correctly tensioned.

Make sure to turn the pulley to line up the timing belt, before testing the tension.



The belt can be twisted to about 45 degrees when the belt has been correctly tensioned.

Make sure to turn the pulley to line up the timing belt, before testing the tension.

Figure 36: Adjustment of spindle belt.

Spindle play

The spindle must be installed with zero backlash. To achieve this, push on the upper bearing block while tightening the two mounting screws at the front of the dispenser.

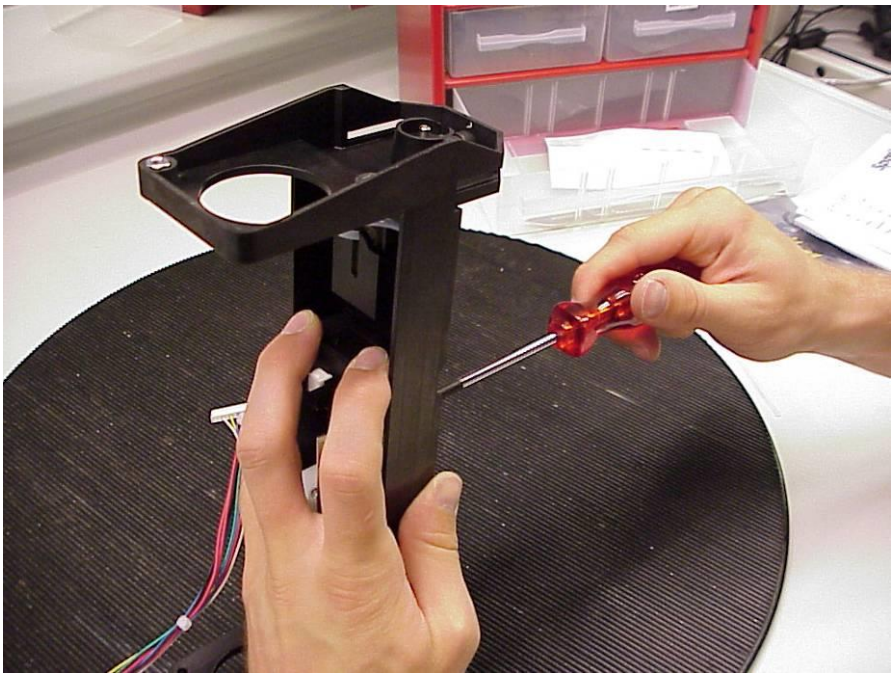


Figure 37: Adjustment of upper bearing Block.

Home flag

Make sure that the home flag is in its most upper position when the dispenser is used in the AS 110 autosampler. The adjustment of the syringe is done by the adjustment software.

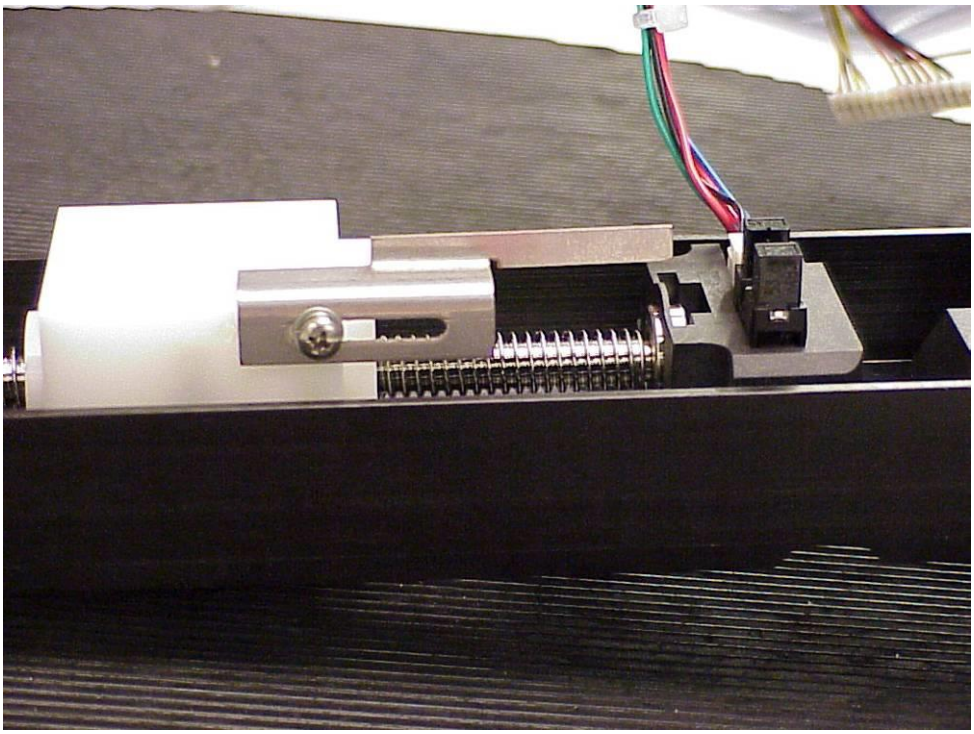


Figure 38: Home flag in most upper position.

Alignment Procedure

Most alignments of the AS 110 autosampler are done by software compensation. The corrections are programmed with a wizard.

The AS 110 can be adjusted by means of PC Control which can be divided into two sections:

- An advanced section that is located under the Service menu
- An user section

The advanced section is intended for service personnel only. All AS 110 adjustments can be performed here.

With the user adjustments section a user is able to fine tune the needle-tray piercing point when f.i. a needle is out of alignment.

Adjustments (Advanced)

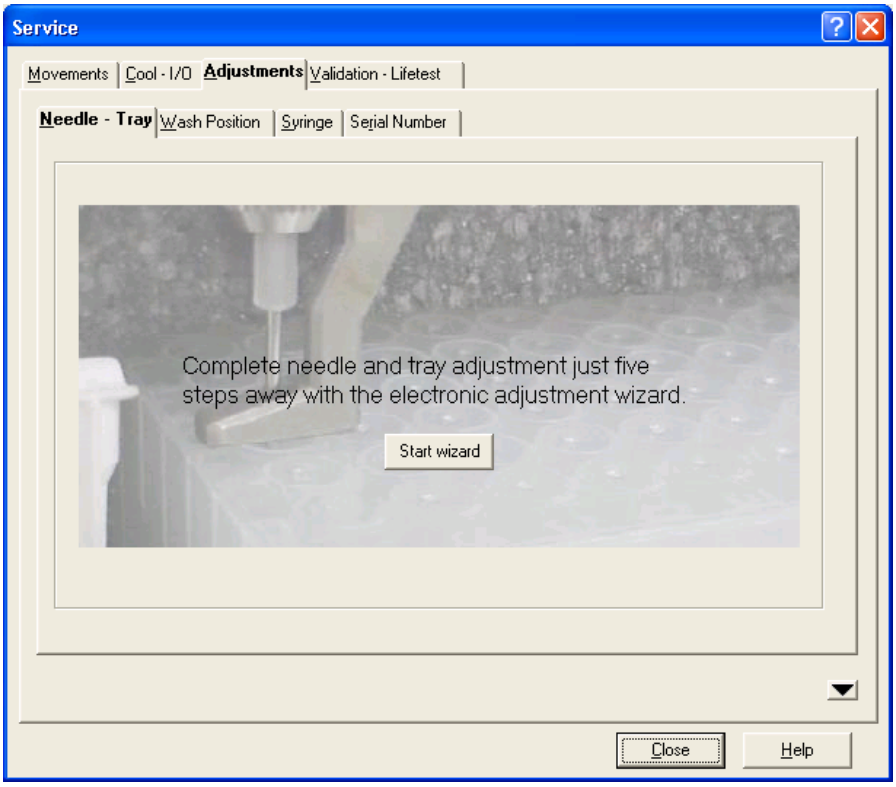
The advanced adjustments consist of four parts:

- Needle-Tray adjustments
- Wash position adjustment
- Syringe adjustment
- Serial number

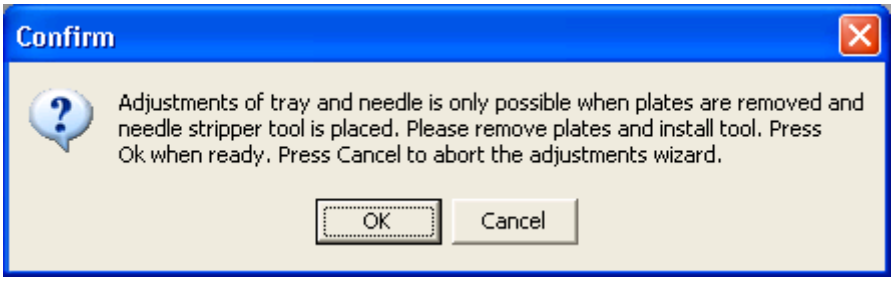
Needle-Tray adjustments

To adjust the Needle and Tray, proceed as follows:

Click the Start wizard button to start needle-tray adjustment.



AS 110 initializes. When initialization is completed the operator is asked to remove the plates.



Click on OK to proceed.

AS 110 moves the tray and needle to the needle vertical (Z) adjustment spot. For safety reason Z adjustment always starts at the same position.

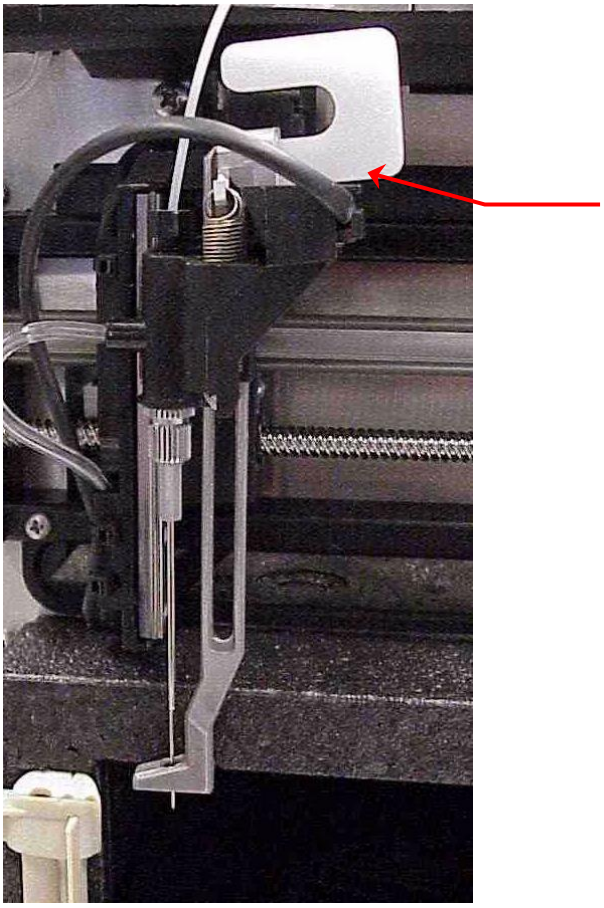
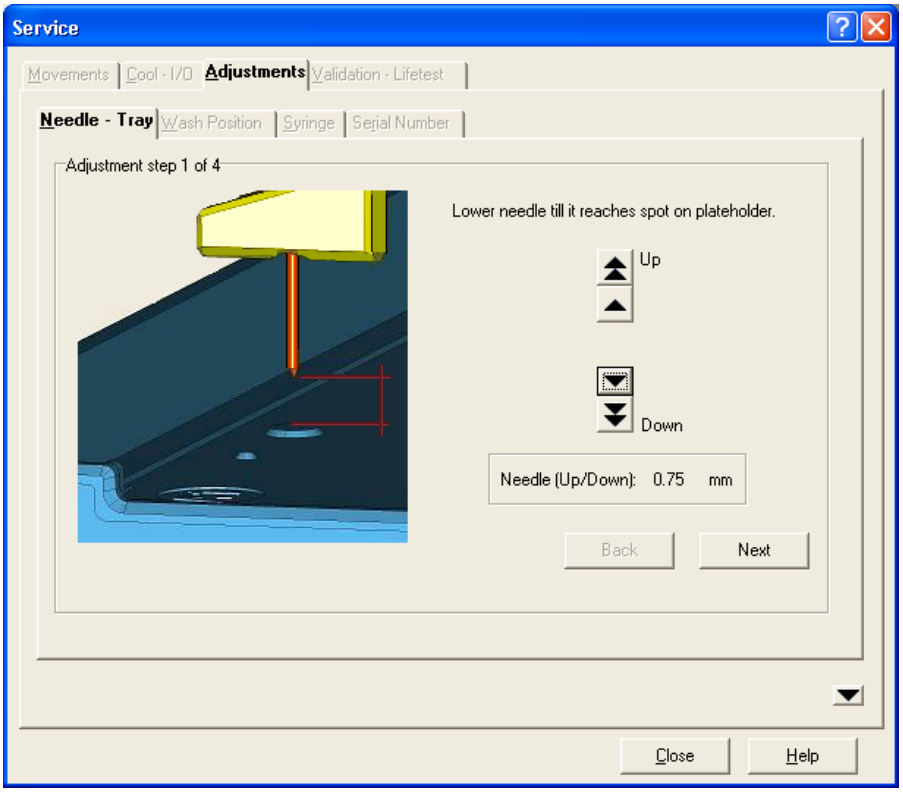


Figure 39: Needle unit with installed stripper tool.

Install the needle stripper tool. Confirm the message with OK.
Lower the needle vertical by means of the arrow buttons till it reaches the large spot on the plate holder.



 Clicking these buttons results in 0,25mm vertical movement.

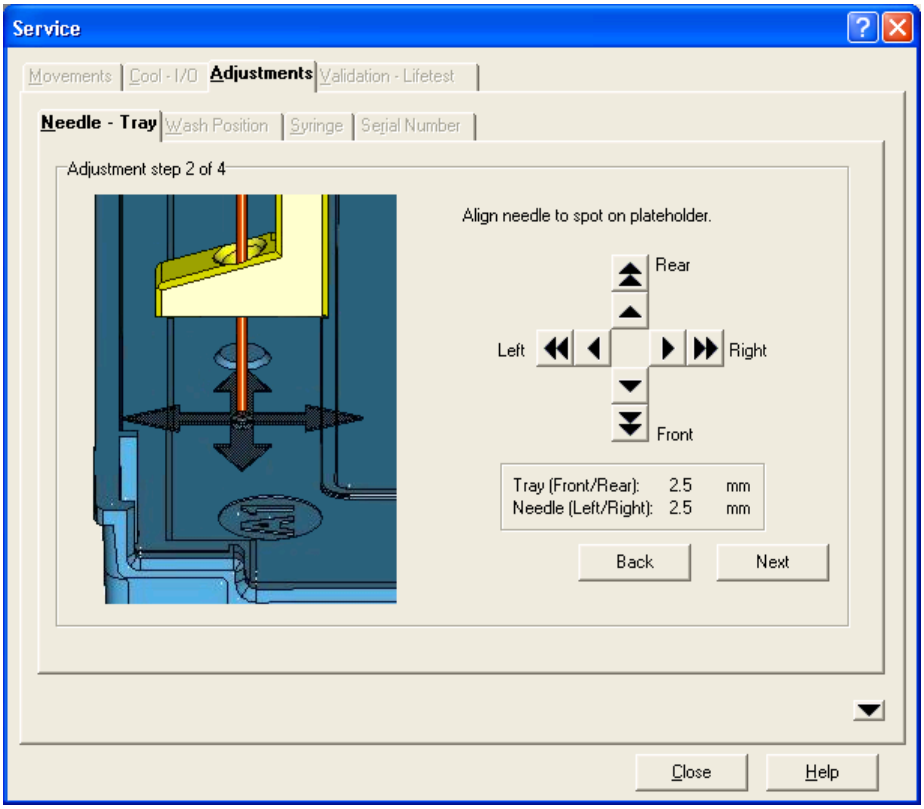
 Clicking these buttons results in 1,00mm vertical movement.

The Needle up/down position can be adjusted within a range of 0,50 up to 4,50 mm.

 Click Next button to proceed with the next step.

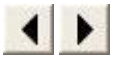
When the needle up/down adjustment has changed the operator will be asked to save the changes or not. Press OK to save or Cancel to ignore.

The needle and tray are moved to the first tray adjustment spot.
Align the needle to the spot on the plate holder. Click on the arrow buttons to move tray and/or needle to the correct position.



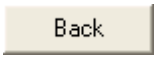
 Clicking these buttons results in 0,05mm tray movement.

 Clicking these buttons results in 0,50mm tray movement.

 Clicking these buttons results in 0,05mm needle movement.

 Clicking these buttons results in 0,50mm needle movement.

The Needle left/right and Tray front/rear position can be adjusted within a range of 0,50 up to 4,50 mm.



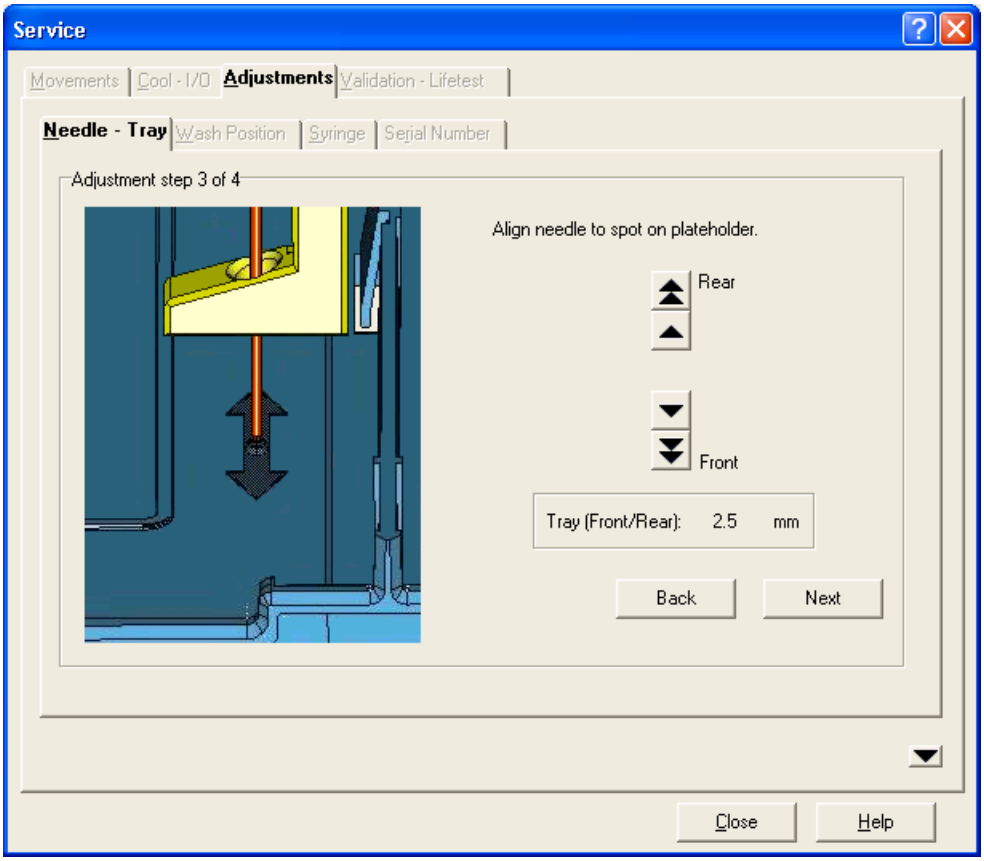
Click Back button to return to step 1.

Click Next button to proceed with the next step.

When the Tray front/rear and/or needle left/right adjustment has changed the operator will be asked to save the changes or not. Press OK to save or Cancel to ignore.

When changes are saved the corresponding Tray-Needle User adjustment parameter is set to 0.

The needle and tray are moved to the second tray adjustment spot.
Align the needle to the spot on the plate holder. Click on the arrow buttons to move the tray to the correct position.



Clicking these buttons results in 0,05mm tray movement.

Clicking these buttons results in 0,50mm tray movement.

The Tray front/rear position can be adjusted within a range of 0,50 up to

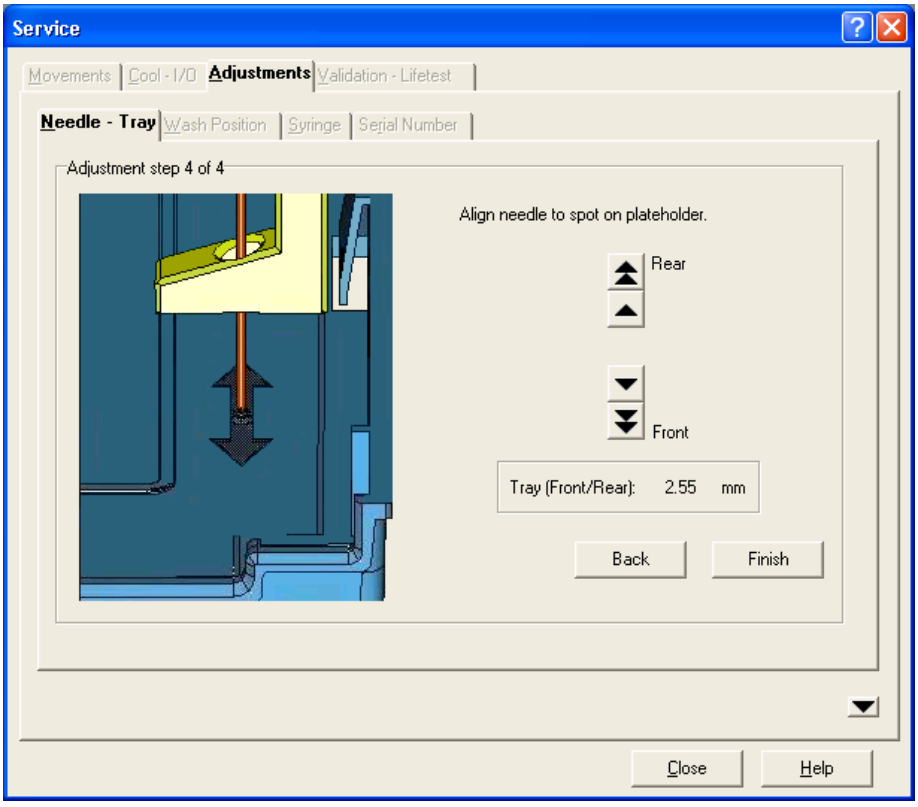
4,50 mm.

Click Back button to return to the step 2.

Click Next button to proceed with the next step.

When the Tray front/rear adjustment has changed the operator will be asked to save the changes or not. Press OK to save or Cancel to ignore.

The needle and tray are moved to the third and last tray adjustment spot. Align the needle to the spot on the plate holder. Click on the arrow buttons to move the tray to the correct position.



Clicking these buttons results in 0,05mm tray movement.

Clicking these buttons results in 0,50mm tray movement.

The Tray front/rear position can be adjusted within a range of 0,50 up to 4,50 mm.

Click Back button to return to the step 2.

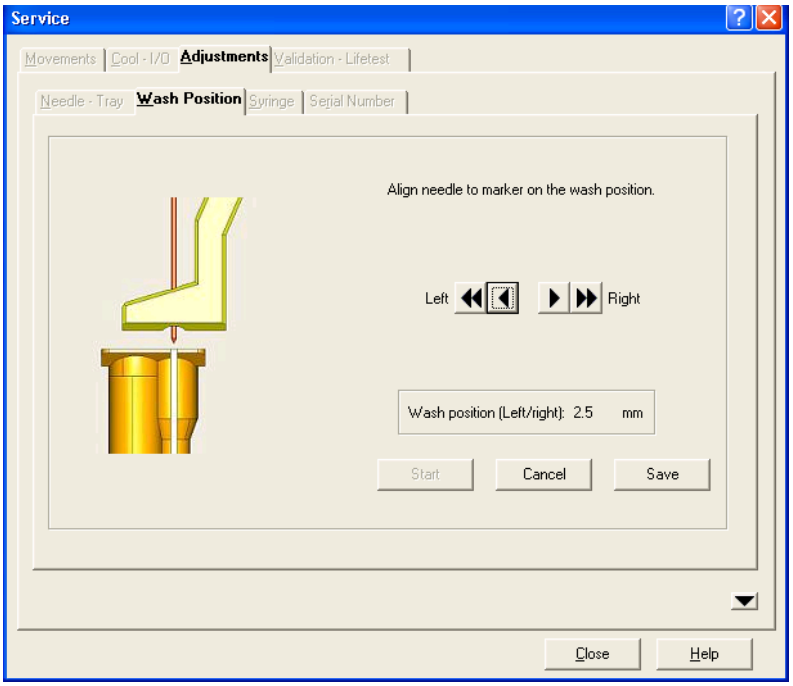
Click Finish button to complete the needle-tray adjustment.

When the Tray front/rear adjustment has changed the operator will be asked to save the changes or not. Press OK to save or Cancel to ignore.

Wash position

Click 

button to align needle to marker on the wash position. Needle moves to the wash position. With the arrow buttons the wash position can be adjusted to the left or the right.



Clicking these buttons results in 0,05mm needle horizontal movement.

Clicking these buttons results in 0,50mm needle horizontal movement.

The wash position can be adjusted within a range of 0,50 up to 4,50 mm.

Cancel

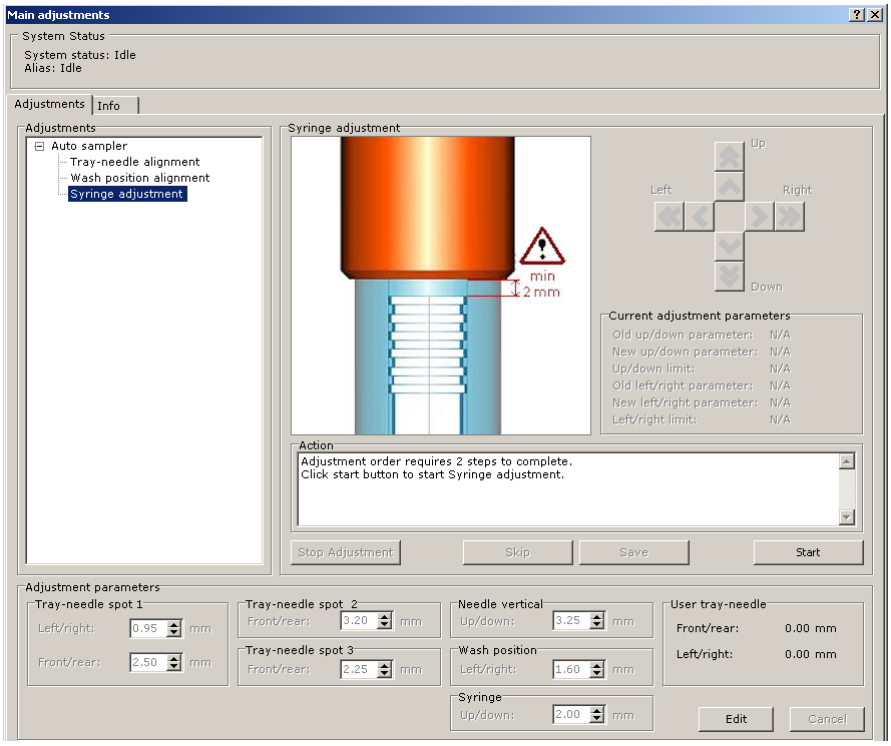
Click Cancel button to ignore changes.

Save

Click Save button to store the wash position adjustment parameter.

Syringe

Click Start button to align the syringe plunger 1mm from upper position. 1mm clearance is needed for the syringe home movement.



Clicking these buttons results in 0,25mm displacement of the syringe.

The syringe can be adjusted within a range of ±2 mm.

Home

Click Home button to check the new adjustment value for the syringe.

Cancel

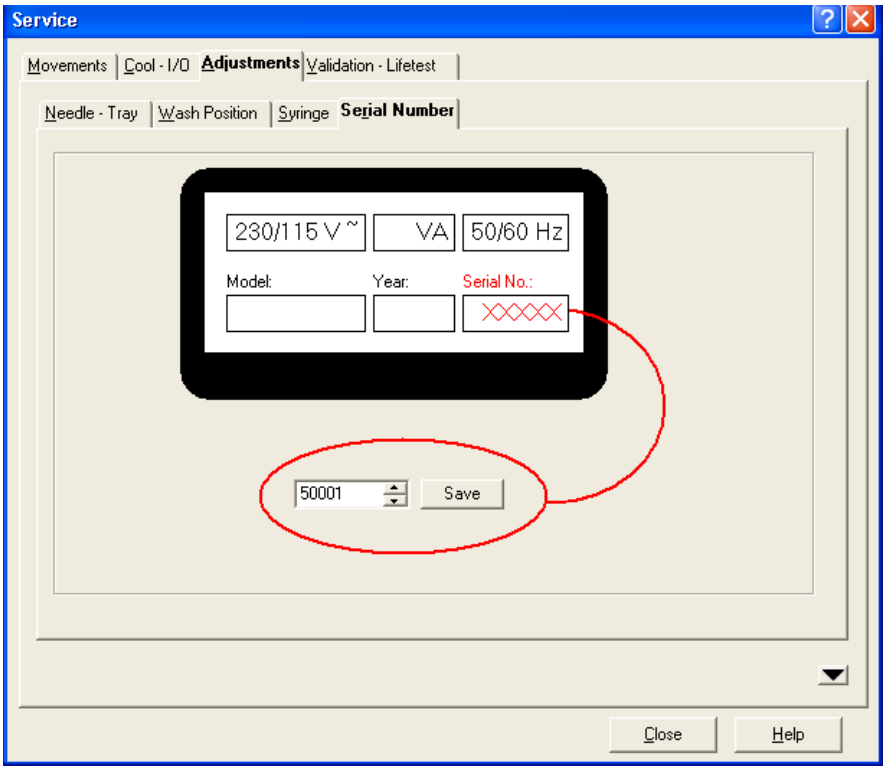
Click Cancel button to ignore changes.

Save

Click Save button to store the syringe adjustment parameter.

Serial Number

The serial number of the instrument can be found on the rear panel of the instrument.



Enter the serial number of the instrument.

Click Save to store the serial number.

Adjustment Parameters

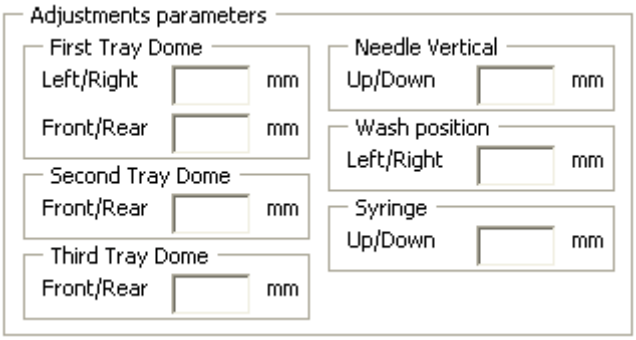


Figure 10: Adjustment parameters label.

The adjustment parameters are written down on a label.

This label is attached to the instrument.

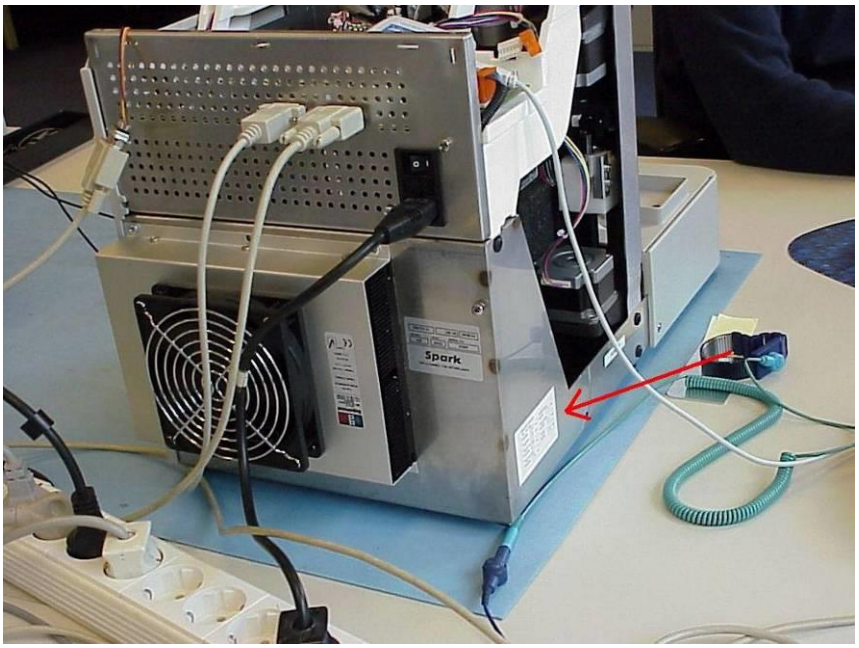


Figure 40: Position of Label on Autosampler.

The adjustment parameters can be read by means of the Adjustment parameters window in Service Adjustments.

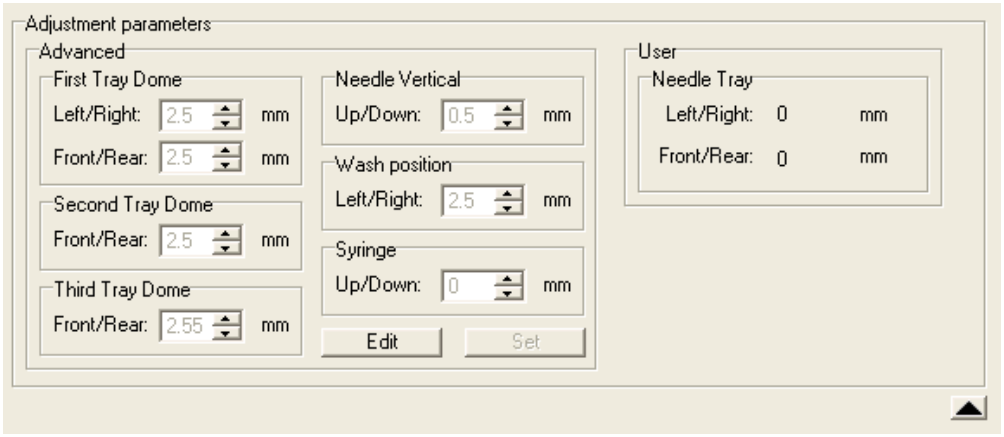


Figure 11: ASM screen of adjustment parameters.

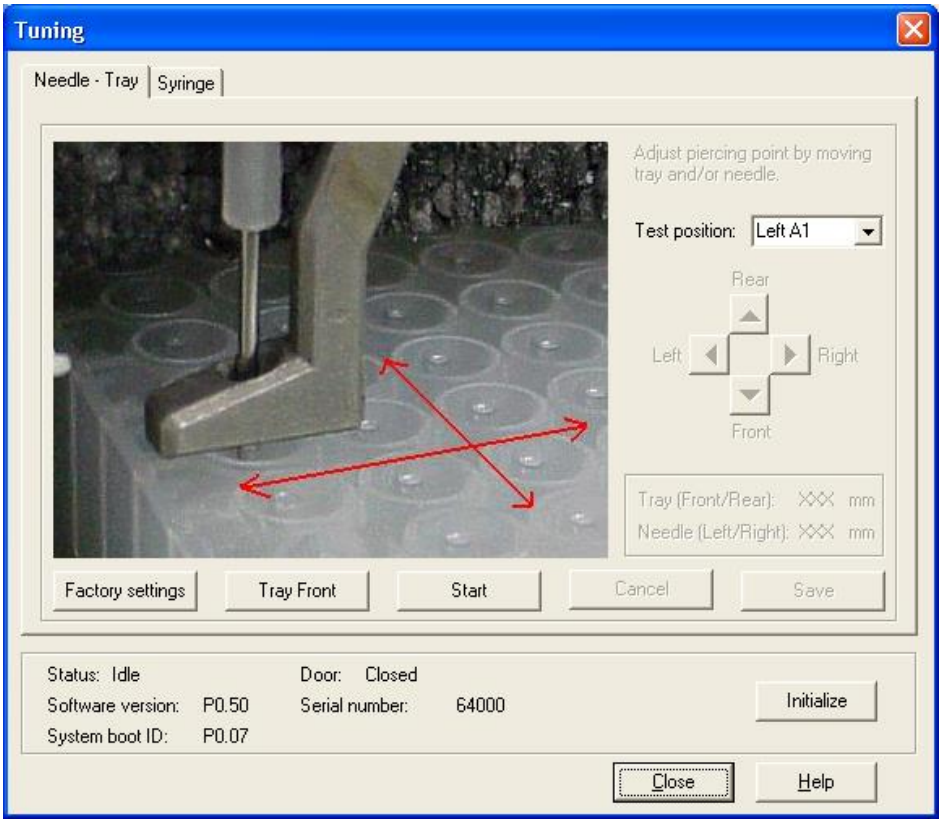
It is also possible to edit the adjustment parameters without performing the adjustment steps f.i. when a printed circuit board has to be exchanged.

Adjustments (User)

The user adjustments consist of two parts:

- Needle-Tray adjustment
- Syringe adjustment

Needle-Tray adjustment
By means of the needle-tray adjustment the needle piercing point can be fine tuned.



For a better check on the piercing point please stick a foil on the configured plate. By means of the Tray Front button the plates can be removed.

Select the desired test position (default Left A1).

Click on the Start button to start the piercing point adjustment.
The needle is pierced into the selected test position.

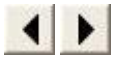
Check the piercing point and adjust needle and/or tray if necessary by means of the arrow buttons.

Click on the Pierce button to check the new adjustment parameters.
Repeat step 4 and 5 to continue adjusting the piercing point.

Click Cancel or Save button.
Click Cancel to ignore the changed adjustment parameters. New adjustment parameter values are not stored.
Click Save to store the new adjustment parameters.

Needle-tray adjustment is completed.

Factory settings Click Factory settings to set the needle-tray user adjustment parameter to 0mm.

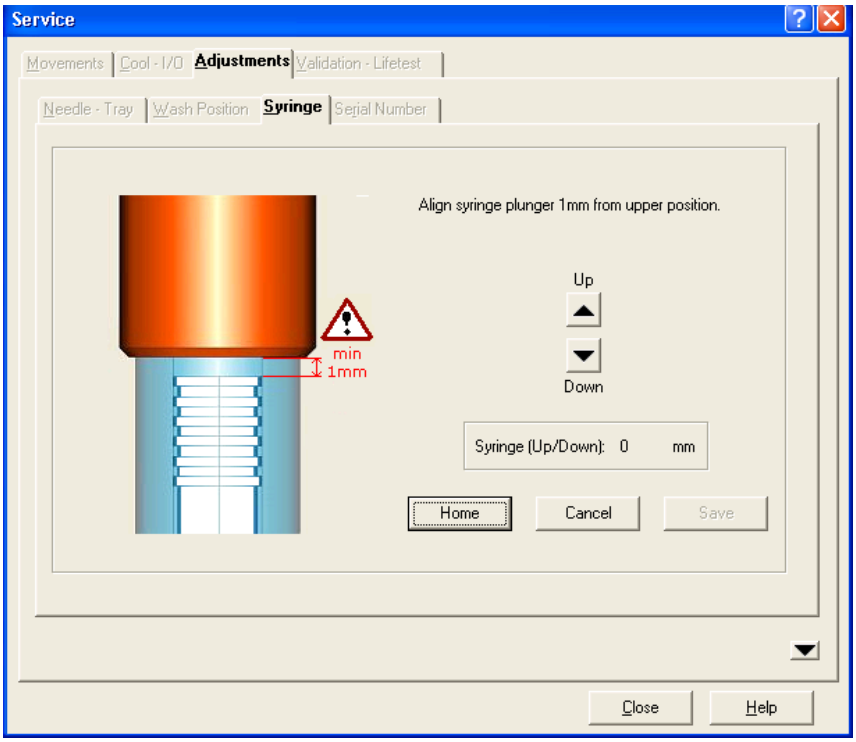
 Clicking these buttons results in 0,05mm needle horizontal movement.

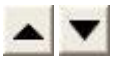
 Clicking these buttons results in 0,05mm tray movement.

The needle-tray user adjustment parameters are factory installed at 0mm .

Syringe

The syringe user adjustment is exactly the same as the syringe advanced adjustment. Click the start button to align the syringe plunger 1mm from upper position. 1mm clearance is needed for the syringe home movement.

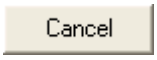




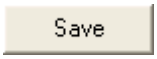
Clicking these buttons results in 0,25mm displacement of the syringe.

The syringe can be adjusted within a range of ±2 mm.

Click Home button to check the new adjustment value for the syringe.



Click Cancel button to ignore changes.



Click Save button to store the syringe adjustment parameter.

Upload of software

Via the serial port the software of AS 110 autosampler can be upgraded from the PC by using a flash file.

Upload procedure

Uploading of software can only be done when the AS 110 is in the ready status. When the AS 110 flash memory contains already software use the following procedure:

- Connect the RS232 cable

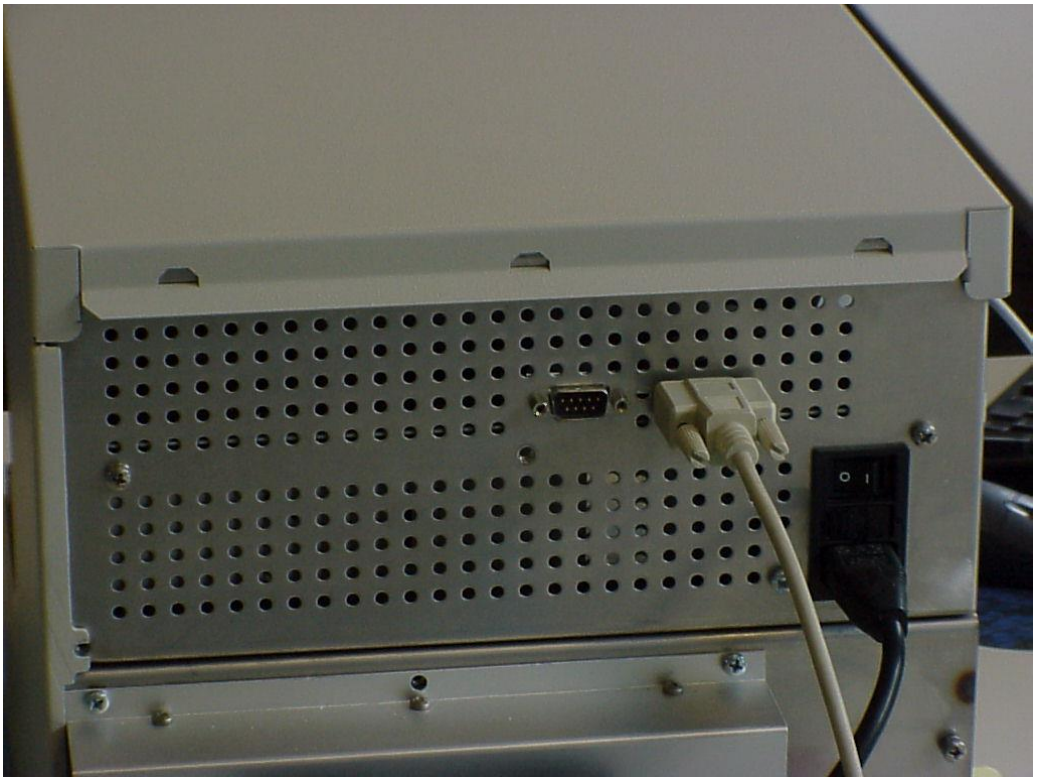
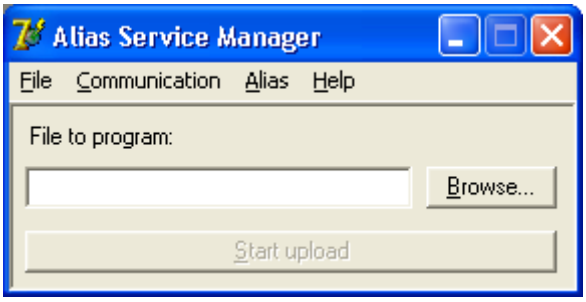
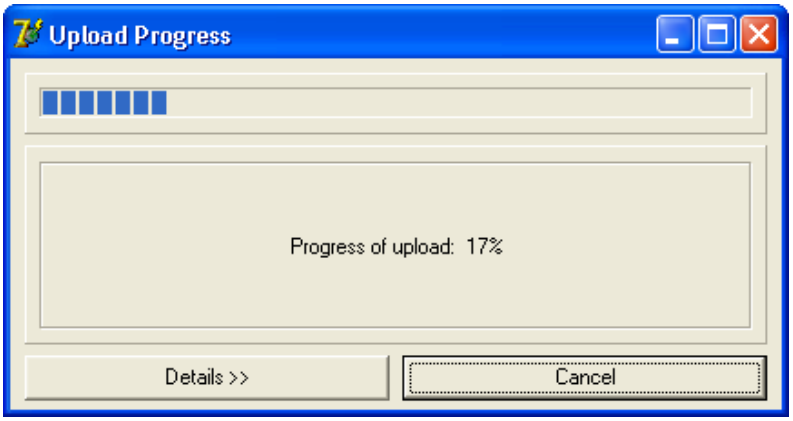


Figure 41: RS232 connector on rear panel of AS 110.

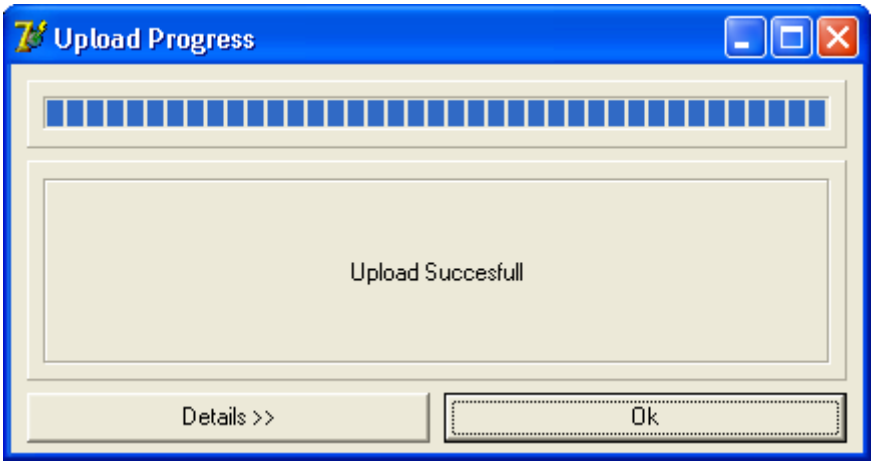
- Start the AS 110 Service Manager application.



- Use Browse to get the specific flash file for uploading.
- Click Start upload to initiate the uploading. The following dialog appears.



The upload is successful when getting the following dialog and the AS 110 is initializing his movements.



C H A P T E R 8

Testprocedure Analytical performance

The Autosampler is tested on the analytical performance with the following procedure and test configuration.

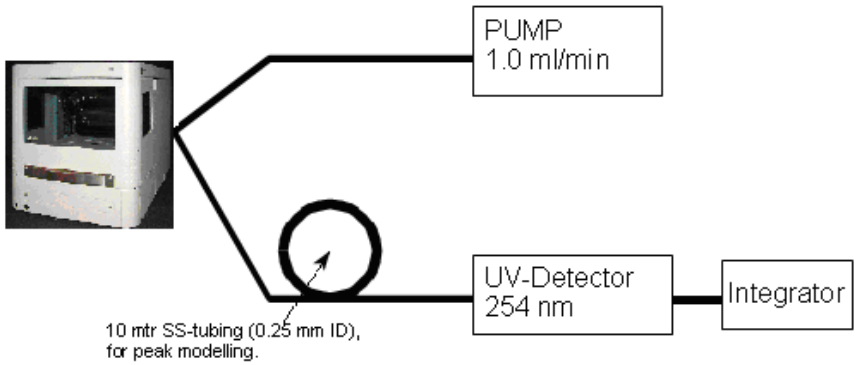


Figure 42: Schematic representation of the AS 100 test set-up

Settings

Mobile phase and wash solvent	:	H2O
Volume of installed loop:	:	100 µL
Syringe volume	:	500 µL
Syringe speed	:	normal
Needle-valve tubing volume	:	15 µL
Buffer tubing	:	1000 µL
Tray type	:	High 96 well
Head space pressure	:	no
Air segment	:	no

Method

Test #1	**µL pick-up**
Injection volume:	10µL
Wash:	Between injections
Wash volume:	500µL
Analysis time:	01:00
Sample	50 ppm uracil
Injections/well:	3
First sample:	A1
Last sampler:	A5

Test #2	**Partial loopfill**
Injection volume:	10µL
Flush volume:	45µL
Wash:	Between injections
Analysis time:	01:00
Sample:	50 and 1000ppm uracil
Blank:	Mobile phase (H_20)
Injections/well	3
First sample:	A6
Last sample:	A12

Fill A1 till A10 with 50 ppm Uracil. Fill A11 with 1000 ppm Uracil, and A12 with H2O. Determine for µL pick-up the RSD (Chrom Perfect) and determine the RSD and carry over of the partial loopfill injection by:

$$RSD\% = \frac{\sigma_{n-1}}{Peak\ area} \times 100\,\% \qquad Carry\ over = \frac{Peak\ area\ blank \times 5}{Peak\ area\ 50\ \ ppm}\ \%$$

The calculated RSD and carry over must be within the following specs:

Reproducibility	- RSD ≤ 1.0% for µl pick-up injections - RSD ≤ 0.5% for partial loopfill injections
Carry over	< 0.05% with programmable needle wash

N.B. The final test is programmed in AS 110 Service Manager (ASM). Via service and validation / life test, there can be chosen between 4 experiments under validation test. Those are:

1: µL pickup,
2: partial loopfill
3: full loop
4: prep mode

By choosing the experiment and clicking on start, the final test will be automatically processed.

A P P E N D I X A

Specifications

General

Sound pressure level	LeAq < 70 dB
Working temperature	10 - 40°C (indoor use only)
Storage temperature	–25 - +60°C
Humidity	20 - 80% RH
Safety and EMC compatibility	According to EC-directives; cCSAus (CSA-UL) approved
Installation class	II
Pollution degree	2
Altitude	up to 2000 m
Dimensions	300 mm x 510 mm x 360 mm (without cooling option) 300 mm x 575 mm x 360 mm (with cooling option)
Free area around instrument	Minimum free distance of 5 cm from obstacles at rear side and air outlets of the cooling units.
Weight	19 kg (without cooling) 21 kg (with cooling)
Max. weight that can be placed on top of AS 110	65 kg
Power requirements	95 - 240 Volt AC ± 10%; 50 - 60 Hz; 200VA
Viscosity range	0.1 - 5 cP

Sampling

Sample capacity	2 Micro Titre Plates according to SBS standards; 96-well high/low and 384-well low formats, 48-vial or 12-vial trays; any combination of plates is allowed, except for 384 Low left and 96 High right.
Vial/Plate dimensions (incl. cap)	Max. plate/vial height: 47 mm (incl. septa or capmat)

Loop volume	*Standard:* 1 - 5000 µL programmable, with 1 µL 10 mL loop optional *Micro:* 0.10 - 20.00 µL programmable with 0.01µL increments
Dispenser syringe	*Standard:* 500 µL standard or 2500 µL for Prep option *Micro:* 25 µL (standard) or 50 µL and 100 µL (optional)
Vial detection	Missing vial/well plate detection by sensor
Headspace pressure	Built-in compressor, but only for vials with septa
Switching time injection valve	Electrically < 100 msec
Piercing precision needle	± 0.6mm
Wash solvent	Integrated wash solvent bottle
Wetted parts in flow path	SS316, PTFE, TEFZEL, VESPEL, Glass, Teflon. Optional: PEEK
Injection cycle time	< 60 sec. in all injection modes for 1 injection ≤ 100 µL including 300 µL wash

Analytical performance

Injection modes	Full loop, partial loopfill and µL pickup PASA™ (pressure-assisted sample aspiration)
Reproducibility AS 110 (500 µL syringe)	RSD ≤ 0.3% for full loop injections RSD ≤ 0.5% for partial loopfill injections, injection volumes > 10 µL RSD ≤ 1.0% for µL pickup injections, injection volumes > 10 µL (valid at 1.0 cP)
Reproducibility AS 110 micro (25µL syringe)	RSD ≤ 0.3% for full loop injections RSD ≤ 1.0% for partial loopfill injections, injection volumes > 0.5 µL RSD ≤ 2.5% for µL pickup injections, injection volumes > 0.5 µL
Carry-over	< 0.05% with 100 µL needle wash

Programming

Interface	AS 110 Service Manager software DataApex Clarity control module
Injection methods	Full loop, partial loopfill and µL pickup
Injection volume	*Standard:* 1 µL - 5000 µL (with 1 µL increment), depending on system settings *Micro:* 0.10 µL – 20.00 µL (with 0.01 µL increment), depending on system settings
Max. injection volume	Full loop = loop volume Partial loopfill = ½ × of loop volume µL Pick up = (loop volume - 3 x needle volume)/2
Injections per vial/well	max. 9 injections
Analysis time	max. 9 hr, 59 min, 59 sec
Wash	Programmable: Wash between injections and Wash between vials
Timed events	Programmable: 4 x AUX ON/OFF
Priority sample	Programmable

Communication

Outputs	1 programmable relay output, programmable as Inject marker (default), Auxiliary, Alarm
Inputs	2 programmable TTL inputs, programmable as Next injection input (default), Freeze input, Stop input
Serial communication port	RS232C

Options (factory installed)

Sample tray cooling	Built-in Peltier cooling Range: 4°C to Ambient - 3°C Temp: air temperature in sample compartment: 4°C ± 2°C (at temperature sensor) (Temperature at relative humidity of 80% and ambient temperature of 25°C)

Options (user-installable)

Bio-compatible sample flow path and valve	Inert sample needle (Silco steel) and bio-compatible valve (PEEK)
Prep Kit (see "Specifications Prep version" on page 74)	2.5 mL syringe, Prep valve, 10 mL sample loop, LSV needle and sample tray for 10 mL vials

Prep version

Note that this specification only lists items that are different from the standard AS 110 specification. The Prep version of AS 110 is designed for Large Sample Volumes (LSV).

Sampling

Sampling capacity	24 vials of 10 mL (LSV)
Vial dimensions (cap included):	Maximum vial height: 47 mm Minimum vial height: 32 mm
Loop volume	Not programmable, injection volume determines the aspirated sample volume
Dispenser syringe	2500 µL syringe
Injection volume	0 µL - 19.999 µL, with 1 µL increments
Valve	Valco 0.75 bore valve
Sample loop	10 mL SS sample loop, 1/8” tubing with 1/16” tubing ends and fittings (Valco)
Buffer tubing	2 mL
Needle	LSV needle with LSV air needle Promis and seal

Analytical performance

Injection method	Partial loopfill injection mode
Reproducibility	RSD ≤ 1.0% for partial loopfill injections, injection volumes >10 µL up to 50% of the installed sample loop
Viscosity range	0.1 – 5 cP
Memory effect	< 0.1% with programmable needle wash

A P P E N D I X B

Accessories & Spares

The following parts available for the AS 110:

The ship kit of the AS 110 contains the following parts:

p/n	Description	Qty
191.0306	Air needle 80 mm (low format well plates)	1
191.0552	CD Rom (ASM en users guide)	1
191.0512	I/O Cable	1
191.0522	Tubing connector T-piece	2
181.0590	power cord EUR	1
181.0592	power cord USA	1
191.0528	Cable Multilink	1
181.0578	Fuse 2,5 AT	2
181.0356	Valco shipkit	1
191.0322	PP wash solvent bottle 250 mL rectangular	1
191.0340*	AS 110 wash bottle adapter	1
191.0342*	AS 110 wash bottle 250 mL, glass	1
191.0328	Silicone tubing (1 meter)	2
191.0300	48 position vial adapter	2

* AS 110 micro is equipped with a glass wash bottle and wash bottle adapter.

The following parts available for the AS 110:

p/n	description
191.0200	AS 110 accessory kit
191.0200M	AS 110 micro accessory kit
191.0322	Wash bottle 250 mL, PP, rectangular
191.0328	Silicone tubing (1 meter)
191.0340	AS 110 wash bottle adapter
191.0342	AS 110 wash bottle 100 mL, glass
191.0512	I/O Cable
191.0522	Tubing connector T-piece
191.0528	AS 110 serial cable, 9M-9F straight
191.0530	Fuse 2 A
191.0532	Fuse 2.5 A
191.0550	AS 110 Tray cover shell
191.0556	Spacer 2.5 x 2.5 x 30
191.0600	AS 110 vial holder 96 low, start-up kit
191.0602	AS 110 sample vials PP, start-up kit
191.0300	48 position vial adapter
191.0302	12 position vial adapter

Needles

p/n	description	type
191.0304	Air needle	all
191.0306	Air needle 80 mm	all
191.0314	AS 110 sample needle, 15 µL	std
191.0316	AS 110 sample needle, bio, 15 uL	std
191.0314M	AS 110 micro, sample needle, bio, 2.4 µL	micro
191.0315M	AS 110 micro, sample needle, 2.4 µL	micro
191.0315U	AS 110 micro, sample needle, 2.4 µL, 1/32"	UHPLC
191.0332M	AS 110 micro, needle union, 1/32" PEEK	micro/UHPLC

Syringes

p/n	description	type
191.0336M	AS 100/110 plunger tip 25 uL (pck/5), ILS	micro/UHPLC
191.0338M	AS 100/110 syringe 25 µL, ILS	micro/UHPLC
181.0311	AS 100/110 plunger tip 100 µL (pck/5), ILS	micro/UHPLC
181.0342	Syringe 100 µL, ILS	micro/UHPLC
181.0543	AS 100 plunger tips 250µL (pck/5), ILS	std FW 1.26 >
181.0344	Syringe 250 µL, ILS	std FW 1.26 >
191.0313	AS 110 plunger tips 500µL (pck/5), ILS	std
191.0326	AS 110 syringe 500µL, ILS	std

Valves, rotor seals and stators

p/n	description	type
191.0330	AS 110 syringe valve	all
181.0324	Valve stainless steel Valco C2-2006	6-p std
181.0332	Rotor seal for Valco C2-2006	6-p std
181.0336	Stator for Valco C2-2006	6-p std
181.0362	Valve stainless steel Valco C2-1006	6-p micro
181.0368	Rotor seal for Valco C2-1006	6-p micro
181.0372	Stator for Valco C2-1006	6-p micro
181.0388*	Rotor seal for Valco C2-1000	10-p
181.0390*	Stator for Valco C2-1000	10-p
181.0392H*	Valve stainless steel Valco C2H-1000	10-p
181.0388H*	Rotor seal for Valco C2H-1000	10-p
181.0390H*	Stator for Valco C2H-1000	10-p
191.0353U	UHPLC valve C82NX-6676	6-p UHPLC
191.0354U	Rotor seal UHPLC valve C72N	6-p UHPLC
191.0356U	Stator UHPLC valve C72NX-6676	6-p UHPLC

*) See warning section below

***) The C2 10p valve is obsolete and is replaced by the C2H 10p valve. The C2H is the improved model, and needs to be purchase as replacement of the C2 valve in case of malfunction. Do not mix parts (stator/rotor) of the C2 and C2H valve, they are not compatible.**

Loops

p/n	description	type
250.1200	Loop 5ul SS Valco C-type	std/micro
250.1201	Loop 2 uL SS Valco C-type	std/micro
250.1202	Loop 10ul SS Valco C-type	std/micro
250.1204	Loop 20ul SS Valco C-type	std/micro
250.1206	Loop 50ul SS Valco C-type	std/micro
250.1208	Loop 100ul SS Valco C-type	std/micro
250.1214	Loop 1 mL SS Valco	std/micro
250.1210	AS 100 short-cut loop A	std/micro
250.1212	AS 100 short-cut loop B	std/micro
250.1220	Loop 1.5 µL SS Valco, 1/32"	UHPLC
250.1222	Loop 2 µL SS Valco, 1/32"	UHPLC
250.1224	Loop 5 µL SS Valco, 1/32"	UHPLC
250.1226	Loop 10 µL SS Valco, 1/32"	UHPLC

Tubing & connections AS flow path

p/n	description	type
191.0320	Buffertubing 1000µL, Tefzel	std
191.0320M	Buffertubing 200µL, Tefzel	micro
191.0334	AS 110, tubing set	std
191.0334M	AS 110 micro, tubing set	micro
191.0334U	AS 110 micro, tubing set, 1/32"	UHPLC
191.0344	AS 110 syringe valve, nut 1/16"	micro
191.0346	AS 110 syringe valve, flangeless ferrule 1/16"	micro
191.0348	AS 110 syringe valve, nut 1/8"	std
191.0350	AS 110 syringe valve, flangeless ferrule 1/8"	std

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