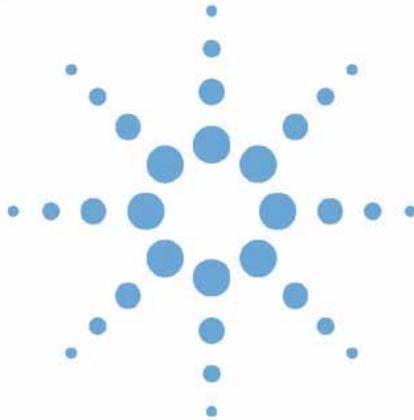




# **Agilent 1200 Series High Performance Autosamplers & Micro Well Plate Autosampler**



**User Manual**



**Agilent Technologies**

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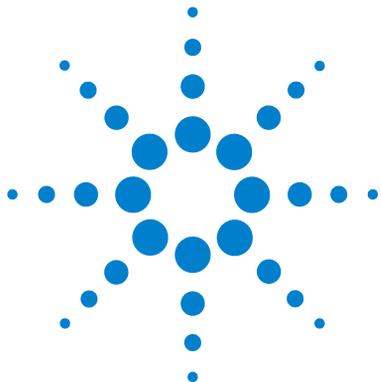
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## Introduction to the 1200 Series Samplers

Three models of Agilent 1200 Series samplers are available that handle vials, well plates, and Eppendorf tubes:

- G1367B Agilent 1200 Series high performance autosampler
- G1367D Agilent 1200 Series high performance autosampler SL
- G1377A Agilent 1200 Series micro well plate autosampler

*The G1367B Agilent 1200 Series high performance autosampler* adds maximum flexibility and fast injection cycles, whenever high sample throughput and speed of analysis are required.

*Features:* Increased sample injection speed for high sample throughput, overlapped injections for increased productivity, minimal delay volumes for rapid gradients and fast equilibration when bypassing the autosampler after sample injection, flexible and convenient sample handling with different types of sample containers. Using 384-well plates allows to process up to 768 samples unattended.

*The G1367D Agilent 1200 Series High Performance Autosampler SL+* is specifically designed for the Agilent 1200 Series Rapid Resolution LC system for increased analysis speed with uncompromised sensitivity, resolution, precision and lowest carry over.

*Features:* Increased pressure range (up to 600 bar) enabling the use of today's column technology (sub-two-micron columns) with the Agilent 1200 Rapid Resolution LC System. Increased robustness by optimized new parts, high speed with lowest carry-over by flow through design, increased sample injection speed for high sample throughput, increased productivity by using overlapped injection mode and flexible and convenient sample handling with different types of sample containers, such as vials and well plates. Using 384-well plates allows you to process up to 768 samples unattended.

*The G1377A Agilent 1200 Series Micro Well Plate Autosampler* is designed to perform capillary LC with injection of sample volumes ranging from nL to  $\mu\text{L}$ .

*Features:* A micro Rheodyne® valve and the optimized design of the needle seat, loop and seat capillaries minimize dispersion. A high-resolution metering device offers resolution ten times better than a standard autosampler, bypass operation facilitates low delay volume, increased sample injection speed for high sample throughput, flexible and convenient sample handling with different types of sample containers. Using 384-well plates allows to process up to 768 samples unattended.

*Technical Principle:* The well plate sampler transport mechanism uses an X-Z-theta robot to optimize the positioning of the sampling arm on the well plate. Once the sampling arm is positioned over the programmed sample position, the programmed sample volume is drawn by the metering device into the sampling needle. The sampling arm then moves to the injection position where the sample is flushed onto the column.

The autosamplers employ a vial/plate pusher mechanism to hold down the vial or the plate while the needle is drawn back from the sample vessel (a must in the case a septum is used). This vial/plate pusher employs a sensor to detect the presence of a plate and to ensure accurate movement regardless of plate used. All axes of the transport mechanism (x-,z-,theta-robot) are driven by stepper-motors. Optical encoders ensure the correct operation of the movement.

The standard metering device (for the G1367B) provides injection volumes from 0.1–100 µl. A multi-draw kit extends the range up to 1500 µl. A 0.1-40µl injection volume metering device is installed in the G1367D, with the option to install an extended volume metering device and loop capillary with up to 100µl injection volume. The micro metering device (for the G1377A) provides injection volumes from 0.01 - 8 µl with the standard loop capillary installed and from 0.01 - 40 µl with the extended loop capillary. The entire flowpath including the metering device is always flushed by the mobile phase after injection for minimum internal carry-over.

An additional needle flush station with a peristaltic pump is installed to wash the outside of the needle. This reduces the already low carry-over for very sensitive analysis. The bottle containing the mobile phase for the wash procedure will be located in the solvent bottle cabinet. Produced waste during this operation is channeled safely away through a waste drain.

The six-port (only 5 ports are used) injection valve unit is driven by a high-speed hybrid stepper motor. During the sampling sequence, the valve unit bypasses the autosampler, and connects flow from the pump to the column directly. During injection and analysis, the valve unit directs the flow through

## 1 Introduction

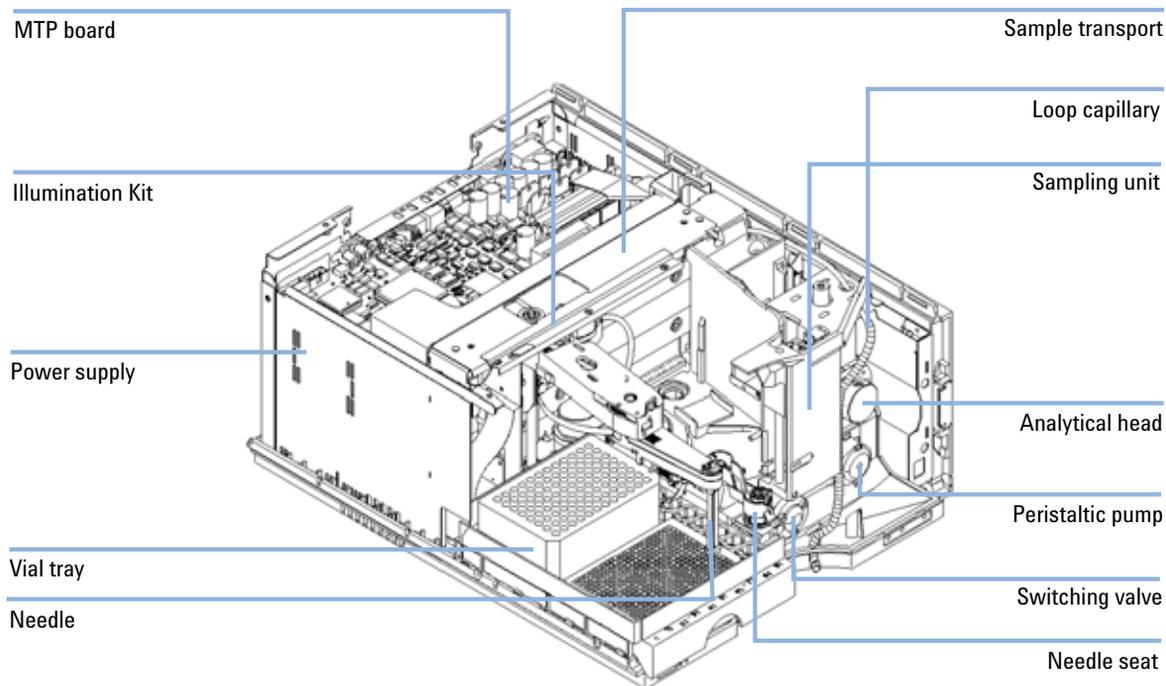
### Introduction to the 1200 Series Samplers

the autosampler which ensures that all of the sample is injected onto the column, and that the metering unit and needle are always free from sample residue before the next sampling sequence begins. All the injection valves have different stator heads and different rotor seals. The volume of each valve is different.

Control of the vial/plate temperature in the thermostatted autosampler is achieved using an additional Agilent 1200 Series module; the Agilent 1200 Series thermostat for ALS/FC/Spotter.

The thermostat contains Peltier-controlled heat-exchangers. A fan draws air from the area above the sample vial tray of the autosampler. It is then blown through the fins of the cooling/heating module. There it is cooled or heated according to the temperature setting. The thermostatted air enters the autosampler through a recess underneath the special designed sample tray. The air is then distributed evenly through the sample tray ensuring effective temperature control, regardless of how many vials are in the tray. In cooling mode condensation is generated on the cooled side of the Peltier elements. This condensed water is safely guided into a waste bottle for condensed water.

## Sampling Sequence



**Figure 1** Overview of the autosampler

The movements of the autosampler components during the sampling sequence are monitored continuously by the autosampler processor. The processor defines specific time windows and mechanical ranges for each movement. If a specific step of the sampling sequence is not completed successfully, an error message is generated. Solvent is bypassed from the autosampler by the injection valve during the sampling sequence. The needle moves to the desired sample vial position and is lowered into the sample liquid in the vial to allow the metering device to draw up the desired volume by moving its plunger back a certain distance. The needle is then raised again and moved onto the seat to close the sample loop. Sample is applied to the column when the injection valve returns to the mainpass position at the end of the sampling sequence.

## 1 Introduction

### Sampling Sequence

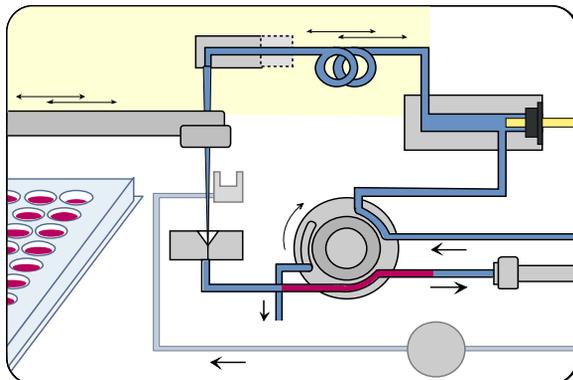
The standard sampling sequence occurs in the following order:

- 1 The injection valve switches to the bypass position.
- 2 The plunger of the metering device moves to the initialization position.
- 3 The needle lock moves up.
- 4 The needle moves to the desired sample vial position.
- 5 The needle lowers into the vial.
- 6 The metering device draws the preset sample volume.
- 7 The needle lifts out of the vial.
- 8 The needle is then moved onto the seat to close the sample loop.
- 9 The needle lock moves down.
- 10 The injection cycle is completed when the injection valve switches to the mainpass position.

If needle wash is required it will be done between step 7 and 8.

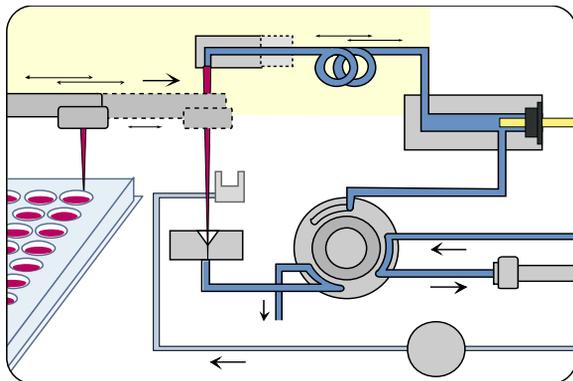
## Injection Sequence

Before the start of the injection sequence, and during an analysis, the injection valve is in the mainpass position (Figure 2 on page 12). In this position, the mobile phase flows through the autosampler metering device, sample loop, and needle, ensuring all parts in contact with sample are flushed during the run, thus minimizing carry-over



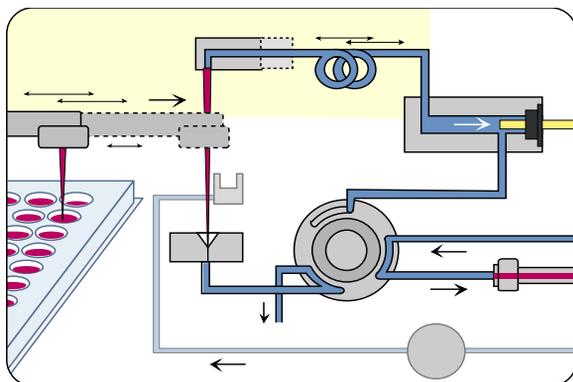
**Figure 2** Mainpass Position

When the sample sequence begins, the valve unit switches to the bypass position (Figure 3 on page 13). Solvent from the pump enters the valve unit at port 1, and flows directly to the column through port 6.



**Figure 3** Bypass Position

The standard injection starts with „draw sample from vial”. In order to do this the needle moves to the desired sample vial position and is lowered into the sample liquid in the vial to allow the metering device to draw up the desired volume by moving its plunger back a certain distance. The needle is then raised again and moved onto the seat to close the sample loop. In case of an injector program several steps are interspersed at this point.



**Figure 4** Drawing the Sample

### **Flush the Needle**

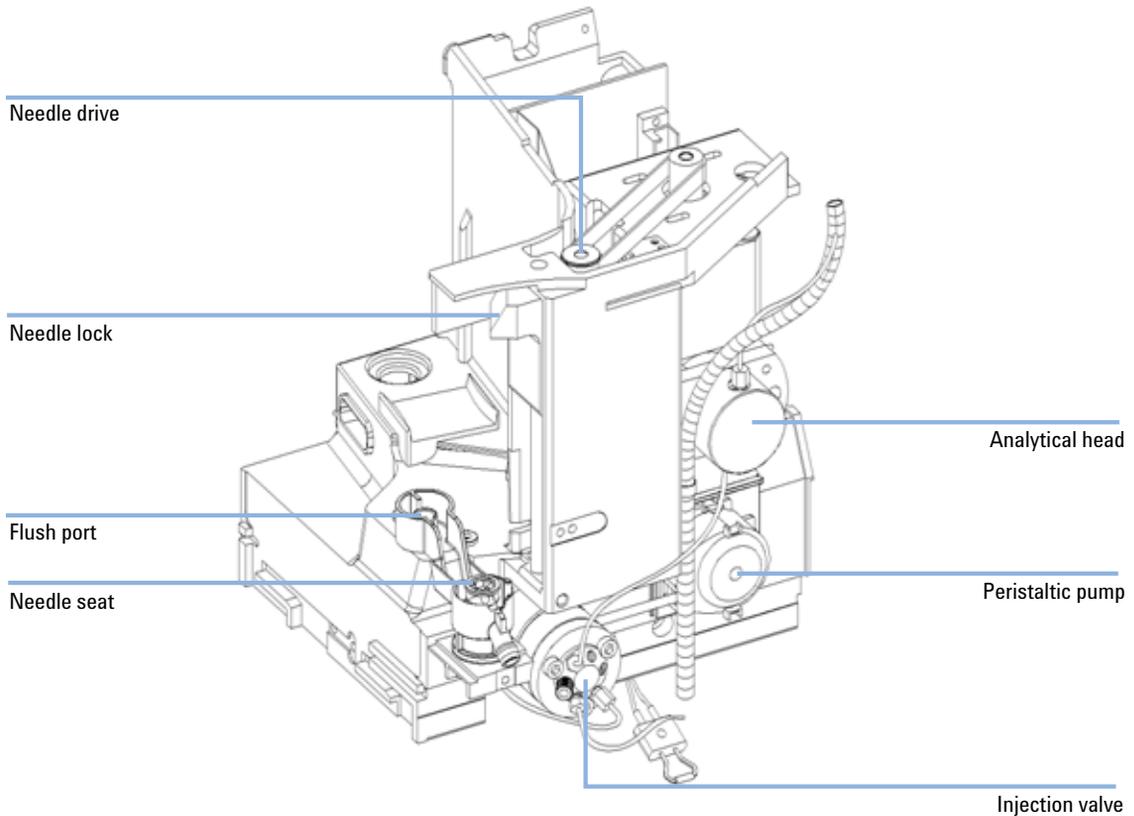
Before injection and to reduce the carry-over for very sensitive analysis, the outside of the needle can be washed in a flush port located behind the injector port on the sampling unit. As soon the needle is on the flush port a peristaltic pump delivers some solvent during a defined time to clean the outside of the needle. At the end of this process the needle returns to the injection port.

### **Inject-and-Run**

The final step is the inject-and-run step. The six-port valve is switched to the main-pass position, and directs the flow back through the sample loop, which now contains a certain amount of sample. The solvent flow transports the sample onto the column, and separation begins. This is the beginning of a „run” within an analysis. In this stage, all major performance-influencing hardware is flushed internally by the solvent flow. For standard applications no additional flushing procedure is required.

## Sampling Unit

The sampling unit consists of subsystems as well. The main carrier part is a die casting part which carries the following functional elements.



**Figure 5** Sampling unit

## Analytical Head

The analytical head is driven by the stepper motor connected to the drive shaft by a toothed belt. The drive nut on the spindle converts the circular movement of the spindle to linear motion. The drive nut pushes the sapphire plunger against the tension of the spring into the analytical head. The base of the plunger sits on the large bearing of the drive nut, which ensures the plunger is always centered. A ceramic ring guides the movement of the plunger in the analytical head. The home position of the plunger is sensed by an infra-red sensor on the sampling unit flex board, while the sample volume is determined by counting the number of steps from the home position (7 nl/motor step). The backward movement of the plunger (driven by the spring) draws sample from the vial.

To reduce potential user mistakes different versions of analytical heads are recognized by RF-tags sitting on the exchangeable assembly.

**Table 1** Analytical head Technical Data

	<b>Standard 100 µl (G1367-60003)</b>	<b>High Pressure 40µl (G1377-60023)</b>	<b>Micro 40 µl (G1377-60013)</b>
Number of steps	15000	15000	60000
Volume resolution	14 nl/motor step	5.6 nl/motor step	1.4 nl/motor step
Maximum stroke	100 µl	40 µl	40 µl
Pressure limit	400 bars	600 bars	400 bars
Plunger material	Sapphire	Sapphire	Sapphire

## Injection-Valve

A high pressure 6-port/2-position-valve to direct streams of mobile phase and sample to different directions (e.g. via loop to column or directly to column).

The two-position 6-port injection valve is driven by a stepper motor. Only five of the six ports are used (port 3 is not used). A lever/slider mechanism transfers the movement of the stepper motor to the injection valve. Two microswitches monitor switching of the valve (bypass and mainpass end positions). The injection valve has a ceramic stator, Vespel rotor seal (Tefzel

seal available), and stainless-steel head. Three screws hold the head and internal components in place. No valve adjustments are required after replacing internal components.

**Table 2** Injection-Valve Technical Data

	<b>Standard (0101-0921)</b>	<b>Micro (0101-1050)</b>	<b>High pressure (0101-1422)</b>
Motor type	4 V, 1.2 A stepper motor	4 V, 1.2 A stepper motor	4 V, 1.2 A stepper motor
Seal material	VespeI™ or TefzeI™	VespeI™	PEEK
Stator material	Ceramic/PEEK	Head coated SST	Ultralife
Number of ports	6	6	6
Switching time	< 150 ms	< 150 ms	< 150 ms

## Needle Flush Station

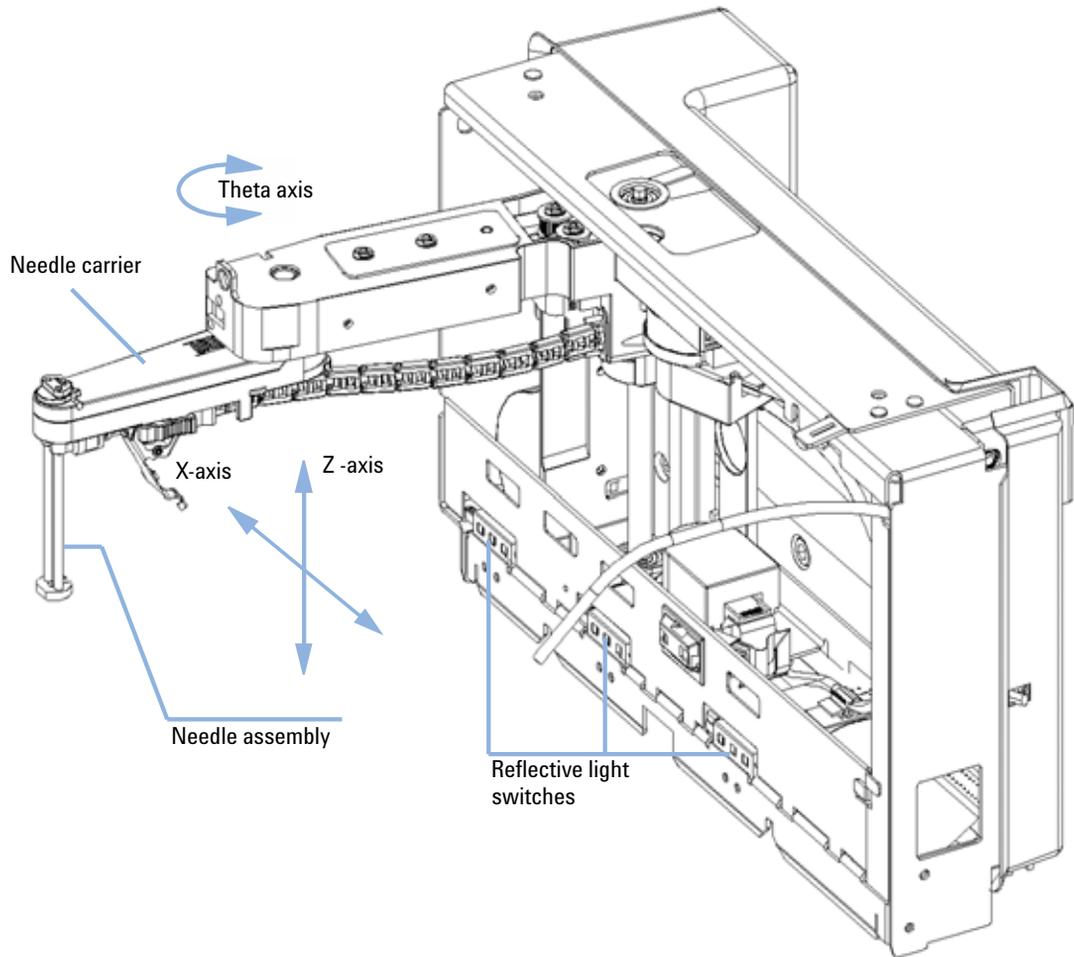
A needle flush station to wash the outer surface of the injection needle and a peristaltic pump to deliver fresh solvent to the wash station. (The reservoir for the solvent is located in the solvent cabinet, the waste is channeled by a separate flex tube to a waste bottle.

## Needle Lock

A needle lock is used to support the needle carrier in its function making a firm seal of the needle in its seat.

The needle lock arm is driven by a stepper motor connected to the spindle assembly by a toothed belt.

## Needle/Sample Transport Assembly



**Figure 6** Needle/Sample Transport Assembly

The needle/sample transport is a multifunctional module capable of moving the needle into various positions (such as different wells in two different plates, different vials, needle wash position and the needle-seat position). The active movable axes are the X-axis, the Z-axis and the theta-axis, the

vial-/plate pusher is an additional passive axis. All axes are stepper motor driven and encoder controlled in order to have tight feedback for the axes position. The theta and Z axes have spring loaded belt-tensioner.

Reflective light switches detect the presence and type of different trays. The X-slide carries the antenna and electronics of a RF-sensor. This device has multiple functions:

- It allows to read and write information from a tag, located in the new tray.
- It allows to increase the number of different trays.
- It allows to read the revision and other data tags of the needle/sample transport assembly and sampling unit.

Complex flex boards make the electrical connection to the various motors, sensors and the MTP-board. The needle carrier has an integrated plate/vial pusher with an additional linear encoder to sense vials and the presence of plates.

The needle and the loop capillary are user-exchangeable.

The back of the needle/sample transport assembly has a cover to protect the electronics from potential solvent vapor.

## Advanced Operating Modes

### Multi-Draw Mode (Optional)

The multi-draw mode provides injection volumes up to 1500  $\mu\text{l}$ . In this case a capillary which holds the additional volume is assembled between seat and valve. Then the aspirated sample is pushed into the enlarged seat capillary before repetitive aspiration starts. After the last aspiration took place the injection valve switches and the mobile phase transports sample towards column.

### Injector Program

A sequence of all available single sampling steps can be tailored to customer needs for special applications. Injector program capability is offered with the standard instrument

### Active Needle Wash

The active needle wash mode allows also the flushing of the outer surface of the needle. This results in an additional decrease of sample carry-over. Duration of the procedure is settable.

### Overlap Injection Cycle

Overlapped injection is the mode where the autosampler runs the injector program for the next analysis during the current analysis (without injecting).

After the sample has reached the column the valve is switched back to bypass and the next injection cycle starts but waits with switching to main-pass until the actual run is finished. This mode allows it to increase the sample throughput.

### Low Delay Volume Mode

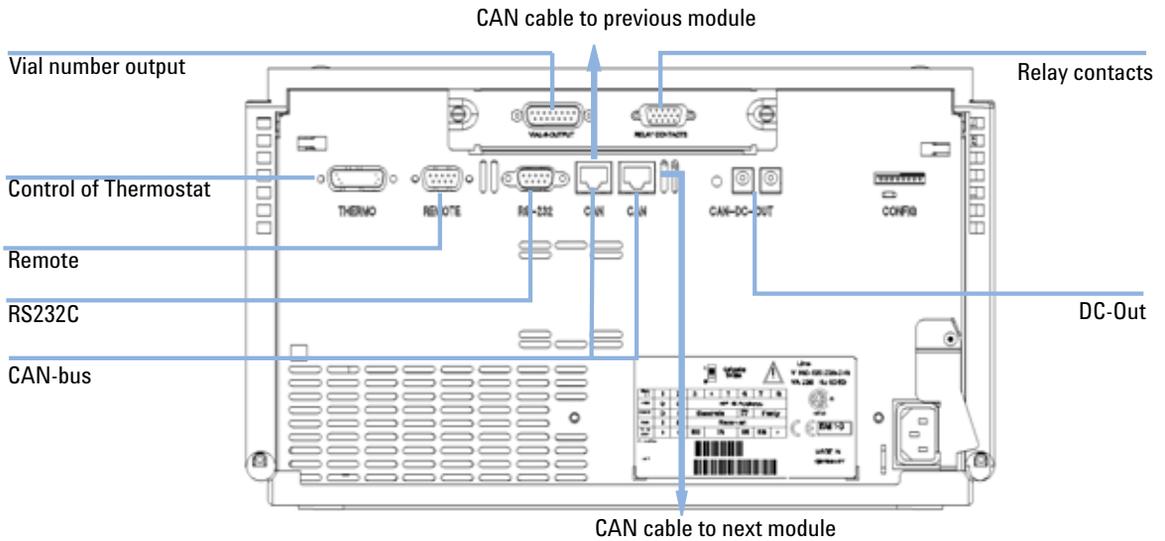
This mode is especially interesting for gradient elution with small bore or capillary columns. The injection valve is switched back to bypass after the sample is eluted beyond the injection valve port # 6. This decreases the delay volume, because the gradient needs not to pass the metering device and the loop capillary.

## Early Maintenance Feedback (EMF)

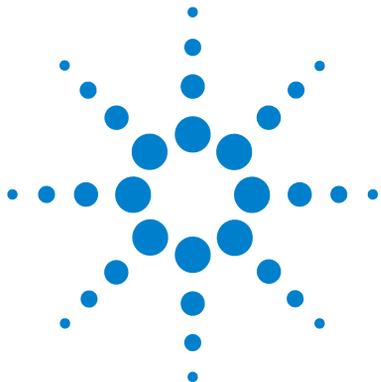
The early maintenance feedback (EMF) feature monitors the usage of specific components in the instrument, and provides feedback when the user-settable limits have been exceeded. The visual feedback in the user interface provides an indication that maintenance procedures should be scheduled.

For details on EMF counters and how to use them, see LMD (Lab Monitor and Diagnostic software) documentation.

## Electrical Connections



**Figure 7** Autosampler Electrical Connections



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## Site Requirements

A suitable environment is important to ensure optimum performance of the autosampler.

### Power Consideration

The autosampler power supply has wide-ranging capability (see [Table 3](#) on page 27). Consequently there is no voltage selector in the rear of the autosampler. There are also no externally accessible fuses, because automatic electronic fuses are implemented in the power supply.

The thermostatted autosampler comprises two modules, the sampler (G1367B/D or G1377A) and the thermostat (G1330B). Both modules have a separate power supply and a power plug for the line connections. The two modules are connected by a control cable and both are turned on by the sampler module. The thermostat power supply has two externally accessible fuses.

#### WARNING

##### ***Damaged electronics***

**Disconnecting or reconnecting the sampler to thermostat cable when the power cords are connected to either of the two modules will damage the electronics of the modules.**

→ Make sure the power cords are unplugged before disconnecting or reconnecting the sampler to thermostat cable.

---

#### WARNING

##### ***Incorrect line voltage at the instrument***

**Shock hazard or damage of your instrumentation can result, if the devices are connected to a line voltage higher than specified.**

→ Connect your autosampler to the specified line voltage.

---

**CAUTION**

Unaccessible power plug.

In case of emergency it must be possible to disconnect the instrument from the power line at any time.

- Make sure the power connector of the instrument can be easily reached and unplugged.
  - Provide sufficient space behind the power socket of the instrument to unplug the cable.
- 

## Power Cords

Your autosampler is delivered with a power cord which matches the wall socket of your particular country or region. The plug on the power cord which connects to the rear of the instrument is identical for all types of power cord.

**WARNING**

***Electric shock***

**The absence of ground connection and the use of an unspecified power cord can lead to electric shock or short circuit.**

- Never operate your instrumentation from a power outlet that has no ground connection.
  - Never use a power cord other than the power cord designed for your region.
- 

**WARNING**

***Use of unsupplied cables***

**The use of cables which haven't been supplied by Agilent Technologies can lead to damage of the electronic components or personal injury.**

- Never use cables other than the ones supplied by Agilent Technologies to ensure proper functionality and compliance with safety or EMC regulations.
-

## Bench Space

The autosampler dimensions and weight (see [Table 3](#) on page 27) allow the instrument to be placed on almost any laboratory bench. The instrument requires an additional 2.5 cm (1.0 inch) of space on either side, and approximately 8 cm (3.1 inches) at the rear for the circulation of air, and room for electrical connections. Ensure the autosampler is installed in a horizontal position.

The thermostatted sampler dimensions and weight (see [Table 3](#) on page 27) allow the instrument to be placed on almost any laboratory bench. The instrument requires an additional 25 cm (10 inches) of space on either side for the circulation of air, and approximately 8 cm (3.1 inches) at the rear for electrical connections. Ensure the autosampler is installed in a horizontal position.

If a complete Agilent 1200 Series system is to be installed on the bench, make sure that the bench is designed to carry the weight of all the modules. For a complete system including the thermostatted sampler it is recommended to position the modules in two stacks, see [Figure 8](#) on page 38. Make sure that in this configuration there is 25 cm (10 inches) space on either side of the thermostatted sampler for the circulation of air.

## Environment

Your autosampler will work within specifications at ambient temperatures and relative humidity as described in [Table 3](#) on page 27.

### CAUTION

Condensation within the autosampler

Condensation will damage the system electronics.

- Do not store, ship or use your autosampler under conditions where temperature fluctuations could cause condensation within the autosampler.
  - If your autosampler was shipped in cold weather, leave it in its box and allow it to warm slowly to room temperature to avoid condensation.
-

## Physical Specifications

**Table 3** Physical Specifications - sampler (G1367B/D / G1377A)

Type	Specification	Comments
Weight	15.5 kg (34.2 lbs)	
Dimensions (height × width × depth)	200 × 345 × 440 mm (8 × 13.5 × 17 inches)	
Line voltage	100 – 240 VAC, ±10%	Wide-ranging capability
Line frequency	50 or 60 Hz, ±5%	
Power consumption (apparent power)	300 VA	Maximum
Power consumption (active power)	200 W	Maximum
Ambient operating temperature	4 to 55 °C (41 to 131 °F)	
Ambient non-operating temperature	-40 to 70 °C (-4 to 158 °F)	
Humidity	< 95%, at 25 to 40 °C (77 to 104 °F)	Non-condensing
Operating Altitude	Up to 2000 m (6500 ft)	
Non-operating altitude	Up to 4600 m (14950 ft)	For storing the autosampler
Safety standards: IEC, CSA, UL	Installation Category II, Pollution Degree 2	

## Performance Specifications

**Table 4** Performance specifications Agilent 1200 Series High Performance Autosampler

Type	Specification
GLP features	Early maintenance feedback (EMF), electronic records of maintenance and errors
Communications	Controller-area network (CAN). RS232C, APG-remote standard, optional four external contact closures and BCD vial number output
Safety features	Leak detection and safe leak handling, low voltages in maintenance areas, error detection and display
Injection range	0.1 – 100 µl in 0.1 µl increments Up to 1500 µl with multiple draw (hardware modification required)
Precision	Typically < 0.25% RSD from 5 – 100 µl, Typically < 1% RSD from 1 – 5 µl variable volume
Pressure range	400 bar (5880 psi)
Sample viscosity range	0.2 – 5 cp
Sample capacity	2 × well plates (MTP) + 10 × 2 ml vials 108 × 2-mL vials in 2 × 54 vial plate plus 10 additional 2 mL vials 30 × 6-mL vials in 2 × 15 vial plate plus 10 additional 2 mL vials 54 Eppendorf tubes (0.5/1.5/2.0mL) in 2 × 27 Eppendorf tube plate  Also compatible with the Agilent 1200 Series sample capacity extension for further expansion of the sample capacity
Injection cycle time	Typically < 30 s using following standard conditions: Default draw speed: 200 µl/min Default eject speed: 200 µl/min Injection volume: 5 µl
Carry-over	Typically < 0.01% using the following conditions: Column: 125 × 4 mm Hypersil ODS, 5 µm Mobile phase: Water/Acetonitrile = 80/20 Flow rate: 1 ml/min Injection volume: 1 µl caffeine (1 mg/ml), 5 µl water to test carryover Outside wash of needle before injection: 20 sec with water using flush port

**Table 5** Performance specifications Agilent 1200 Series High Performance Autosampler SL+

Type	Specification
GLP features	Early maintenance feedback (EMF), electronic records of maintenance and errors
Communications	Controller-area network (CAN), RS232C, APG-remote standard, optional four external contact closures and BCD vial number output
Safety features	Leak detection and safe leak handling, low voltages in maintenance areas, error detection and display
Injection range	0.1 – 40 µl in 0.1 µl increments Up to 100 µl with extended injection volume (hardware modification required)
Precision	Typically < 0.25% RSD from 5 – 40 µl, Typically < 0.5% RSD from 2 – 5 µl, Typically < 0.7% RSD from 1 – 2 µl volume. Measured with injections of benzylalcohol.
Pressure range	Up to 600 bar (8700 psi)
Sample viscosity range	0.2 – 5 cp
Sample capacity	2 × well plates (MTP) + 10 × 2 ml vials 108 × 2-mL vials in 2 × 54 vial plate plus 10 additional 2 mL vials 30 × 6-mL vials in 2 × 15 vial plate plus 10 additional 2 mL vials 54 Eppendorf tubes (0.5/1.5/2.0mL) in 2 × 27 Eppendorf tube plate  Also compatible with the Agilent 1200 Series sample capacity extension for further expansion of the sample capacity

## 2 Site Requirements and Specifications

### Performance Specifications

**Table 5** Performance specifications Agilent 1200 Series High Performance Autosampler SL+

Injection cycle time	Typically < 17 s using following standard conditions: Default draw speed: 100 µl/min Default eject speed: 100 µl/min Injection volume: 5 µl
Carry-over	Typically < 0.004% using the following conditions: Column: Agilent Zorbax SB-C18, 21x50mm 1.8µm (P/N 827700-902) Mobile Phase: A: H2O + 0.05% TFA, B: ACN+ 0.045 TFA Gradient: 0.1min 10% B, 3.1 min 90% B, 3.2 min 90 % B, 3.21 10 %B, 4.5min stop Flow rate: 0.5 ml/min Temperature: 25C Wavelength: 257 nm Sample : 1200 ng/ul Chlorhexidine (dissolved in H2O with 0.1% TFA), 1ul injected and measure both on Agilent 6410 QQQ and G1315C DAD Wash solution: H2O with 0.1% TFA (5 sec)

**Table 6** Performance Specifications Agilent 1200 Series Micro Well Plate Autosampler

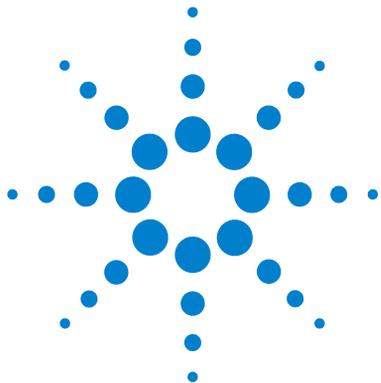
Type	Specification
GLP features	Early maintenance feedback (EMF), electronic records of maintenance and errors
Communications	Controller-area network (CAN). RS232C, APG-remote standard, optional four external contact closures and BCD vial number output
Safety features	Leak detection and safe leak handling, low voltages in maintenance areas, error detection and display
Injection range	0.01– 8 µl in 0.01 µl increments with the small loop capillary 0.01– 40 µl in 0.01 µl increments with the extended loop capillary
Precision	Typically < 0.5% RSD of peak areas from 5 – 40 µl, Typically < 1% RSD from 1 – 5 µl Typically < 3% RSD from 0.2 – 1 µl
Pressure range	up to 400 bar (5880 psi)
Sample viscosity range	0.2 – 5 cp
Sample capacity	2 × well-plates (MTP) + 10 × 2 ml vials 108 x 2-mL vials in 2 x 54 vial plate plus 10 additional 2 mL vials 30 x 6-mL vials in 2 x 15 vial plate plus 10 additional 2 mL vials 54 Eppendorf tubes (0.5/1.5/2.0 mL) in 2 x 27 Eppendorf tube plate

**Table 6** Performance Specifications Agilent 1200 Series Micro Well Plate Autosampler

Type	Specification
Injection cycle time	Typically < 30 s using following standard conditions: Default draw speed: 4 µl/min Default eject speed: 10 µl/min Injection volume: 0.1 µl
Carry-over	Typically < 0.05% using the following conditions: Column: 150 x 0.5 mm Hypersil ODS, 3 µm Mobile phase: Water/Acetonitrile = 85/15 Column Flow rate: 13 µl/min Injection volume: 1 µl caffeine (=25 ng caffeine), 1 µl water to test carryover Outside wash of needle before injection: 20 sec with water using flush port

## **2 Site Requirements and Specifications**

### **Performance Specifications**



## 3 Installing the Autosampler

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## Unpacking the Sampler

**NOTE**

If you need to ship the autosampler at a later date, always use the shipping protection foam parts (see “[Transporting the Sampler](#)” on page 53).

---

### Damaged Packaging

Upon receipt of your autosampler, inspect the shipping containers for any signs of damage. If the containers or cushioning material are damaged, save them until the contents have been checked for completeness and the autosampler has been mechanically and electrically checked. If the shipping container or cushioning material is damaged, notify the carrier and save the shipping material for the carrier’s inspection.

### Delivery Checklist

Ensure all parts and materials have been delivered with the autosampler. For this compare the shipment content with the checklist included in each instrument box. Please report missing or damaged parts to your local Agilent Technologies sales and service office.

### Accessory Kits

Each shipment contents an Accessory kit with the necessary tools to install the system and to have an operating system.

- The Accessory kit (G1367-68705) shown in [Table 7](#) on page 35 is shipped with the (G1367B/D) high performance autosampler and SL+ version.
- The Accessory kit (G1377-68705) shown in [Table 8](#) on page 35 is shipped with the (G1377A) micro well plate autosampler.

**Table 7**    High Performance Autosampler and SL+ version Accessory Kit Contents  
 G1367-68705

Description	Quantity	Part Number
Capillary sampler-column (380 mm, 0.17 mm ID)	1	<b>01090-87306</b>
96 well plate 0.5 ml, PP (pack of 10)	1	<b>5042-1386</b>
Tubing assembly	1	<b>5063-6527</b>
Filter kit	1	<b>5064-8240</b>
CAN cable, 1 m	1	<b>5181-1519</b>
Vials, screw cap 100/pk	1	<b>5182-0716</b>
Blue screw caps 100/pk	1	<b>5182-0717</b>
Hex key 9/64 inch (for injection-valve screws)	1	<b>8710-0060</b>
Wrench, 4mm both ends	2	<b>8710-1534</b>
Rheotool socket wrench 1/4 inch	1	<b>8710-2391</b>
Hex key 4.0 mm, 15 cm long, T-handle	1	<b>8710-2392</b>
Hex key 9/64 inch, 15 cm long, T-handle	1	<b>8710-2394</b>
Hex key 2.0 mm	1	<b>8710-2438</b>
ESD wrist strap	1	<b>9300-1408</b>
Air channel adapter	1	<b>G1329-43200</b>
Capillary WPS to column (250 mm, 0.17 mm ID)	1	<b>G1367-87304</b>
WPS leak kit	1	<b>G1367-60006</b>
Tool for micro seat capillary	1	G1377-44900

**Table 8**    Micro well plate Autosampler Accessory Kit Contents G1377-68705

Description	Quantity	Part Number
96 well plate 0.5 ml, PP (pack of 10)	1	<b>5042-1386</b>
Tubing assembly	1	<b>5063-6527</b>

### 3 Installing the Autosampler

#### Unpacking the Sampler

**Table 8** Micro well plate Autosampler Accessory Kit Contents G1377-68705

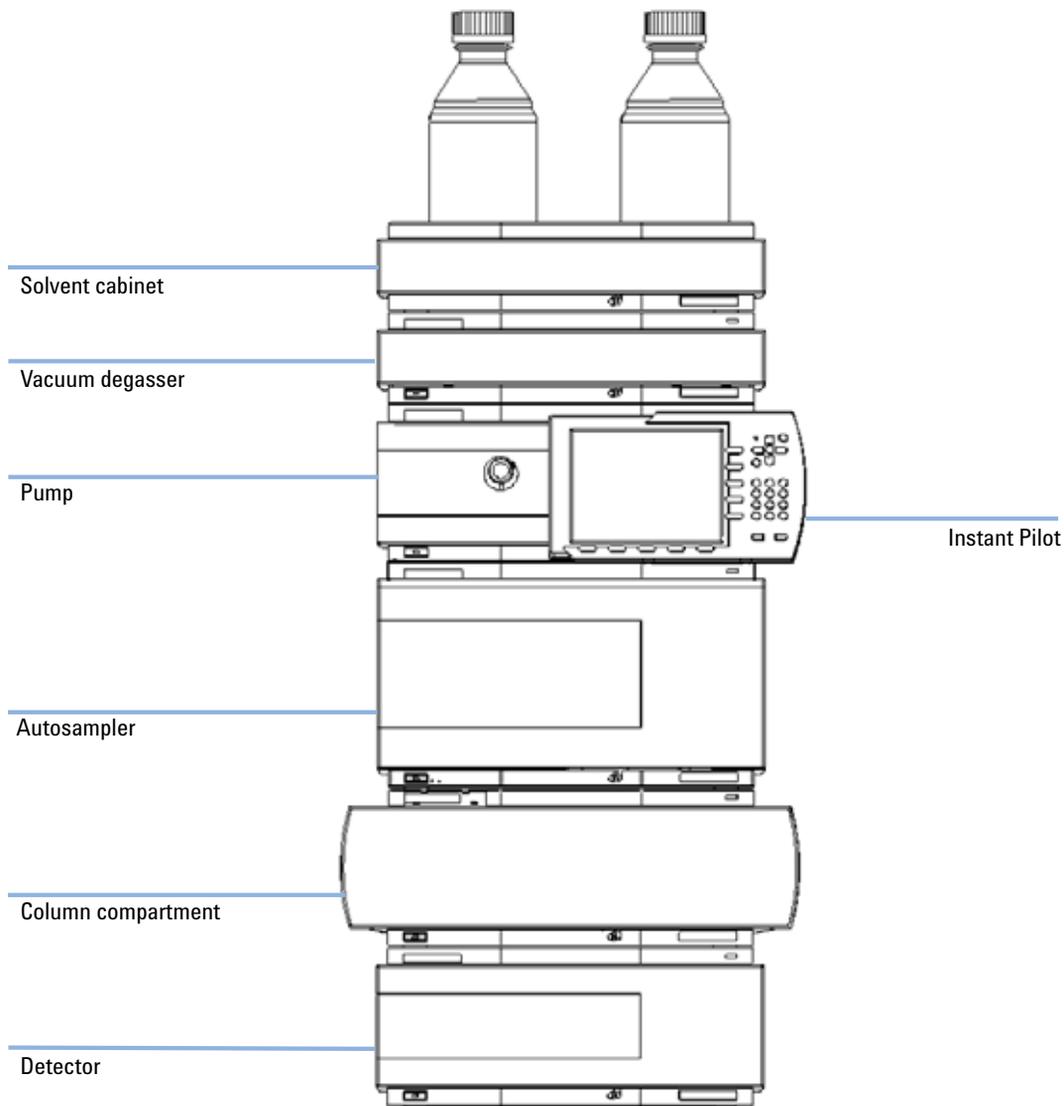
<b>Description</b>	<b>Quantity</b>	<b>Part Number</b>
Filter kit	1	<b>5064-8240</b>
CAN cable, 1 m	1	<b>5181-1519</b>
Vials, screw cap 100/pk	1	<b>5182-0716</b>
Blue screw caps 100/pk	1	<b>5182-0717</b>
Hex key 9/64 inch (for injection-valve screws)	1	<b>8710-0060</b>
Wrenches 1/4 — 5/16 inch	2	<b>8710-0510</b>
Wrench 4.0 mm open end	1	<b>8710-1534</b>
Rheotool socket wrench 1/4 inch	1	<b>8710-2391</b>
Hex key 4.0 mm, 15 cm long, T-handle	1	<b>8710-2392</b>
Hex key 9/64 inch, 15 cm long, T-handle	1	<b>8710-2394</b>
Hex key 2.5 mm, 15 cm long, straight handle	1	<b>8710-2412</b>
Hex key 2.0 mm	1	<b>8710-2438</b>
ESD wrist strap	1	<b>9300-1408</b>
Torque adapter	1	<b>G1315-45003</b>
Air channel adapter	1	<b>G1329-43200</b>
Capillary sampler-column (500 mm, 0.05 mm ID)	1	<b>G1375-87304</b>
40 µl Loop capillary	1	<b>G1377-87300</b>
WPS leak kit	1	<b>G1367-60006</b>
Seat capillary (150 mm, 0.075 mm ID)	1	G1367-87316
Tool for micro seat capillary	1	G1377-44900

## Optimizing the Stack Configuration

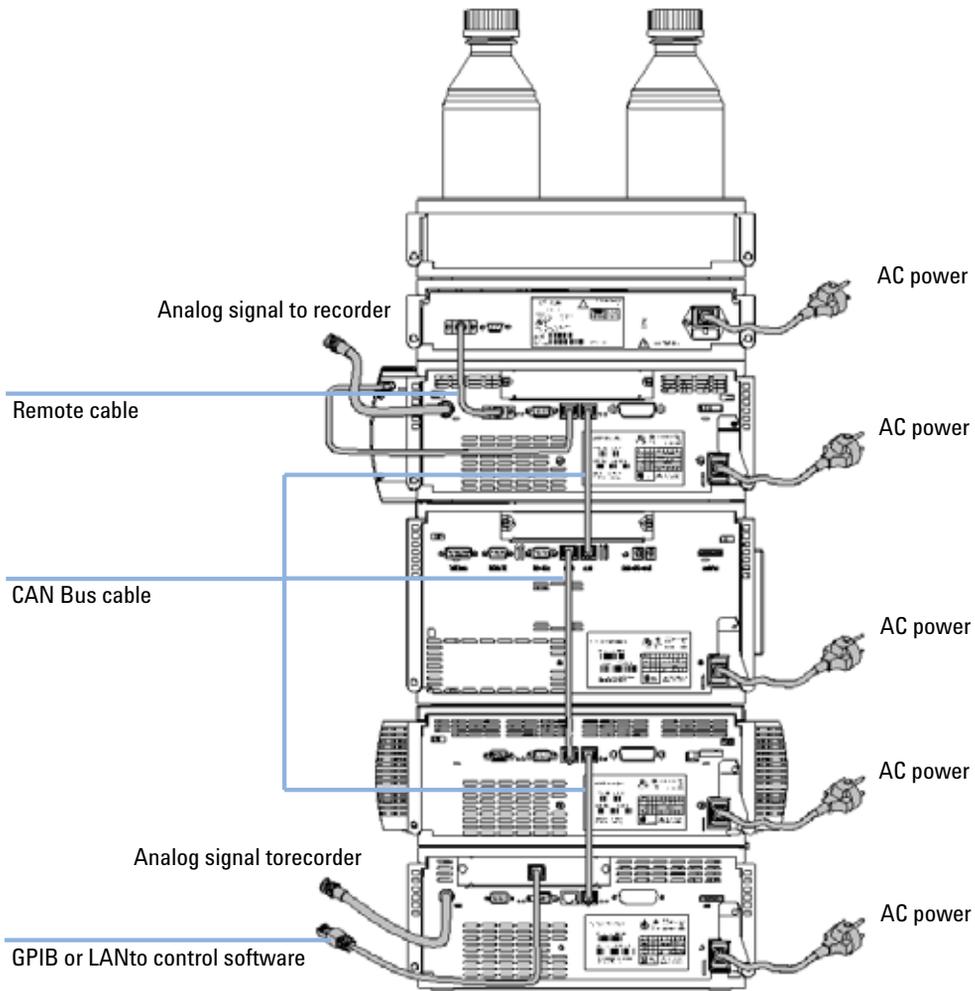
If your autosampler is part of a system, you can ensure optimum performance, ensuring minimum delay volume by installing the following configuration. [Figure 8](#) on page 38 and [Figure 9](#) on page 39 show the configuration recommended for the sampler. [Figure 10](#) on page 40 and [Figure 11](#) on page 41 show the configuration recommended for the thermostatted sampler.

### 3 Installing the Autosampler

#### Optimizing the Stack Configuration



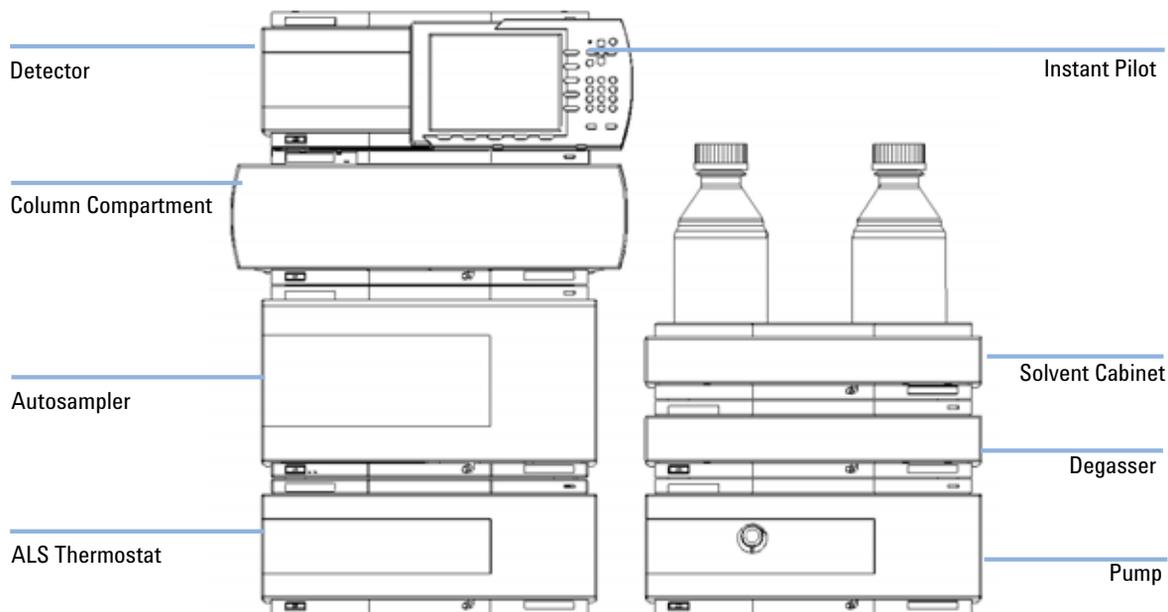
**Figure 8** Recommended Stack Configuration - Well Plate Autosampler (Front View)



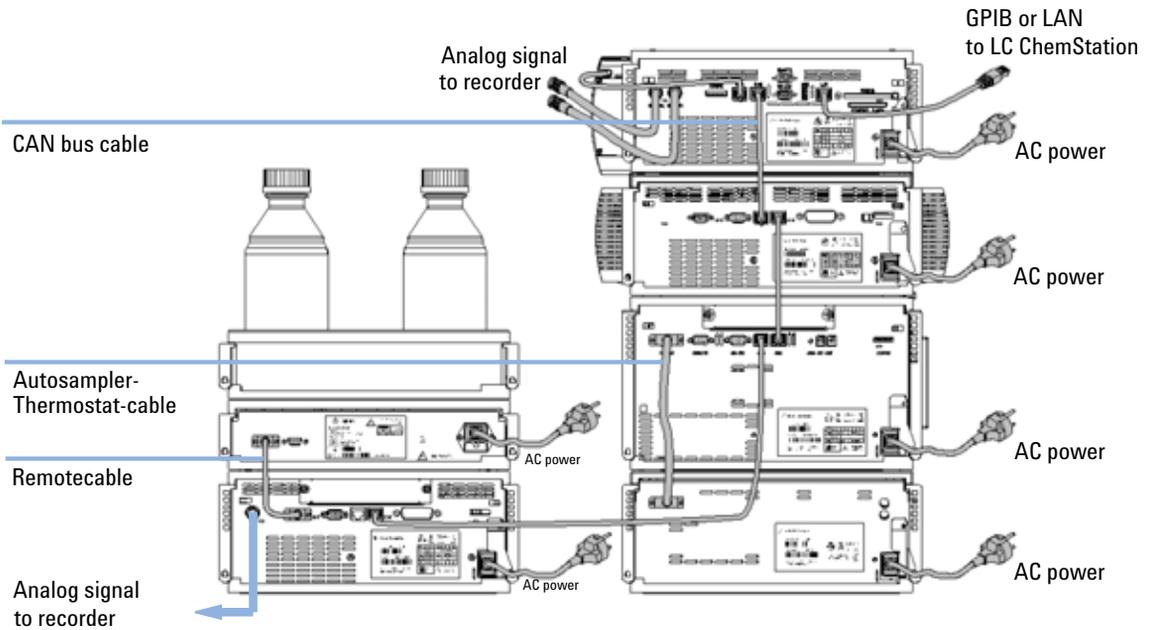
**Figure 9** Recommended Stack Configuration - Well Plate Autosampler (Rear View)

### 3 Installing the Autosampler

#### Optimizing the Stack Configuration



**Figure 10** Recommended Stack Configuration - Thermostatted Autosampler (Front View)



**Figure 11** Recommended Stack Configuration - Thermostatted Autosampler (Rear View)

## Installing the Autosampler

Parts required	#	Description
	1	Sampler Power cord.

**Preparations**

- Locate bench space Provide power connections Unpack the sampler

### WARNING

***Instruments are partially energized when switched off***

**The power supplies still use some power, even if the power switch on the front panel is turned off.**

- To disconnect the thermostatted autosampler from line power, unplug the power cord from the autosampler and the ALS thermostat.
- Make sure that it is always possible to access the power plug.

### WARNING

***Personal injury***

**To avoid personal injury, keep fingers away from the needle area during autosampler operation.**

- Do not attempt to insert or remove a vial or a plate when the needle is positioned.

### CAUTION

***“Defective on arrival” problems***

If there are signs of damage to the autosampler, please do not attempt to install the autosampler. Inspection by Agilent is required to evaluate if the instrument is in good condition or damaged.

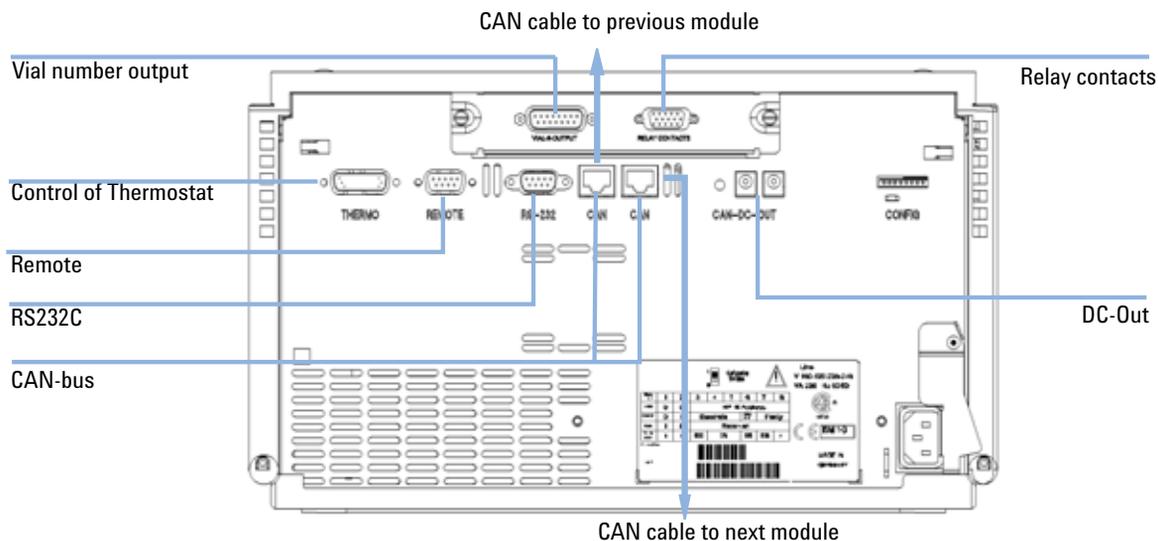
- Notify your Agilent sales and service office about the damage.
- An Agilent service representative will inspect the instrument at your site and initiate appropriate actions.

- 1 Install the LAN interface board in the sampler (if required).
- 2 Remove the adhesive tape which covers the side and front doors.

- 3** Open the front door and remove the left side door.
- 4** Remove the transport protection foam.
- 5** Re-install the corrugated waste tube in the plastic port.
- 6** Re-install the left side door (take care of the magnet at the back).
- 7** Place the autosampler in the stack or on the bench in all horizontal position.
- 8** Ensure the power switch at the front of the sampler is OFF.
- 9** Connect the power cable to the power connector at the rear of the sampler.
- 10** Connect the CAN cable to the other Agilent 1200 modules.
- 11** If a Agilent ChemStation is the controller, connect the LAN connection to the LAN interface
- 12** Connect the APG remote cable (optional) for non Agilent 1200 Series instruments.
- 13** Ensure the side panel is correctly installed.
- 14** Turn ON power by pushing the button at the lower left hand side of the sampler.
- 15** Close the front door. The exhaust fan will turn ON and remove the vapor from the tray compartment. After 1-2 minutes the sampler will start the hardware initialisation process. At the end of this process the status LED should be off.

### 3 Installing the Autosampler

#### Installing the Autosampler



**Figure 12** Cable Connections

#### NOTE

The sampler is turned ON when the line power switch is pressed and the green indicator lamp is illuminated. The sampler is turned OFF when the line power switch is protruding and the green light is OFF.

## Installing a Thermostatted Autosampler

Parts required	#	Description
	1	Sampler and thermostat Power cord.

**Preparations**

- Locate bench space Provide power connections Unpack the sampler and the thermostat

### WARNING

*Instrument is partially energized when switched off*

**The power supply still uses some power, even if the power switch at the front of the panel is turned off.**

→ To disconnect the sampler from the line, unplug the power cord.

---

### WARNING

*Damaged electronics*

**Disconnecting or reconnecting the sampler to thermostat cable when the power cords are connected to either of the two modules will damage the electronics of the modules.**

→ Make sure the power cords are unplugged before disconnecting or reconnecting the sampler to thermostat cable.

---

### WARNING

*Damage through condensation*

**If the condensation tube is located in liquid the condensed water cannot flow out of the tube and the outlet is blocked. Any further condensation will then remain in the instrument. This may damage the instruments electronics.**

→ Make sure that the condensation tube is always above the liquid level in the vessel.

---

### 3 Installing the Autosampler

#### Installing a Thermostatted Autosampler

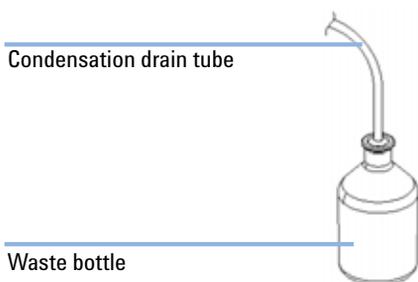
#### WARNING

#### *Personal injury*

To avoid personal injury, keep fingers away from the needle area during autosampler operation.

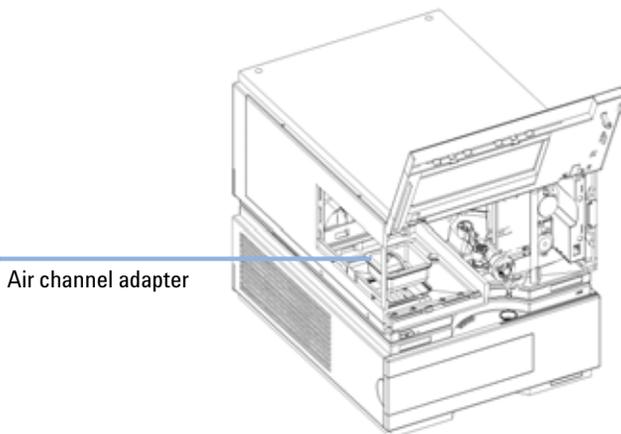
→ Do not attempt to insert or remove a vial or a plate when the needle is positioned.

- 1 Place the thermostat on the bench.
- 2 Remove the front cover and route the condensation drain tube to the waste bottle.



**Figure 13** Condensation leak outlet

- 3 Install the LAN interface board in the sampler (if required).
- 4 Remove the adhesive tape which covers the side and front doors.
- 5 Open the front door and remove the left side door.
- 6 Remove the transport protection foam.
- 7 Re-install the corrugated waste tube in the plastic port.
- 8 Re-install the left side door (take care of the magnet at the back).
- 9 Place the sampler on top of the thermostat. Make sure that the sampler is correctly engaged in the thermostat locks.
- 10 Remove the tray and the plastic cover from the tray base, place the air channel adapter into the sampler tray base. Make sure the adapter is fully pressed down. This assures that the cold airstream from the thermostat is correctly guided to the tray area of the well plate sampler.

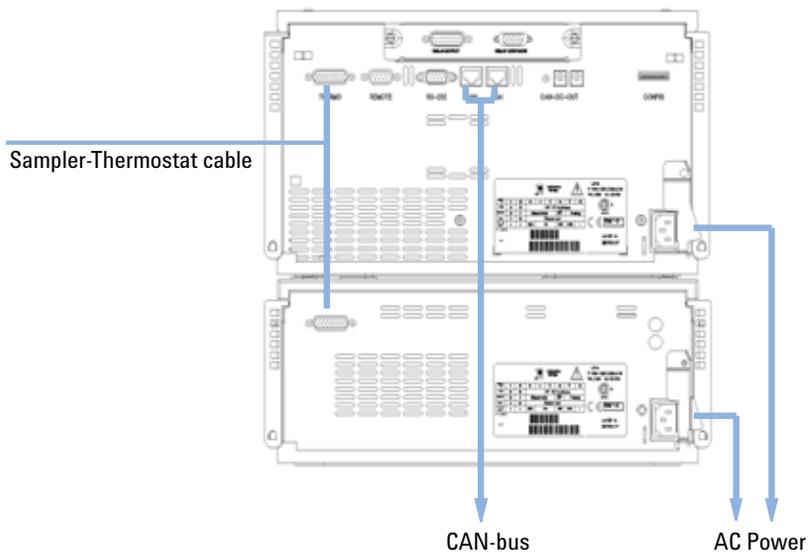


**Figure 14** Installation of Thermostat and Autosampler

- 11** Re-install the tray.
- 12** Ensure the power switch on the front of the sampler is OFF and the power cables are disconnected.
- 13** Connect the cable between the sampler and the thermostat, see [Figure 15](#) on page 48.
- 14** Connect the power cables to the power connectors.
- 15** Connect the CAN cable to other Agilent 1200 series modules.
- 16** If a Agilent ChemStation is the controller, connect the LAN connection to the LAN interface
- 17** Connect the APG remote cable (optional) for non Agilent 1200 Series instruments.
- 18** Ensure the side panel is correctly installed.
- 19** Turn ON power by pushing the button at the lower left hand side of the sampler.
- 20** Close the front door.  
The exhaust fan will turn ON and remove the vapor from the tray compartment. After 1-2 minutes the sampler will start tile hardware initialisation process. At the end of this process the status LED should be off.

### 3 Installing the Autosampler

#### Installing a Thermostatted Autosampler



**Figure 15** Connection at the rear of thermostatted Autosampler

#### NOTE

The sampler is turned ON when the line power switch is pressed and the green indicator lamp is illuminated. The sampler is turned OFF when the line power switch is protruding and the green light is OFF.

## Flow Connections to the Sampler

Parts required	#	Description
	1	Parts from the accessory kits, see <a href="#">“Accessory Kits”</a> on page 34

**Preparations**

- Sampler is installed in the LC system

### WARNING

**When opening capillary or tube fittings solvents may leak out.**

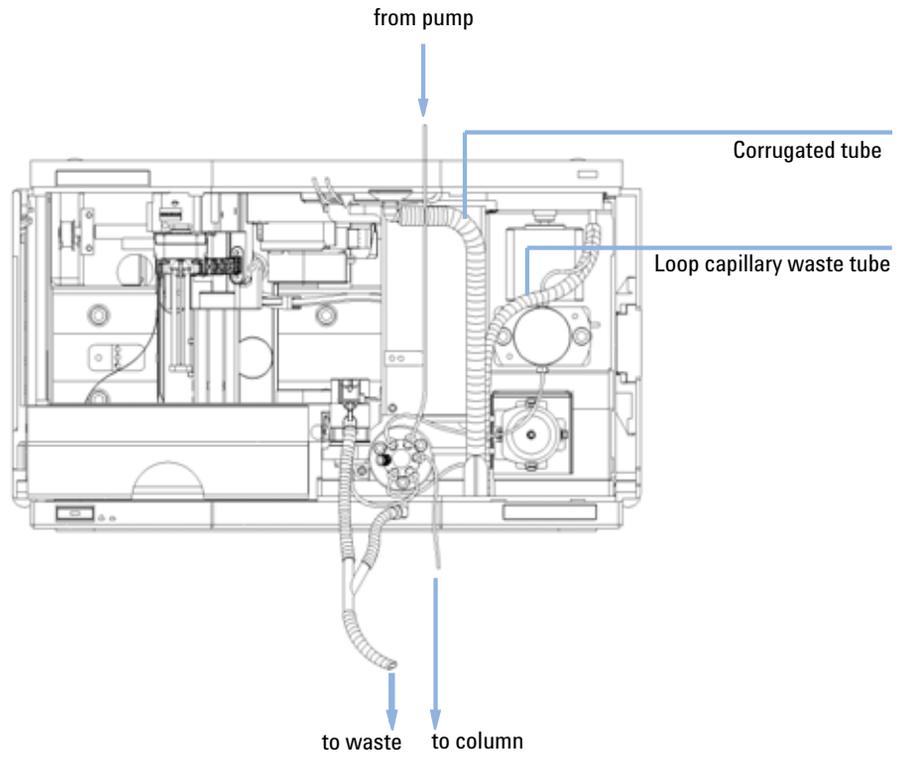
**The handling of toxic and hazardous solvents and reagents can hold health risks.**

→ Please observe appropriate safety procedures (for example, goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the solvent vendor, especially when toxic or hazardous solvents are used.

- 
- 1 Connect the pump outlet capillary to port 1 of the injection valve.
  - 2 Connect column-compartment inlet capillary to port 6 of the injection valve.
  - 3 Connect the corrugated waste tube to the seat adapter and the solvent waste from the leak plane.
  - 4 Ensure that the waste tube is positioned inside the leak channel.
  - 5 Drive the tube from the peristaltic flush pump to the solvent bottle in the solvent cabinet
  - 6 Seat capillary: see recommendations in [“Choice of Seat Capillary”](#) on page 80

### 3 Installing the Autosampler

Flow Connections to the Sampler



**Figure 16** Hydraulic Connections

## Installing the Sample Tray

- 1 Press the bottom on the right side to release the front door.
- 2 Lift the front door.
- 3 Load the sample tray with sample well plates and vials as required.
- 4 Slide the sample tray into the autosampler so that the rear of the sample tray is seated firmly against the rear of the sample-tray area.
- 5 Press the front of the sample tray down to secure the tray in the autosampler.

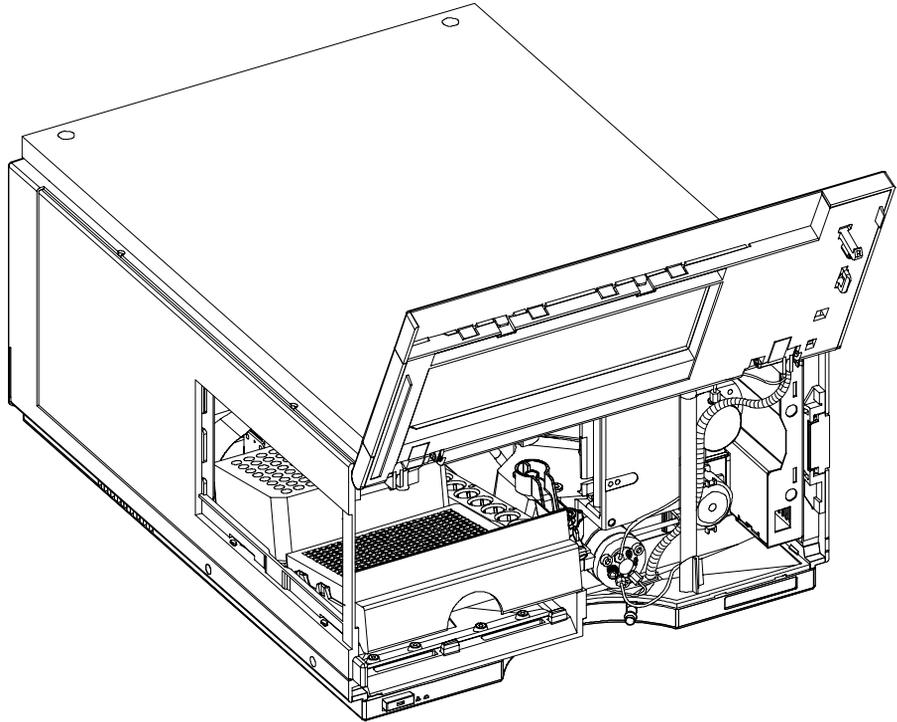
### NOTE

If the tray pops out of position the air channel adapter is not correctly inserted.

---

### 3 Installing the Autosampler

#### Installing the Sample Tray



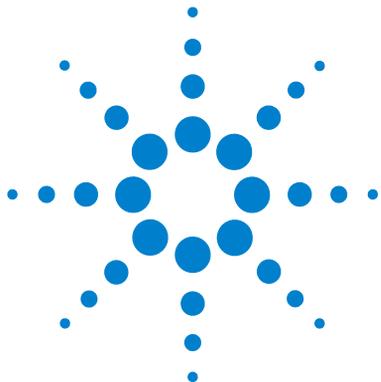
**Figure 17** Installing the Sample Tray

## Transporting the Sampler

When moving the autosampler inside the laboratory, no special precautions are needed. However, if the autosampler needs to be shipped to another location via carrier, ensure:

- The transport assembly is in the park position. Use the Lab Monitor and Diagnostic software or the Instant Pilot for this command.
- The vial tray and the sample transport mechanism is secured with the transport protection foam.

### **3** **Installing the Autosampler** Transporting the Sampler



## 4 Using the Autosampler

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List of Recommended Vials and Caps 59

Configure Well Plate Types 61

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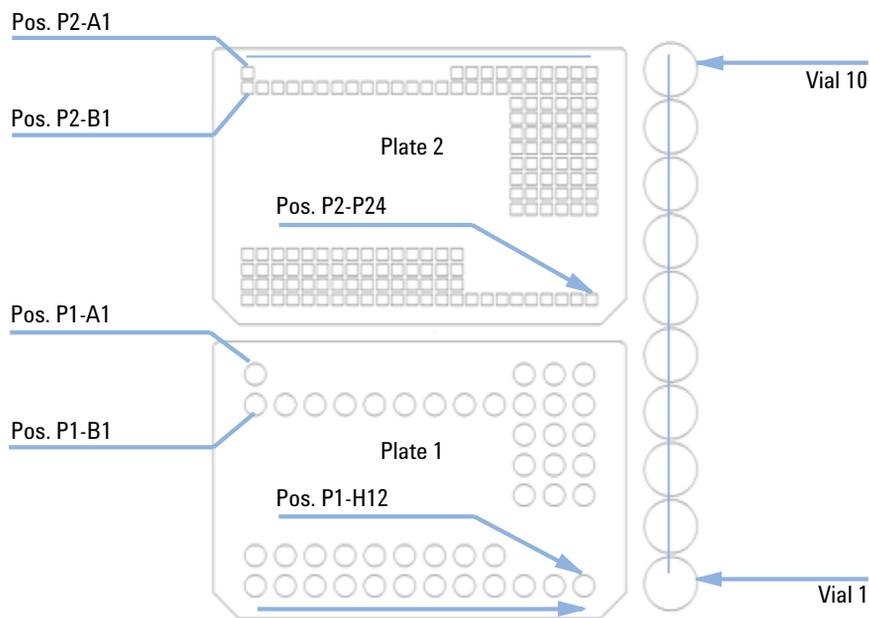


## Sample Trays

### Supported Trays for an Autosampler

**Table 9** Trays for an Autosampler

G2258-60011	Tray for 2 well plates or vial plates and 10 x 2 ml vials
-------------	---



**Figure 18** Numbering of vial and well plate position

## List of Recommended Plates and Closing Mat

### WARNING

#### *Explosive gas mixtures*

There is a risk of building explosive gas mixtures in the instrument if flammable solvents are used.

- Cover the plates.
- Remove the plates from the sampler after turning it OFF.

### WARNING

#### *Contamination with adhesives*

Closing mats with adhesive can give some contamination in the system. The adhesive is soluble in most of the solvents used in HPLC.

- In general do not use closing mats with adhesive. The sampler has no prepunch needle, therefore the adhesive will clog the needle after several injections.

**Table 10** Recommended plates and closing mat

Description	Rows	Columns	Plate height	Volume (µl)	Part Number	Package
384Agilent	16	24	14.4	80	<b>5042-1388</b>	30
384Corning	16	24	14.4	80	No Agilent PN	
384Nunc	16	24	14.4	80	No Agilent PN	
96Agilent	8	12	14.3	400	<b>5042-1386</b> <b>5042-1385</b>	10 120
96Agilent conical	8	12	17.3	150	<b>5042-8502</b>	25
96CappedAgilent	8	12	47.1	300	<b>5065-4402</b>	1
96Corning	8	12	14.3	300	No Agilent PN	
96CorningV	8	12	14.3	300	No Agilent PN	
96DeepAgilent31mm	8	12	31.5	1000	<b>5042-6454</b>	50

## 4 Using the Autosampler

### List of Recommended Plates and Closing Mat

**Table 10** Recommended plates and closing mat

Description	Rows	Columns	Plate height	Volume (µl)	Part Number	Package
96DeepNunc31mm	8	12	31.5	1000	No Agilent PN	
96DeepRitter41mm	8	12	41.2	800	No Agilent PN	
96Greiner	8	12	14.3	300	No Agilent PN	
96GreinerV	8	12	14.3	250	No Agilent PN	
96Nunc	8	12	14.3	400	No Agilent PN	
Closing mat for all 96 Agilent plates	8	12			<b>5042-1389</b>	50

**Table 11** Recommended Vial plates

Description	Part Number
• Vial plate for 54 x 2 ml vials (6/pk)	<b>G2255-68700</b>
• Vial plate for 15 x 6 ml vials (1/pk)	<b>5022-6539</b>
• Vial Plate for 27 Eppendorf tubes	<b>5022-6538</b>

## List of Recommended Vials and Caps

**Table 12** Crimp Top Vials

Description	Volume (ml)	100/Pack	1000/Pack	100/Pack (silanized)
Clear glass	2	5181-3375	5183-4491	
Clear glass, write-on spot	2	5182-0543	5183-4492	5183-4494
Amber glass, write-on spot	2	5182-3376	5183-4493	5183-4495

**Table 13** SnapTop Vials

Description	Volume (ml)	100/Pack	1000/Pack	100/Pack (silanized)
Clear glass	2	5182-0544	5183-4504	5183-4507
Clear glass, write-on spot	2	5182-0546	5183-4505	5183-4508
Amber glass, write-on spot	2	5182-0545	5183-4506	5183-4509

**Table 14** Screw Top Vials

Description	Volume (ml)	100/Pack	1000/Pack	100/Pack (silanized)
Clear glass	2	5182-0714	5183-2067	5183-2070
Clear glass, write-on spot	2	5182-0715	5183-2068	5183-2071
Amber glass, write-on spot	2	5182-0716	5183-2069	5183-2072

## 4 Using the Autosampler

### List of Recommended Vials and Caps

**Table 15** Crimp Caps

<b>Description</b>	<b>Septa</b>	<b>100/Pack</b>
Silver aluminum	Clear PTFE/red rubber	<b>5181-1210</b>
Silver aluminum	Clear PTFE/red rubber	<b>5183-4498</b> (1000/Pack)
Blue aluminum	Clear PTFE/red rubber	<b>5181-1215</b>
Green aluminum	Clear PTFE/red rubber	<b>5181-1216</b>
Red aluminum	Clear PTFE/red rubber	<b>5181-1217</b>

**Table 16** Snap Caps

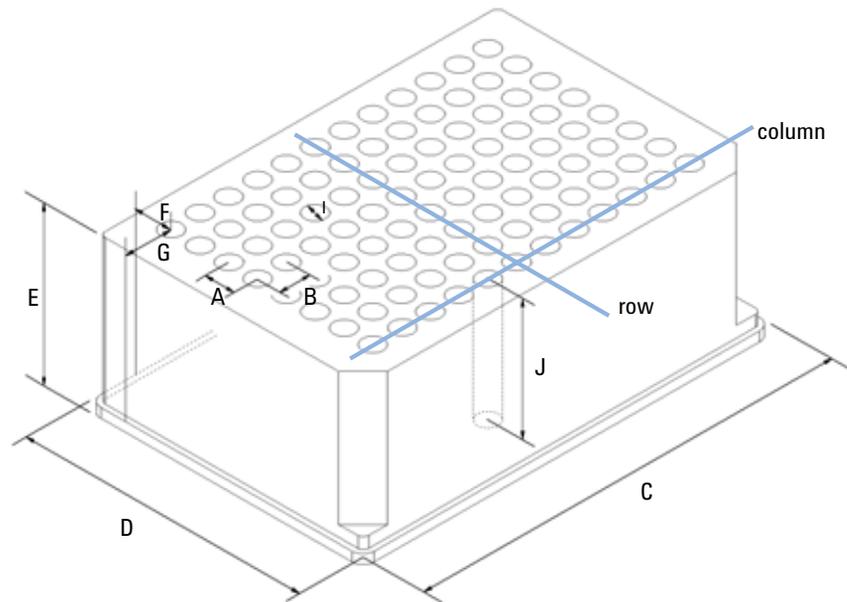
<b>Description</b>	<b>Septa</b>	<b>100/Pack</b>
Clear polypropylene	Clear PTFE/red rubber	<b>5182-0550</b>
Blue polypropylene	Clear PTFE/red rubber	<b>5182-3458</b>
Green polypropylene	Clear PTFE/red rubber	<b>5182-3457</b>
Red polypropylene	Clear PTFE/red rubber	<b>5182-3459</b>

**Table 17** Screw Caps

<b>Description</b>	<b>Septa</b>	<b>100/Pack</b>
Blue polypropylene	Clear PTFE/red rubber	<b>5182-0717</b>
Green polypropylene	Clear PTFE/red rubber	<b>5182-0718</b>
Red polypropylene	Clear PTFE/red rubber	<b>5182-0719</b>
Blue polypropylene	Clear PTFE/silicone	<b>5182-0720</b>
Green polypropylene	Clear PTFE/silicone	<b>5182-0721</b>
Red polypropylene	Clear PTFE/silicone	<b>5182-0722</b>

## Configure Well Plate Types

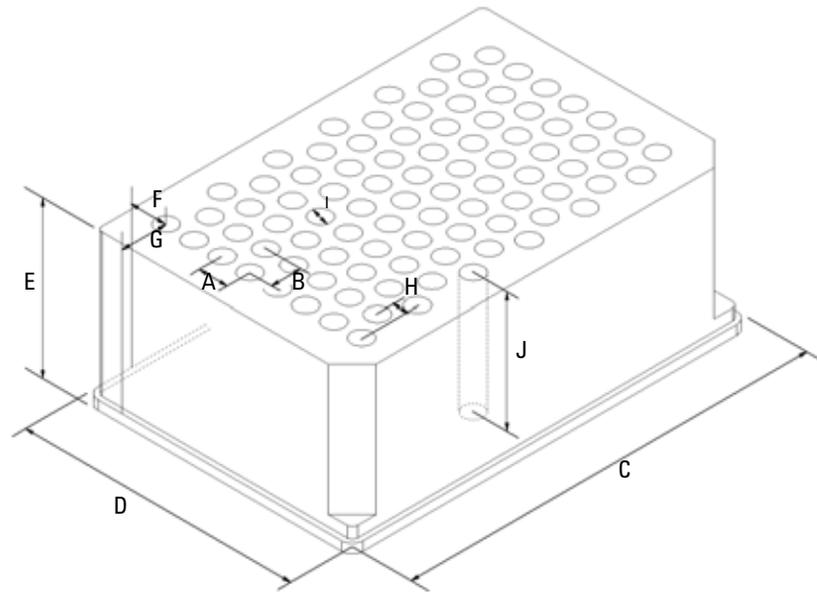
If the plate you are using is not found on the “[List of Recommended Plates and Closing Mat](#)” on page 57 you may configure a custom plate. Measure the exact dimensions of the plate as marked below and enter the values in the plate configuration table of the ChemStation.



**Figure 19** Well Plate Dimensions (straight)

## 4 Using the Autosampler

### Configure Well Plate Types



**Figure 20** Well Plate Dimensions (staggered)

**Table 18** Well Plate Dimensions

Location	Description	Definition	Limits
	Rows	Number of rows on the plate	up to 16
	Columns	Number of columns on the plate	up to 24
	Volume	Volume (in $\mu\text{l}$ ) of a sample vessel	
A	Row distance	Distance (in mm) between the center of two rows	
B	Column distance	Distance (in mm) between the center of two columns	
C	Plate length	X size (in mm) at the bottom of the plate	127.75+/- 0.25 mm (SBS Standard)

**Table 18** Well Plate Dimensions

Location	Description	Definition	Limits
D	Plate width	Y size (in mm) at the bottom of the plate	85.50+/-0.25 mm (SBS Standard)
E	Plate height	Size (in mm) from the bottom to the top of the plate	up to 47 mm
F	Row offset	Distance (in mm) from the back edge (bottom) to the center of the first hole (A1)	
G	Column offset	Distance (in mm) from the left edge (bottom) to the center of the first hole (A1)	
H	Column shift	Offset (in mm) to Y when the rows are not straight but staggered	
I	Well diameter	Diameter (in mm) of the well	at least 4 mm
J	Well depth	Distance (in mm) from the top of the plate to the bottom of the well	up to 45 mm

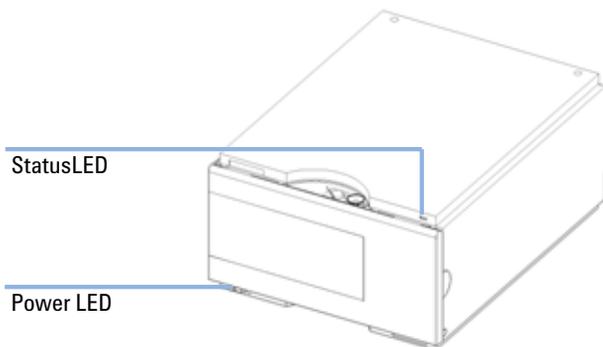
**NOTE**

The distances need to be measured with high precision. It is recommended to use calipers.

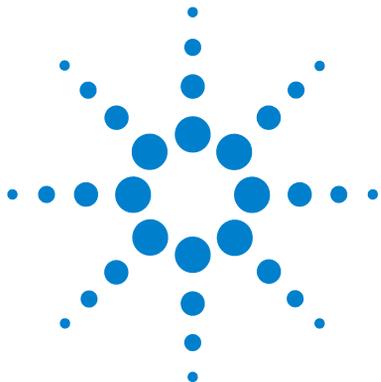
## Turn ON and Initialization Steps

A successful turn-on/initialization takes about 3.5 minutes, and consists of five steps

- 1** WPS turn on, begins when the main power button is pushed ON. Power indicator turns green. Front cover latch activates immediately.
- 2** Main fan and exhaust fan turn-on immediately.
- 3** Main board self-test begins. Status indicator tests red, green and yellow, then goes to yellow. This takes about 20 seconds (from turn-on). The status indicator remains yellow until the initialization process is complete. The user interface indicates “initializing” during this period.
- 4** The vapor blowout period begins. This lasts for about 2 minutes.
- 5** WPS sample transport and sampling unit initialization begins at the 2-minutes mark (from turn-on), if the front cover is closed. If the front cover is open at the 2 minutes mark, initialization will start only when the front cover is closed. Initialization takes about 1.5 minutes. When initialization is complete the needle is in the needle seat, the needle lock is down, and the status indicator is off.



**Figure 21** Instrument LED indicator



## 5 Optimizing Performance

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## Optimizing Performance

Autosamplers are more and more used in HPLC to improve the productivity in the laboratories and the consistency and accuracy of analytical results.

The informations below will help you on how to optimize some parameters to achieve best results for:

- lowest carry-over for reliable quantitative data
- Fast injection cycles for high throughput
- Low delay volume for fast gradient
- Precise injection volume

Specific information for optimizing the performance of the Agilent 1200 series high performance autosampler SL+ can be found in the *Agilent 1200 Series Rapid Resolution LC System User Manual*.

## Optimization for Lowest Carry-Over

### Optimization for Lowest Carry-Over

Carry over (CO) on 1100/1200 Agilent system is not only a topic for injection systems but may have multiple sources:

Hardware related

- sample loop
- needle outside
- needle inside
- needle seat
- seat capillary
- injection valve
- flush time
- wash vials
- fittings
- column (carry-over depends on frit design/material/blockage)
- surface activity of frits
- capillaries

Chemistry/Physics related:

- suitable sample solvent (has to be compatible with mobile phase)
- suitable wash solvent
- suitable mobile phase
- column packing material (e.g. interaction of basic sample with silanols of stationary phase)

The autosampler continuous flow-through design ensures that sample loop, needle inside, seat capillary, and the mainpass of the injection valve is always in the flow line. These parts are continuously flushed during an isocratic and also during a gradient analysis. The residual amount of sample remaining on the outside of the needle after injection may contribute to carry-over in some instances. When using small injection volumes or when injecting samples of

low concentration immediately after samples of high concentration, carry-over may become noticeable. Cleaning the needle in the flush port or using the automated needle wash enables the carry-over to be minimized and prevents also contamination of the needle seat.

## **Module dependant carry-over performance**

All Agilent 1200 series High Performance Autosampler are considering low carry-over. Nevertheless the Agilent 1200 series High Performance Autosampler SL+ is best performing regarding carry-over.

## **General recommendations for lowest carry-over**

Issues in setting up the experiments:

- Use a flush solvent which dissolves the sample well (e.g. aqueous/(organic) acidic for basic samples); set needle wash time to at least 10 sec.
- Use a sample solvent which is compatible with sample and mobile phase. Organic sample solvents (e.g. DMSO) injected into aqueous mobile phase often cause samples to partially deposit on surfaces causing high carry-over. Chlorhexidine, for example, dissolved as a free base in methanol and injected into an acidic aqueous mobile phase shows increased carryover than if it is dissolved in 0.1% TFA. Since it dissolves slowly (but well) in acidic aqueous solvents, it partially deposits on surfaces during the injection cycle.
- Take care at loop capillary change: Push loop capillary forward when tightening the fitting to the needle, ensuring gapless transition from loop to needle. A replaced needle-seat-pair may need 100-200 injections for best carry-over results

Routinely work:

- Prime flush pump for 30 sec. with appropriate solvent previous to the first run after usage outage.
- Ensure that the needle seat is not contaminated. For cleaning the needle seat see chapter “Cleaning the needle seat”.
- Use mainpass operation to avoid discrimination of samples.

- Notice backpressure of a new column; an increase of 10% over time may cause an 10 fold increase in carry-over due to the column.
- Blank vials can be used at least 30 injections.

## Specific recommendations if bypass operation is performed

Bypass operation can severely impact carry-over performance due to the fact that during gradient operation the sample path is not flushed with organic mobile phase. This may cause sample discrimination and/or adsorption of especially lipophilic components in loop, needle and seat flow path.

The term bypass operation in this context describes all cases where the Autosampler is switched to the “Bypass Mode” so that the exposure of the Autosampler’s internal flow path parts to the solvent flow coming from the pump may become too short. This may be the case:

- when overlapped Injection with option “when sample is flushed out” is selected
- when the delay volume is minimized by using “Automated Delay Volume Reduction”

This mode is not recommended as there may arise two sources for carry-over. The outlet groove of the injection valve may be contaminated with sample. This is the minor issue and can be resolved by performing steps for cleaning the injection valve (by method or by injector program). The much more problematic issue is that there may remain portions of sample in the sampler. Especially if the sample and sample solvent doesn’t fit to the mobile phase an arbitrarily large amount of sample may miss the column but stay in the main pass. The “Injector Purge Kit” was developed for this purpose. During run the syringe is used as purge pump and afterwards exchanges the purge solvent with (gradient) start conditions. Using this kit decreases the poor bypass carry-over significantly. Eventually main pass performance may be obtained. But the kit does not resolve the problem of discriminating sample compounds.

Contraindication for usage:

- If run times are below 2-3min the purge kit won’t help as the purge step with reasonable purge volume lasts at least 2min.
- In highly carry-over sensitive applications purge kit is not recommended as best performance is got when the Autosampler stays in mainpass the full solvent gradient.

Control software support for the Purge kit is provided and fully operated and controlled through the ChemStation or and G4208A Instant Pilot via the Autosampler Settings (Requires Agilent ChemStation B.01.03 or higher and Firmware A.06.01 and higher on ALL Agilent 1200 Series modules that are part of the system and Firmware B.04.01 for the Control Module).

## **Using the Automated Needle Wash**

The automated needle wash can be programmed either as “injection with needle wash” or the needle wash can be included into the injector program. When the automated needle wash is used, the needle is moved into the wash port after the sample is drawn. By washing the needle after drawing a sample, the sample is removed from the outer surface of the needle immediately. As the flush port is automatically refilled with fresh wash solvent this option should be used routinely. Using wash vials is usually not necessary but available for special applications.

### **Using a wash vial**

If a wash vial is used, it should be considered not to cap the vial. Otherwise small amounts of sample remain on the surface of the septum, which may be carried on the needle to the next sample.

## **Using the Flush Port**

During the injection process when the sample is in the loop and when the valve still is in Bypass, the outside of the needle can be washed in a flush port located behind the injection port on the sampling unit. During the wash cycle as soon the needle is in the flush port a peristaltic pump fills the flush port with fresh solvent during a defined time. The volume of the flush port is about 680  $\mu\text{l}$  and the pump delivers 6 ml/min. Setting the wash time to 10 seconds is sufficient to refill 2 times the flush port. In most cases this is enough to clean the needle outside. Additionally after the needle left the flush port the flush pump keeps running runs for 6 sec. to ensure refill with fresh solvent. At the end of this flush process – if “injection with needle wash” is selected – the needle returns to the injection port, the injection valve is switched to the mainpass position and directs the pump flow back through the sample loop.

For further information on how to reduce carry over see “[Optimization for Lowest Carry-Over](#)” on page 67

### Recommended Wash Solvents

- water
- ethanol
- methanol
- water/acid (especially for basic compounds)
- water/base (especially for acidic compounds)
- water/acetonitrile

#### NOTE

The life time of the tubing in the peristaltic pump is shortened by the usage of organic solvents.

---

## Cleaning the needle seat

If flush port has run out of solvent or the option “needle wash” hasn’t been used for several injections or in case the needle seat has got contaminated, the needle seat may be contaminated and carry-over is significantly higher than expected. For cleaning the needle seat there is an automatic procedure using the mobile phase’s solvents. If that doesn’t work a manual cleaning has to be done. the following procedure can be used to clean the needle seat

### Automatic procedure

There’s an injector command for flushing the seat. So a cleaning method can be set up using an injector program.

Injector program

- INJECT
- FLUSH SEAT for 90.0 sec., 0.0 mm offset

## 5 Optimizing Performance

### Optimization for Lowest Carry-Over

- VALVE mainpass

Line 1 starts the run so the pump's time table is started. Line 2 let's the needle move above the seat and switches the valve to mainpass so that the pump's solvent is directed through the loop and the needle onto the seat. The liquid leaves the seat via the drainage for the flush port. The offset can be used for getting a kind of blast pipe effect. Generally an offset of 0.0mm is a proper value. After the flush time (here 90sec) the valve is switched to bypass. Line 3 moves the needle back into the seat and switches valves back to main pass to restore hydraulic flow as it was before the cleaning process.

The pump's time table can be used if special solvents for cleaning are connected to the pump or if the flushing flow should be adjusted. Here's an illustrating example:

	Time	%B	Flow	Max. Press.
1	0.00	100.0		
2	0.10		0.500	
3	0.11		3.000	
4	0.70	100.0	3.000	
5	0.71	0.0	0.500	

Along with upper injector program this time table uses solvent B for cleaning the seat with an even higher flow rate than the perhaps limiting 0.5ml/min for column flow. To ensure that the flow rate isn't applied to the column and that column doesn't come in contact with flush solvent (in this case solvent B) choose a considerably long time (in this case 90sec) for flushing the seat in the injector program.

### Manual procedure

If the automatic procedure doesn't succeed there is the semi-automatic seat back-flushing.

Preparation

- Move the needle to home position.
- Set pump flow to zero

- Connect the seat capillary with the pump capillary using a zero dead volume fitting.

#### Flushing

- Increase pump flow: The seat is flushed backwards, solvent bubbles over the seat and leaves the seat via the drainage for the flush port

#### Reconfigure system

- Set pump flow to zero
- Connect the pump outlet capillary to port 1 of injection valve
- Connect the seat capillary to port 5 of the injection valve.
- Reset the injector.

## Fast Injection Cycle and Low Delay Volume

### Fast Injection Cycle and Low Delay Volume

Short injection cycle times for high sample throughput is one of the main issues in analytical laboratories. Shortening cycle time starts with:

- shortening column length
- high flow rate
- steep gradient
- The detector balance may be set to OFF

### General recommendations for Fast Injection Cycle Times

As described in this section, the first step to provide short cycle times is optimizing the chromatographic conditions. Then the following Autosampler related issues should be considered:

- Use proper solvent for needle wash to decrease the wash time
- Reduce injection volume
- Increase eject speed
- Increase draw speed (if the viscosity of the sample and the solvent in Autosampler's flow path allows it)
- Do injection preparation in parallel with column equilibration (section "Overlapped Injection after gradient is flushed out")

Having optimized these parameters, further reduction of cycle times can be obtained if column equilibration is short compared to injector preparation or if automated column regeneration is configured. "Overlapped Injection during run mode" decreases this time between runs. But note that carry-over and discrimination may increase dramatically doing so.

## Overlapped Injection after gradient is flushed out

In this process the injection can be done in parallel to column equilibration phase without compromising any of the Autosampler's specifications.

This mode has one parameter. The time when to start the overlapped injection defined as "time after begin of run".

Considering a composition gradient that ends after 1 min. with reestablishing starting conditions the overlap time has to be set to somewhat above 1 min. to let the pump fill also the Autosampler's loop with start conditions.

## Overlapped Injection during Run

In this process, as soon as the sample has reached the column, the injection valve is switched back to bypass and the next injection cycle is performed except for switching the injection valve to mainpass. This is done after actual run is finished and next analysis is started. Doing so the sample preparation time is saved as parallel to the run.

Switching the valve into the bypass position reduces the system delay volume by the complete Autosampler's flow path volume e.g. 270 $\mu$ l for G1367B. Here the mobile phase is directed to the column without passing sample loop, needle and needle seat capillary. This can help to have faster cycle times especially if low flow rates have to be used like it is mandatory in narrow bore and micro bore HPLC.

### NOTE

Having the valve in bypass position can increase the carry-over in the system.

---

The injection cycle times also depend on the injection volume. In identically standard condition, injecting 100  $\mu$ l instead of 1  $\mu$ l, increase the injection time by approximately 8 sec. In this case and if the viscosity of the sample allows it, the draw and eject speed of the injection system has to be increased.

## Precise Injection Volume

### Injection Volumes Less Than 2 $\mu\text{l}$

When the injection valve switches to the BYPASS position, the mobile phase in the sample loop is depressurized. When the syringe begins drawing sample, the mobile phase is further subjected to decreasing pressure. If the mobile phase is not adequately degassed, small gas bubbles may form in the sample loop during the injection sequence. When using injection volumes  $< 2 \mu\text{l}$ , these gas bubbles may affect the injection-volume precision. For best injection-volume precision with injection volumes  $< 2 \mu\text{l}$ , use of the Agilent 1200 Series degasser is recommended to ensure the mobile phase is adequately degassed. Also, using the automated needle wash (see [“Using the Automated Needle Wash”](#) on page 70) between injections reduces carry-over to a minimum, improving injection-volume precision further.

## Draw and Eject Speed

### Draw Speed

The speed at which the metering unit draws sample out of the vial may have an influence on the injection volume precision when using viscous samples. If the draw speed is too high, air bubbles may form in the sample plug, affecting precision. The default draw speed is suitable for the majority of applications, however, when using viscous samples, set the draw speed to lower speed for optimum results. A “DRAW” statement in an injector program also uses the draw speed setting which is configured for the autosampler.

## Eject Speed

The default draw speed is suitable for the majority of applications. When using large injection volumes, setting the eject speed to a higher value speeds up the injection cycle by shortening the time the metering unit requires to eject solvent at the beginning of the injection cycle (when the plunger returns to the home position).

An “EJECT” statement in an injector program also uses the eject speed setting which is configured for the autosampler. A faster eject speed shortens the time required to run the injector program. When using viscous samples, a high eject speed should be avoided.

**Table 19** Draw and eject speed

	Draw speed (µl)	Eject speed (µl)
<i>High performance autosampler</i>		
Default value	200	200
Minimum	10	10
Maximum	1000	1000
<i>High performance autosampler SL+</i>		
Default value	100	100
Minimum	4	4
Maximum	1000	1000
<i>Micro Well Plate Autosampler with 8 µl loop capillary</i>		
Default value	4	10
Minimum	0.7	0.7
Maximum	20	100
<i>Micro Well Plate Autosampler with 40 µl loop capillary</i>		
Default value	4	10

## 5 Optimizing Performance

### Precise Injection Volume

**Table 19** Draw and eject speed

	<b>Draw speed (μl)</b>	<b>Eject speed (μl)</b>
Minimum	0.7	0.7
Maximum	250	250

## Choice of Rotor Seal

### Vespel™ Seal

The standard seal has sealing material made of Vespel. Vespel is suitable for applications using mobile phases within the pH range of 2.3 to 9.5, which is suitable for the majority of applications. However, for applications using mobile phases with pH below 2.3 or above 9.5, the Vespel seal may degrade faster, leading to reduced seal lifetime.

### Tefzel™ Seal

For mobile phases with pH below 2.3 or above 9.5, or for conditions where the lifetime of the Vespel seal is drastically reduced, a seal made of Tefzel is available. Tefzel is more resistant than Vespel to extremes of pH, however, is a slightly *softer* material. Under normal conditions, the expected lifetime of the Tefzel seal is shorter than the Vespel seal, however, Tefzel may have the longer lifetime under more extreme mobile phase conditions.

### PEEK Seal

With the High Performance SL+ Autosampler a PEEK rotor seal is used. This warrants a leak tight system at high pressures and allows the usage of solvents ranging from pH 2.3 to 12. The PEEK material may show a reduced lifetime if used with following solvents:

- Methylene chloride
- DMSO
- THF
- High concentrations of sulfuric acid
- High concentrations of nitric acid

## Choice of Seat Capillary

Different models of seat capillaries are available for the high performance autosampler, the SL version and the micro well plate autosampler:

### **For the high performance autosampler**

The needle seat assembly includes the needle seat and the seat capillary. The part number for this assembly is: G1367-87101

### **For the high performance autosampler SL+**

The needle seat assembly is made up of two parts:

- Needle seat **G1367-87105**
- Seat capillary **G1367-87303** (0.12 mm, 150 mm)  
**G1367-87302** (0.17 mm, 150 mm)

The capillary pre-installed in the high performance autosampler SL+ is the G1367-87302.

### **For the micro well plate sampler**

The needle seat assembly is made up of two parts:

- Needle seat **G1377-87101**
- Seat capillary **G1375-87317** (100  $\mu\text{m}$ , 150 mm)  
**G1375-87316** (75  $\mu\text{m}$ , 150 mm)  
**G1375-87300** (50  $\mu\text{m}$ , 150 mm)

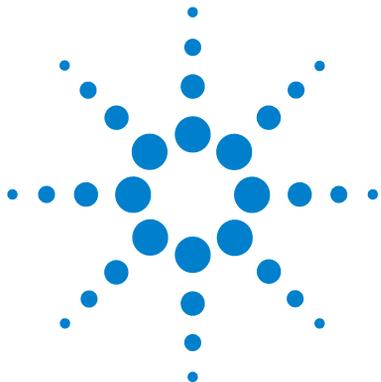
**part number: G1375-87317 (100  $\mu\text{m}$ )** is the capillary preinstalled in the micro well plate autosamplers upon delivery. This capillary is recommended for applications with a 0.3 mm column or higher. It provides less plugging of the capillary in general and especially with biological samples. For small K' this capillary can provide a higher peak width for isocratic analysis.

**part number: G1375-87316 (75  $\mu\text{m}$ )** is available as a spare part and is recommended for applications with a 0.3 mm column or smaller. This capillary gives full chromatographic performance.

**part number: G1375-87300 (50  $\mu\text{m}$ )** is available as a spare part and is recommended for applications with a 0.3 mm column or smaller. This capillary gives full chromatographic performance. Due to the small diameter, this capillary can show some blockage.

## **5 Optimizing Performance**

### **Choice of Seat Capillary**



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## Agilent Lab Monitor & Diagnostic Software

The Agilent Lab Monitor & Diagnostic Software (LMD) is an application-independent tool that provides diagnostic capabilities for all Agilent 1200 Series HPLC modules. It includes tests, calibrations, and tools, such as injector steps and maintenance positions. In addition to these features of the LMD 'Basic' edition, the 'Advanced' edition of LMD provides Guided Diagnostics, which interactively supports users of LC instruments to resolve typical issues. Based on chromatographic symptoms, Guided Diagnostics helps users to identify the root cause of their problem, and leads them through the necessary steps to resolve it.

LMD also allows users to monitor the status of their LC instruments. The Early Maintenance Feedback (EMF) feature helps to carry out preventive maintenance. In addition, users can generate a status report for each individual LC instrument.

The tests and diagnostic features as provided by the Agilent Lab Monitor & Diagnostic Software may differ from the descriptions in this manual. For details refer to the LMD help files.

This manual provides lists with the names of Error Messages, Not Ready messages, and other common issues.

# Overview of the Sampler's Indicators and Test Functions

## Status Indicators

The autosampler is provided with two status indicators which indicate the operational state (prerun, not ready, run, and error states) of the instrument. The status indicators provide a quick visual check of the operation of the autosampler (see [“Status Indicators”](#) on page 87).

## Error Messages

In the event of an electronic, mechanical or hydraulic failure, the instrument generates an error message in the user interface. For details on error messages and error handling, please refer to the Agilent Lab Monitor & Diagnostic Software.

## Maintenance Functions

The maintenance functions position the needle assembly, the needle carrier, the sample transport assembly and the metering device for easy access when doing maintenance (see [“Maintenance Functions”](#) on page 89).

## Sample Transport Self Alignment

The sample transport self alignment with the sampling unit and the well plate tray is required to compensate for larger deviations in positioning the needle carrier.

The sample transport self alignment is required after disassembling the system or when you exchange the sample transport, the sampling unit, the tray or the MTP main board.

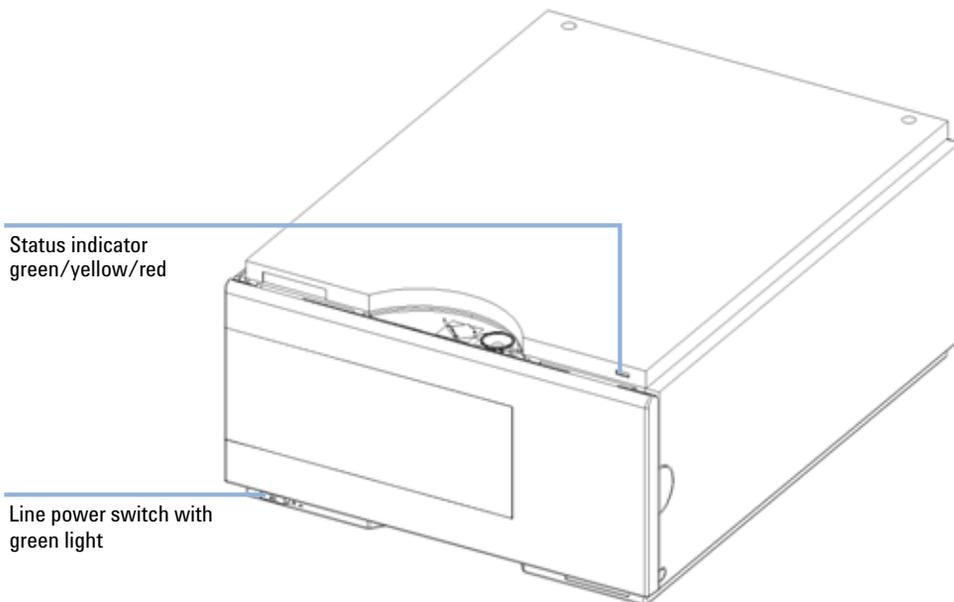
This function is in the diagnose screen of the Chemstation or the Control Module.

### **Step Commands**

The step functions enable execution of each step of the sampling sequence individually. The step functions are used primarily for troubleshooting, and for verification of correct autosampler operation after repair (see [“High Performance Autosampler Step Commands”](#) on page 91). For details on step commands, please refer to the Agilent Lab Monitor & Diagnostic Software.

## Status Indicators

Two status indicators are located on the front of the autosampler. The lower left indicates the power supply status, the upper right indicates the autosampler status.



### Power Supply Indicator

The power supply indicator is integrated into the main power switch. When the indicator is illuminated (*green*) the power is ON.

### Instrument Status Indicator

The instrument status indicator indicates one of four possible instrument conditions:

## 6 Troubleshooting and Diagnostics

### Status Indicators

- When the status indicator is *OFF* (and power switch light is on), the instrument is in a *prerun* condition, and is ready to begin an analysis.
- A *green* status indicator indicates the instrument is performing an analysis (*run* mode).
- A *yellow* status indicator indicates a *not-ready* condition. The instrument is in a not-ready state when it is waiting for a specific condition to be reached or completed (for example, front door not closed), or while a self-test procedure is running.
- An *error* condition is indicated when the status indicator is *red*. An error condition indicates the instrument has detected an internal problem which affects correct operation of the instrument. Usually, an error condition requires attention (for example, leak, defective internal components). An error condition always interrupts the analysis.

## Maintenance Functions

Some maintenance procedures require the needle arm, metering device, and needle carrier to be moved to specific positions to enable easy access to components. The maintenance functions move these assemblies into the appropriate maintenance position. In the ChemStation the sampler maintenance positions can be selected from the Maintenance menu in the Diagnosis display. In the Control Module the functions can be selected in the Test screens of the autosampler. In the Agilent Lab Monitor & Diagnostic Software the maintenance positions can be selected from the "Tools" icon.

### Maintenance Functions

The maintenance functions moves the arm assembly in a specific position in order to enables easy access for maintenance operations

#### Home Position

The “home position” function moves the arm to the right side for better access and exchange of the trays

#### Park Position

The “park position” function moves the arm to the left side of the tray. In this position it is possible to secure the sample transport mechanism with the protection foam. The sample transport is than ready for transporting.

#### Change Piston

The “change-piston” function draws the piston away from the home position, relieving the tension on the spring. In this position, the analytical head assembly can be removed and reinstalled easily after maintenance. This position is also used to change the analytical head plunger and metering seal.

**Table 20** Maintenance positions

Function	Arm position in X	Arm position in Theta	Arm Position in Z	Note
Change Needle	Left side	Straight	Up	No current on Theta
Change Carrier assembly	Left side	Straight	Middle	No current on the ST
Change Loop capillary	Middle	Left	Up	
Home position	Right side	Left rear	Up	
Park arm	Left side	Right rear	Up	

## Sample Transport Self Alignment

The sample transport alignment with the sampling unit and the well plate tray is required to compensate for larger deviations in positioning the needle carrier. This function is in the diagnose screen of the Chemstation or the Control Module. In the Agilent Lab Monitor & Diagnostic Software, this function is in the "Calibration" icon.

The sample transport self alignment is required after disassembling the system or when you exchange:

- The sample transport.
- The sampling unit.
- The MTP main board.
- The autosampler tray base

## High Performance Autosampler Step Commands

Each movement of the sampling sequence can be done under manual control. This is useful during troubleshooting, where close observation of each of the sampling steps is required to confirm a specific failure mode or verify successful completion of a repair.

Each injector step command actually consists of a series of individual commands that move the autosampler components to predefined positions, enabling the specific step to be done.

**Table 21** Step Commands

<b>Step</b>	<b>Action</b>	<b>Comments</b>
<b>Valve Bypass</b>	Switches injection valve to the bypass position.	
<b>Plunger Home</b>	Moves the plunger to the home position.	
<b>Needle Up</b>	Lifts the needle arm to the upper position.	Command also switches the valve to bypass if it is not already in that position.
<b>Move to Location</b>	Move the needle arm to the vial location on the plate	
<b>Needle into sample</b>	Lowers the needle into the vial.	
<b>Draw</b>	Metering device draws the defined injection volume.	Command lifts the needle, and lowers the needle into sample. Command can be done more than once (maximum draw volume of 40/100/5000 µl cannot be exceeded). Use <b>Plunger Home</b> to reset the metering device.
<b>Needle Up</b>	Lifts the needle out of the vial.	
<b>Needle into Seat</b>	Lowers the needle arm into the seat.	

**Table 21** Step Commands

Step	Action	Comments
<b>Valve Mainpass</b>	Switches the injection valve to the mainpass position.	
<b>Needle Up/Mainpass</b>	Lifts the needle arm to the upper position and Switches the injection valve to the mainpass position.	

## Troubleshooting

If the autosampler is unable to perform a specific step due to a hardware failure, an error message is generated. You can use the step commands to perform an injection sequence, and observe how the autosampler responds to each command.

[Table 22](#) on page 92 summarizes the step commands, and lists the error messages and probable causes associated with each possible failure.

**Table 22** Step Failures

Step Function	Probable Failure Modes
Valve Bypass	Valve not connected. Defective injection valve.
Plunger Home	Defective or dirty sensor on the sampling-unit flex board. Defective metering-drive motor.
Needle	Defective or dirty sensor on the sampling-unit flex board. Sticking needle-arm assembly. Defective needle-drive motor.
Draw	Sum of all draw volumes exceeds 100 µl (or 40 µl). Defective metering-drive motor.
Needle	Defective or dirty sensor on the sampling-unit flex board. Sticking needle-arm assembly. Defective needle-drive motor.

**Table 22** Step Failures

<b>Step Function</b>	<b>Probable Failure Modes</b>
Valve Mainpass	Valve not connected. Defective injection valve.
Needle Up/Mainpass	Blockage in the sample loop or needle (no solvent flow). Defective or dirty sensor on the sampling-unit flex board. Sticking needle-arm assembly. Defective needle-drive motor. Valve not connected. Defective injection valve.

# Troubleshooting the G1367B/D and G1377A Autosampler

## Gather Information About the Problem

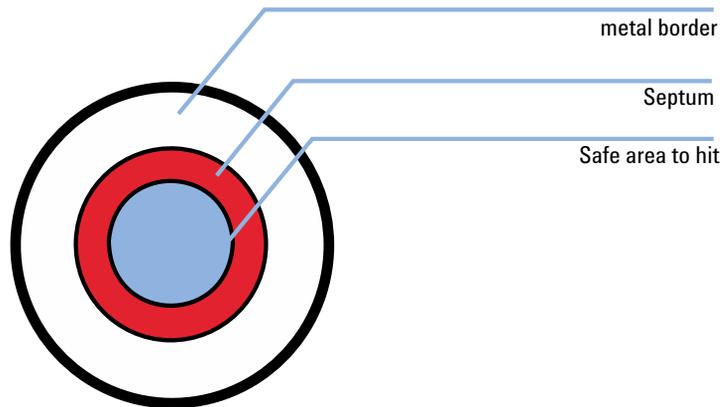
- When did the problem start?
- What was done/changed prior to the start of the problem?

In the Agilent Lab Monitor & Diagnostic Software the "Instrument Status Report" generates a report. This report includes the Instrument configuration with the instrument serial numbers and the firmware revisions, the instrument error history, the EMF editor, the result of the guided diagnostic and the method parameter (optional).

## Needle Centering Over the Vial or the Well

**NOTE**

The positioning of the needle is very precise. You have to take no action if the needle hits in the safe area.



**Figure 22** Vial cap

**NOTE**

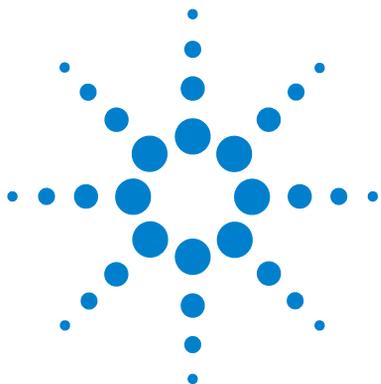
If the diameter for the safe area is approximately *1mm smaller* than the diameter of the septum no corrective action is necessary.

### Action to Take if the Needle Does Not Hit in the Safe Area

- ✓ Check if the right vials or plates are used (see) or (see [“List of Recommended Vials and Caps”](#) on page 59).
- ✓ Make sure the needle is correctly installed. It should be pushed into the needle carrier as far forward as possible and centered in the vial pusher.
- ✓ Upgrade the firmware revision to A.04.14 or higher and the ChemStation revision to A.08.04 or higher
- ✓ Perform an auto-alignment (without any plates in place)
- ✓ Change the tray G2258-60011 (see service note G1367-007)

## **6 Troubleshooting and Diagnostics**

### **Needle Centering Over the Vial or the Well**



## 7 Maintenance

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## Introduction to Maintenance and Repair

### Simple Repairs - Maintenance

The autosampler is designed for easy repair. The most frequent repairs such as changing a needle assembly can be done from the front of the instrument with the instrument in place in the system stack. These repairs are described in “[Maintenance Procedures](#)” on page 105.

### Exchanging Internal Parts - Repairs

Some repairs may require exchange of defective internal parts. Exchange of these parts requires removing the autosampler from the stack, removing the covers, and disassembling the autosampler.

### Warnings and Cautions

#### **WARNING**

#### *Personal injury*

**Repair work at the autosampler can lead to personal injuries, e.g. shock hazard, when the autosampler cover is opened and the instrument is connected to power.**

- Remove the power cable from the instrument before opening the autosampler cover.
  - Do not connect the power cable to the autosampler while the covers are removed.
-

**WARNING**

**Toxic and hazardous solvents**

**The handling of solvents and reagents can hold health risks.**

- When opening capillary or tube fittings solvents may leak out.
- Please observe appropriate safety procedures (for example, goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the solvent vendor, especially when toxic or hazardous solvents are used.

**CAUTION**

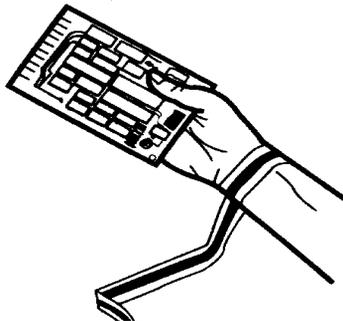
**Electrostatic discharge at electronic boards and components**

Electronic boards and components are sensitive to electrostatic discharge (ESD).

- In order to prevent damage always use an ESD protection when handling electronic boards and components.

## Using the ESD Strap

- 1 Unwrap the first two folds of the band and wrap the exposed adhesive side firmly around your wrist.
- 2 Unroll the rest of the band and peel the liner from the copper foil at the opposite end.
- 3 Attach the copper foil to a convenient and exposed electrical ground.



**Figure 23** Using the ESD Strap

## Cleaning the module

The module case should be kept clean. Cleaning should be done with a soft cloth slightly dampened with water or a solution of water and mild detergent. Do not use an excessively damp cloth as liquid may drip into the module.

### **WARNING**

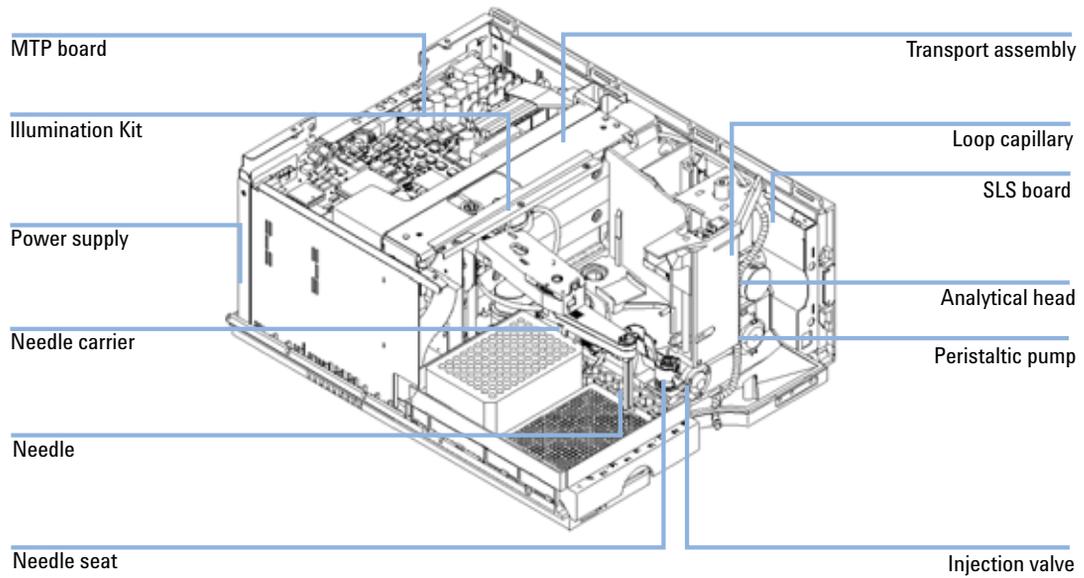
**Liquid shall not touch the module electronics.**

**It could cause shock hazard and it could damage the module.**

→ Do not let liquid drip into the module.

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# Overview of Main Repair Procedures



## **Maintenance Functions**

Some maintenance procedures require the needle arm, metering device, and needle carrier to be moved to specific positions to enable easy access to components. The maintenance functions move these assemblies into the appropriate maintenance position. For details, refer to “[Maintenance Functions](#)” on page 89.

## Early Maintenance Feedback (EMF)

Maintenance requires the exchange of components in the flow path which are subject to mechanical wear or stress. Ideally, the frequency at which components are exchanged should be based on the intensity of usage of the instrument and the analytical conditions, and not on a predefined time interval. The early maintenance feedback (EMF) feature monitors the usage of specific components in the instrument, and provides feedback when the user-setable limits have been exceeded. The visual feedback in the user interface provides an indication that maintenance procedures should be scheduled.

### EMF Counters

The autosampler provides four EMF counters. Each counter increments with autosampler use, and can be assigned a maximum limit which provides visual feedback in the user interface when the limit is exceeded. Each counter can be reset to zero after maintenance has been done. The autosampler provides the following EMF counters:

#### Injection Valve Counter

This counter counts the number of valve switching EF4512, since the last reset of the counter.

#### Needle Assembly Counter

This counter counts the total number of needle into seat movements (used for the needle life time) EF4510, since the last reset of the counter.

#### Seat Assembly Counter

This counter counts the total number of needle into seat movements (used for the seat life time) EF4511, since the last reset of the counter.

#### Peristaltic Pump

This counter gives the accumulates active pump time in units seconds EF4513.

## Using the EMF Counters

The user-settable EMF limits for the EMF counters enable the early maintenance feedback to be adapted to specific user requirements. The wear of autosampler components is dependent on the analytical conditions, therefore, the definition of the maximum limits need to be determined based on the specific operating conditions of the instrument.

## Setting the EMF Limits

The setting of the EMF limits must be optimized over one or two maintenance cycles. Initially, no EMF limit should be set. When instrument performance indicates maintenance is necessary, make note of the values displayed by the injection valve and needle movements counters. Enter these values (or values slightly less than the displayed values) as EMF limits, and then reset the EMF counters to zero. The next time the EMF counters exceed the new EMF limits, the EMF flag will be displayed, providing a reminder that maintenance needs to be scheduled.

## Maintenance Procedures

The procedures described in this section can be done with the autosampler in place in the stack. These procedures can be done on a more frequent basis.

**Table 23** Simple Repair Procedures

Procedure	Typical Frequency	Notes
Exchanging the needle assembly	When the limit in the needle into seat counter in the EMF is exceeded. When needle shows indication of damage or blockage	See <a href="#">“Removing the Needle Assembly”</a> on page 106
Exchanging the needle carrier assembly	When the needle carrier is defective	See <a href="#">“Removing the Needle Carrier Assembly”</a> on page 110
Exchanging the needle seat assembly	When the limit in the needle into seat counter in the EMF is exceeded. When needle seat shows indication of damage or blockage	See <a href="#">“Exchange the Needle Seat Assembly (G1367-87101) on the G1367B Samplers”</a> on page 112
Exchanging the stator face	When the valve performance shows indication of leakage or wear	See <a href="#">“Stator Face”</a> on page 116
Exchanging the rotor seal	When the limit in the injector valve switches counter in the EMF is exceeded. When the valve performance shows indication of leakage or wear	See <a href="#">“Rotor Seal”</a> on page 117
Exchanging the metering seal	When autosampler reproducibility indicates seal wear	See <a href="#">“Metering Seal and Plunger”</a> on page 119
Exchanging the loop capillary	When loop capillary blocked or broken	See <a href="#">“Removing the Loop Capillary”</a> on page 121
Exchanging the peristaltic pump	When tubing broken	See <a href="#">“Peristaltic Pump”</a> on page 125

## Removing the Needle Assembly

<b>When</b>	<ul style="list-style-type: none"><li>• When the needle is visibly damaged</li><li>• When the needle is blocked</li></ul>									
<b>Tools required</b>	<ul style="list-style-type: none"><li>• Two 1/4 inch-5/16 inch wrenches 8710-0510 (supplied in accessory kit)</li><li>• 4 mm open end wrench 8710-1534 (supplied in accessory kit)</li></ul>									
<b>Parts required</b>	<table><thead><tr><th>#</th><th>Part number</th><th>Description</th></tr></thead><tbody><tr><td>1</td><td>G1367-87202</td><td>Needle assembly for G1367B/D</td></tr><tr><td>1</td><td>G1377-87201</td><td>Needle assembly for G1377A</td></tr></tbody></table>	#	Part number	Description	1	G1367-87202	Needle assembly for G1367B/D	1	G1377-87201	Needle assembly for G1377A
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1	G1367-87202	Needle assembly for G1367B/D								
1	G1377-87201	Needle assembly for G1377A								

### WARNING

#### Risk of injury by uncovered needle

**An uncovered needle is a risk of harm to the operator.**

- Be careful when you remove the needle assembly.
- Use the silicon safety tube supplied with every new needle.

- 1 In the user interface start the maintenance mode and select the “Change Needle/Seat” function. In the Agilent Lab Monitor & Diagnostic Software the “Change Needle/Seat” function can be found in the “Tools” icon.
- 2 Open the front door and remove the side door.
- 3 Remove the plate tray from the tray base.
- 4 Push the silicon safety tube, supplied in the WPS leak kit (G1367-60006) and with every new needle, over the needle.
- 5 Unlock the needle tighter lock system.
- 6 Loosen the loop capillary fitting on the analytical head side.
- 7 Remove the loop capillary corrugated waste tube.
- 8 Pinch the holder clamp, pull back and remove the needle assembly with the loop capillary from the needle carrier.
- 9 Attach the 5/16 inch wrench to hold position at the needle assembly. Use the 4 mm wrench to loosen the fitting of the loop capillary.

**NOTE**

Do not bend the sheet metal of the needle.

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**10** Pull the loop capillary out from the needle assembly.

## Installing the Needle Assembly

<b>When</b>	<ul style="list-style-type: none"><li>• When the needle is visibly damaged</li><li>• When the needle is blocked</li></ul>									
<b>Tools required</b>	<ul style="list-style-type: none"><li>• Two 1/4 inch-5/16 inch wrenches 8710-0510 (supplied in accessory kit)</li><li>• 4 mm open end wrench 8710-1534 (supplied in accessory kit)</li></ul>									
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### WARNING

#### Risk of injury by uncovered needle

**An uncovered needle is a risk of harm to the operator.**

- Be careful when you remove the needle assembly.
- Use the silicon safety tube supplied with every new needle.

- 1 Push the silicon safety tube, supplied in the WPS leak kit (G1367-60006) and with every new needle, over the needle.
- 2 Pull the loop capillary in the new needle assembly (G1367-87202 or G1377-87201).
- 3 Attach the 5/16 inch wrench to hold position at the needle assembly. Use the 4 mm wrench to tighten the fitting of the loop capillary.

### NOTE

Do not hold the needle during this step to avoid to bending it.

- 4 Push the loop capillary into the loop capillary protection tube until it comes out on the sampling unit side.
- 5 Tighten the loop capillary fitting to the analytical head.
- 6 Install the loop capillary corrugated waste tube over the loop capillary.
- 7 Pinch the holder clamp and reinsert the needle assembly into the needle carrier.
- 8 Lock the needle tighter lock system.

- 9 Push the black chain into the needle assy until the stop.
- 10 Check the alignment of the needle in the needle pusher of the needle carrier by viewing from several directions to see that it is aligned in the center of the needle pusher.

**NOTE**

The needle must be centered in the needle pusher as all alignment by the autosampler is calculated from the needle pusher position.

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- 11 Remove the silicon safety tube from the needle.
- 12 Replace the plate tray in the tray base. Re-install the side door and close the front door.
- 13 In the user interface close the "Change Needle/Seat" function and exit the maintenance mode. In the Agilent Lab Monitor & Diagnostic Software the "Change Needle/Seat" function can be found in the "Tools" icon.

## Removing the Needle Carrier Assembly

<b>When</b>	When the needle carrier is defect						
<b>Tools required</b>	• 2 mm hex key 8710-2438 (supplied in accessory kit)						
<b>Parts required</b>	<table><thead><tr><th>#</th><th>Part number</th><th>Description</th></tr></thead><tbody><tr><td>1</td><td>G1367-60010</td><td>Needle Carrier assembly</td></tr></tbody></table>	#	Part number	Description	1	G1367-60010	Needle Carrier assembly
#	Part number	Description					
1	G1367-60010	Needle Carrier assembly					

### WARNING

#### Risk of injury by uncovered needle

**An uncovered needle is a risk of harm to the operator.**

- Be carefull when you remove the needle carrier assembly.
- Use the silicon safety tube supplied with every new needle.

- 1 In the user interface start the maintenance mode and select the “Change Needle Carrier” function. In the Agilent Lab Monitor & Diagnostic Software the "Change Needle Carrier" function can be found in the "Tools" icon.
- 2 Open the front door and remove the side door.
- 3 Remove the plate tray from the tray base.
- 4 Push the silicon safety tube, supplied in the WPS leak kit (G1367-60006) and with every new needle, over the needle.
- 5 Pinch the holder clamp, pull back and remove the needle assembly from the needle carrier.
- 6 Unplug the flex board on the sample transport.
- 7 Unscrew the three holding hex screws with the 2 mm hex key.
- 8 Remove the needle carrier assy.

## Installing the Needle Carrier Assembly

**When** When the needle carrier is defect

**Tools required** • 2 mm hex key 8710-2438 (supplied in accessory kit)

**Parts required**

#	Part number	Description
1	G1367-60010	Needle Carrier assembly

- 1 Install a new needle carrier (G1367-60010) on place
- 2 Install the three holding hex screws with the 2 mm hex key.
- 3 Plug in the flex board on the sample transport.
- 4 Push the silicon safety tube, supplied in the WPS leak kit (G1367-60006) and with every new needle, over the needle.
- 5 Pinch the holder clamp and reinsert the needle assembly into the needle carrier.
- 6 Check the alignment of the needle in the needle pusher of the needle carrier by viewing from several directions to see that it is aligned in the center of the needle pusher.

**NOTE**

The needle must be centered in the needle pusher as all alignment by the autosampler is calculated from the needle pusher position.

- 7 Remove the silicon safety tube from the needle.
- 8 Replace the plate tray in the tray base.
- 9 Re-install the side door and close the front door.
- 10 In the user interface close the “Change Needle Carrier” function and exit the maintenance mode. The instrument will reset. In the Agilent Lab Monitor & Diagnostic Software the "Change Needle Carrier" function can be found in the "Tools" icon.

## Exchange the Needle Seat Assembly (G1367-87101) on the G1367B Samplers

- When**
- When the seat is visibly damaged
  - When the seat capillary is blocked

- Tools required**
- 1/4 inch-5/16 inch wrench 8710-0510 (supplied in accessory kit)
  - 4 mm open end wrench 8710-1534 (supplied in accessory kit)
  - Flat screwdriver

**Parts required**

**# Part number Description**

1 G1367-87101 Needle-Seat assy (0.17 mm ID 2.3 µl) for G1367B

- 1 In the user interface start the maintenance mode and select the “Change Needle/Seat” function. In the Agilent Lab Monitor & Diagnostic Software the "Change Needle/Seat" function can be found under the "Tools" icon
- 2 Open the front door and remove the side door.
- 3 Remove the plate tray from the tray base.
- 4 Disconnect the seat capillary from the injection valve (port 5) with the 1/4 inch wrench.
- 5 Use the flat-head screwdriver to remove the needle seat.
- 6 Insert the new needle seat assembly (G1367-87101). Press it firmly in position.
- 7 Connect the seat capillary to the injection valve (port 5) with the 1/4 inch wrench.
- 8 Replace the plate tray in the tray base. Re-install the side door and close the front door.
- 9 In the user interface close the “Change Needle/Seat” function and exit the maintenance mode. In the Agilent Lab Monitor & Diagnostic Software the "Change Needle/Seat" function can be found under the "Tools" icon.

## Exchange the Needle Seat ( G1367-87105) on the G1367D Exchange the Needle Seat ( G1377-87101) on the G1377A

- When**
- When the seat is visibly damaged
  - When the seat capillary is blocked

- Tools required**
- 1/4 inch-5/16 inch wrench 8710-0510 (supplied in accessory kit)
  - 4 mm open end wrench 8710-1534 (supplied in accessory kit)
  - Flat screwdriver

**Parts required**

#	Part number	Description
1	G1367-87105	Needle-Seat (without capillary) for G1367D
1	G1367-87303	Optional Seat Capillary (150 mm 0.12 mm ID) for G1367-87105 Needle Seat
1	G1367-87302	Optional Seat Capillary (150 mm 0.17 mm ID) for G1367-87105 Needle Seat
1	G1377-87101	Needle-Seat (without capillary) for G1377A
1		Optional G1375-87317 Seat Capillary (150 mm 0.10 mm ID) for G1377-87101 Needle Seat
1	G1375-87316	Optional Seat Capillary (150 mm 0.075 mm ID) for G1377-87101 Needle Seat
1	G1375-87300	Optional Seat Capillary (150 mm 0.05 mm ID) for G1377-87101 Needle Seat

- 1 In the user interface start the maintenance mode and select the “Change Needle/Seat” function. In the Agilent Lab Monitor & Diagnostic Software the "change needle/seat" function can be found under the "Tools" icon.
- 2 Open the front door and remove the side door.
- 3 Remove the plate tray from the tray base.
- 4 Disconnect the seat capillary from the needle seat with the 4 mm open wrench.
- 5 Use the flat-head screwdriver to remove the needle seat.
- 6 Insert the new needle seat. Press it firmly in position.
- 7 Connect the seat capillary to the needle seat with the 4 mm open wrench.
- 8 Replace the plate tray in the tray base. Re-install the side door and close the front door.
- 9 In the user interface close the “Change Needle/Seat” function and exit the maintenance mode. In the Agilent Lab Monitor & Diagnostic Software the "change needle/seat" function can be found under the "Tools" icon.

## 7 Maintenance

### Maintenance Procedures

**NOTE**

The seat capillary can be exchanged alone if the needle seat is not damaged.

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## Exchange the Seat Capillary on the G1377A and G1367D

- When**
- When the seat is visibly damaged
  - When the seat capillary is blocked

- Tools required**
- 1/4 inch-5/16 inch wrench 8710-0510 (supplied in accessory kit)
  - 4 mm open end wrench 8710-1534 (supplied in accessory kit)
  - Flat screwdriver

**Parts required**

#	Part number	Description
1	G1375-87317	Seat Capillary (150 mm 0.10 mm ID) for G1377-87101 Needle Seat
1	G1375-87316	Seat Capillary (150 mm 0.075 mm ID) for G1377-87101 Needle Seat
1	G1375-87300	Seat Capillary (150 mm 0.05 mm ID) for G1377-87101 Needle Seat
1	G1377-87101	Optional Needle-Seat (without capillary) for G1377A
1	G1367-87303	Seat Capillary (150 mm 0.120 mm ID) for G1367-87104 Needle Seat
1	G1367-87302	Seat Capillary (150 mm 0.170 mm ID) for G1367-87104 Needle Seat
1	G1367-87105	Optional Needle-Seat (without capillary) for G1367D

- 1** Disconnect the seat capillary from the injection valve (port 5) with the 1/4 - 5/16 inch wrench.
- 2** Remove the needle seat, see [“Exchange the Needle Seat \( G1367-87105\) on the G1367D Exchange the Needle Seat \( G1377-87101\) on the G1377A”](#) on page 113.
- 3** Use the seat capillary mounting tool (provided in the accessory kit) and replace the seat capillary from the seat with the 4 mm wrench.
- 4** Install the seat assembly in its location and reconnect the capillary to the injection valve (port 5).
- 5** Follow the procedure in [“Exchange the Needle Seat \( G1367-87105\) on the G1367D Exchange the Needle Seat \( G1377-87101\) on the G1377A”](#) on page 113 to finish the installation.

**NOTE**

Choose the seat capillary diameter, as function of the column and the application you run on the system. See, [“Choice of Seat Capillary”](#) on page 80.

## Stator Face

<b>When</b>	<ul style="list-style-type: none"><li>• When poor injection-volume reproducibility</li><li>• When leaking injection valve</li></ul>						
<b>Tools required</b>	<ul style="list-style-type: none"><li>• 1/4 inch-5/16 inch wrench 8710-0510 (supplied in accessory kit)</li><li>• 9/64 inch 15 cm long, T-handle hex key 8710-2394 (supplied in accessory kit)</li></ul>						
<b>Parts required</b>	<table><thead><tr><th>#</th><th>Part number</th><th>Description</th></tr></thead><tbody><tr><td>1</td><td>0100-1851</td><td>Stator Face</td></tr></tbody></table>	#	Part number	Description	1	0100-1851	Stator Face
#	Part number	Description					
1	0100-1851	Stator Face					

### CAUTION

Damage of the stator face

The stator face is held in place by the stator head. When removing the stator head, the stator face can be damaged.

→ When removing the stator head, ensure the stator face does not fall out of the valve.

### NOTE

This procedure is only for the injection valve on the G1367B samplers. The injection valve on the G1367D and the G1377A samplers have no ceramic stator face.

- 1 Open the front door.
- 2 Remove all capillaries from the injection-valve ports with the 1/4 inch wrench.
- 3 Unscrew and remove the three stator screws from the stator head with the 9/64 inch wrench.
- 4 Remove the stator head and stator face.
- 5 Place the new stator face (0100-1851) on the stator head. The pins on the stator face must engage in the holes on the stator head.
- 6 Install this stator head/face assy on the injection valve. Tighten the screws alternately with the 9/64 inch wrench until the stator head is secure.
- 7 Reconnect all the capillaries to the injection valve ports with the 1/4 inch wrench.
- 8 Close the front cover.

## Rotor Seal

<b>When</b>	<ul style="list-style-type: none"> <li>• When poor injection-volume reproducibility</li> <li>• When leaking injection valve</li> </ul>																		
<b>Tools required</b>	<ul style="list-style-type: none"> <li>• 1/4 inch-5/16 inch wrench 8710-0510 (supplied in accessory kit)</li> <li>• 9/64 inch 15 cm long, T-handle hex key 8710-2394 (supplied in accessory kit)</li> </ul>																		
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1	0100-1853	Vespel Rotor Seal for 0101-0921 injection valve (G1367B)																	
1	0100-1849	Tefzel Rotor Seal for 0101-0921 injection valve (G1367B)																	
1	0100-2231	PEEK Rotor Seal for 0101-0921 injection valve (G1367B)																	
1	0100-2088	Vespel Rotor Seal for 0101-1050 injection valve (G1377A)																	
1	0101-1416	PEEK Rotor Seal for 0101-1422 injection valve (G1367D)																	

### CAUTION

Damage of the stator face

The stator face is held in place by the stator head. When removing the stator head, the stator face can be damaged.

→ When removing the stator head, ensure the stator face does not fall out of the valve.

### NOTE

The injection valve 0101-1050 for the G1377A sampler has no stator face. The injection valve 0101-1422 for the G1367D sampler has no stator face.

- 1 Open the front door.
- 2 Remove all capillaries from the injection-valve ports with the 1/4 inch wrench.
- 3 Unscrew and remove the three stator screws from the stator head with the 9/64 inch wrench.
- 4 Remove the stator head, the stator face and the stator ring.
- 5 Remove the rotor seal (and isolation seal if required).
- 6 Install the new rotor seal and isolation seal (if required). The metal spring inside the isolation seal must face toward the valve body. In other words, the metal spring should not be visible when the isolation seal is installed.

## **7 Maintenance**

### **Maintenance Procedures**

- 7** Reinstall the stator ring.
- 8** Place the stator face on the stator head. The pins on the stator face must engage in the holes on the stator head.
- 9** Install this stator head/face assy on the injection valve. Tighten the screws alternately with the 9/64 inch wrench until the stator head is secure.
- 10** Reconnect all the capillaries to the injection valve ports with the 1/4 inch wrench.
- 11** Close the front cover.

## Metering Seal and Plunger

### Removing the Metering Seal

- When**
- When poor injection-volume reproducibility
  - When leaking metering device

- Tools required**
- 1/4 inch-5/16 inch wrench 8710-0510 (supplied in accessory kit)
  - 4 mm open end wrench 8710-1534 (supplied in accessory kit)
  - 4 mm, 15 cm long, T-handle hex key 8710-2392 (supplied in accessory kit)
  - Small flat head screwdriver.

**Parts required**

#	Part number	Description
1	5063-6589	Metering Seal (pack of 2) for the G1367-60003 100 µl Analytical Head
1	5063-6586	Metering Plunger for the G1367-60003 100 µl Analytical Head
1	5022-2175	Metering Seal (pack of 1) for the G1377-60013 40 µl Analytical Head
1	5064-8293	Metering Plunger for the G1377-60013 40 µl Analytical Head

- 1 In the user interface start the maintenance mode and select the “Change Piston” function. In the Agilent Lab Monitor & Diagnostic Software the "Change Piston" function can be found under the "Tools" icon.
- 2 Open the front door
- 3 Remove the corrugated leak tubing
- 4 Remove the two capillaries from the analytical head (Use a 1/4 inch wrench if you have a SST capillary or a 4 mm wrench if you have a fused silica capillary).
- 5 Unscrew alternately the two fixing screws with the 4 mm hex key and remove them.
- 6 Pull the analytical head away from the sampling unit.
- 7 Remove the two fixing screws from the base of the analytical head.
- 8 Remove the head body.
- 9 Using the piston, carefully remove the metering seal. Clean the chamber and ensure all particular matter is removed.

### Installing the Metering Seal

- When**
- When poor injection-volume reproducibility
  - When leaking metering device

## 7 Maintenance

### Maintenance Procedures

- Tools required**
- 1/4 inch-5/16 inch wrench 8710-0510 (supplied in accessory kit)
  - 4 mm open end wrench 8710-1534 (supplied in accessory kit)
  - 4 mm, 15 cm long, T-handle hex key 8710-2392 (supplied in accessory kit)
  - Small flat head screwdriver.

**Parts required**

#	Part number	Description
1	5063-6589	Metering Seal (pack of 2) for the G1367-60003 100 µl Analytical Head
1	5063-6586	Metering Plunger for the G1367-60003 100 µl Analytical Head
1	5022-2175	Metering Seal (pack of 1) for the G1377-60013 40 µl Analytical Head
1	5064-8293	Metering Plunger for the G1377-60013 40 µl Analytical Head

- 1** Install the new metering seal. Press it firmly into position.
- 2** Reassemble the analytical head. Press the plunger assembly into the seal.
- 3** Put the two fixing screws in place and reinstall the analytical head to the sampling unit.
- 4** Tighten alternately the two fixing screws with the 4 mm hex key.
- 5** Connect the two capillaries to the analytical head (Use a 1/4 inch wrench if you have a SST capillary or a 4 mm wrench if you have a fused silica capillary).
- 6** Reinstall the corrugated leak tubing.
- 7** Close the front door.
- 8** In the user interface close the “Change Piston” function and exit the maintenance mode. In the Agilent Lab Monitor & Diagnostic Software the "Change Piston" function can be found under the "Tools" icon.

## Removing the Loop Capillary

- When**
- Capillary blocked
  - Capillary broken
- Tools required**
- Two 1/4 inch-5/16 inch wrenches 8710-0510 (supplied in accessory kit)

**Parts required**

#	Part number	Description
1	G1367-87300	Loop capillary (injection volume up to 100 µl) for the G1367B
1	G1377-87310	Loop capillary (injection volume up to 40 µl) for the G1367D
1	G1375-87315	Loop capillary (injection volume up to 8 µl) for the G1377A
1	G1377-87300	Loop capillary (injection volume up to 40 µl) for the G1377A

### WARNING

#### Risk of injury by uncovered needle

**An uncovered needle is a risk of harm to the operator.**

- Be careful when you remove the loop capillary.
- Use the silicon safety tube for the needle.

### NOTE

If the loop capillary is not broken and no solvent has leaked into the loop capillary tube, the solvent draw up steps using the syringe can be skipped (steps 5, 6, 8).

- 1 In the user interface start the maintenance mode and select the “Change Loop Capillary” function. In the Agilent Lab Monitor & Diagnostic Software the "Change Loop Capillary" function can be found under the "Tools" icon.
- 2 Open the front door and remove the side door.
- 3 Remove the plate tray from the tray base.
- 4 Push the silicon safety tube over the needle
- 5 Remove the corrugated loop capillary waste tube and introduce the small tubing from the leak kit into the loop capillary protection tube.
- 6 Draw up the liquid with the syringe.
- 7 Unlock the needle tighter lock system.
- 8 Draw up the rest of the solvent from the loop capillary protection tube.

## **7 Maintenance**

### **Maintenance Procedures**

- 9** Loosen the loop capillary fitting on the analytical head side.
- 10** Pinch the holder clamp, pull back and remove the needle assembly with the loop capillary from the needle carrier.
- 11** Attach the 5/16 inch wrench to hold position at the needle assembly. Use the 4 mm wrench to loosen the fitting of the loop capillary.
- 12** Pull the loop capillary out from the needle assembly.

## Installing the Loop Capillary

**When** Capillary blocked  
Capillary broken

**Tools required** • Two 1/4 inch-5/16 inch wrench 8710-0510 (supplied in accessory kit)

**Parts required**

#	Part number	Description
1	G1367-87300	Loop capillary (injection volume up to 100 µl) for the G1367B
1	G1377-87310	Loop capillary (injection volume up to 40 µl) for the G1367D
1	G1375-87315	Loop capillary (injection volume up to 8 µl) for the G1377A
1	G1377-87300	Loop capillary (injection volume up to 40 µl) for the G1377A

- 1 Pull the new loop capillary in the needle assembly.
- 2 Attach the 5/16 inch wrench to hold position at the needle assembly. Use the second wrench to tighten the loop capillary fitting.
- 3 Push the loop capillary into the loop capillary protection tube until it comes out on the sampling unit side.
- 4 Re install the loop capillary corrugated waste tube over the loop capillary.
- 5 Retighten the loop capillary fitting on the analytical head.
- 6 Pinch the holder clamp and reinsert the needle assembly into the needle carrier.
- 7 Push the black chain into the needle assembly until the stop.
- 8 Lock the needle tighter lock system.
- 9 Check the alignment of the needle in the needle pusher of the needle carrier by viewing from several directions to see that it is aligned in the center of the needle pusher.

### NOTE

The needle must be centered in the needle pusher as all alignment by the autosampler is calculated from the needle pusher position.

- 10 Remove the silicon safety tube from the needle.
- 11 Replace the plate tray in the tray base. Re-install the side door and close the front door.

## 7 Maintenance

### Maintenance Procedures

- 12 In the user interface close the "Change Loop Capillary" function and exit the maintenance mode. In the Agilent Lab Monitor & Diagnostic Software the "Change Loop Capillary" function can be found under the "Tools" icon.

## Peristaltic Pump

**When** • Tubing blocked or broken.

**Tools required** • sand paper

<b>Parts required</b>	<b>#</b>	<b>Part number</b>	<b>Description</b>
	1	5065-4445	Peristaltic pump with Pharmed tubing

### NOTE

The peristaltic pump is a replaceable unit. The tubing inside the pump is not replaceable.

- 1** Remove the corrugated leak tubing.
- 2** Press the two clips on the front of the peristaltic pump.
- 3** Pull the pump forward off the motor shaft.
- 4** Disconnect the tubing leading to the wash port and the tubing coming from the solvent bottle.
- 5** Connect the wash port tubing to the upper tubing of the new pump (use sandpaper to get a good grip on the tubing).
- 6** Connect the tubing coming from the solvent bottle to the lower tubing of the new pump.
- 7** Push the pump onto the motor shaft until the clips click into place.
- 8** Reinstall the corrugated leak tubing.

## Installing Interface Board

**When** • For all repairs inside the sampler or for installation of the board.

**Tools required** • Flat-head screwdriver.

**Parts required**

#	Description
1	Interface board

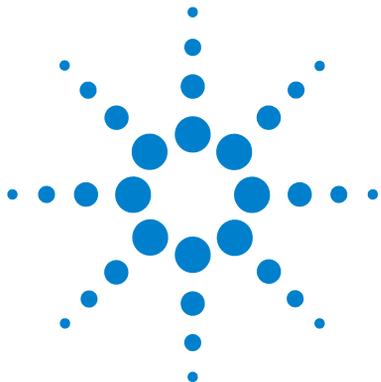
### CAUTION

#### *Electrostatic discharge at the interface board*

The interface board is sensitive to electrostatic discharge.

→ Always use the ESD strap when handling electronic boards.

- 
- 1 Switch off the autosampler at the main power switch.
  - 2 Disconnect all cables from the existing interface board. Then loosen the interface board holding screws and slide the board out of its holding rails.
  - 3 Identify the interface board slot cover. Loosen the two holding screws, and remove the cover.
  - 4 Carefully insert the new interface board into the holding rails, and push the board into the slot. Make sure the board plugs into the socket correctly.
  - 5 Reconnect all cables to the new interface board.
  - 6 Switch on the sampler.



## 8 Parts and Materials for Maintenance

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G1367-68705 133

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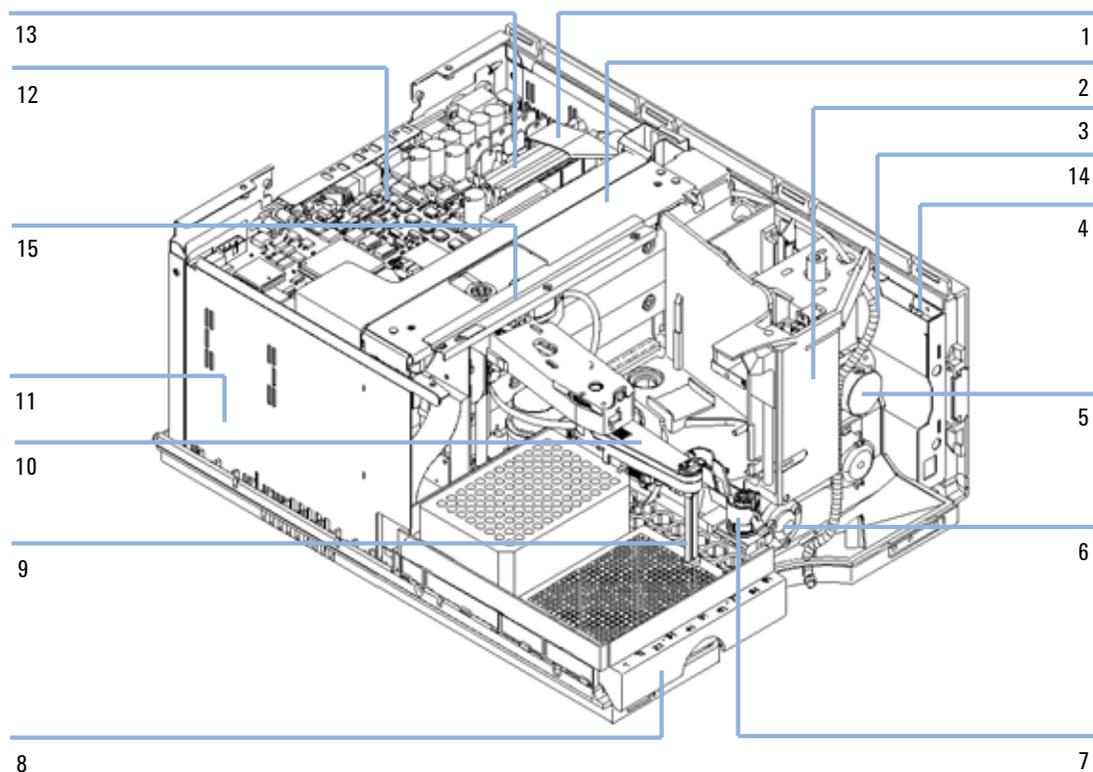
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## Sampler Main Assemblies



**Figure 24** Autosampler Main Assemblies

**Table 24** Autosampler Main Assemblies

Item	Description	Part Number
1	Ribbon Cable (from SU to MTP)	<b>G1313-81602</b>
2	Sample Transport assembly for G1367B/D Sample Transport assembly for G1377A	<b>G1367-60019</b> <b>G1377-60009</b>

**Table 24** Autosampler Main Assemblies

<b>Item</b>	<b>Description</b>	<b>Part Number</b>
3	Sampling Unit assembly for G1367B	<b>G1367-60008</b>
	Sampling Unit assembly for G1367D	<b>G1367-60028</b>
	Sampling Unit assembly for G1377A (The assy comes without injection valve and analytical head)	<b>G1377-60008</b>
4	SLS board (not shown)	<b>G1367-66505</b>
5	Analytical Head assembly (100 µl) for G1367B	<b>G1367-60003</b>
	Analytical Head assembly (40 µl) for G1367D	<b>G1377-60023</b>
	Analytical Head assembly (40 µl) for G1377A	<b>G1377-60013</b>
6	Injection Valve assembly for G1367B	<b>0101-0921</b>
	Injection Valve assembly for G1367D	<b>0101-1422</b>
	Micro Injection valve assembly for G1377A	<b>0101-1050</b>
7	Needle Seat assy for G1367B	<b>G1367-87101</b>
	Needle Seat assy for G1367D (without capillary)	<b>G1367-87105</b>
	Seat cap. (0.12 mm) for G1377-87104 Needle Seat	<b>G1367-87303</b>
	Seat cap. (0.17 mm) for G1377-87104 Needle Seat	<b>G1367-87302</b>
	Needle Seat assy for G1377A (without capillary)	<b>G1377-87101</b>
	Seat cap. (0.10 mm ID) for G1377-87101 Needle Seat	<b>G1375-87317</b>
Seat cap. (0.075 mm) for G1377-87101 Needle Seat	<b>G1375-87316</b>	
Seat cap. (0.05 mm) for G1377-87101 Needle Seat	<b>G1375-87300</b>	
8	Plate Tray base	<b>G2258-60011</b>
9	Needle assy for G1367B/D	<b>G1367-87202</b>
	Needle assy for G1377A	<b>G1377-87201</b>
10	Needle Carrier assembly	<b>G1367-60010</b>
11	Power supply assembly (not visible)	<b>0950-2528</b>
12	Autosampler Main Board (MTP)	<b>G1367-66520</b>
	Exchange Assembly - MTP board	<b>G1367-69520</b>
13	Ribbon Cable (from ST to MTP)	<b>G1364-81601</b>
	Ribbon Cable (from SLS to MTP) (not visible)	<b>G1367-81600</b>
14	Loop capillary for G1367B	<b>G1367-60007</b>
	Loop capillary for G1367D	<b>G1377-87310</b>
	Loop capillary for G1377A (8µl injection volume)	<b>G1375-87315</b>
	Loop capillary for G1377A (40µl injection volume)	<b>G1377-87300</b>

## 8 Parts and Materials for Maintenance

### Sampler Main Assemblies

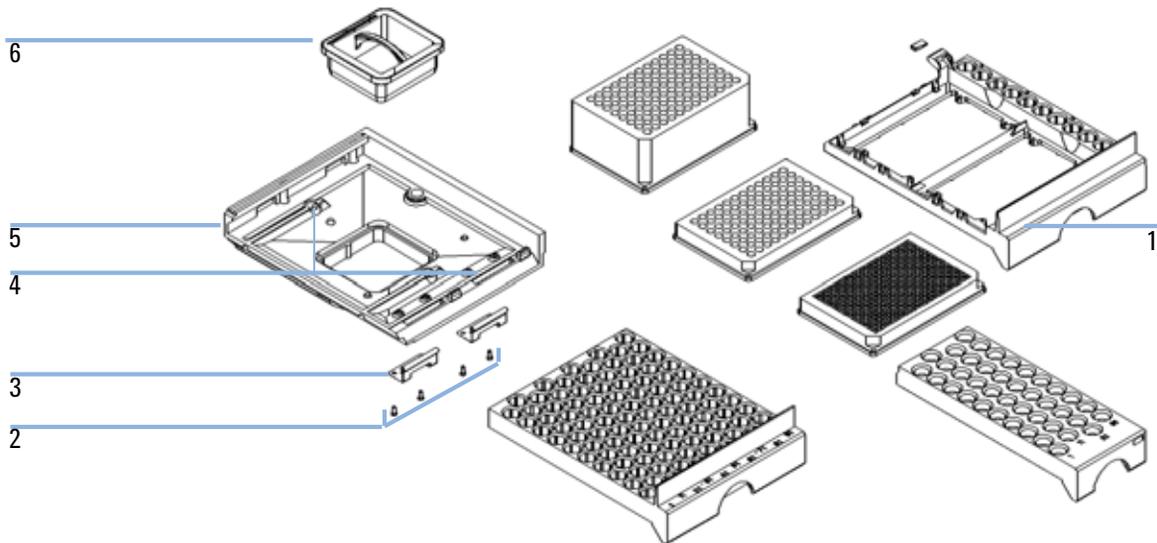
**Table 24** Autosampler Main Assemblies

<b>Item</b>	<b>Description</b>	<b>Part Number</b>
15	Illumination assembly for sampler	<b>G1367-60040</b>
	Sampler-TCC cap. (380 mm, 0.17 mm id) for G1367/68A	<b>01090-87306</b>
	Sampler-TCC cap. (500 mm, 0.05 mm id) for G1377/78A	<b>G1375-87304</b>
	Fan (not visible)	<b>3160-1017</b>
	Fan exhaust (not visible)	<b>3160-4097</b>
	BCD board (not visible)	<b>G1351-68701</b>

# Vial Trays

**Table 25** Autosampler Vial Trays and Tray Base

Item	Description	Part Number
1	Tray for 2 plates + 10 × 2-ml vials	G2258-60011
2	Screws for springs	0515-0866
3	Spring	G1313-09101
4	Spring stud	0570-1574
5	Tray base (includes items 4,5,6)	G1329-60000
6	Adapter air channel	G1329-43200
	Plug channel (not shown)	G1367-47200



**Figure 25** Vial trays and Tray Base

## 8 Parts and Materials for Maintenance

### Vial Trays

**Table 26** Recommended plates and closing mat

Description	Rows	Columns	Plate height	Volume (µl)	Part Number	Package
384Agilent	16	24	14.4	80	5042-1388	30
384Corning	16	24	14.4	80	No Agilent PN	
384Nunc	16	24	14.4	80	No Agilent PN	
96Agilent	8	12	14.3	400	<b>5042-1386</b> <b>5042-1385</b>	10 120
96Agilent conical	8	12	17.3	150	<b>5042-8502</b>	25
96CappedAgilent	8	12	47.1	300	<b>5065-4402</b>	1
96Corning	8	12	14.3	300	No Agilent PN	
96CorningV	8	12	14.3	300	No Agilent PN	
96DeepAgilent31mm	8	12	31.5	1000	<b>5042-6454</b>	50
96DeepNunc31mm	8	12	31.5	1000	No Agilent PN	
96DeepRitter41mm	8	12	41.2	800	No Agilent PN	
96Greiner	8	12	14.3	300	No Agilent PN	
96GreinerV	8	12	14.3	250	No Agilent PN	
96Nunc	8	12	14.3	400	No Agilent PN	
Closing mat for all 96 Agilent plates	8	12			<b>5042-1389</b>	50

**Table 27** Recommended Vial plates

Description	Part Number
Vial plate for 54x2ml vials (6/pk)	<b>G2255-68700</b>
Vial plate for 15x6ml vials (1/pk)	<b>5022-6539</b>
Vial plate for 27 Eppendorf tubes (1/pk)	<b>5022-6538</b>

## High Performance Autosampler and SL+ Version Accessory Kit G1367-68705

**Table 28** High Performance Autosampler and SL+ version Accessory Kit G1367-68705

Description	Quantity	Part Number
Capillary sampler-column (380 mm, 0.17 mm ID)	1	<b>01090-87306</b>
96 well plate 0.5 ml, PP (pack of 10)	1	<b>5042-1386</b>
Tubing assembly	1	<b>5063-6527</b>
Filter kit	1	<b>5064-8240</b>
CAN cable, 1 m	1	<b>5181-1519</b>
Vials, screw cap 100/pk	1	<b>5182-0716</b>
Blue screw caps 100/pk	1	<b>5182-0717</b>
Hex key 9/64 inch (for injection-valve screws)	1	<b>8710-0060</b>
Wrench, 4 mm both ends	2	<b>8710-1534</b>
Rheotool socket wrench 1/4 inch	1	<b>8710-2391</b>
Hex key 4.0 mm, 15 cm long, T-handle	1	<b>8710-2392</b>
Hex key 9/64 inch, 15 cm long, T-handle	1	<b>8710-2394</b>
Hex key 2.0 mm	1	<b>8710-2438</b>
ESD wrist strap	1	<b>9300-1408</b>
Air channel adapter	1	<b>G1329-43200</b>
Capillary WPS to column (250 mm, 0.17 mm ID)	1	<b>G1367-87304</b>
WPS leak kit	1	<b>G1367-60006</b>
Tool for micro seat capillary	1	<b>G1377-44900</b>

## Micro Well Plate Autosampler Accessory Kit G1377-68705

**Table 29** Micro Well Plate Autosampler Accessory Kit Contents G1377-68705

<b>Description</b>	<b>Quantity</b>	<b>Part Number</b>
96 well plate 0.5 ml, PP (pack of 10)	1	<b>5042-1386</b>
Tubing assembly	1	<b>5063-6527</b>
Filter kit	1	<b>5064-8240</b>
CAN cable, 1 m	1	<b>5181-1519</b>
Vials, screw cap 100/pk	1	<b>5182-0716</b>
Blue screw caps 100/pk	1	<b>5182-0717</b>
Valve catalog	1	<b>5988-2999</b>
Hex key 9/64 inch (for injection-valve screws)	1	<b>8710-0060</b>
Wrenches 1/4 — 5/16 inch	2	<b>8710-0510</b>
Wrench 4.0 mm open end	1	<b>8710-1534</b>
Rheotool socket wrench 1/4 inch	1	<b>8710-2391</b>
Hex key 4.0 mm, 15 cm long, T-handle	1	<b>8710-2392</b>
Hex key 9/64 inch, 15 cm long, T-handle	1	<b>8710-2394</b>
Hex key 2.5 mm, 15 cm long, straight handle	1	<b>8710-2412</b>
Hex key 2.0 mm	1	<b>8710-2438</b>
ESD wrist strap	1	<b>9300-1408</b>
Torque adapter	1	<b>G1315-45003</b>
Air channel adapter	1	<b>G1329-43200</b>
Capillary sampler-column (500 mm, 0.05 mm ID)	1	<b>G1375-87304</b>
40 µl Loop capillary	1	<b>G1377-87300</b>
WPS leak kit	1	<b>G1367-60006</b>

## Micro Well Plate Autosampler Accessory Kit G1377-68705

**Table 29** Micro Well Plate Autosampler Accessory Kit Contents G1377-68705

<b>Description</b>	<b>Quantity</b>	<b>Part Number</b>
Seat capillary (150 mm, 0.075 mm ID)	1	<b>G1367-87316</b>
Tool for micro seat capillary	1	<b>G1377-44900</b>

**8**   **Parts and Materials for Maintenance**  
Multi-Draw Kit G1313-68711 (Only For G1367B)

## Multi-Draw Kit G1313-68711 (Only For G1367B)

**Table 30**   Multi-Draw Kit

<b>Item</b>	<b>Description</b>	<b>Part Number</b>
1	Seat capillary, 500 $\mu$ l, 0.5 mm id	<b>G1313-87307</b>
2	Seat capillary, 1500 $\mu$ l, 0.9 mm id	<b>G1313-87308</b>
3	Union	<b>0100-0900</b>

## G1373A Injector Purge Kit Parts

**Table 31** Injector Purge Kit Parts for G1367B Autosamplers

<b>Description</b>	<b>Part Number</b>
Plastic cover cabinet kit with rail (includes top and side covers and the bolt carrier for mounting the front door).	<b>5064-1533</b>
6-Position-7-Ports 1200 Series CAN valve Assay (Reorder number, for repairs, only)	<b>G1156-60001</b>
Stator for G1156A valve	<b>0101-1410</b>
1-Groove Rotor seal for G1156A valve	<b>0101-1411</b>
Wellplate Autosampler Purge Accessory kit (not orderable separately), includes items 6-22	<b>G1373-68705</b>
2x Solvent bottle, clear glass, 1l	<b>9301-1420</b>
2x Bottle head assembly	<b>G1311-60003</b>
Tubing Set 100 cm (2x, for solvent connection from degasser to the purge valve)	<b>G1373-67300</b>
2x PEEK Adapter for tubing from degasser to valve port	<b>0100-1847</b>
Blanking Nut SST	<b>01080-83202</b>
Flexible Capillary 0.25 mm ID, length 320 mm	<b>5065-9980</b>
1/16" front ferrules for SST capillaries, 1/16" back ferrules for SST capillaries, Fitting Screw long, pack of 10	<b>5065-4454</b>
3-groove Rotor seal for max. 600 bar (G1367D WPS injection valve, purge kit setup)	<b>0101-1409</b>
Restriction capillary for injection valve waste outlet	<b>G1373-87300</b>
CAN cable, 1 m long (for 1200 Series module to module CAN connections)	<b>5181-1519</b>
DC CAN cable (to supply power to the G1156A valve from e.g. the G1367B WP-ALS)	<b>5181-1533</b>
Rheotool socket wrench	<b>8710-2391</b>

## 8 Parts and Materials for Maintenance

### G1373A Injector Purge Kit Parts

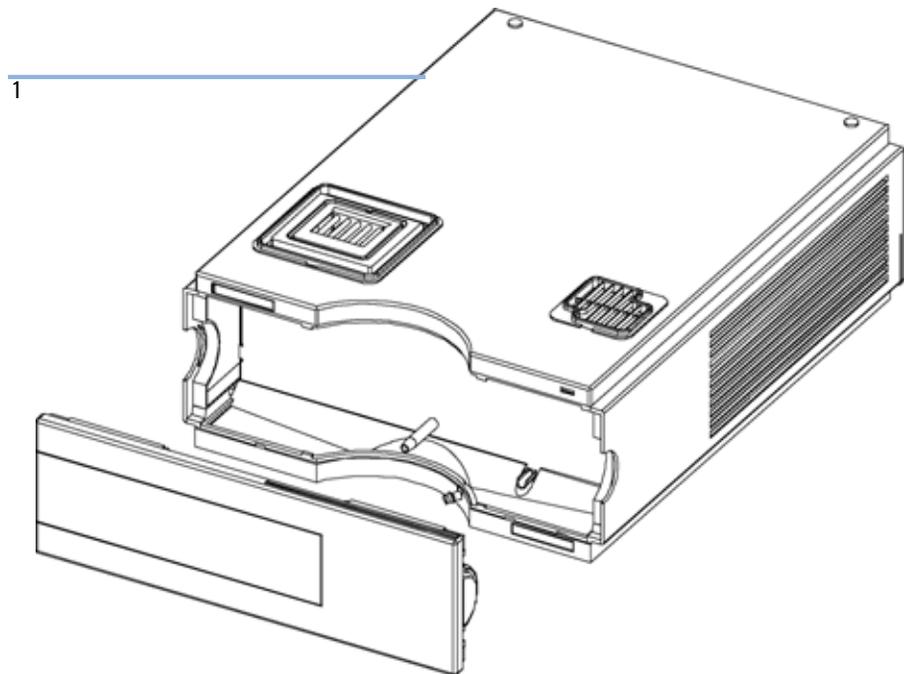
**Table 31** Injector Purge Kit Parts for G1367B Autosamplers

<b>Description</b>	<b>Part Number</b>
9/64" Hex key driver	<b>8710-2394</b>
Priming Syringe (for solvent inlet tubing, reorder number, pack of 10)	<b>5062-8534</b>
Syringe Adapter for priming syringe	<b>9301-1337</b>
ChemStation CD ROM Rev. B.01.03 or higher for the use of this kit	N/A
Installation Note (this note)	N/A

## Thermostat for ALS/FC/Spotter

**Table 32** Thermostat for ALC/FC/Spotter

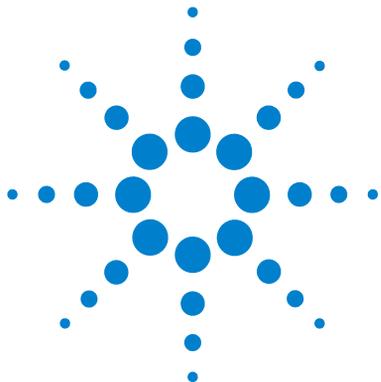
Item	Description	Part Number
1	Thermostat, exchange assembly	G1330-69040



**Figure 26** Thermostat for ALS/FC/Spotter

## **8 Parts and Materials for Maintenance**

### **Thermostat for ALS/FC/Spotter**



## 9 Appendix

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This appendix provides general safety and environmental information.



## General Safety Information

### General Safety Information

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Aligent Technologies assumes no liability for the customer's failure to comply with these requirements.

### General

This is a Safety Class I instrument (provided with terminal for protective earthing) and has been manufactured and tested according to international safety standards.

### Operation

Before applying power, comply with the installation section. Additionally the following must be observed.

Do not remove instrument covers when operating. Before the instrument is switched on, all protective earth terminals, extension cords, auto-transformers, and devices connected to it must be connected to a protective earth via a ground socket. Any interruption of the protective earth grounding will cause a potential shock hazard that could result in serious personal injury. Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any intended operation.

Make sure that only fuses with the required rated current and of the specified type (normal blow, time delay, and so on) are used for replacement. The use of repaired fuses and the short-circuiting of fuseholders must be avoided.

**CAUTION**

Ensure the proper usage of the equipment.

The protection provided by the equipment may be impaired.

→ The operator of this instrument is advised to use the equipment in a manner as specified in this manual.

---

Some adjustments described in the manual, are made with power supplied to the instrument, and protective covers removed. Energy available at many points may, if contacted, result in personal injury.

Any adjustment, maintenance, and repair of the opened instrument under voltage should be avoided as much as possible. When inevitable, this should be carried out by a skilled person who is aware of the hazard involved. Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present. Do not replace components with power cable connected.

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

Do not install substitute parts or make any unauthorized modification to the instrument.

Capacitors inside the instrument may still be charged, even though the instrument has been disconnected from its source of supply. Dangerous voltages, capable of causing serious personal injury, are present in this instrument. Use extreme caution when handling, testing and adjusting.

When working with solvents please observe appropriate safety procedures (e.g. goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet by the solvent vendor, especially when toxic or hazardous solvents are used.

## Safety Symbols

**Table 33** Safety Symbols

Symbol	Description
	The apparatus is marked with this symbol when the user should refer to the instruction manual in order to protect risk of harm to the operator and to protect the apparatus against damage.
	Indicates dangerous voltages.
	Indicates a protected ground terminal.
	Indicates eye damage may result from directly viewing the light produced by the deuterium lamp used in this product.
	The apparatus is marked with this symbol when hot surfaces are available and the user should not touch it when heated up.

### WARNING

#### A WARNING

alerts you to situations that could cause physical injury or death.

- Do not proceed beyond a warning until you have fully understood and met the indicated conditions.

### CAUTION

A caution

alerts you to situations that could cause loss of data and damage of equipment.

- Do not proceed beyond a caution until you have fully understood and met the indicated conditions.

## Lithium Batteries Information

### WARNING

Lithium batteries may not be disposed-off into the domestic waste. Transportation of discharged Lithium batteries through carriers regulated by IATA/ICAO, ADR, RID, IMDG is not allowed.

**Danger of explosion if battery is incorrectly replaced.**

- Discharged Lithium batteries shall be disposed off locally according to national waste disposal regulations for batteries.
  - Replace only with the same or equivalent type recommended by the equipment manufacturer.
- 

### WARNING

**Lithiumbatteri - Eksplosionsfare ved fejlagtig håndtering.**

**Udskiftning må kun ske med batteri af samme fabrikat og type.**

- Lever det brugte batteri tilbage til leverandøren.
- 

### WARNING

**Lithiumbatteri - Eksplosionsfare.**

**Ved udskiftning benyttes kun batteri som anbefalt av apparatfabrikanten.**

- Brukt batteri returneres apparatleverandøren.
- 

### NOTE



Bij dit apparaat zijn batterijen geleverd. Wanneer deze leeg zijn, moet u ze niet weggooien maar inleveren als KCA.

---

## The Waste Electrical and Electronic Equipment Directive

### Abstract

The Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC), adopted by EU Commission on 13 February 2003, is introducing producer responsibility on all electric and electronic appliances starting with 13 August 2005.

#### NOTE

This product complies with the WEEE Directive (2002/96/EC) marking requirements. The affixed label indicates that you must not discard this electrical/electronic product in domestic household waste.

Product Category:

With reference to the equipment types in the WEEE Directive Annex I, this product is classed as a "Monitoring and Control Instrumentation" product.

---

#### NOTE



Do not dispose off in domestic household waste

To return unwanted products, contact your local Agilent office, or see [www.agilent.com](http://www.agilent.com) for more information.

---

## Radio Interference

Never use cables other than the ones supplied by Agilent Technologies to ensure proper functionality and compliance with safety or EMC regulations.

### **Test and Measurement**

If test and measurement equipment is operated with equipment unshielded cables and/or used for measurements on open set-ups, the user has to assure that under operating conditions the radio interference limits are still met within the premises.

## Sound Emission

### Manufacturer's Declaration

This statement is provided to comply with the requirements of the German Sound Emission Directive of 18 January 1991.

This product has a sound pressure emission (at the operator position) < 70 dB.

- Sound Pressure  $L_p < 70$  dB (A)
- At Operator Position
- Normal Operation
- According to ISO 7779:1988/EN 27779/1991 (Type Test)

## Solvent Information

### Flow Cell

To protect optimal functionality of your flow-cell:

- Avoid the use of alkaline solutions (pH > 9.5) which can attack quartz and thus impair the optical properties of the flow cell.
- If the flow cell is transported while temperatures are below 5 degree C, it must be assured that the cell is filled with alcohol.
- Aqueous solvents in the flow cell can built up algae. Therefore do not leave aqueous solvents sitting in the flow cell. Add a small % of organic solvents (e.g. acetonitrile or methanol ~5%).

### Use of Solvents

Observe the following recommendations on the use of solvents.

- Brown glass ware can avoid growth of algae.
- Avoid the use of the following steel-corrosive solvents:
  - Solutions of alkali halides and their respective acids (for example, lithium iodide, potassium chloride, and so on),
  - High concentrations of inorganic acids like sulfuric acid and nitric acid, especially at higher temperatures (if your chromatography method allows, replace by phosphoric acid or phosphate buffer which are less corrosive against stainless steel),
  - Halogenated solvents or mixtures which form radicals and/or acids, for example:  
$$2\text{CHCl}_3 + \text{O}_2 \rightarrow 2\text{COCl}_2 + 2\text{HCl}$$

This reaction, in which stainless steel probably acts as a catalyst, occurs quickly with dried chloroform if the drying process removes the stabilizing alcohol,
  - Chromatographic grade ethers, which can contain peroxides (for example, THF, dioxane, di-isopropylether) such ethers should be filtered through dry aluminium oxide which adsorbs the peroxides,
  - Solvents containing strong complexing agents (e.g. EDTA),
  - Mixtures of carbon tetrachloride with 2-propanol or THF.

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<http://www.agilent.com>

Select “**Products**” - “**Chemical Analysis**”

It will also provide the latest firmware of the Agilent 1200 series modules for download.

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## In This Book

This manual contains user information about the Agilent 1200 Series High Performance Autosamplers & Micro Well Plate Autosampler. The manual describes the following:

- introduction to the sampler,
- site requirements and specifications,
- installing and using the sampler,
- optimizing performance,
- troubleshooting and diagnostics,
- maintenance,
- parts and materials,
- safety and legal information.

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