ANTEC
LEYDEN

ALEXYS AS 100
Autosampler

Service manual

Edition 1, 2004 181.0020

CE

DECLARATION OF CONFORMITY

The manufacturer hereby declares that the product

ALEXYS AS 100 auto sampler	type 181

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

EEC directives 89/392, 91/368 and 93/44 (machine safety) and EEC directives 73/23 and 93/68 (low voltage safety):

Safety requirements for laboratory equipment (Class I, Installation cat. II, Pollution degree 2)	EN61010-1

EEC directives 89/336 and 92/31 (EMC requirements):

EMC requirements for electrical equipment for measurement, control and laboratory use	EN 61326-1
Emission- Industrial, Scientific and Medical (ISM) equipment	EN 55011 (Class B)
Harmonic current emissions	EN 61000-3-2
Voltage fluctuations and flicker	EN 61000-3-3

Attention

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 this instrument to devices, which do not meet relevant safety standards.

June 28, 2004

Important notice

This AS 100 Service Manual is designed for use by personnel who have had training and are experienced in servicing this type of equipment. Because of the possible hazards to an inexperienced person in servicing this product, as well as the risk of damage to the instrument, servicing should be performed by qualified service personnel only.

We make no representations or warranties, either express of implied, that the information contained in this AS 100 Service Manual is complete or accurate. It is understood that the purchaser must assume all risk in the use of this Manual for the purpose of performing service upon the instrument it covers. Components of this instrument which are considered user-serviceable are discussed in detail in the instrument's Users Manual.

Antec Leyden strongly recommends to use only original Antec Leyden spare parts, otherwise we do not guarantee any specification or liabilities.

Safety instructions

The following pages summarise cautionary information basic to the safe operation of this instrument. These safety hazards are indexed by page number in order of their appearance in the manual. However, it is strongly recommended that the user should read the entire manual carefully before attempting to service the instrument. In addition, be sure to heed all, **DANGER**, **WARNING**, **CAUTION**, **ATTENTION** and **NOTE** signs and pictograms which are specifically defined as follows:

DANGER:
The "DANGER sign" denotes a hazard. It calls attention to a procedure, practice or the like, which, if not correctly done or adhered to, could results in injury or loss of life.

Do not proceed beyond a "DANGER sign" until the indicated conditions are fully understood and met.

CAUTION

CAUTION:
The "CAUTION sign" denotes a hazard. It calls attention to a procedure, practice or the like, which, if not correctly done or adhered to, could result in damage or destruction of parts or all of the equipment.

Do not proceed beyond a "CAUTION sign" until the indicated conditions are fully understood and met.

ATTENTION:
The "ATTENTION sign" denotes relevant information.

Read this information first, it might be helpful or necessary before continuing.

ATTENTION:

Observe precautions for handling Electrostatic discharge sensitive devices.

Electrical hazards

The following safety practices are intended to insure the safe operation of the equipment.

1. Removal of some panels exposes potentially dangerous voltages. Disconnect the instrument from all power sources before removing protective panels.
2. Replace blown fuses with size and rating stipulated on the fuse panel or holder and in the manual where listed.
3. Replace or repair faulty or frayed insulation on power cords.
4. Check actual line voltage to confirm it is the value for which this instrument is wired. Be sure power cords are plugged into correct voltage sources.

General precautions

1. Perform periodic leak checks on supply lines.
2. 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.

Mechanical safety

Good mechanical safety practices are more important than ever, now that microprocessors are taking control of mechanical devices. Yet, the area of mechanical safety is often overlooked during instrument servicing. We may be able to change this situation if you heed the following safety tips:

1. Remember to keep clothing and fingers away from rotating components. It is easy to slip, lose a tie, or get cut while working near one of these devices.

2. Unless it is absolutely essential, never run mechanical components without the protective guards in place.

3. Always use the tools specifically recommended for the job. This not only reduces the chances of injury, it minimises damage to the instrument.

4. Although not always possible, it is recommended that mechanical devices should be adjusted or calibrated with the power OFF. This is especially important if you are working with a microprocessor-controlled instrument, which can start running without notice or user-intervention.

5. After the mechanical repairs have been completed, always check that all mounting hardware and safety shields are in place and secure. By doing so you will not only ensure safe operation of the instrument, but may reduce call-backs.

As you can appreciate, all it takes is good common sense, plus good safety techniques that are basic and easy to remember. With this in mind, you should have no trouble servicing mechanical devices safely.

Electrical safety

It is shocking but true! Many people service instruments without giving much thought to electrical safety. Unfortunately, this can be a dangerous mistake. As electrical/electronic devices are used more widely in modern instrumentation, it means that you may be exposed to more and more potential shock hazards.
It pays to take a few precautions before and during servicing to avoid injury from electrical shock. Here are a few safety tips that can help keep you on the job without a sudden vacation:

1 Avoid standing on damp floors! People have been shocked simply by standing on a damp floor and working on live equipment.

2 Be sure to disconnect the power cord before working on any high voltage circuitry! As power switches disappear from new equipment, this precaution is very easy to overlook.

3 Read and heed ALL caution labels! The are posted for your safety.

4 Take care of your test equipment. Be sure to use the right probes for the right job. Measuring high voltage, for example, requires a well insulated high-voltage probe.
Damaged probes and cables are dangerous and should not be used.
Also, be cautious around test equipment like an oscilloscope. The oscilloscope case may become live if you connect the cable ground to a live circuit. Avoid this dangerous situation at all times!

The basic tips regarding good electrical safety practices are easy to remember. Combined with good common sense, they should keep you on the job for a long time to come.

Tools

The list below gives an overview of the tools which may be required to perform service:

Service tools

Philips screwdriver #1
Philips screwdriver #2 (long shaft)
Flat head screwdriver
Hex key 1.5mm
Hex key 1.6mm
Hex key 2 mm
Hex key 2.5mm
Hex key 3mm
Hex key 9/64" (Injection valve)
Wrench 5.5 mm
Ring wrench 7mm (with open inlet)
Ring wrench 13mm (Syringe valve nut)
Wrench ¼" + 5/15"
Adjustable wrench 0-20mm

Solvents / Tubing

Uracil solution 50 ppm in water
PEEK tubing L=10 M OD: 1.6mm ID:0.25mm (1/16"x0.01")

Test equipment

Multimeter
UV detector 254nm (specs: noise $9x10^{-5}$ AU, Linearity 0-1.3AU)
AC 100 & ALEXYS data system / recorder

Service keyboard

The AS 100 only has a serial RS232 interface and the AS 100 ALEXYS software driver does not give access to the autosampler service mode.

A service keyboard (p/n 181.0580) is absolutely necessary to enter the AS 100 service mode.

Installation

1. Remove AS 100 top cover
2. Connect keyboard to connector J10 on the AS 100 main board, located at the right side of the electronics compartment. See figure below.
3. Power up the AS 100. The display on the service keyboard will start-up with AS 100 main menu.

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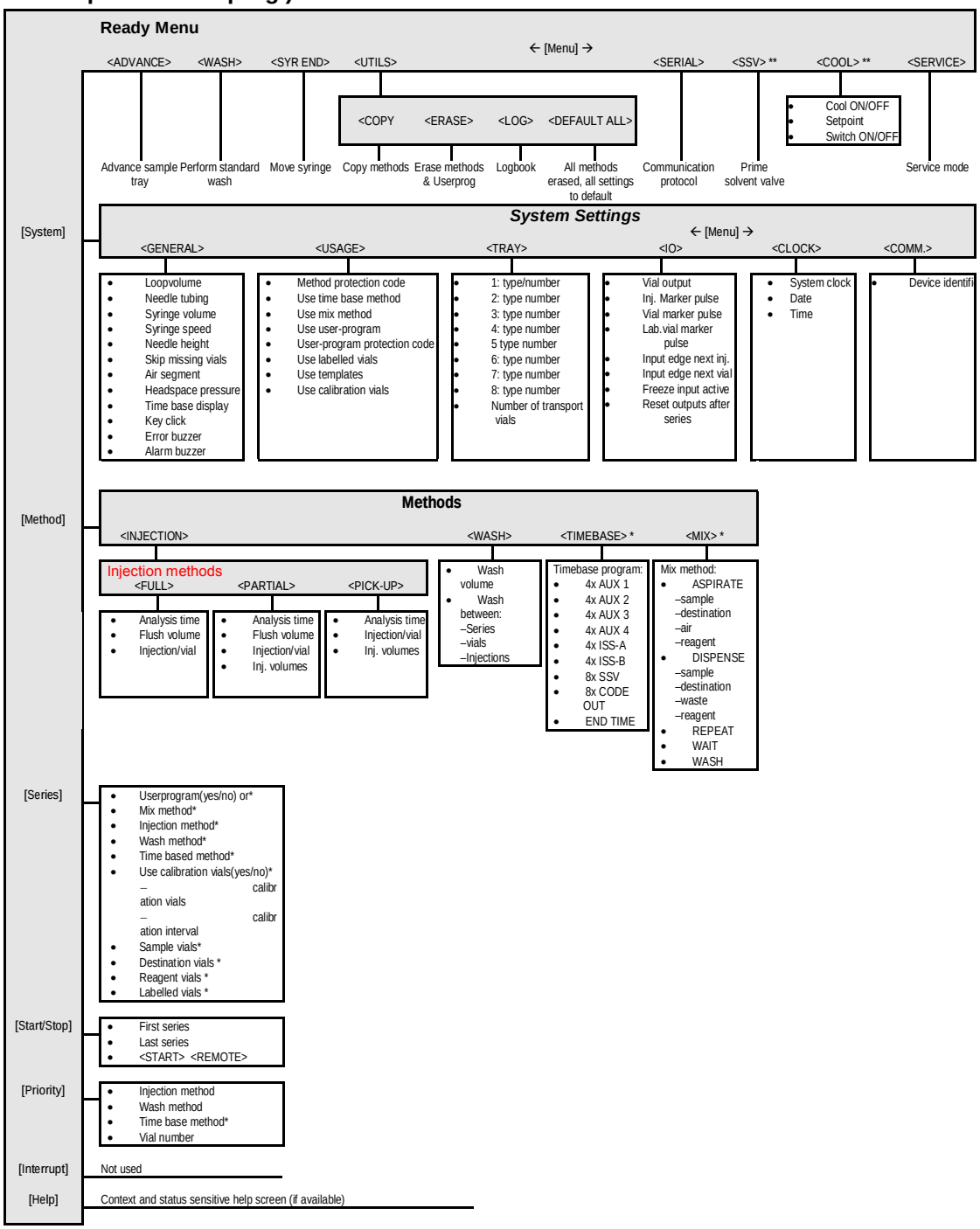
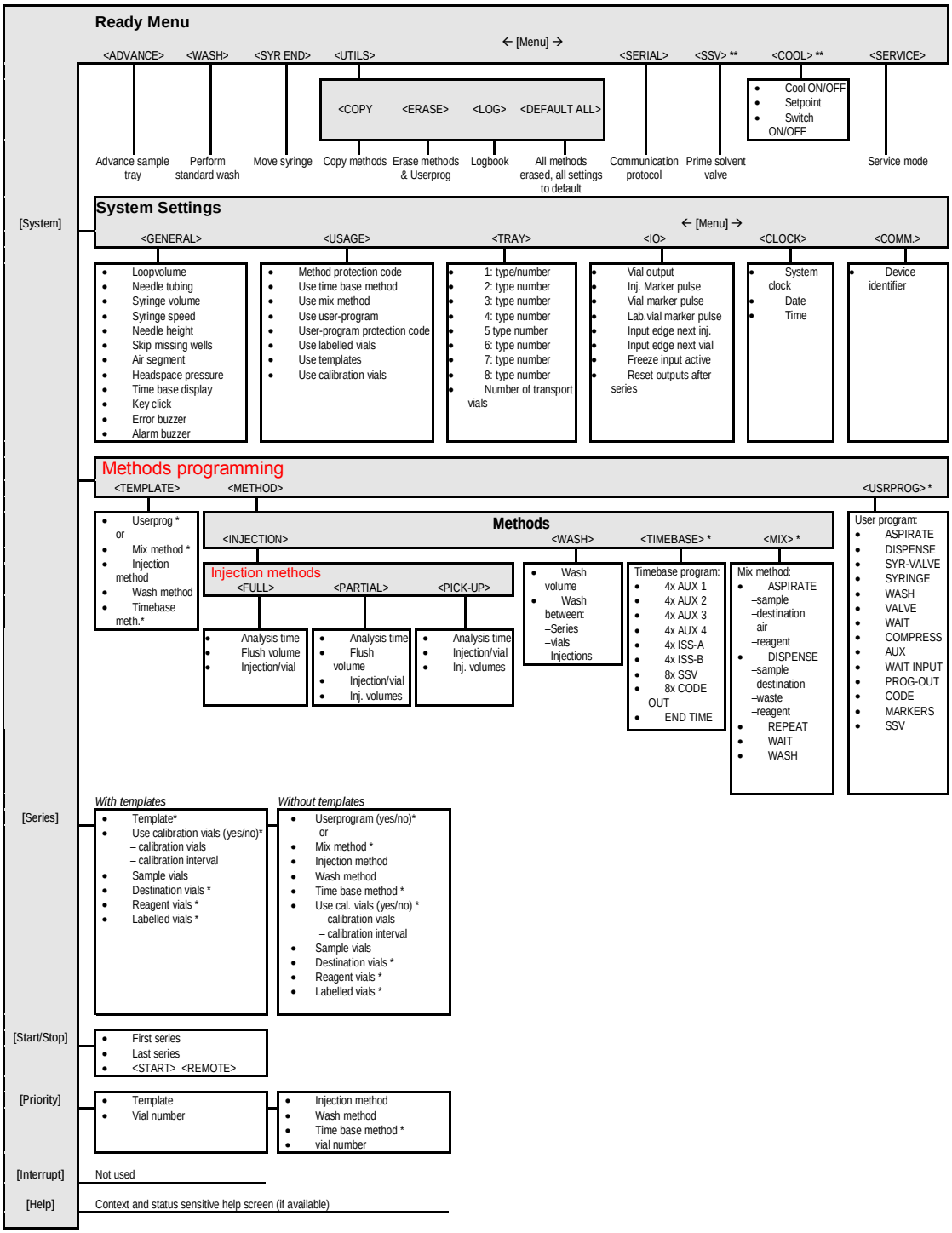
C H A P T E R 1

Programming Chart

(with template & user prog.)



(with template & user prog.)



Note ***: These parameters depend on the contents of the methods used and/or the System Settings of the AS 100.**

Note ****: Optional Soft-function keys.**

PRIORITY: Only available when user-program and mix method have been disabled in the System Settings.

C H A P T E R 2

Connections

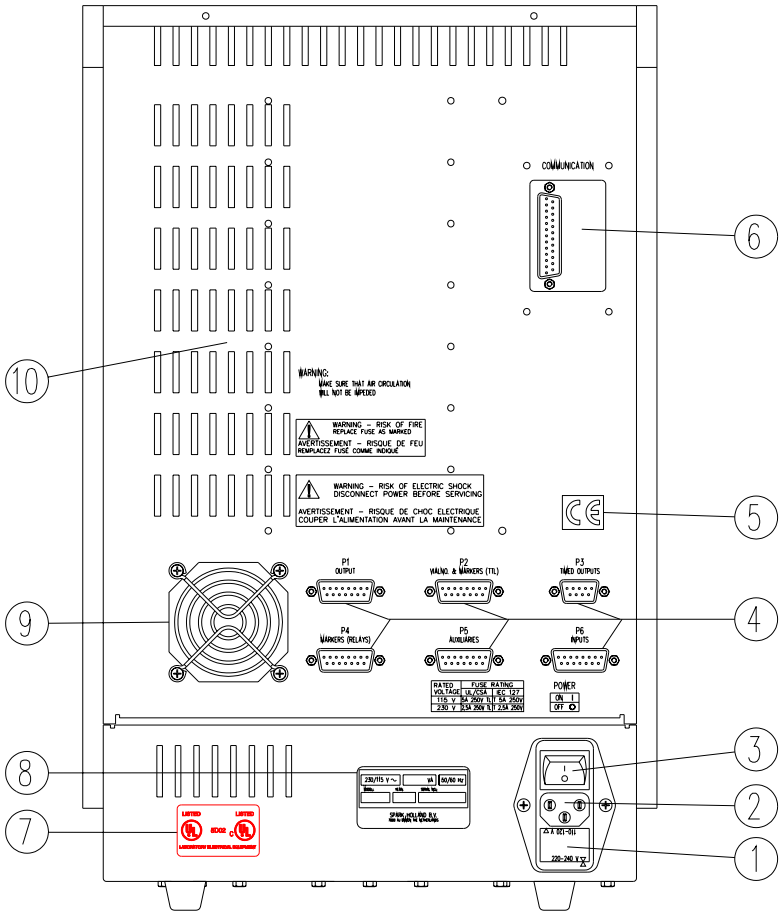


Fig. 1. Rear side of the AS 100.

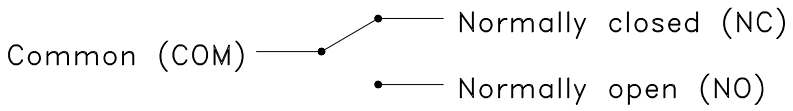
1	Fuses and voltage selector
2	Mains input
3	Mains switch
4	I/O connectors
5	CE-mark
6	Communication interface connector
7	UL label
8	Type label and serial number
9	Fan (only when tray cooling is installed)
10	Ventilation holes

Relay outputs

Connector **P1** OUTPUTS (Relays)

Pin	Description	Pin	Description
1	OUT 1 – Normally open	9	Spare
2	OUT 1 – Common	10	Alarm output – Normally open
3	OUT 1 – Normally closed	11	Alarm output – Common
4	OUT 2 – Normally open	12	Alarm output – Normally closed
5	OUT 2 – Common	13	24 V DC
6	OUT 2 – Normally closed	14	Power Ground
7	Spare	15	Power Ground
8	Spare	16	Spare

Vmax = 28 V DC / V AC, Imax = 0.25 A



Connector **P4** MARKERS (Relays)

Pin	Description	Pin	Description
1	Inject Marker – Normally open	9	Labelled well marker – Normally closed
2	Inject Marker – Common	10	Stop I/O – Normally open
3	Inject Marker – Normally closed	11	Stop I.O – Common
4	Well Marker – Normally open	12	Stop I/O – Normally closed
5	Well Marker – Common	13	24 V DC
6	Well Marker – Normally closed	14	Power Ground
7	Labelled well marker – Normally open	15	Power Ground
8	Labelled well marker – Common	16	

Vmax = 28 V DC / V AC, Imax = 0.25 A

The Relay inject marker contacts are closed/ open during (default) 1 second at the moment the Injection valve switches from LOAD to INJECT.

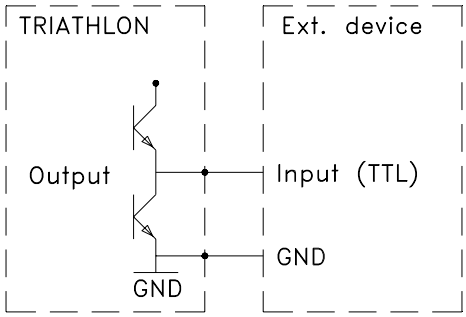
Connector **P5** AUXILIARIES (Relays)

Pin	Description	Pin	Description
1	AUX 1 – Normally open	9	AUX 3 – Normally closed
2	AUX 1 – Common	10	AUX 4 – Normally open
3	AUX 1 – Normally closed	11	AUX 4 – Common
4	AUX 2 – Normally open	12	AUX 4 – Normally closed
5	AUX 2 – Common	13	24 V DC
6	AUX 2 – Normally closed	14	Power Ground
7	AUX 3 – Normally open	15	Power Ground
8	AUX 3 – Common	16	

Vmax = 28 V DC / V AC, Imax = 0.25 A

Maximum current for 24 V DC supply is 0.5 A total.

TTL outputs



Connector P2 VIAL NO. & MARKERS

Pin	Description	Pin	Description
1	Inject Marker	9	D4 (BCD or HEX) (10 or 16)
2	Well Marker	10	D5 (BCD or HEX) (20 or 32)
3	Labelled well marker	11	D6 (BCD or HEX) (40 or 64)
4	Stop I/O	12	D7 (BCD or HEX) (80 or 128)
5	D0 (BCD or HEX) (1)	13	Signal Ground
6	D1 (BCD or HEX) (2)	14	Signal Ground
7	D2 (BCD or HEX) (4)	15	Signal Ground
8	D3 (BCD or HEX) (8)	16	

Vmax = 5.5 V, logical 1: > 3.5 V, logical 0: < 1.0 V DC output source/ sink current ±20 mA

Examples of BCD VIAL NUMBER OUTPUT

BCD	D7 (80)	D6 (40)	D5 (20)	D4 (10)	D3 (8)	D2 (4)	D1 (2)	D0 (1)	Vial Number
Output	1	0	0	1	0	1	1	0	96
Output	0	1	0	1	1	0	0	1	59
Output	0	0	1	0	1	0	0	1	29
Output	0	0	0	1	0	0	0	0	10

The maximum vial number output in BCD code is 99, therefore select in case of micro-vials the HEX-code.

Examples of HEX VIAL NUMBER OUTPUT

HEX	D7 (128)	D6 (64)	D5 (32)	D4 (16)	D3 (8)	D2 (4)	D1 (2)	D0 (1)	Vial Number
Output	1	0	0	1	0	1	1	0	150
Output	0	1	1	0	0	0	0	0	96
Output	0	1	0	1	0	1	0	1	85
Output	0	0	1	1	1	0	1	1	59

Connector P3 TIMED OUTPUTS; 4 bit time base code output.

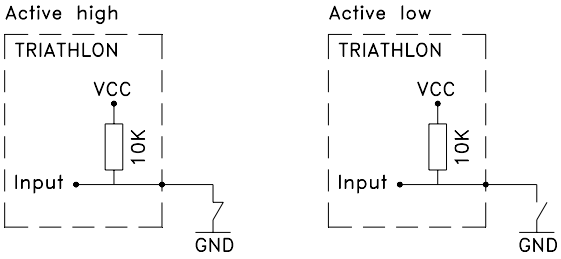
Pin		Pin	Description
1	Time base 0 (HEX 1)	6	Signal Ground
2	Time base 1 (HEX 2)	7	Signal Ground
3	Time base 2 (HEX 4)	8	Signal Ground
4	Time base 3 (HEX 8)	9	Signal Ground
5	Not used		

Vmax = 5.5 V, logical 1: > 3.5 V DC, logical 0: < 1.0 VDC output source/ sink current ±20 mA.

The TTL Inject Marker is an active high contact. The level is high during (default) 1 second at the moment the Injection valve switch from LOAD to INJECT.

TTL inputs

Connector P6 INPUTS (TTL)



The P6 input connector is an active high or active low TTL input, user definable in the System Settings.
The Next Injection input and the Next injection input can be used when the AS 100 works in Remote Control.
The Freeze input and Stop I/O can be used to control the AS 100 by other devices.
The four inputs (Input 1 – 4) can only be used in the user program, e.g. to control the sequence of the steps in this method.

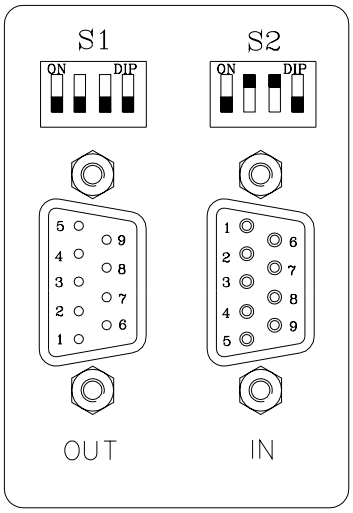
Connector P6 INPUTS (TTL)

Pin	Description	Pin	Description
1	Next injection input	9	Signal Ground
2	Next well input	10	Signal Ground
3	Freeze input	11	Signal Ground
4	Stop I/O	12	Signal Ground
5	INPUT 1	13	Signal Ground
6	INPUT 2	14	Signal Ground
7	INPUT 3	15	Signal Ground
8	INPUT 4	16	

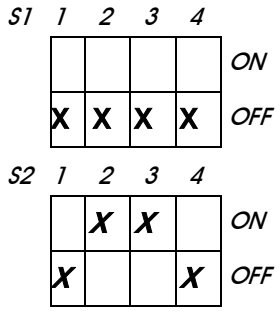
Serial interface connections – Multi-Link communication

The AS 100 is standard equipped with a Multi-Link male-female 9 pins D-connector for serial communication. This interface allows you to connect your AS 100 with other instruments and the PC. With the use of the Device Identifier, the address of the AS 100 can be selected from 20 to 29. To change the Device Identifier, press: SYSTEM, MENU and <COMM.>

To get access to the serial mode press MENU and <SERIAL>.



Set the dipswitch S1 and S2 as follows:



Port	Description
Out	To next device
In	To PC

The pin connections of the 9 pins D-connectors are as follows:

Port OUT (9 pins D-connector male)		Port IN (9 pins D-connector female)	
Pin	**Description**	**Pin**	**Description**
2	Rx-2	2	Tx-1
3	Tx-2	3	Rx-1
4	Valve_out	4	Valve_in
5	Gnd	5	Gnd
6	AS_ready_in	6	AS_ready_out
7	Downstream_sync_2	7	Downstream_sync_1
8	Upstream_sync_2	8	Upstream_sync_1

For testing the hardware of the serial port, see chapter 3.7 of this manual.

Serial interface connections – Cable configuration

The interface cable configurations are as follows:

Multi-Link PCB (181.0502)

Cable: 09 wires 1:1 pinning Foil shielded Sub-D 09M Sub-D 09F

9 pins sub-D Female (PC)	**9 pins sub-D Male (Instrument)**
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
Shield	Shield

Signal descriptions

NEXT INJECTION INPUT:
From Ready screen: A NEXT INJECTION INPUT given while the AS 100 is in the Ready mode, will execute the programmed series as if it was started with the START/STOP key. This means: the AS 100 will not wait for a second NEXT INJECTION INPUT.

In Remote control: The NEXT INJECTION INPUT given in the remote control mode, start the programmed injection. After finishing this injection sequence the AS 100 will wait for a new NEXT INJECTION INPUT, or NEXT VIAL INPUT.

NEXT VIAL INPUT:
When a NEXT VIAL INPUT is given; the AS 100 will perform the next injection always from the next vial, even if not all the programmed injections are carried out in that vial.

FREEZE INPUT:
The AS 100 will freeze the analysis time for the time this input is active. If the FREEZE INPUT is activated while the analysis time is not running, the AS 100 will perform all programmed pre-injection sample handling (Mix method, and loading part of the injection method). But the AS 100 will wait with injecting the sample until the FREEZE INPUT is no longer active.

STOP I/O:
From Ready screen: The stop I/O output is low when the AS 100 is in the READY screen. The output is high during processing, and when it is forced low the AS 100 stops immediately and return to the READY screen.

In Remote control: In case of the AS 100 is in remote control mode, the run of the AS 100 remains in remote control and can not be re-started with a NEXT INJECTION INPUT.

INJECT MARKER:
TTL: The inject marker is an active high contact. This level is high during (default) 1 second at the moment of the injection

Relay: The inject marker contacts are closed/ open during (default) 1 second at the moment of the injection.

C H A P T E R 3

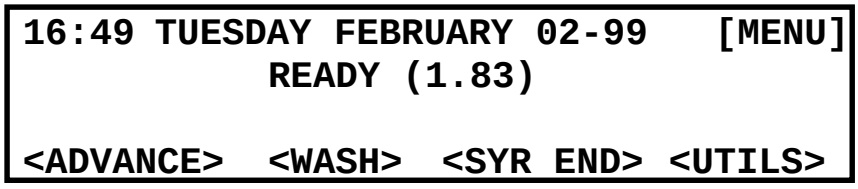
Service Mode and adjustments

The software of the AS 100 is provided with a service mode. In the service mode, it is possible to control all the outputs, mechanical movements and to require information from all the inputs. Since the service mode is only to be used by a qualified service engineer, it is protected by a service code. To enter the service mode for the AS 100 it is necessary to connect a service keyboard (p/n 181.0580). To enter the service mode from the "READY" screen, press **[MENU]** followed by the SOFTKEY **<SERVICE>.** After this it is necessary to enter the service code **10 11 63**.

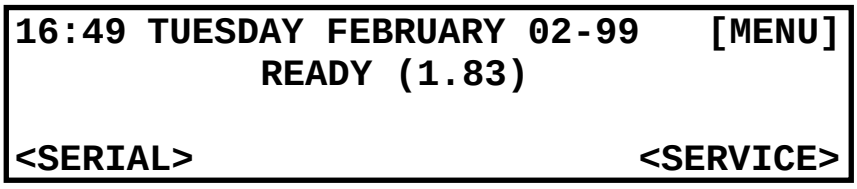
The service mode is set up in such a way that each function of the unit has its own page(s). To enter a required function press the corresponding soft-key.

To enter the service mode proceed as follows:

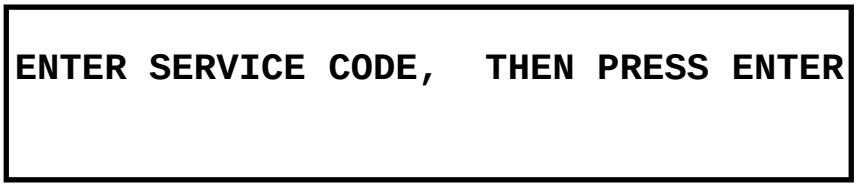
- Power up the unit



- Press: [MENU]

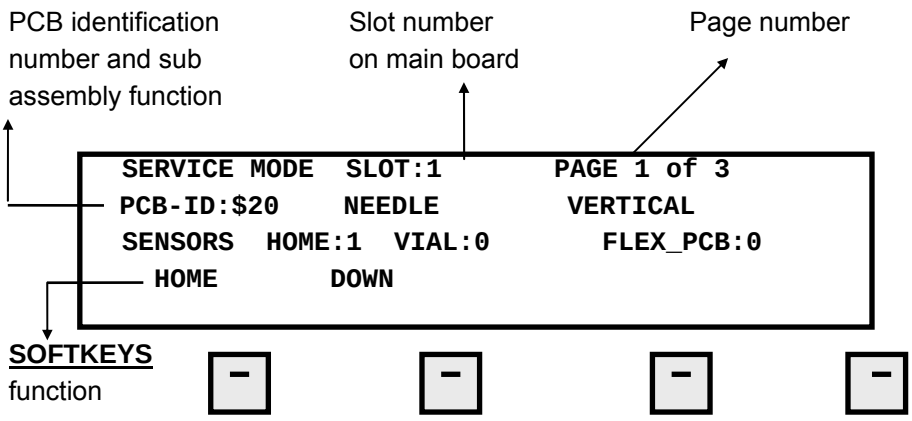


- Press: <SERVICE>



Press: 10 11 63 <Enter>

Below is an example of one of the screens in the service mode. Each sub assembly is controlled by its own driver board, which is connected via slots on the CPU board. Starting with slot number 0 you can step with the "MENU" button on the keypad through all the slots.



Sample Screen

		To increase the page number.
		To decrease the page number.
	Menu	To move to the next SLOT or to the next main function.
	Escape	To leave the service mode.

If during initialization an Error occurs press "Start/Stop" to continue.

After slot 7 there are 3 more main functions (which are only available in the service mode). For a description, refer to the end of this chapter.

Although there is no fixed position for the different boards, the software detects the position and the function of the board. The factory installation is as follows:

SLOT	PCB-ID	FUNCTION	
0	$60	COOLING	(only if option is installed)
1	$FF	EMPTY	
2	$11	SYRINGE	
3	$FF	EMPTY	
4	$20	NEEDLE	
5	$30	VALVE	
5	$32	VALVE + ISS VALVES + SSV (if option is installed)	
6	$10	TRAY	
7	$40	EXT.I/O	

The new PCB is multi-functional for all the different Valve options as well as for the SSV valve. The PCB-ID depends on the dipswitch settings.

INSTALLED OPTIONS	1	2	3	4	PCB-ID
INJ. VALVE	0	0	0	0	$30
INJ. VALVE + ISS A	0	1	0	0	$32
INJ. VALVE + ISS B	0	0	1	0	$34
INJ. VALVE + ISS A + ISS B	0	1	1	0	$36
INJ. VALVE + SSV	0	0	0	1	$38
INJ. VALVE + SSV + ISS A	0	1	0	1	$3A
INJ. VALVE + SSV + ISS B	0	0	1	1	$3C
INJ. VALVE + SSV + ISS A + ISS B	0	1	1	1	$3E

* 0 = OFF
1 = ON

Cooling PCB

```
SERVICE MODE  SLOT:0       PAGE 1 of 3
PCB-ID:$60    COOLING      SETPOINT: 4°C
ACTUAL: 4°C $11COUNTS  332mV POWER: -72%
  OFF
```

SETPOINT	Can be changed with numeric keypad.
ACTUAL	Current temp of cooling ring
$11COUNTS	Output from the AD Converter. (depends on the actual temperature)
332mV	Output from cooling ring sensor. (depends on the actual temperature)
POWER	Power in % on which the peltiers are working. (-) = cooling (+) = heating
SOFTKEY	To switch the peltiers on or off

```
SERVICE MODE  SLOT:0       PAGE 2 of 3
PCB-ID:$60    COOLING       PSU FAN

  OFF      SLOW     FAST
```

PSU FAN	Fan motor on the rear panel of the unit. This fan is only present if the cool-option is installed.	
SOFTKEYS	OFF	Turns the fan off.
	SLOW	Will start the fan at half speed.
	FAST	Will start the fan at high speed.

```
SERVICE MODE  SLOT:0       PAGE 3 0f 3
PCB-ID:$60    COOLING       FAN 1-2

  OFF      SLOW       FAST
```

PSU FAN	The 2 fans used to cool the heat sinks below the peltiers.	
SOFTKEYS	OFF	Turns the fan off.
	SLOW	Will start the fan at half speed.
	FAST	Will start the fan at high speed.

The SOFTKEYS on page 2 and 3 are overruled if the cooling is turned on (page 1 of 3).

Syringe PCB

```
SERVICE MODE  SLOT:2       PAGE 1 of 4
PCB-ID:$11    SYRINGE
SENSORS  HOME:1  ROTATION:1
  HOME
```

SENSORS HOME:X — Indicates the status of the syringe home sensor.
This sensor is used to check if syringe is in the home position.
X= 1 if sensor vane inside sensor
X= 0 if sensor vane outside sensor

ROTATION:X — Indicates the status of the rotation sensor. This sensor is used to check if the syringe spindle turns without obstructions. Placed at the top end of the spindle.
X= 1 if rotation vane is inside sensor
X= 0 if slot of rotation vane inside sensor

SOFTKEYS HOME — Resets the syringe to its home position.

```
SERVICE MODE  SLOT:2       PAGE 2 of 4
PCB-ID:$11    SYRINGE       LOAD:XXX%
          FREQ START: XXXHz END:XXXXHz
  START
```

PROGRAMMABLE PARAMETERS:	LOAD:XXX%	Enter value how far the syringe to be moved down. (100 % is the full syringe length)
	FREQ. START	Enter start frequency for the stepper motor (for example. 300 Hz)
	END	Enter end freq. (max. speed) for the stepper motor. (for example. 5000 Hz). The maximum speed is 8355 Hz (speed 9 in mix & userprog)
SOFTKEYS	START	Will move the syringe spindle down for the value entered in the load parameter

```
SERVICE MODE  SLOT:2       PAGE 3 of 4
PCB-ID:$11    SYRINGE     UNLOAD:XXX%
           FREQ START: XXXHz END:XXXXHz
  START
```

PROGRAMMABLE PARAMETERS:	UNLOAD:X%	Enter value how far the syringe to be moved up. (100 % is the full syringe length)
	FREQ. START	Enter start frequency for the stepper. (for example. 300 Hz)
	END	Enter end frequency for the stepper motor. (for example. 5000 Hz)
SOFTKEYS	START	Will move the syringe spindle up for the amount entered in the unload parameter

```
SERVICE MODE  SLOT:2       PAGE 4 of 4
PCB-ID:$11    SYRINGE       VALVE….
SENSORS LEFT:X RIGHT:X
   WASH     NEEDLE    WASTE
```

SENSORS

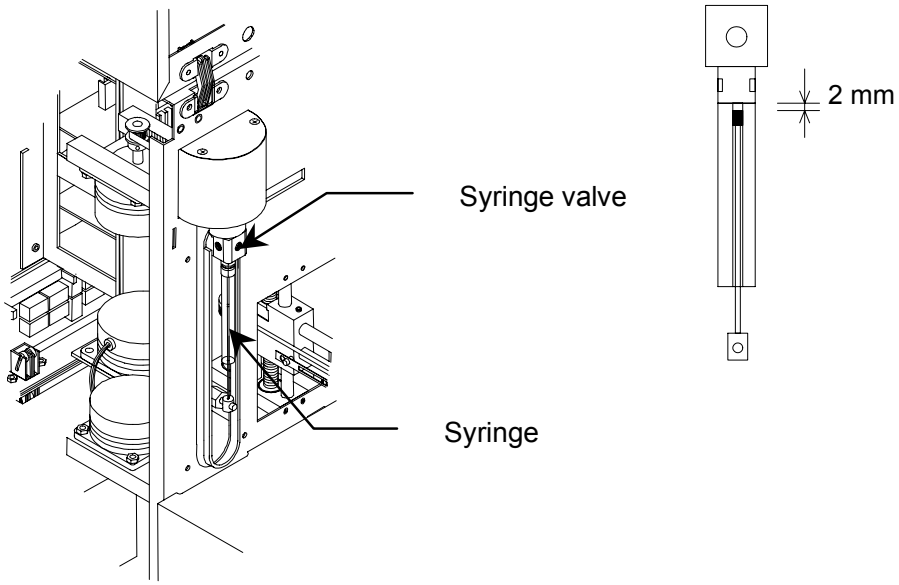
LEFT:X — Indicates the status of the left syringe valve sensor
- X= 1 if rotation vane is inside sensor. (light beam interrupted)
- X= 0 if slot of rotation vane is inside sensor

RIGHT:X — Indicates the status of the left syringe valve:
- X= 1 if rotation vane is inside sensor. (light beam interrupted)
- X= 0 if slot of rotation vane is inside sensor

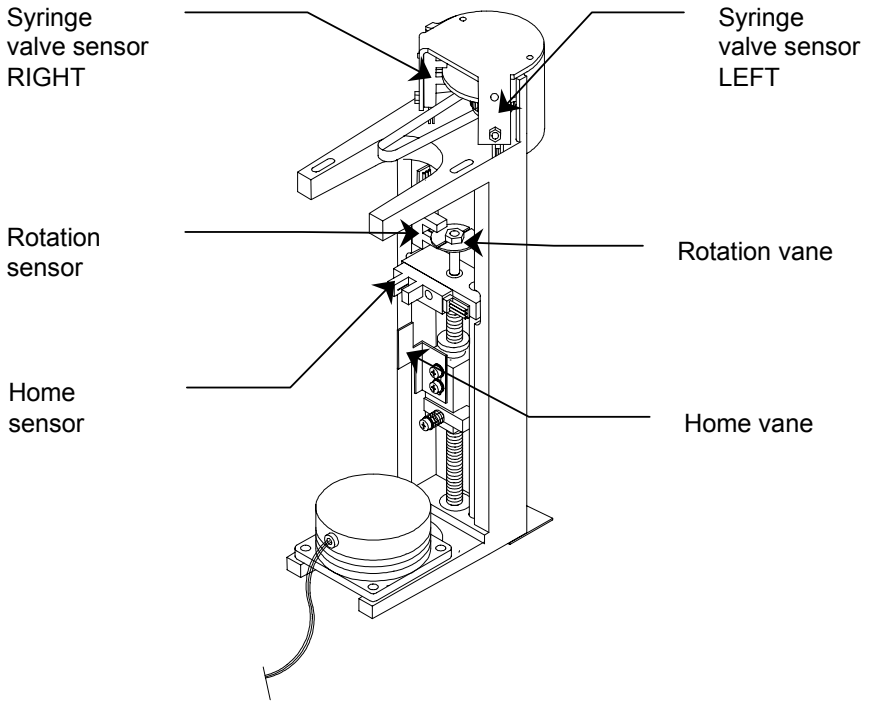
SOFTKEYS	SENSORS	Left	Right
WASH	Sets the syringe valve in waste position.	0	1
NEEDLE	Sets the syringe valve in needle position.	0	0
WASTE	Sets the syringe valve in waste position.	1	0

Syringe PCB - Home position syringe

To set the home position from the syringe proceed as follows:



- Check if the syringe is installed correctly. Completely tightened in the luerlock.
- Turn the spindle counter-clockwise (use the geared belt as grip) until the syringe is completely up.
- Turn the spindle clockwise for approximately 1 ½ stroke.
- Set service mode screen on page 1.
- Loosen the 2 screws that secure the home vane sensor.
- Slide the home vane upwards until the home sensor indication on the LCD is 1.
- Press the Softkey “HOME” and check if the distance between the tip from the plunger and the end of the syringe is approximately 2 mm.


Syringe valve sensor RIGHT
Syringe valve sensor LEFT
Rotation sensor
Rotation vane
Home sensor
Home vane

Needle PCB

```
SERVICE MODE  SLOT:4       PAGE 1 of 4
PCB-ID:$20    NEEDLE        VERTICAL
SENSORS  HOME:X  VIAL:X       FLEX-PCB:X
   HOME      DOWN
```

SENSORS (vertical movement)	HOME:X	Indicates the status of the vertical home sensor. This sensor is used to check if the needle arm is completely up. X= 1 if sensor vane is inside sensor X= 0 if sensor vane is outside sensor
	VIAL:X	Indicates the status of the vial sensor. X= 1 if vane is inside sensor X= 0 if vane is outside sensor
	FLEX-PCB	To indicate if Flex-PCB is correctly installed. X= 1 If Flex-PCB is not correctly connected to the Needle PCB. X= 0 If Flex-PCB is correctly connected to the Needle PCB.
SOFTKEYS	HOME	Will move the needle arm to its most upper position.
	DOWN	Will move the needle arm to its lowest position.

It is possible to move the needle arm down on every random position. Make sure the needle arm is not obstructed during the down action. Otherwise you might destroy needles or other parts.

To allow the needle arm to move down, the following conditionings are necessary:

- **Horizontal needle position sensor should be 0**
- **Tray stop sensor should be 0**

In case the position sensor is 1 the AS 100 will return an Error 35. If the tray stop sensor is 1 the AS 100 will return an Error 37.

```
SERVICE MODE  SLOT:4       PAGE 2 of 4
PCB-ID:$20    NEEDLE        HORIZONTAL
SENSORS  HOME:X  POSITION:X   FLEX-PCB:X
   HOME      NEXT    PREVIOUS
```

SENSORS (horizontal needle movement)

HOME:X — Indicates the status of the horizontal home sensor, This sensor is used to check if the needle train is completely at its home position.

sensor

- X= 1 If optical sensor is interrupted by butt strap.
- X= 0 If optical sensor is not interrupted by butt strap.

POSITION:X — Indicates the status of position sensor. This sensor is used to stop the needle train at an correct position.

- X= 1 If optical sensor is interrupted by butt strap.
- X= 0 If optical sensor is not interrupted by butt strap.

SOFTKEYS

HOME — Will move the needle train to its home position.

NEXT — Will move the needle train to the next horizontal position.

PREVIOUS — Will move the needle train to its previous position.

Before the needle arm might be moved horizontal the following conditions are necessary:

- **Vertical home sensor should be 1 (Page 1 of 4)**
- **Sample needle home sensor should be 1 (Page 3 of 4)**

In case the Vertical home sensor is 0 the AS 100 will return an Error 34.
If the sample needle home sensor is 0 the AS 100 will return an Error 42.

```
SERVICE MODE  SLOT:4       PAGE 3 of 4
PCB-ID:$20    NEEDLE        SAMPLE NDL
SENSORS  HOME:X  CYCLE:X     FLEX-PCB:X
   HOME      DOWN
```

SENSORS (sample needle)

HOME:X — Indicates the status of the sample needle home sensor.
This sensor is used to check if the sample needle is completely at its home position. (up)
X= 1 If sample needle is up.
X= 0 If sample needle is not completely up.

CYCLE:X — Indicates the status of the cycle sensor.
This sensor is used to count the rotation from the sample needle spindle.
X= 1 If sensor is interrupted.
X= 0 If sensor is not interrupted.

SOFTKEYS

HOME — Will move the sample needle to its home position.

DOWN — Will move the sample needle to its lowest position.

```
SERVICE MODE  SLOT:4       PAGE 4 of 4
PCB-ID:$20    NEEDLE        COMPRESSOR
                             FLEX-PCB:X
    ON        OFF
```

SENSORS There are no sensors used for the compressor.

SOFTKEYS

ON Turns the compressor ON.

OFF Turns the compressor OFF.

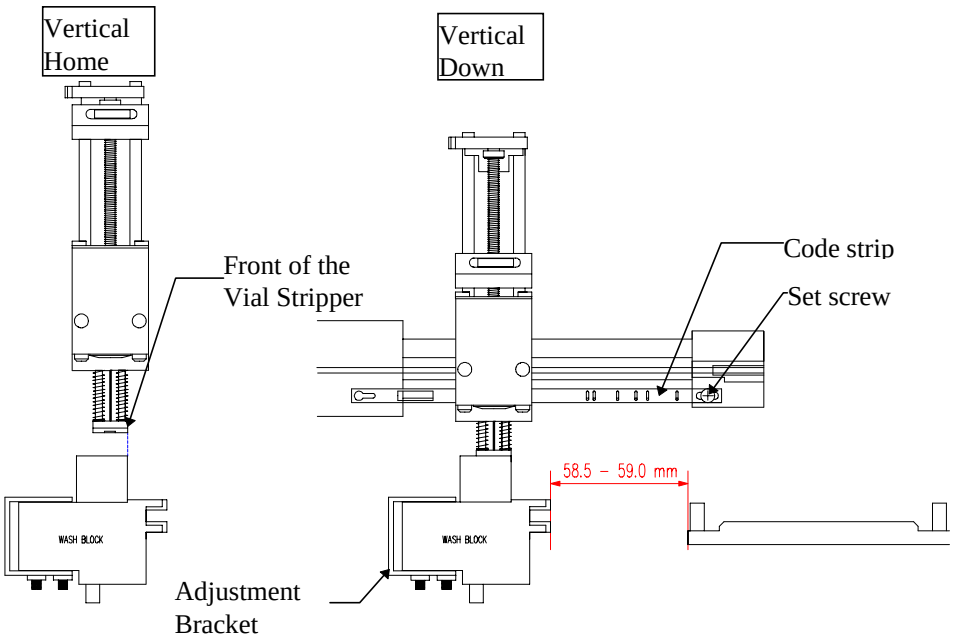
Needle PCB - Needle adjustments

The needle unit is adjustable in the horizontal and vertical movement.

Needle adjustments – Horizontal

The horizontal movement is controlled by a code strip, which is a part of the needle unit.
Before making an adjustment on the horizontal movement, make sure the correct position of the wash position block. (See stop code sensor adjustment)

The horizontal movement should be adjust in such a way that the front of the vial stripper is in line with the front of the wash block. See drawing below.

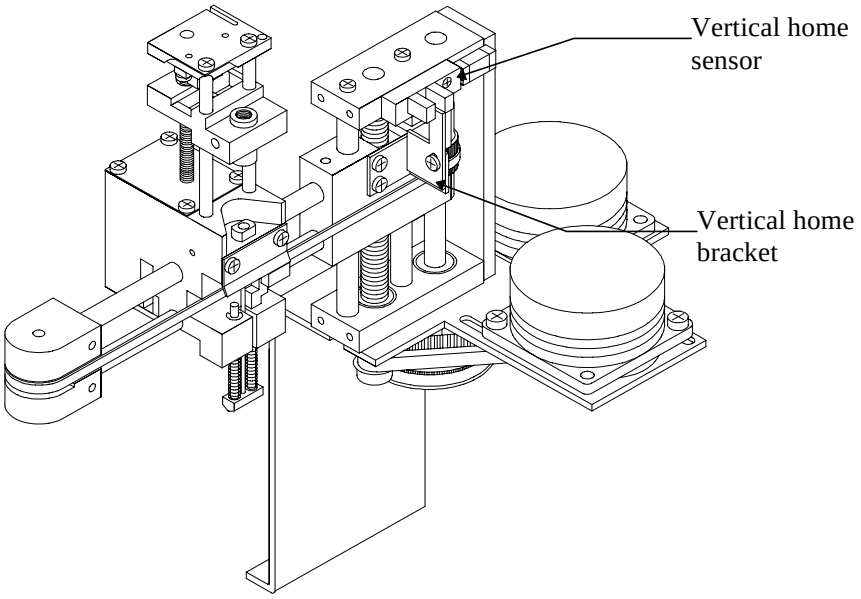


For controlling and adjustments, proceed as follows:

- Make sure wash block is in correct position.
- Set AS 100 in service mode (Menu; Service; 10 11 63; Enter).
- Go to slot concerning Needle board PCB ID$20.
- Go to page 2 of 4 and press “HOME”; “NEXT”; “NEXT”.

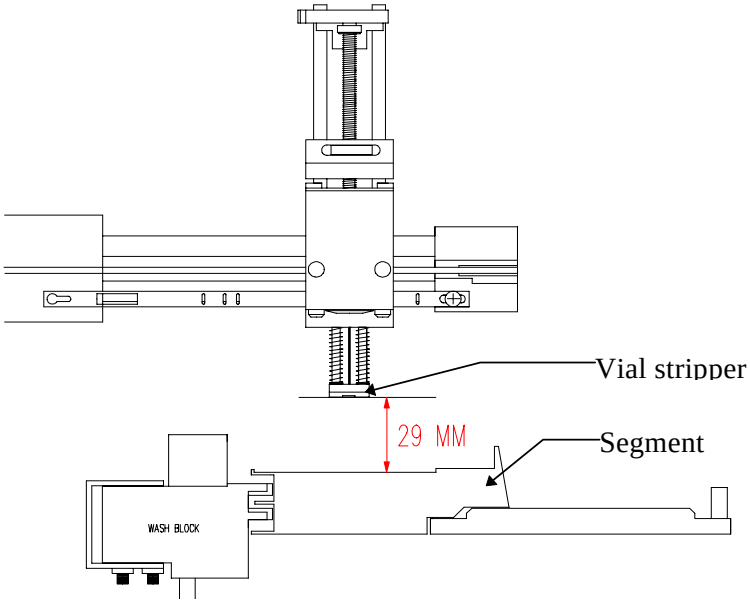
- Return to page 1 of 4 and press “DOWN”
- Check in line position of the vial stripper and wash position block.
- If not loose screw marked Y and move the code strip forward or backward depending on the outlining of the vial stripper and wash position block.
- Press the soft-key “HOME”
- Go to page 2 of 4 and press “HOME”; “NEXT”; “NEXT”
- Return to page 1 of 4 and press “DOWN”
- Check again in line position of the vial stripper and wash position block.
- If not repeat adjustment steps.

Needle adjustments – Vertical home position



For vertical home adjustment proceed as follows:

- Set Autosampler in service mode (Menu; Service; 10 11 63; Enter)
- Go to slot concerning Needle board PCB ID$20
- Go to page 2 of 4 and press “ HOME”; “NEXT”; “NEXT”; “NEXT”.
- Check the distance between the bottom of the vial sensor and the top of the tray segments. The distance should be 29 mm.



If the distance is not correct proceed as follows:

- Set the vertical home sensor bracket higher or lower depending on the distance.
  After moving the bracket:
- Go to page 1 of 4 and press “DOWN”; ”HOME”
- Check the distance and repeat if necessary.

Valve PCB

```
SERVICE MODE  SLOT:5       PAGE 1 of 5
PCB-ID:$3E    VALVE         INJECTOR
SENSORS  LOAD:X  INJECT:X
   LOAD     INJECT
```

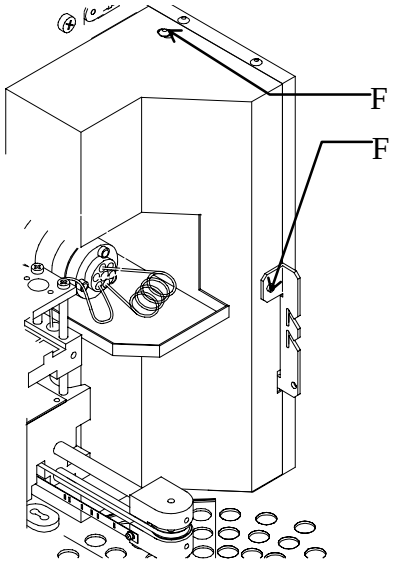
SENSORS (valve position)	LOAD:X	Indicates the status of the load position sensor. This sensor is used to detect the position from the injection valve. X= 1 if sensor vane is inside sensor. X= 0 if sensor vane is outside sensor.
	INJECT:X	Indicates the status of the inject position sensor. This sensor is used to detect the position from the injection valve. X= 1 if vane is inside sensor. X= 0 if vane is outside sensor.
SOFTKEYS	LOAD	To set the Valve in the load position.
	INJECT	To set the Valve in the inject position.

The number of pages for the Valve PCB depends on the installed options. In case of only 1 Valve (injection valve) there is only 1 page. If the ISS option is installed page 2 and 3 are to control these optional valves. Page 4 and 5 are used to control the SSV valve. See below for a description.

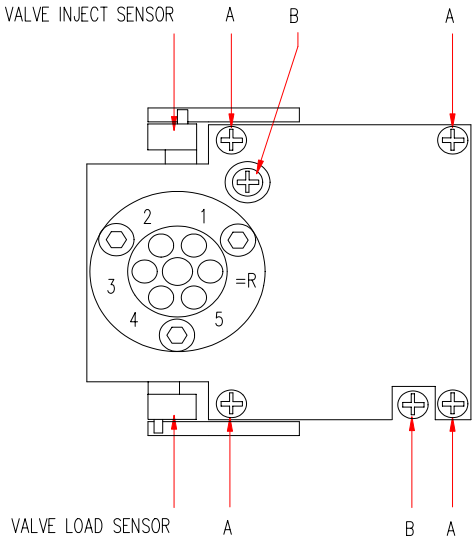
```
SERVICE MODE  SLOT:5       PAGE 4 of 5
PCB-ID:$3E    VALVE          SSV
ACTIVE VALVE: 1
   <SSV1>   <SSV2>   <SSV3>    <SSV4>
```

On the third line of the display the opened port is displayed. By means of the **SOFTKEY** the different solvent ports can be opened. To control SSV5 and 6 switch over to Page 5.

Valve PCB - Removing the injection valve assembly



- Remove all the solvent lines from the injection valve.
- Remove the screws marked F.
- Remove the injection valve cover.
- The injection valve assembly is now completely accessible.



To remove the complete injection valve assembly proceed as follows:

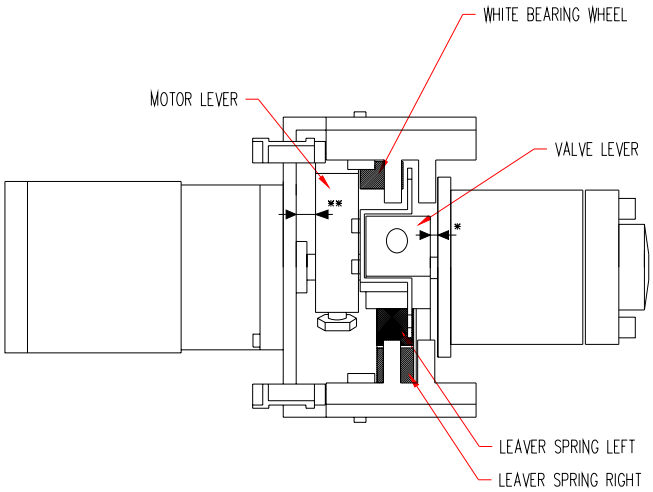
- Remove the valve connector J3 from the valve board.
- Remove the connectors from both sensors.
- Loosen the 2 screws marked B.

The entire injection valve assembly can now be removed

To disassemble/replacing only the injection valve themselves proceed as follows:

- Remove the 4 screws marked A.
- Remove the injection valve including the mounting plate.
- Remove the valve lever from the injection valve

The two screws that hold the injection valve are now reachable.



* Adjust the valve lever on the valve as far as possible to the right, without touching the mounting plate.
** Adjust the motor lever on the motor, so that the bearing wheel is free of the valve lever.

Notes for reassembling:

- Make sure the detector strap is in-line with the optical sensors.
- Place the injection valve manual in the inject position (detection strap is inside of the inject sensor).
- Turn the motor lever in the position with the white bearing down (Out of the lever springs!).
- Switch the injection valve manual, by turning the motor lever, for checking on mechanical obstructions.

Tray PCB

```
SERVICE MODE  SLOT:6        PAGE 1 of 2
PCB-ID:$10    TRAY           SEARCH:X  X
SENSORS STOP:X CODE:X
   START                          TYPE
```

SEARCH (parameter) — A value can be entered to which the tray will search after pressing the SOFTKEY START

SENSORS (valve position)

STOP:X — Indicate the status of the stop position sensor. This sensor is used to stop the tray at a correct position.
- X= 1 if sensor is interrupted by stop code plate.
- X= 0 if sensor not interrupted by stop code plate.

CODE:X — Indicate the status of the tray code sensor. This sensor is used to determine the type and number of segment.
- X= 1 If code disk is interrupt the sensor.
- X= 0 If code disk is not interrupting the sensor.

SOFTKEYS

START — After pressing this key the tray will search for the position entered in the search parameter.

TYPE — To change the type of segment.

```
SERVICE MODE  SLOT:6        PAGE 2 of 2
PCB-ID:$10    TRAY
SEGM: C8 D7 – A8 A2 A7 A5 B2
```

On the third line of this page the type and number of segments that where installed during the tray search are shown. This information can be used to check if the sensors do read the correct type of segments. The numbers shown in the above screen are an example.

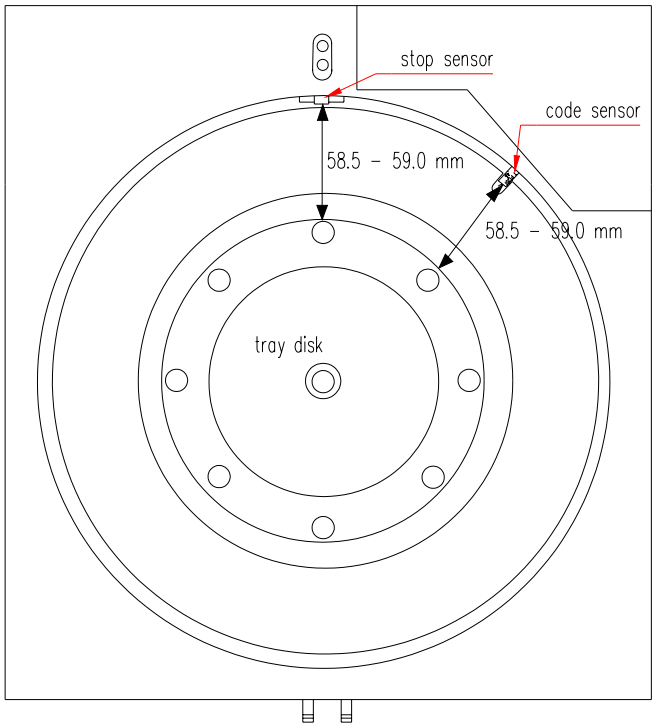
Tray PCB – Tray sensors

Tray code sensor

In the bottom plate of each segment is a code corresponding with the type and the number of the segment. This code is read-out by the tray code sensor, for location of this sensor see drawing below.

Stop sensor

Each segment has furthermore a stainless steel plate in the middle, which takes care for the stop position. The small gap's in the stop code plates corresponding with the centre of the vials. The gap's in the stop code plates are recognised by the tray stop sensor that is a part of the wash position.



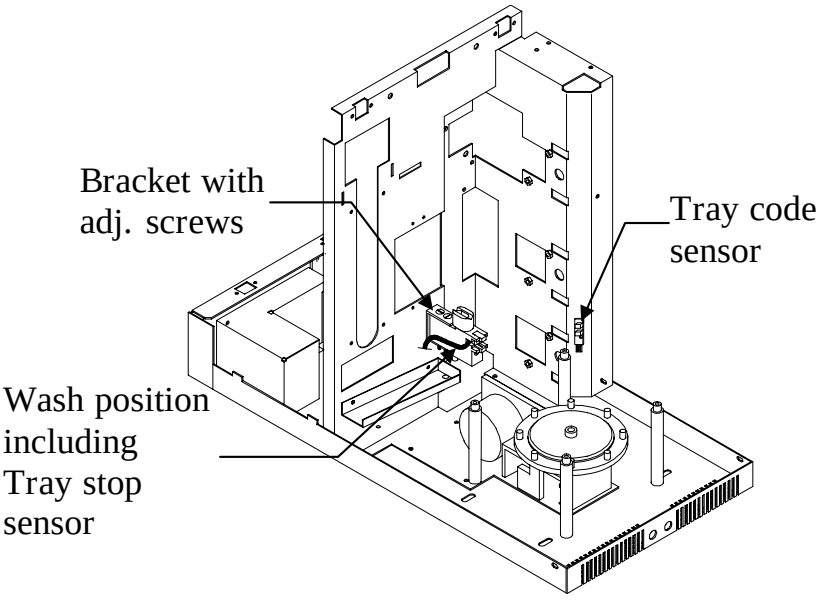
Top view

After replacing one of these sensors it is necessary to check the distance between the black tray disc and the front of the sensors. The distance should be 58.5 - 59.0mm. The distance for the tray code sensor can be

changed by placing some washers between the sensor and the main-frame.

Adjusting the stop sensor:

- Remove tubing's from the injection valve.
- Remove injection valve cover.
- Remove tray cover.
- Loosen the adjustment screws of the wash position.
- Set the distance at 58.5 - 59.0 mm from the tray disc.
- Tighten the adjustment screws, and make sure the wash position is in line with the centre of the tray disk.



I/O PCB

```
SERVICE MODE  SLOT:7       PAGE 1 of 10
PCB-ID:$40    EXT. I/O      I CONTROL
I STAT = 0
    ON        OFF
```

I/O STAT = 0 Indicates the status from the current limit output circuit

SOFTKEYS

ON	Turns the 24 VDC output on.
OFF	To switch OFF the 24 VDC output.

```
SERVICE MODE  SLOT:7       PAGE 2 of 10
PCB-ID:$40    EXT. I/O      INPUTS
NEXT INJ=X  NEXT VIAL=X  FREEZE=X
STOP I/O=X  IN1=X  IN2=X IN3=X  IN4=X
```

Line 3 and 4 provide information on the status from the different inputs.

If **X** = **1** the input is **high**.
If **X** = **0** the input is **low**.

```
SERVICE MODE  SLOT:7       PAGE 3 of 10
PCB-ID:$40    EXT. I/O      MARKERS

   INJ       VIAL    LABELED
```

SOFTKEYS

INJ	Activate the inject-marker output.
VIAL	Activate the vial-marker output.
LABELED	Activate the labeled vial output.

The duration from these pulses depends on the I/O system settings.

```
SERVICE MODE  SLOT:7       PAGE 4 of 10
PCB-ID:$40    EXT. I/O      STOP I/O
STOP I/O = X
    ON        OFF
```

STOP I/O	Indicates the status from the STOP I/O input	
	X=1	The input is high
	X=0	The input is low
SOFTKEYS	ON	Will force the output to a high level.
	OFF	Will force the output to a low level.

```
SERVICE MODE  SLOT:7      PAGE 5/6 of 10
PCB-ID:$40    EXT. I/O      AUXILIARIES

  AUX1 ON   AUX1 OFF  AUX2 ON   AUX2 OFF
```

On page 5 and 6 it is possible to control the AUXILIARY outputs by pressing the corresponding **SOFTKEY**.

```
SERVICE MODE  SLOT:7       PAGE 7 of 10
PCB-ID:$40    EXT. I/O      VIAL NO OUTP
SETTING OF OUTPUT IS: XXX   NUMBER:000
```

On this page it is possible to control the vial number output by entering a number. The type of output HEX or BCD code depends on the system settings. After entering a number the corresponding outputs will be activated.

```
SERVICE MODE  SLOT:7       PAGE 8 of 10
PCB-ID:$40    EXT. I/O      TIMEBASE OUT
                            CODE:00
```

Page 8 is to control the time base output. After entering a code the corresponding number in BCD will be active on the output.

```
SERVICE MODE  SLOT:7      PAGE 9 of 10
PCB-ID:$40    EXT. I/O     PROG OUTPUTS

   1 ON     1 OFF      2 ON    2 OFF
```

On this page it is possible to control the 2 programmable outputs. These 2 relays outputs are only available in the user's method.

SOFTKEYS	1	ON	Will change the status from output one.
		OFF	Will force the output to default value.
	2	ON	Will change the status from output two.
		OFF	Will force output 2 to default value.

```
SERVICE MODE  SLOT:7      PAGE 10 of 10
PCB-ID:$40    EXT. I/O     PROG OUTPUTS

SPARE ON  SPARE OFF  ALARM ON  ALARM OFF
```

On this page it is possible to control the Spare output and the Alarm output. The Spare output is not supported by the standard firmware. The Alarm output is active whenever the unit is stopped by an error.

SOFTKEYS	SPARE	ON	Will change the status from the Spare output.
		OFF	Will force the output to default value.
	ALARM	ON	Will change the status from the alarm output.
		OFF	Will force the alarm output to default value.

Serial port test

The duration from these pulses depends on the I/O system settings.

The screen that follows slot 7 provides a way to check the serial interface. This screen gives also information on the setting from the communication port. This setting can not be changed.

```
SERVICE MODE  SERIAL PORT   PAGE 1 of 1
PROTOCOL: SPARKLINK    RS232 TEST:   000
9600 BAUD, 8 DATA, NO PARITY, 1 STOP BIT
   START
```

To check to communication port a short circuit should be made between pin 2 and 3 on the RS 232 connector. If the Multi-link is used a short circuit should be made between pin 2 and 3 on Sub-D connector IN on the rear-side of the AS 100. After this connection is made Press the Softkey START.

Tray calibration

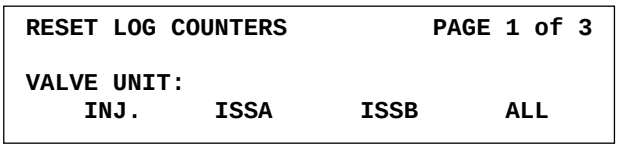
On this screen it is possible to readjust the stop position from the tray.

```
SERVICE MODE  CALIBRATION   PAGE 1 of 1
TRAY STOP POSITION : +X  STEPS
```

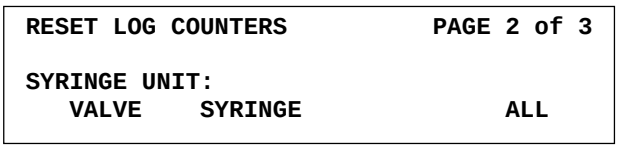
The X value can be changed by means of the up / down keys. Each + step will cause the tray to stop 0.01 mm later. In other words if the needle penetrates the septum to far to the left of the vial centre the X value should be increased or visa versa.

Reset LOG counters

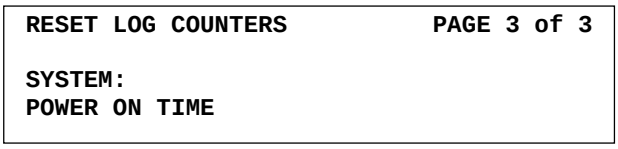
This function in the service mode is used to clear the LOG counters.
These LOG counters are in the normal operation mode read-only.
Use these clear functions only if the corresponding part is replaced.



Page 1 is to erase the counters for the injection valves.



Page 2 is to erase the counters for the syringe system.

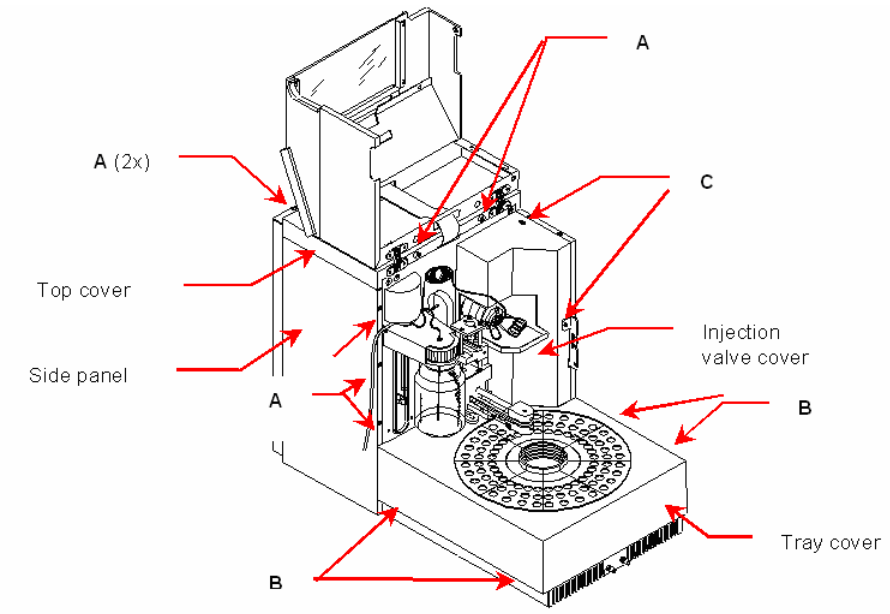


Page 3 is to erase the Power on time.

It is not possible to erase the EVENT information.

C H A P T E R 4

Disassembling



Injection Valve Mechanism

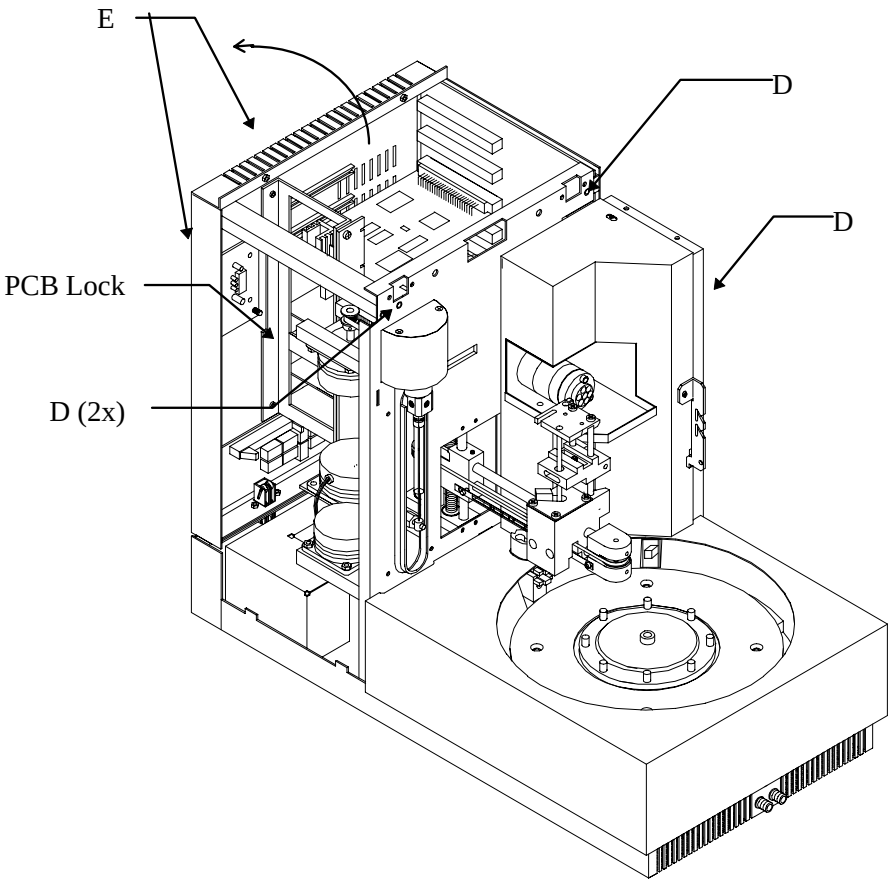
- Disconnect all the tubing's from the valve.
- Remove screws marked C.
- Slide the injection valve cover to the front.

Tray Drive and Cooling

- Remove the injection valve cover. (see 4.1)
- Remove the screws marked B
- Lift the tray cover out of the bottom plate and slide it forwards.

Electronics

- To achieve access to the electronics remove screws marked **A**
- Lift the top cover and both the side panels.

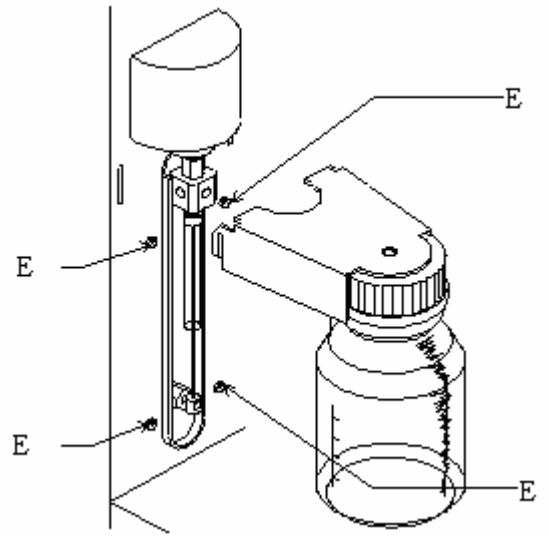


- Remove screws marked D

Now it is possible to open the rear panel in the direction from the arrow. In order to remove or replace one of the boards remove the PCB lock (screws E).

Dispenser

- Remove the top and side panels (see 4.3)
- Remove the solvent bottle.
- Remove all the solvent lines from the dispenser valve.
- Disconnect all the connectors from the Dispenser PCB.
- Remove the marked screws E.
- It is now possible to remove the entire assy from the AS 100.

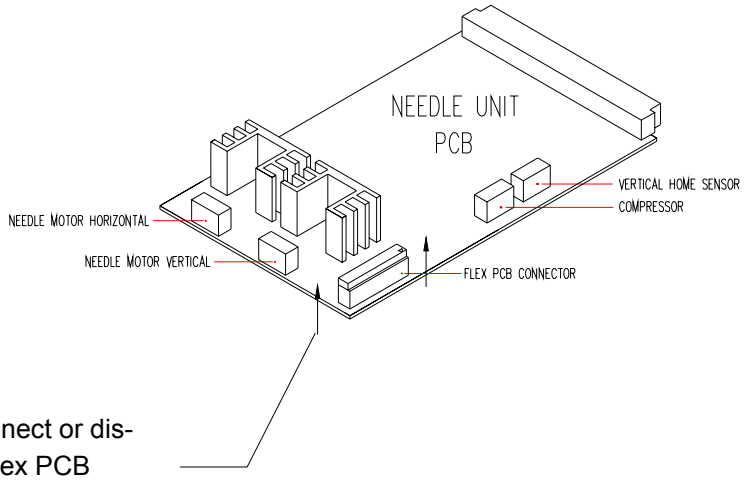


Needle unit

Before removing the needle unit, it is necessary to remove the Dispenser. and to open the rear panel completely (see previous paragraphs)

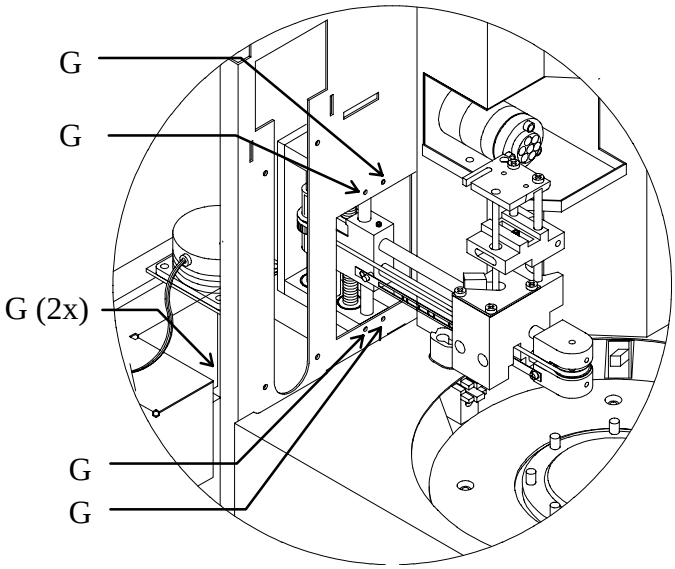
- Disconnect all the cables from the boards.

In order to disconnect the Flex PCB from the Board the top of the connector should be lifted.



Lift top to connect or disconnect the flex PCB

- Remove the injection needle.
- Disconnect the air tubing from the needle train.
- Pull the Flex PCB through the mainframe slot.
- Loose the marked screws G.(6x).



- Move the needle train to the front of the Needle unit.
- Move the needle arm completely down, by rotating the vertical movement belt manually.

In this situation it is possible to remove the entire needle unit. After replacing a needle unit, it is necessary to readjust the penetrating point. See the following paragraphs in chapter 3:

1. Needle adjustments
2. Stop sensor adjustment

C H A P T E R 5

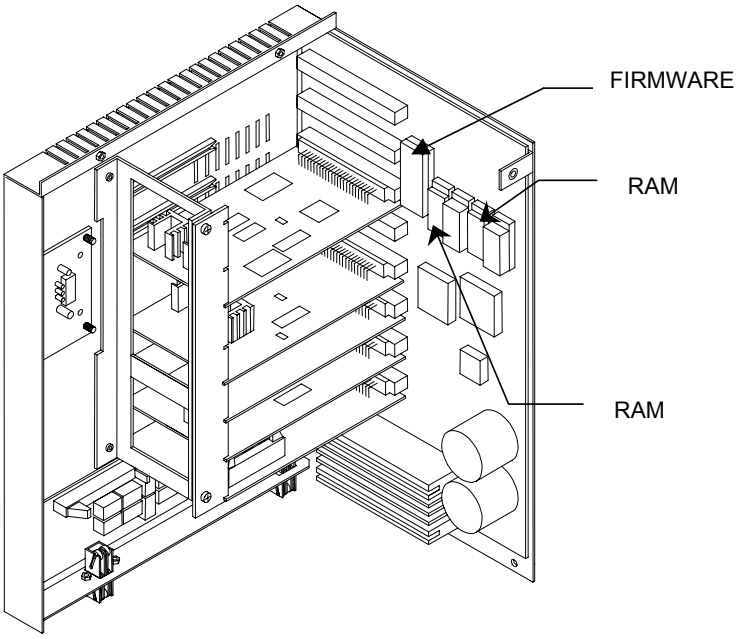
Firmware replacement

The EPROM is highly sensitive for Static discharges.

The EPROM, which contains the Software, is located on the CPU Board. See drawing.

For replacement proceed as follows:

- Make a notice of the System Settings and Methods (All settings might be default after replacement.)
- Turn mains power off.
- Open the top cover (See chapter 4).



- Replace the EPROM (See drawing for location)
- Replace the top cover (4 screws).
- Check and reprogram the System Settings and Methods.

C H A P T E R 5

Trouble shooting guide

Error codes

Every malfunction of the AS 100 will be reported as an error code. In the list below, each error code is described and also the action to solve the mentioned error is given.

Error codes – Injection valve and ISS valves unit

Error	Cause	Action
11	The output from both the sensors is high (1)	• Check the output from the optical sensors in the service mode
12	It takes more then 1.5 sec. before the sensor vane leaves the optical sensor	• Check for loosen parts • Check the DC motor • Check optical sensors
13	The switching time of the injection valve exceeds 500 msec.	• Check rotorseal and stator (Torque to turn the valve might increased dramati-cally.) • Check the motor and valve levers • Check the DC motor
14	ISS A Valve is not in a valid position	See ERROR 11
15	The ISS Valve A did not switch within 1.5 sec.	See ERROR 12
17	ISS B Valve is not in a valid position	See ERROR 11
18	The ISS Valve B did not switch within 1.5 sec.	See ERROR 12

Error codes – Syringe dispenser unit

Error	Cause	Action
21	The syringe valve does not switch. The output code from the two sensors does not correspond to the software settings.	• Check the two sensors in the service mode (turn the valve by hand using the valve sensor disc as a grip) • Check the stepper motor • Check the belt tension • Check for loosen parts
22	The syringe did not reach the home position in time. The spindle rotates correct, but the syringe never reaches its home position.	• Check screw treats in transport block assy, if worn out replace transport block spindle assy • Check home sensor in Service mode
23	The syringe spindle did not make the correct number of rotations. The number of pulses created by the rotation sensor does not correspond with the number of steps send to the stepper motor.	• Remove syringe • If OK without syringe check sample flow path for obstruction • If Error still occurs check: – Optical sensor – Stepper motor – Belt tension – Loosened pulley
24	The spindle does not rotate. No pulses created by the rotation sensor.	See error 23

Error codes – Needle unit

Error	Cause	Action
30	The sample needle arm did not reach or leave the home position. (vertical) The status from the needle arm “home sensor” does not change after a vertical arm movement	Move the needle arm down in the service mode. If there is no movement at all check: If the needle arm moves down For ± 2cm check: • Optical sensor • Stepper motor • Belt • Pulleys
31	The sample needle arm is in an invalid horizontal position while moving down. During the down movement from the needle arm the needle holder is set into an incorrect position	Only activated by an improper use of the system Press STOP twice to deactivate the Error.
32	The sample needle arm did not reach its destination within a certain time	Check: - Belt tension Loosened pulleys Position and home sensor of horizontal needle movement.
33	If the number of steps leaded to the stepper-motor is not enough to reach the destination	See 32
34	Sample needle arm not in vertical home while moving horizontally. The status of the vertical home sensor is not the same as the software expects	Check, in the service mode, the status of the vertical home sensor 1 if light-beam interrupted 0 if light-beam not interrupted

Error	Cause	Action
35	The status of the horizontal position sensor is 1 and the software tells the needle holder to move Can also occur by defective Battery RAM.	Reset the unit by switching the power of and on Replace the 2 Battery RAM chips of the CPU
36	The horizontal position sensor detects to many gaps while moving to the next position	Check the horizontal position sensor in the service mode Output is 0 in case of a gap
37	The software tells the needle arm to move down while the status of the tray stop sensor is 1	Check the tray stop sensor in the service mode. 1 if light-beam interrupted 0 if light-beam not interrupted
39	Vial sensor sticks. The software tells the needle arm to move down while the status of the vial sensor is 1	Check the vial sensor in the service mode 1 if light-beam interrupted 0 if light-beam not interrupted Check if the vial stripper can move up and down without any obstructions
40	The sample needle spindle does not rotate correctly. The software tells the sample needle to move up or down but there are no pulses generated by the sensor	Check the sample needle mechanism for any obstructions. For example: • Sample needle broken • Tubing of sample needle sticks behind sample loop • Air-prepuncturing needle bent (replace!) • Rest samples in between air-prepuncturing needle and sample needle • Belt broken • Sensor defect • Transport block sticks on shaft (clean shafts) • Motor brushes worn-out • Flex PCB broken or interrupted

Error	Cause	Action
41	The sample needle did not reach or leave home position. The software tells the sample needle to move up or down and the status of the sample needle home sensor does not change	Check the sample needle home sensor in the service mode
42	The sample needle is not at home position. A horizontal or vertical movement from the needle holder is requested and the output from the sample needle home position sensor is 0.	Check if the sample needle is completely up if yes check the sample needle home sensor in the service mode

Error codes – Tray unit

Error	**Cause**	**Action**
51	During the search for a vial the status from the tray stop sensor remains the same	Check the tray stop sensor in the service mode 1 if light-beam is interrupted 0 if light-beam is not interrupted
52	The software searches a curtain type of segment which is not installed on the unit	Change the programming or place the segment
53	The status of the sample needle home sensor is 0 when the software tells the tray to turn.	Reset the unit by turning the mains power off and on. If the error remains check sample needle home sensor.

Error codes – Vials

Error	Cause	Action
60	Missing vial. Only available when Skip Missing Vial is set to NO in the System Settings or during the execution of a Mix method	Check if vial is placed in the tray segment, or check the vial sensor in the service mode.
61	Missing segment	Check if segment is placed.
62	Missing transport vial	Check if the programmed transport vials are placed.
64	Missing vial for reagent A	Check if vial for reagent A is placed.
65	Missing vial for reagent B	Check if vial for reagent B is placed.
66	Missing vial for reagent C	Check if vial for reagent C is placed.
67	Missing vial for reagent D	Check if vial for reagent D is placed.
68	Missing destination vial	Check if programmed range of destination vials is placed.
69	Not enough transport liquid available due to missing transport vials	Check if programmed range of transport vials are placed, or if programmed range contains the necessary volume.

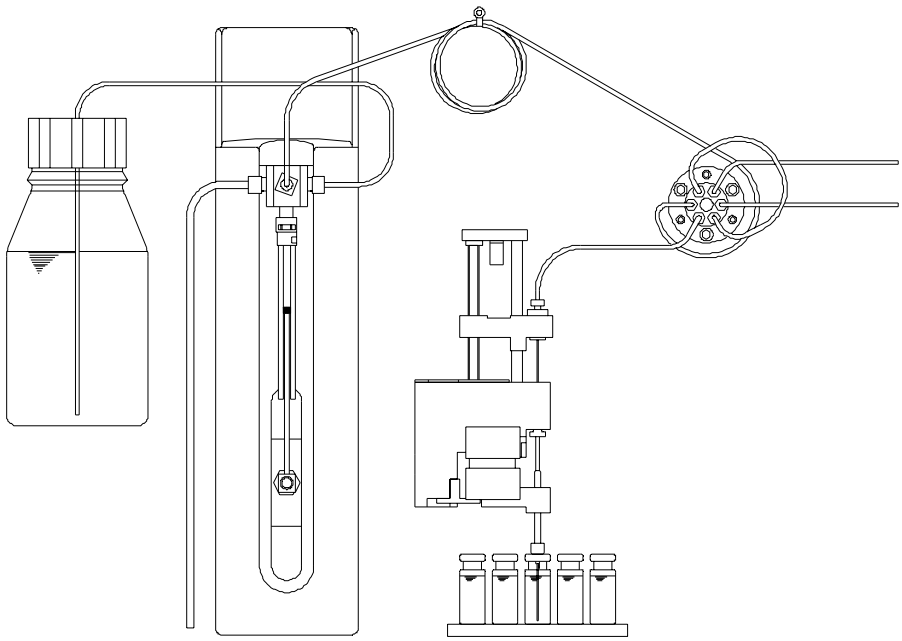
Error codes – Electronics

Error	Cause	Action
71	Flex PCB of the sample needle is not connected.	Check for a proper installed flex PCB on the needle board. Align flex PCB in connector. Check in service mode for status.
72	Invalid configuration of the AS 100. If a PCB required to operate the unit is missing	Check for loosen PCB's
73	Current limit of the external I/O exceeded If the current for the external 24 V exceeds 500mA	Disconnect remote connectors.
75	Error occurred during initialisation, the AS 100 can not start	An essential part is not properly working and the AS 100 can not execute the programmed method Turn mains power off, power up the unit again and check for other error codes for more details.

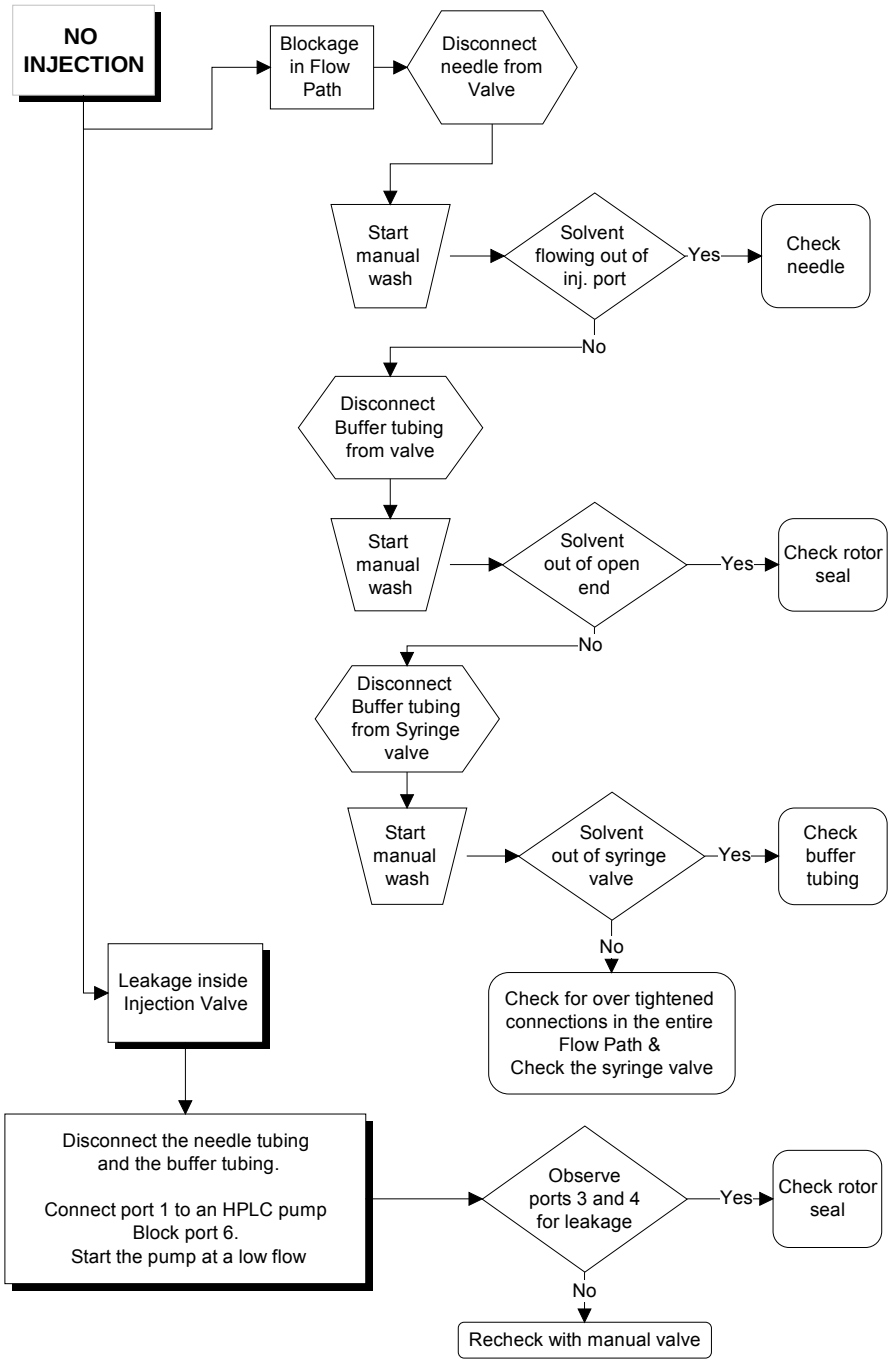
Analytical

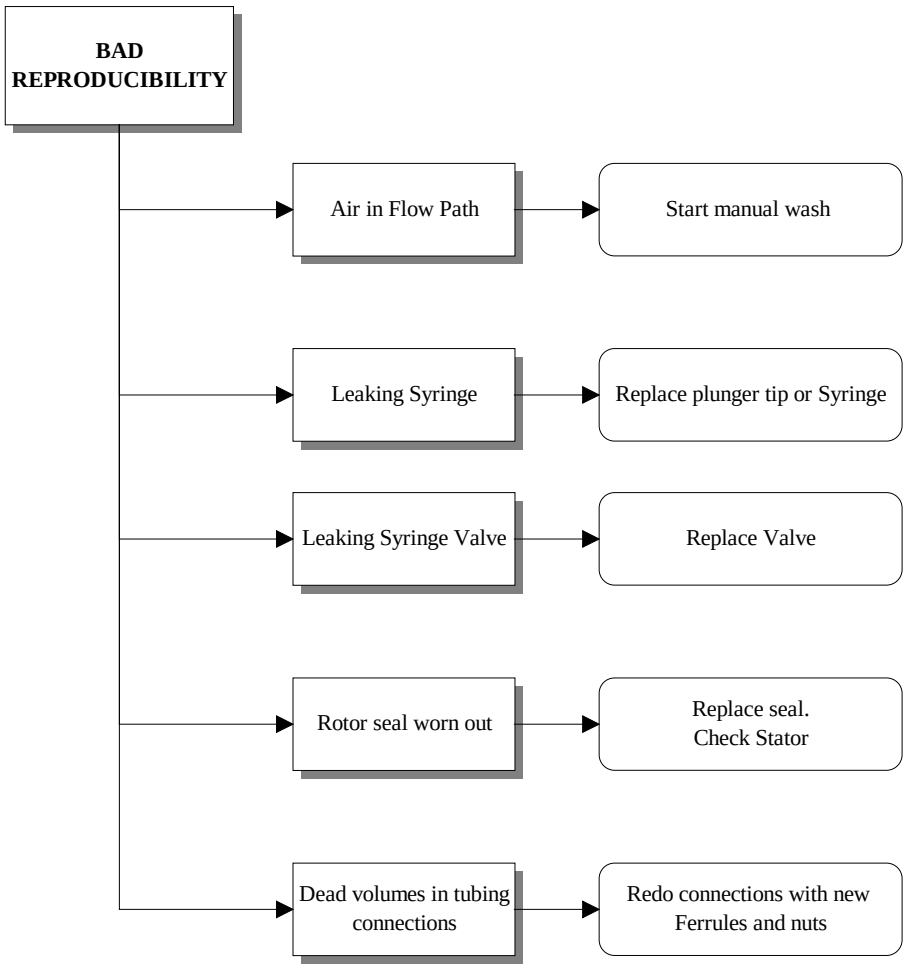
In cases of analytical problems the best thing to start with is to determine if the cause for the problem is in the autosampler or in the rest of the system.

In order to do this replace the autosampler by a manual injector and do some manual Flushed loop injections. If the results are fine the fault has to be found in the autosampler, if not the HPLC system should be checked.



In the diagrams on the next pages it is assumed that the unit is working without Errors. Please keep in mind that analytical problems also might be caused by external influences, like temperature and or light sensitive samples. For this reason it is important to be sure the application was running without problems before and nothing has been changed.


NO INJECTION
Blockage in Flow Path
Disconnect needle from Valve
Start manual wash
Solvent flowing out of inj. port
Yes
Check needle
No
Disconnect Buffer tubing from valve
Start manual wash
Solvent out of open end
Yes
Check rotor seal
No
Disconnect Buffer tubing from Syringe valve
Start manual wash
Solvent out of syringe valve
Yes
Check buffer tubing
No
Check for over tightened connections in the entire Flow Path & Check the syringe valve
Leakage inside Injection Valve
Disconnect the needle tubing and the buffer tubing.
Connect port 1 to an HPLC pump Block port 6.
Start the pump at a low flow
Observe ports 3 and 4 for leakage
Yes
Check rotor seal
No
Recheck with manual valve


BAD REPRODUCIBILITY
Air in Flow Path
Start manual wash
Leaking Syringe
Replace plunger tip or Syringe
Leaking Syringe Valve
Replace Valve
Rotor seal worn out
Replace seal. Check Stator
Dead volumes in tubing connections
Redo connections with new Ferrules and nuts

C H A P T E R 6

Needle volumes

The AS 100 can be equipped with several types of needles, all the needles are only available as an assembly (supplied with tubing, nuts, ferrules)

All the needles (except the standard stainless steel needles) are also supplied with an air nut. The air nut should be replaced when changing the sample needle from a different version, in order to take care for the same overhead vial pressure. All types of needles are working in combination with the same air-prepuncturing needle.

PART NUMBER	Description
181.0322	Air-prepuncturing needle
181.0312	St. steel sample needle 15µL valco
181.0316	Peek sample needle 15µL valco
181.0366	Fused silica sample needle 5.3 uL valco

p/n	Stainless Steel Needle			Tubing			
	O.D. (mm)	I.D. (mm)	Length (mm)	O.D. (mm)	I.D. (mm)	Length (mm)	Volume (µl)
181.0352	0,65	0,25	135	1,6	0,25	145	15

p/n	Peek / Fused Silica Needles			
	O.D. (mm)	I.D. (mm)	Length (mm)	Volume (µl)
181.0316	0,65	0,25	300	15
181.0366	0,375	0,15	300	5

C H A P T E R 7

List of accessories

Table I. Accessories AS 100

Part nr.	Description
181.0302	Tube connector
181.0304	Needle wash insert vial
181.0306	Needle holder
181.0308	Transport Nut M5
181.0310	Plunger replacement tip 100 µL (pck/10)
181.0312	St. steel sample needle 15µL valco
181.0314	Tubingset 900
181.0316	Peek sample needle 15µL valco
181.0318	Buffer tubing 500 µL
181.0320	Syringe waste tubing extra long
181.0322	Air/prepuncturing needle
181.0324	Valco Stainless steel valve C2-2006 SPHT, .4mm
181.0326	Valco Peek valve C2-2346 SPHT
181.0328	Syringe valve
181.0330	Luerlock 1/4" fem 0,6 bore
181.0332	Rotor seal for Valco C2-2006
181.0334	Rotor seal for Valco C2-2346
181.0336	Stator for Valco C2-2006
181.0338	Peek stator for Valco C2-2346
181.0340	Wash solvent bottle 250 mL
181.0342	Syringe 100 µL luerlock
181.0344	Syringe 250 µL
181.0346	Valco 100µL PEEK loop
181.0348	Valco 100µL Stainless steel loop
181.0354	T-connector waste tubing
181.0356	Valco ship kit for C2-2006
181.0358	Silicon tubing 7.0-10mm
181.0360	Wash solvent assembly
181.0362	Valco micro stainless steel valve C2-1006 SPHT, .25mm
181.0364	Valco 5µL Stainless steel loop
181.0366	Fused silica sample needle 5.3 uL valco
181.0368	Rotor seal micro for Valco C2-1006
181.0370	Valco 20µL Stainless steel loop
181.0372	Stator for Valco C2-1006
181.0374	Cooling cover
181.0376	Fan
181.0502	MultiLink Interface PCB
181.0504	EPROM
181.0506	Syringe dispenser assembly
181.0508	Needle unit assembly
181.0510	Needle holder assembly
181.0512	Wash position assembly

Part nr.	Description
181.0514	Tray drive assembly
181.0516	CPU/bus PCB incl. Firmware
181.0518	Tray PCB
181.0520	Syringe PCB
181.0522	Needle unit PCB
181.0524	Flex PCB
181.0526	Inj. Valve PCB
181.0528	Inj. Valve PCB incl. ISS/SSV
181.0530	I/O PCB
181.0532	Peltier PCB
181.0534	New syringe spindle replacement
181.0536	Spindle assy up/down
181.0538	Motor assy needle up/down
181.0540	Replacement steppermotor 2.2A
181.0542	Plunger replacement tip 250µL (pck/10)
181.0544	Rubber feet selfadhesive
181.0546	Stop sensor assembly
181.0548	Replacement steppermotor 1.05A
181.0550	Flex PCB incl. Sample needle motor
181.0552	Code sensor with brush
181.0554	Shipping box incl inserts
181.0556	Replacement peltier assembly 0900
181.0558	Geared belt 912 MXL 025
181.0560	Belt 25.0 x 1.20
181.0562	Geared belt 760 MXL
181.0564	Geared belt 1880 MXL 012
181.0566	Geared belt 520 MXL
181.0568	Pulley PLA 18 MXL 025 6F-5
181.0570	Pulley PLA 18 MXL 025 6F-1/4"
181.0572	RAM battery backup MK48Z58
181.0574	RAM battery backup M48T08
181.0576	Optical sensor
181.0578	Fuse 2.5 AT (EUR)
181.0580	Service Keyboard
181.0588	Inject marker cable
181.0590	power cord EUR
181.0592	power cord USA
181.0594	Fuse 5 AT (USA)
181.0596	AS 100 serial cable, 9M-9F pins
181.0600	Tray set cool; 8 s, 1.8 mL, 12 p, 12 mm
181.0602	Tray set (std); 8 s, 1.8 mL, 12 p, 12 mm
181.0604	Tray set 0.5 mL, type D.
181.0606	Tray set 4 mL, type B.
181.0608	Tray set 10 mL, type C.
181.0610	Tray segment; standard tray, number 1
181.0612	Tray segment; standard tray, number 2
181.0614	Tray segment; standard tray, number 3
181.0616	Tray segment; standard tray, number 4
181.0618	Tray segment; standard tray, number 5
181.0620	Tray segment; standard tray, number 6

Part nr.	Description
181.0622	Tray segment; standard tray, number 7
181.0624	Tray segment; standard tray, number 8
181.0626	Tray segment; tray with cooling option, number 1
181.0628	Tray segment; tray with cooling option, number 2
181.0630	Tray segment; tray with cooling option, number 3
181.0632	Tray segment; tray with cooling option, number 4
181.0634	Tray segment; tray with cooling option, number 5
181.0636	Tray segment; tray with cooling option, number 6
181.0638	Tray segment; tray with cooling option, number 7
181.0640	Tray segment; tray with cooling option, number 8
181.0672	Tray segment 4mL Type B number 1
181.0674	Tray segment 4mL Type B number 2
181.0676	Tray segment 4mL Type B number 3
181.9678	Tray segment 4mL Type B number 4
181.0680	Tray segment 4mL Type B number 5
181.0682	Tray segment 4mL Type B number 6
181.0684	Tray segment 4mL Type B number 7
181.0686	Tray segment 4mL Type B number 8
181.0688	Tray segment 10mL Type C number 1
181.0690	Tray segment 10mL Type C number 2
181.0692	Tray segment 10mL Type C number 3
181.0694	Tray segment 10mL Type C number 4
181.0696	Tray segment 10mL Type C number 5
181.0698	Tray segment 10mL Type C number 6
181.0700	Tray segment 10mL Type C number 7
181.0702	Tray segment 10mL Type C number 8
181.0704	Tray segment 0.5mL Type D number 1
181.0706	Tray segment 0.5mL Type D number 2
181.0708	Tray segment 0.5mL Type D number 3
181.0710	Tray segment 0.5mL Type D number 4
181.0712	Tray segment 0.5mL Type D number 5
181.0714	Tray segment 0.5mL Type D number 6
181.0716	Tray segment 0.5mL Type D number 7
181.0718	Tray segment 0.5mL Type D number 8

C H A P T E R 8

Syringe speed

100 uL Syringe

	Flow in mL/min. through needle						Motor Frequency					
Scale	Load			Unload			Load			Unload		
Factor	Low	Normal	High	Low	Normal	High	Low	Normal	High	Low	Normal	High
0,1	0,01	0,03	0,04	0,05	0,11	0,14	50	100	151	219	424	544
0,2	0,03	0,05	0,08	0,11	0,21	0,27	100	201	300	436	844	1097
0,3	0,04	0,08	0,11	0,16	0,32	0,41	151	300	449	656	1280	1634
0,4	0,05	0,10	0,15	0,22	0,43	0,55	201	400	595	872	1706	2194
0,5	0,06	0,12	0,19	0,27	0,53	0,69	251	499	746	1097	2133	2742
0,6	0,08	0,15	0,22	0,33	0,64	0,83	300	595	893	1301	2560	3339
0,7	0,09	0,17	0,26	0,38	0,74	0,96	349	698	1037	1536	2953	3840
0,8	0,10	0,20	0,30	0,44	0,87	1,13	400	791	1200	1745	3490	4517
0,9	0,11	0,22	0,34	0,49	0,96	1,28	449	893	1347	1969	3840	5120
1	0,12	0,25	0,38	0,55	1,07	1,37	499	997	1506	2194	4266	5485

250 uL Syringe

	Flow in mL/min. through needle						Motor Frequency					
Scale	Load			Unload			Load			Unload		
Factor	Low	Normal	High	Low	Normal	High	Low	Normal	High	Low	Normal	High
0,1	0,03	0,06	0,09	0,14	0,27	0,34	50	100	151	219	424	544
0,2	0,06	0,13	0,19	0,27	0,53	0,69	100	201	300	436	844	1097
0,3	0,09	0,19	0,28	0,41	0,80	1,02	151	300	449	656	1280	1634
0,4	0,13	0,25	0,37	0,55	1,07	1,37	201	400	595	872	1706	2194
0,5	0,16	0,31	0,47	0,69	1,33	1,71	251	499	746	1097	2133	2742
0,6	0,19	0,37	0,56	0,81	1,60	2,09	300	595	893	1301	2560	3339
0,7	0,22	0,44	0,65	0,96	1,85	2,40	349	698	1037	1536	2953	3840
0,8	0,25	0,49	0,75	1,09	2,18	2,82	400	791	1200	1745	3490	4517
0,9	0,28	0,56	0,84	1,23	2,40	3,20	449	893	1347	1969	3840	5120
1	0,31	0,62	0,94	1,37	2,67	3,43	499	997	1506	2194	4266	5485

500 uL Syringe

	Flow in mL/min. through needle						Motor Frequency					
Scale	Load			Unload			Load			Unload		
Factor	Low	Normal	High	Low	Normal	High	Low	Normal	High	Low	Normal	High
0,1	0,06	0,13	0,19	0,27	0,53	0,68	50	100	151	219	424	544
0,2	0,13	0,25	0,38	0,55	1,06	1,37	100	201	300	436	844	1097
0,3	0,19	0,38	0,56	0,82	1,60	2,04	151	300	449	656	1280	1634
0,4	0,25	0,50	0,74	1,09	2,13	2,74	201	400	595	872	1706	2194
0,5	0,31	0,62	0,93	1,37	2,67	3,43	251	499	746	1097	2133	2742
0,6	0,38	0,74	1,12	1,63	3,20	4,17	300	595	893	1301	2560	3339
0,7	0,44	0,87	1,30	1,92	3,69	4,80	349	698	1037	1536	2953	3840
0,8	0,50	0,99	1,50	2,18	4,36	5,65	400	791	1200	1745	3490	4517
0,9	0,56	1,12	1,68	2,46	4,80	6,40	449	893	1347	1969	3840	5120
1	0,62	1,25	1,88	2,74	5,33	6,86	499	997	1506	2194	4266	5485

1000 uL Syringe

	Flow in mL/min. through needle						Motor Frequency					
Scale	Load			Unload			Load			Unload		
Factor	Low	Normal	High	Low	Normal	High	Low	Normal	High	Low	Normal	High
0,1	0,13	0,25	0,38	0,55	1,06	1,36	50	100	151	219	424	544
0,2	0,25	0,50	0,75	1,09	2,11	2,74	100	201	300	436	844	1097
0,3	0,38	0,75	1,12	1,64	3,20	4,09	151	300	449	656	1280	1634
0,4	0,50	1,00	1,49	2,18	4,27	5,49	201	400	595	872	1706	2194
0,5	0,63	1,25	1,87	2,74	5,33	6,86	251	499	746	1097	2133	2742
0,6	0,75	1,49	2,23	3,25	6,40	8,35	300	595	893	1301	2560	3339
0,7	0,87	1,75	2,59	3,84	7,38	9,60	349	698	1037	1536	2953	3840
0,8	1,00	1,98	3,00	4,36	8,73	11,29	400	791	1200	1745	3490	4517
0,9	1,12	2,23	3,37	4,92	9,60	12,80	449	893	1347	1969	3840	5120
1	1,25	2,49	3,77	5,49	10,67	13,71	499	997	1506	2194	4266	5485

10 uL Syringe

Speed Setting	Flow	Motor Frequency
1	0,60	24
2	1,25	50
3	2,48	99
4	3,75	150
5	7,68	307
6	10,65	426
7	13,70	548
8	17,45	698
9	21,33	853
wash	5,00	200

The 10 mL syringe can only be used in combination with the USER PROGRAM method. The Setting low, normal and high as well as the scale factor are not available

Flow in mL/min through needle in Mix Methods for a Syringe of (µL*)*

Speed Setting	100	250	500	1000	Motor Frequency
1	0,05	0,13	0,25	0,50	201
2	0,12	0,31	0,62	1,25	499
3	0,25	0,62	1,25	2,49	997
4	0,38	0,94	1,88	3,77	1506
5	0,77	1,92	3,84	7,68	3072
6	1,07	2,67	5,33	10,67	4266
7	1,37	3,43	6,86	13,71	5485
8	1,75	4,36	8,73	17,45	6981
9	2,13	5,33	10,67	21,33	8533

C H A P T E R 9

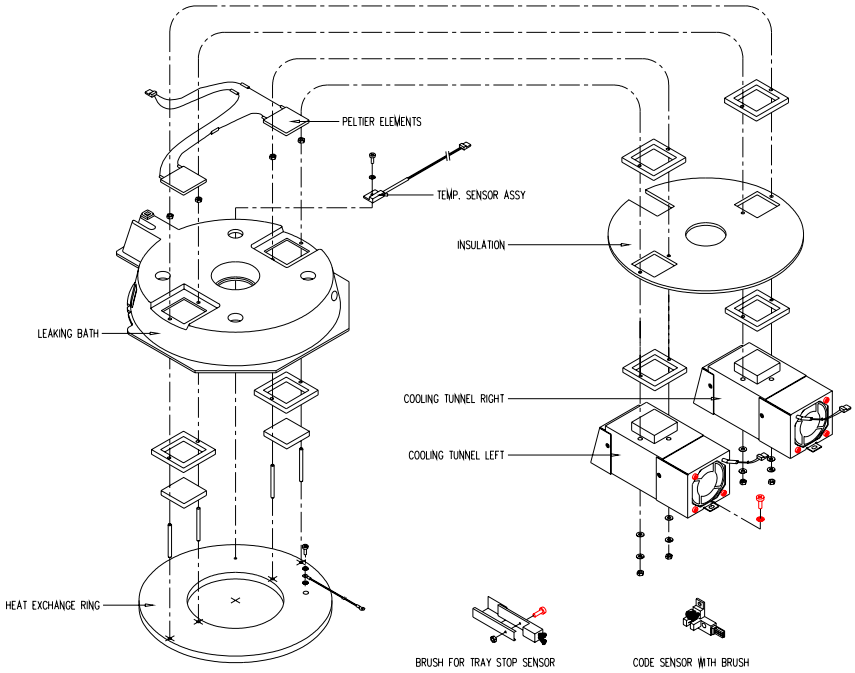
Cooling option

The AS 100 can optional be equipped with an Peltier cooling. This option is only factory installed. The cooling option includes a heat exchange ring mounted underneath the sample tray, a special set of sample tray segments a tray cover, a brush for the tray stop sensor and a code sensor with brush.

The aluminium bottom plates of the tray segments are sliding over the heat exchange ring to ensure maximum contact between the tray and the heat exchange ring.

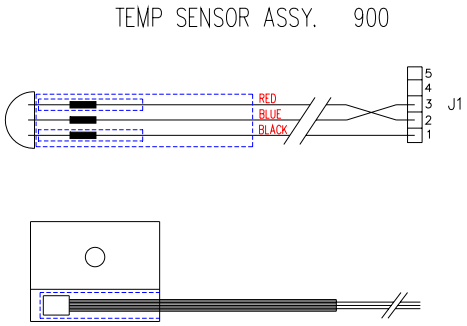
Sample vials are completely surrounded by the aluminium tray inserts.

The heat exchange ring is cooled with 2 Peltier elements which are controlled by the Peltier printed circuit board.

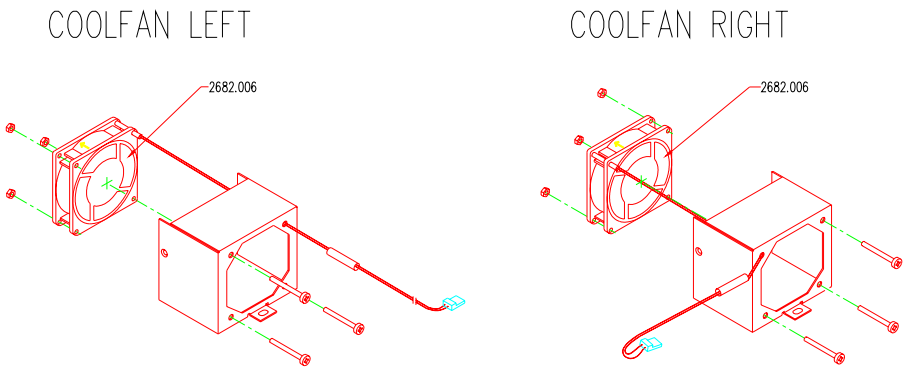


Temperature sensor

The temperature from the heat exchange ring is measured with a temperature sensor.



This temperature sensor is located at the bottom of the heat exchange ring. The two Peltier elements are mounted between the heat exchange ring and the heat sinks. Two fans are used to cool the heatsinks, one for each Peltier element.



In case of a defect Peltier element it is necessary to replace the complete sub assembly (181.0556).

Spare parts cooling option

Part no	Description
181.0376	Fan
181.0556	Replacement peltier assembly
181.0374	Cooling cover
181.0552	Code sensor with brush
181.0532	Peltier PCB

C H A P T E R 1 0

Performance check

Reference : User manual
Service mode entry code: 101163

To be carried out by personal with good knowledge of HPLC instrumental laboratory practice.

Settings & adjustments

Check the "System" settings "General", the default and for this check assumed values are:

- Loop volume: 100 µl
- Needle tubing volume: 15 µl
- Syringe volume: 250 µl
- Dispenser speed: Normal
- Sample needle height: 02 mm
- Skip missing vial: YES
- Air segment: YES
- Head space pressure: YES

Check the "System" settings "Tray", the default and for this check assumed values are:

- Tray type A1 - A8

Program a simple method and series

Method:1		Series	
- Partial loop fill:			
- Analysis time:	1:00 min	- Inj. method:	1
- Flush volume:	35 µl	- Wash:	None
- Injections/vial:	3	- First vial:	A01
- Inj. volume:	10 µl	- Last vial:	A05

- Check the optical sensors of the needle unit and both tray sensors visually. If they look dirty then clean the optical path (e.g. water or methanol).
- Check the sample needle height as follows (Ready mode):

1. Set sample needle height at 00 mm in "Systems" settings "General"

2. Run a series or use the service mode to move the needle down inside an open vial at position A03 with segment 8 removed. Check the position of the needle point. With a standard vial it should be just above the bottom.

Many safety precautions are in the service mode overruled, so be careful in selecting functions to perform.

- If needle height is correct, set the "software" height back to the old value in "System" settings "General". Preferably not at zero.
- If necessary, adjust the needle depth mechanically just above vial bottom, having the "software" height set at 0 in "System" settings "General".
- Proceed to "Ready mode"
- Move needle-holder-assy manually forward.
- Pull the spring-loaded stripper up.
- Check that the sample needle is positioned just inside the air needle (not visible anymore).

This last requirement is essential and overrules the preceding adjustments. Check the needle penetration position with the aid of a few empty capped vials.

- Run a series or use the service mode to move the needle into a vial.
- Check the position of the penetration holes of the septa (center " 0.6mm).
- If necessary, correct the position as follows:

    1. Forward/backward with the stop-slits strip.
    2. left/right by entering the service mode and at "Calibration" (9e screen) entering correction steps (max. 50 steps = max. .5mm, see also HELP function).

Functions

- Check the dispenser and connected tubing by performing a few wash routines.
- Check for leakages of the tube connections, the syringe Luer-lock connection and the syringe plunger.
- Perform also a "Syringe end" and "Syringe home" to check the drain connections.
- Remove a possible air-bubble above the syringe plunger.
- Check the leakage drains of the tray and the injection valve by inserting some water.

- If a cool option is present then check the performance by measuring the time required to cool from ambient to 12°C down. Required time is approximately. 12 min.

Set-point is 4°C, so do not perform this check at ambient temperatures below 18°C.

Performance

- Carry out a shortened test-procedure as described in the User manual (181.0010).
- Use 5 vials (second one a blank) and perform a partial loop fill method with settings as specified on the previous page.
- Reproducibility should be ≤ 0.5% (calculated according the users manual).
- Memory effect should be < 0.2%. Memory effect defined as the ratio of peak-area vial-1 and peak area (vial-2 minus vial-3).
- If reproducibility and/or memory effect is not correct:

1. Check needle and tube-connections between needle and injection valve on dead volume or blockage.
2. Check injection valve on leakage's (see user manual).

Repeat if a possible cause has been found and corrected.

C H A P T E R 1 1

Analytical performance test

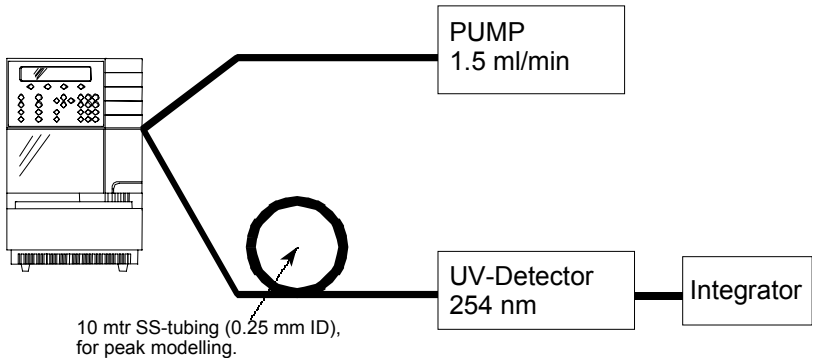
The AS 100 is factory tested for reproducibility and carry-over according to the following test procedure.

Performance test – Analytical system

The AS 100 is tested in an analytical system under the following conditions:

Pump	flow = 1.5 mL/min
UV detector	λ = 254 nm
Sample	Uracil in distilled water (50 ppm)
Eluent	Destilled water

The following configuration was used:



Performance test – Rel. standard deviation (RSD%)

The following formulas is used for calculating the RSD:

$$\overline{Peak\ area} = \frac{\sum Peak\ area}{n}$$

$$\sigma_{n-1} = \sqrt{\frac{\sum\left(Peak\ area - \overline{Peak\ area}\right)^2}{n-1}}$$

$$RSD\% = \frac{\sigma_{n-1}}{Peak\ area} \times 100\%$$

Performance test – Reproducability

- The default system settings were used, except for the following:

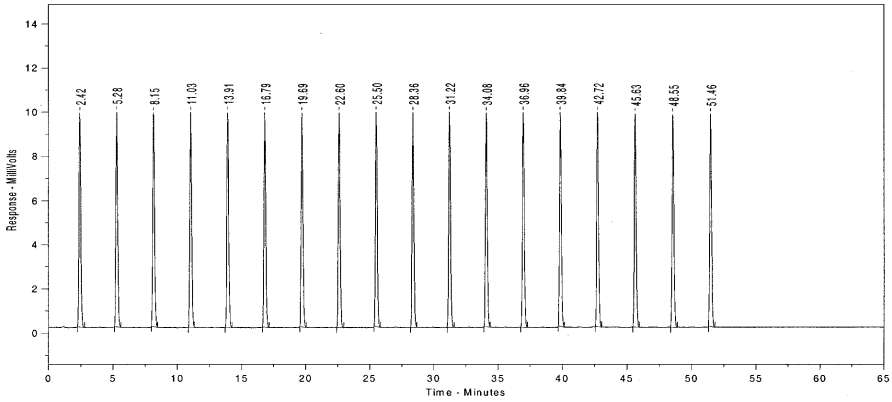
  <GENERAL> Air segment: NO
  <TRAYS> Location first transport vial: A7
  Location last transport vial: A7

- Six vials are filled with sample on positions A1 - A6.
- The transport solvent vial is filled with eluent and placed on position A7.
- The wash solvent bottle is filled with 80% H_2O / 20% Iso-propanol or methanol.

Injection method		**Wash method**		**Series**	
Number	1	Number	1	Number	1
Type	µL pick-up	Wash between inj.		First vial	A 01
Analysis time	1:00 min	Wash volume	300 µL	Last vial	A 06
Injections/vial	3			Injection method	1
Injection volume 1	5 µL			Wash method	1
Injection volume 2	5 µL				
Injection volume 3	5 µL				

Example chromatogram reproducibility test

Date: 03/05/2000 10:30:56
Raw file: c:\progra~1\CPSPIRIT\Test2.0162.RAW
Method: C:\Program Files\CPSpirit\std.met
Serial number:09005030
Tested on system: Chrom 2



Peak #	Ret. Time	Peak Area	Peak Height
1	2.42	111071.1	10124.8
2	5.28	111477.3	10153.4
3	8.15	111475.8	10220.7
4	11.03	111357.6	10291.2
5	13.91	111592.7	10288.3
6	16.79	111499.2	10108.9
7	19.69	111518.3	10119.8
8	22.60	111539.2	10173.1
9	25.50	111313.4	10202.4
10	28.36	111271.1	10216.0
11	31.22	111450.0	10267.8
12	34.08	111545.1	10197.3
13	36.96	111557.8	10156.7
14	39.84	111540.9	10181.0
15	42.72	111322.6	10281.0
16	45.63	111387.0	10137.1
17	48.55	111468.4	10240.7
18	51.46	111637.7	10199.3

RSD (Area) % 0.1258727

Performance test – Carry-over test

- The default system settings were used, except for the following:

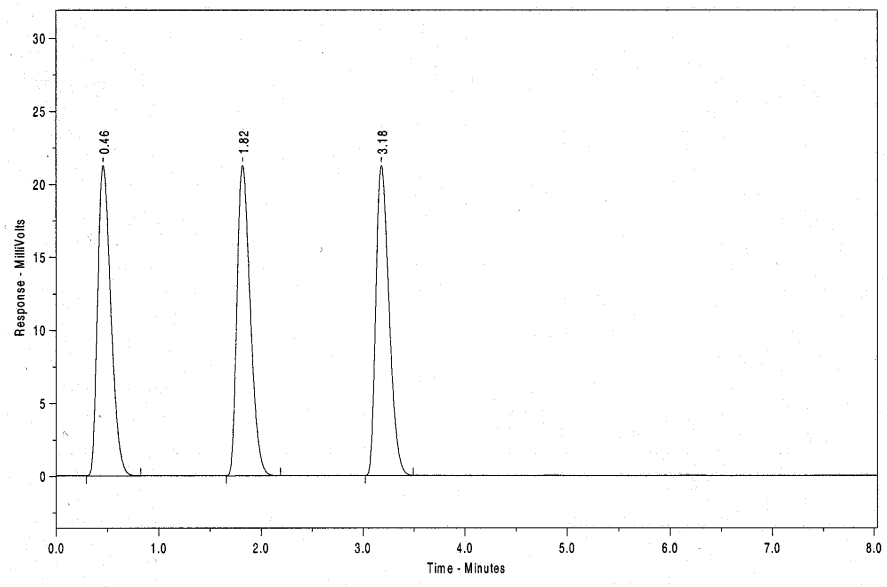
  <GENERAL> Air segment: ON

- A tray with one sample vial filled with sample (50 ppm Uracil, A01).
- One sample vial filled with eluent (A02).
- 10 µL injection volume.
- The wash solvent bottle is filled with 80% H_2O / 20% Iso-propanol or methanol.

Injection method		**Series**	
Number	1	Number	1
Type	Partial loopfill	Injection method	1
Analysis time	1:00 min	Wash method	None
Flush volume	35µL	Mix method	None
Injections/vial	3	First vial	1
Injection volume 1	10 µL	Last vial	2
Injection volume 2	10 µL		
Injection volume 3	10 µL		

Example chromatogram carry-over test

Date: 03/05/2000 11:48:34
Raw file: c:\progra~1\CPSPIRIT\Test2.0163.RAW
Method: C:\Program Files\CPSpirit\std.met
Serial number:09005030
Tested on system: Chrom 2



Peak#	Ret.Time	Peak Area	Peak Height
1	046	213903.6	22358.1
2	1.82	213661.2	22406.4
3	3.16	213993.5	22361.8

RSD (Area) % 8.036543E-02

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