1290 Infinity II High-Speed Pumps

Agilent InfinityLab LC Series

User Manual

Notices

Document Information

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Safety Notices

CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

In This Guide…

This manual covers:

- Agilent 1290 Infinity II High-Speed Pump (G7120A)
- Agilent 1290 Infinity II Bio High-Speed Pump (G7132A)

1 Introduction

This chapter gives an introduction to the pump and an instrument overview.

2 Site Requirements and Specifications

This chapter provides information on environmental requirements, physical and performance specifications.

3 Using the Pump

This chapter explains the operational parameters of the Agilent 1290 Infinity II High-Speed Pumps.

4 Preparing the Pump

This chapter provides information on how to set up the module for an analysis and explains the basic settings.

5 Optimizing Performance

This chapter gives hints on how to optimize performance or use additional devices.

6 Troubleshooting and Diagnostics

Overview about the troubleshooting and diagnostic features.

7 Error Information

This chapter describes the meaning of error messages, and provides information on probable causes and suggested actions how to recover from error conditions.

8 Maintenance

This chapter describes the maintenance of the Agilent 1290 Infinity II High-Speed Pumps.

9 Parts and Materials for Maintenance

This chapter provides information on parts for maintenance.

10 Identifying Cables

This chapter provides information on cables used with the modules.

11 Hardware Information

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12 LAN Configuration

This chapter provides information on connecting the module to the Agilent ChemStation PC.

13 Appendix

This chapter provides addition information on safety, legal and web.

Contents

1 Introduction

This chapter gives an introduction to the pump and an instrument overview.

Agilent 1290 Infinity II High-Speed Pump

Product Description

The Agilent 1290 Infinity II High-Speed Pump can enhance your efficiency through high speed and chromatographic performance.

A low-delay-volume mixer allows you to run fast gradients for narrow-bore applications for high laboratory efficiency.

The new 1290 Infinity II LC power range has a high instrument efficiency, allowing you to run any HPLC and UHPLC method.

The full ISET range enables you to transfer existing methods from different instruments, including current Agilent systems as well as instruments from other manufacturers.

Active damping, automatic purge valve, new ultralow dispersion kits or low delay-volume capability, combine to achieve high instrument and analytical efficiency.

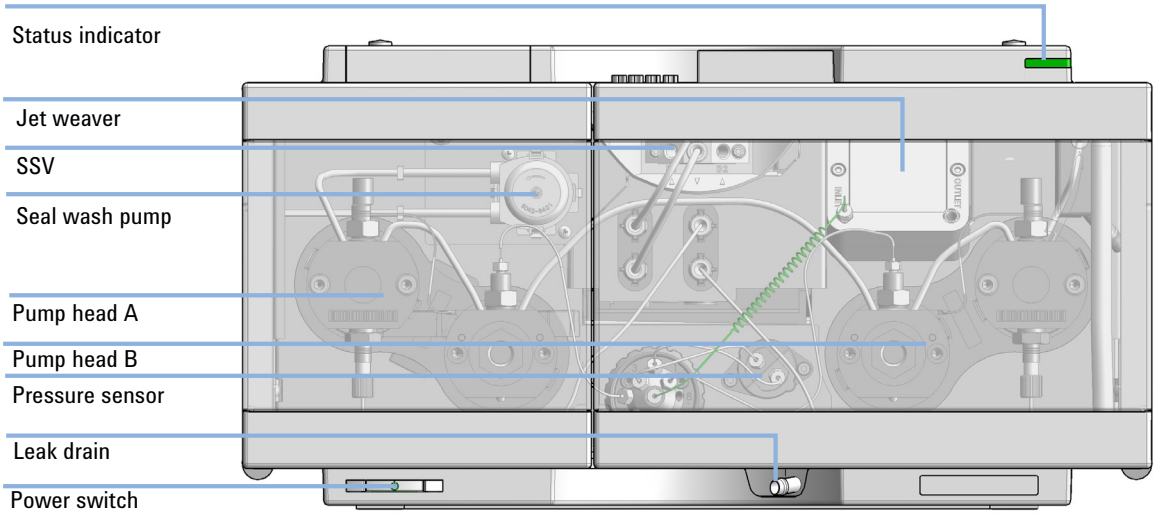


Figure 1 Overview of the High-Speed Pump

Features

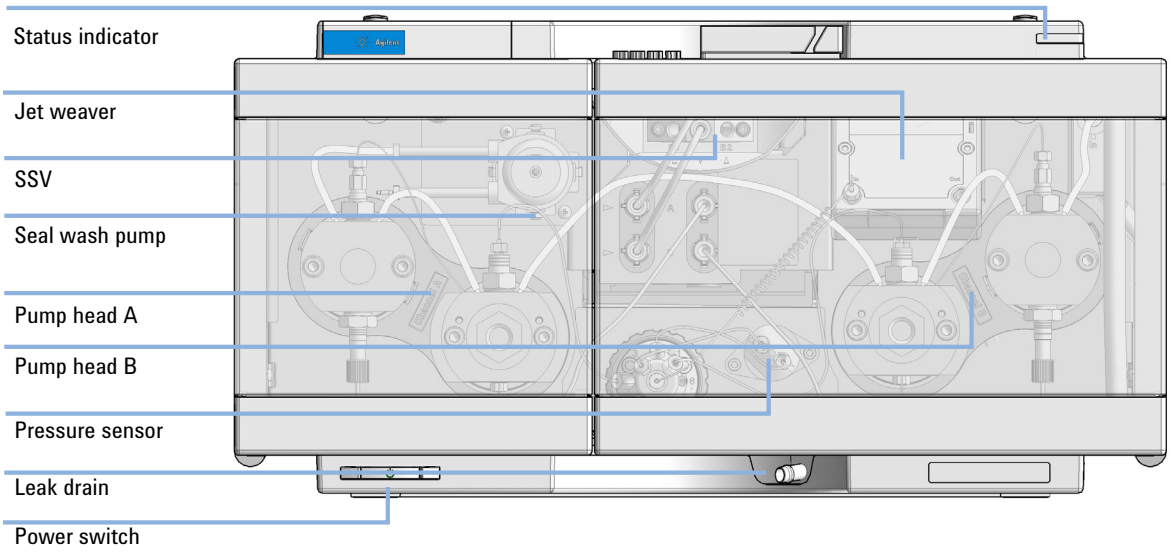
- High performance in terms of accuracy and precision for flow and composition.
- High power range combining high pressure up to 1300 bar and high analytical flow rates up to 5 mL/min for high chromatographic performance.
- The unique Intelligent System Emulation Technology (ISET) enables the emulation of current Agilent 1100, 1200 and 1260 Infinity series instrument, as well as Waters Alliance, Waters H-Class, Waters Acquity and Shimadzu Prominence.
- Low delay volumes (to 10 µL) for running fast gradients on narrow-bore columns make this pump a suitable front-end for LC/MS applications.
- Active damping with independently controllable high resolution pump drives and firmware-embedded tuning algorithms significantly reduce ripples and associated UV noise.
- The new Agilent Jet Weaver mixer, based on multi-layer microfluidic technology, facilitates high efficiency mixing in combination with low delay volume for high UV-detector sensitivity.
- Integrated high efficiency degasser with low internal volume is based on PTFE AF technology and has a fast change-over of solvents for purging and priming the pump.
- Built-in active seal-wash for increased uptime.

Agilent 1290 Infinity II Bio High-Speed Pump

Product Description

The 1290 Infinity II Bio High-Speed Pump is a binary UHPLC pump consisting of biocompatible material for use in biopharma (critical quality attributes) and other applications utilizing high salt and extreme pH conditions. It uses high-pressure blending from two solvents at pressures up to 1300 bar and flow rates up to 5 mL/min.

The 1290 Infinity II Bio High-Speed Pump has an exceptionally low delay volume, achieving high throughput and highest resolution for the most demanding applications, giving you highest confidence in your results. It is the ideal front end for LC/MS applications.



Features

- The biocompatible pump is resistant to corrosion from high salt concentrations and harsh cleaning procedures for increased instrument uptime.
- High salt tolerance and wide pH range offers increased flexibility.
- Power range combines ultrahigh pressure up to 1300 bar and high analytical flow rates up to 5 mL/min for maximum UHPLC performance.
- Bio Jet Weaver Mixer, based on multilayer microfluidic technology, combines highest efficiency mixing with lowest delay volume for highest UV-detector sensitivity.
- Integrated high-efficiency degasser with low internal volume is based on PTFE AF technology and provides fast change-over of solvents for purging and priming the pump.
- Built-in active seal wash increases instrument uptime.
- Lowest delay volumes down to 10 µL allow you to run ultrafast gradients on narrow-bore columns, making this pump the ideal front-end for LC/MS applications.

Pump Principle

Agilent 1290 Infinity II High-Speed Pumps feature a dual pump head design for the generation of binary gradients.

The solvent selection valve allows the choice of two solvents per pump head. However, this valve cannot be switched during a run.

Each pump head is equipped with two independently actuated pistons in series.

Delivery cycle:

1. Piston two moves forward to deliver solvent into the flow path. The flow-rate is thereby determined by the speed of the piston.

   At the same time, piston one draws solvent from the solvent reservoir. The two piston chambers are isolated by a check valve (outlet ball valve).
2. Shortly before the end of the delivery stroke of piston two, piston one reverses its direction. The check valve (passive inlet valve) at the inlet of piston chamber one closes while the solvent in piston chamber one gets compressed to system operating pressure.
3. Piston two reverses while piston one delivers the set flow rate into the flow path and re-fills piston chamber two.
4. When piston two has reached the end of its intake stroke it reverses and the delivery cycle starts again with step 1)

Reproducible solvent properties are maintained by an integrated two-channel solvent degasser. It is located between the solvent selection valve and the pump heads.

The pump automatically compensates for pressure and flow instabilities caused by the complex relationship between solvent compressibility and system pressure.

The only user interaction is selecting the appropriate solvent or solvent mixture per channel from a drop-down list.

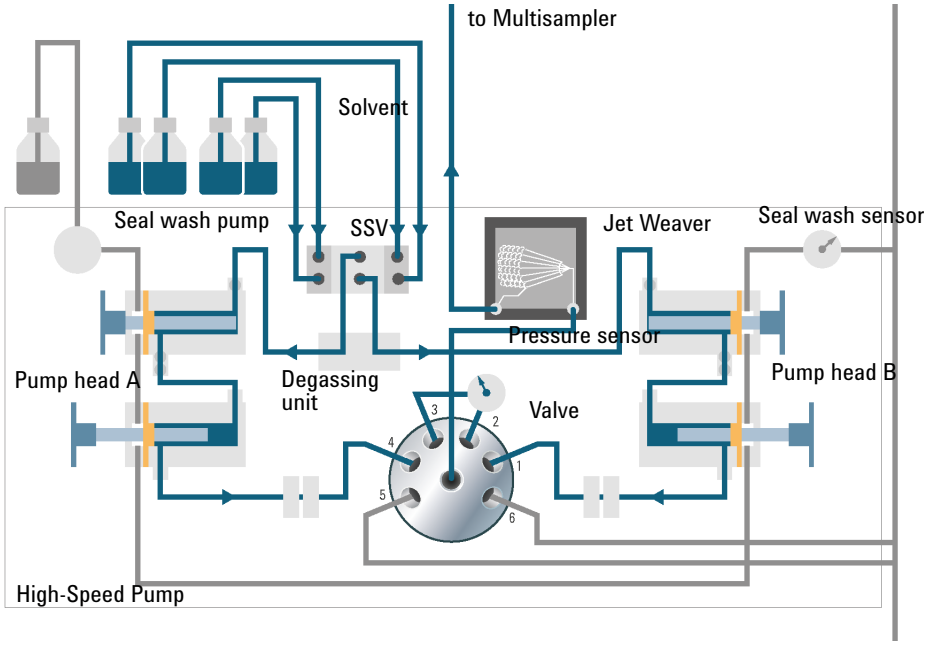


Figure 2 The hydraulic path

Leak and Waste Handling

The Agilent InfinityLab LC Series has been designed for safe leak and waste handling. It is important that all security concepts are understood and instructions are carefully followed.

The solvent cabinet is designed to store a maximum volume of 8 L solvent. The maximum volume for an individual bottle stored in the solvent cabinet should not exceed 2 L. For details, see the usage guideline for the Agilent Infinity II Solvent Cabinets (a printed copy of the guideline has been shipped with the solvent cabinet, electronic copies are available on the Internet).

All leak plane outlets are situated in a consistent position so that all Infinity and Infinity II modules can be stacked on top of each other. Waste tubes are guided through a channel on the right hand side of the instrument, keeping the front access clear from tubes.

The leak plane provides leak management by catching all internal liquid leaks, guiding them to the leak sensor for leak detection, and passing them on to the next module below, if the leak sensor fails. The leak sensor in the leak plane stops the running system as soon as the leak detection level is reached.

Solvent and condensate is guided through the waste channel into the waste container:

- from the detector's flow cell outlet
- from the Multisampler needle wash port
- from the Sample Cooler or Sample Thermostat (condensate)
- from the pump's Seal Wash Sensor (if applicable)
- from the pump's Purge Valve or Multipurpose Valve

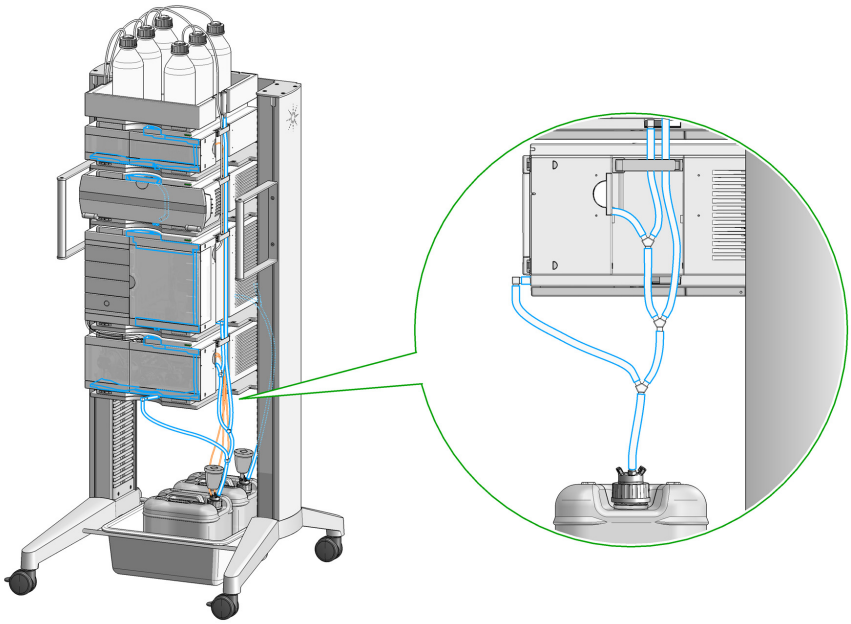


Figure 3 Infinity II Leak Waste Concept (Flex Bench installation)

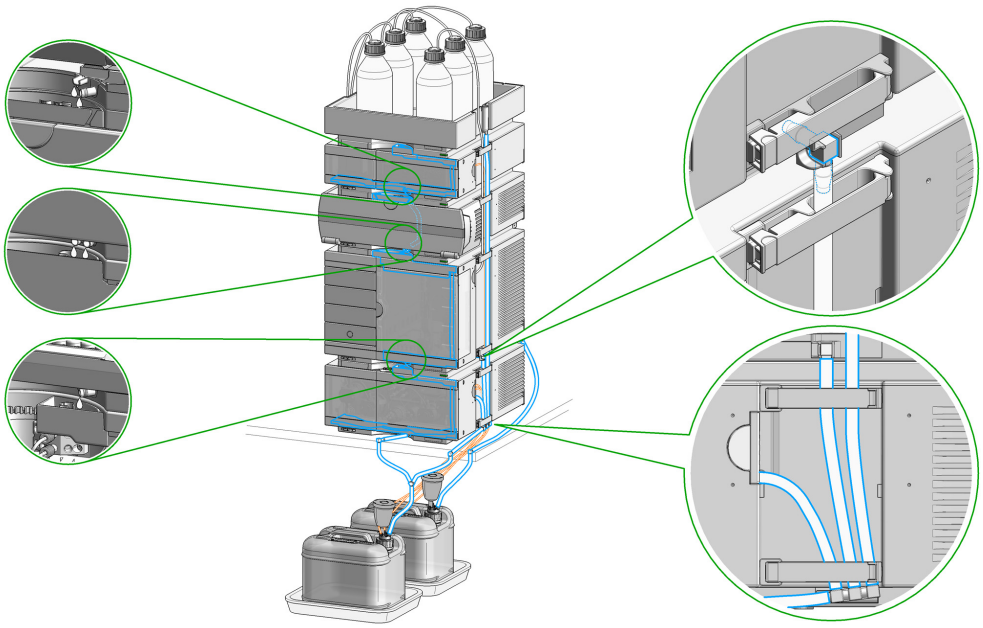


Figure 4 Infinity II Single Stack Leak Waste Concept (bench installation)

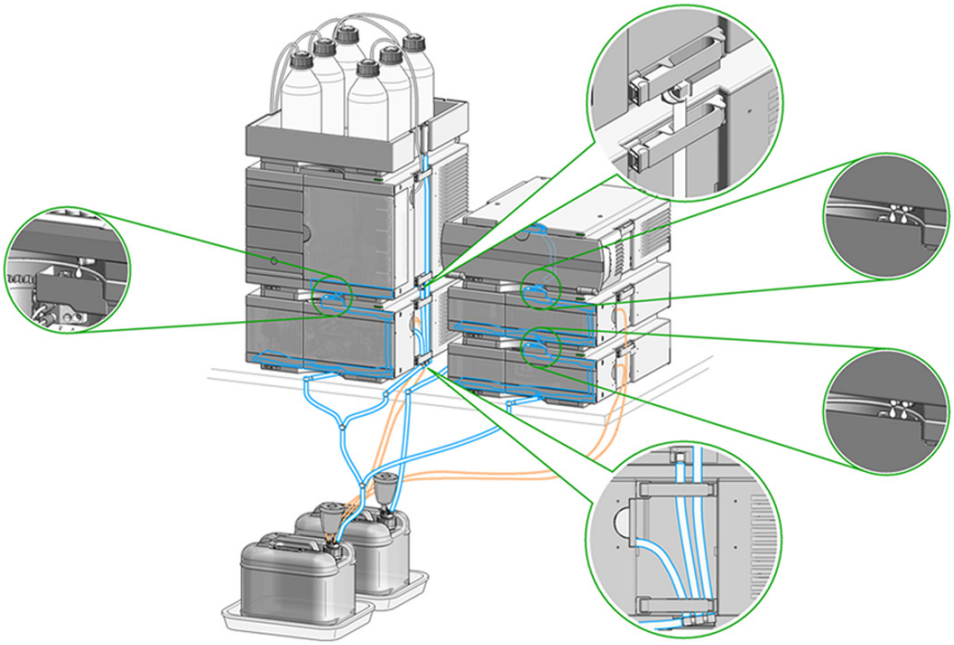


Figure 5 Infinity II Two Stack Leak Waste Concept (bench installation)

The waste tube connected to the leak plane outlet on each of the bottom instruments guides the solvent to a suitable waste container.

Leak Sensor

CAUTION

Solvent incompatibility

The solvent DMF (dimethylformamide) leads to corrosion of the leak sensor. The material of the leak sensor, PVDF (polyvinylidene fluoride), is incompatible with DMF.

- ✓ **Do not use DMF as mobile phase.**
- ✓ **Check the leak sensor regularly for corrosion.**

Waste Concept

1 Agilent recommends using the 6 L waste can with 1 Stay Safe cap GL45 with 4 ports (5043-1221) for optimal and safe waste disposal. If you decide to use your own waste solution, make sure that the tubes don't immerse in the liquid.

2 Site Requirements and Specifications

This chapter provides information on environmental requirements, physical and performance specifications.

Site Requirements

A suitable environment is important to ensure optimal performance of the instrument.

Power Considerations

The module power supply has wide ranging capability. It accepts any line voltage in the range described in Table 1 on page 25. Consequently there is no voltage selector in the rear of the module. There are also no externally accessible fuses, because automatic electronic fuses are implemented in the power supply.

WARNING

Hazard of electrical shock or damage of your instrumentation

can result, if the devices are connected to a line voltage higher than specified.

- ✓ **Connect your instrument to the specified line voltage only.**

WARNING

Electrical shock hazard

The module is partially energized when switched off, as long as the power cord is plugged in.

The cover protects users from personal injuries, for example electrical shock.

- ✓ **Do not open the cover.**
- ✓ **Do not operate the instrument and disconnect the power cable in case the cover has any signs of damage.**
- ✓ **Contact Agilent for support and request an instrument repair service.**

WARNING

Inaccessible 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

Country-specific power cords are available for the module. The female end of all power cords is identical. It plugs into the power-input socket at the rear. The male end of each power cord is different and designed to match the wall socket of a particular country or region.

Agilent makes sure that your instrument is shipped with the power cord that is suitable for your particular country or region.

WARNING

Unintended use of power cords

Using power cords for unintended purposes can lead to personal injury or damage of electronic equipment.

- ✓ **Never use a power cord other than the one that Agilent shipped with this instrument.**
- ✓ **Never use the power cords that Agilent Technologies supplies with this instrument for any other equipment.**
- ✓ **Never use cables other than the ones supplied by Agilent Technologies to ensure proper functionality and compliance with safety or EMC regulations.**

WARNING

Absence of ground connection

The absence of ground connection can lead to electric shock or short circuit.

- ✓ **Never operate your instrumentation from a power outlet that has no ground connection.**

WARNING

Electrical shock hazard

Solvents may damage electrical cables.

- ✓ **Prevent electrical cables from getting in contact with solvents.**
- ✓ **Exchange electrical cables after contact with solvents.**

Bench Space

The module dimensions and weight (see Table 1 on page 25) allow you to place the module on almost any desk or laboratory bench. It needs an additional 2.5 cm (1.0 inches) of space on either side and approximately 8 cm (3.1 inches) in the rear for air circulation and electric connections.

If the bench shall carry a complete HPLC system, make sure that the bench is designed to bear the weight of all modules.

The module should be operated in a horizontal position.

NOTE

Agilent recommends that you install the HPLC instrument in the InfinityLab Flex Bench rack. This option helps to save bench space as all modules can be placed into one single stack. It also allows to easily relocate the instrument to another laboratory.

WARNING

Heavy weight

The module is heavy.

- ✓ **Carry the module at least with 2 people.**
- ✓ **Avoid back strain or injury by following all precautions for lifting heavy objects.**
- ✓ **Ensure that the load is as close to your body as possible.**
- ✓ **Ensure that you can cope with the weight of your load.**

Condensation

CAUTION

Condensation within the module

Condensation can damage the system electronics.

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

Physical Specifications

Physical Specifications Agilent 1290 Infinity II High-Speed Pump (G7120A)

Table 1 Physical Specifications G7120A

Type	Specification	Comments
Weight	21.0 kg (46.3 lbs)	
Dimensions (height × width × depth)	200 x 396 x 436 mm (7.9 x 15.6 x 17.2 inches)	
Line voltage	100 – 240 V~, ± 10 %	Wide-ranging capability
Line frequency	50 or 60 Hz, ± 5 %	
Power consumption	210 VA / 180 W	
Ambient operating temperature	4 – 55 °C (39 – 131 °F)	
Ambient non-operating temperature	-40 – 70 °C (-40 – 158 °F)	
Humidity	< 95 % r.h. at 40 °C (104 °F)	Non-condensing
Operating altitude	Up to 3000 m (9842 ft)	
Safety standards: IEC, EN, CSA, UL	Overvoltage category II, Pollution degree 2	For indoor use only.
ISM Classification	ISM Group 1 Class B	According to CISPR 11

Physical Specifications Agilent 1290 Infinity II Bio High-Speed Pump (G7132A)

Table 2 Physical Specifications G7132A

Type	Specification	Comments
Weight	22.5 kg (49.6 lbs)	
Dimensions (height × width × depth)	200 x 396 x 436 mm (7.9 x 15.6 x 17.2 inches)	
Line voltage	100 – 240 V~, ± 10 %	Wide-ranging capability
Line frequency	50 or 60 Hz, ± 5 %	
Power consumption	210 VA / 180 W	
Ambient operating temperature	4 – 55 °C (39 – 131 °F)	
Ambient non-operating temperature	-40 – 70 °C (-40 – 158 °F)	
Humidity	< 95 % r.h. at 40 °C (104 °F)	Non-condensing
Operating altitude	Up to 3000 m (9842 ft)	
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Performance Specifications

Performance Specifications Agilent 1290 Infinity II High-Speed Pump (G7120A)

Table 3 Performance Specifications G7120A

Type	Specification	Comments
Hydraulic system	Two dual pistons in series pump with proprietary servo-controlled variable stroke design and smooth motion control for active damping.	
Pump resolution step size	300 pL	
Flow range	Settable: 0.001 – 5 mL/min, in 0.001 mL/min increments (executed in 300 pL/step increments)	
Flow precision	≤0.07 % RSD or 0.01 min SD, whichever is greater	Based on retention time at constant temperature
Flow accuracy	±1 % or ±10 µL/min, whichever is greater	
Pressure operating range	Up to 130 MPa (1300 bar) at 0 – 2 mL/min ramping down to 80 MPa (800 bar) at 5 mL/min	
Pressure pulsation	<1 % amplitude or <0.5 MPa (5 bar), whichever is greater	
Compressibility compensation	Automatic	
Recommended pH range	1.0 – 12.5	Solvents with pH <2.3 should not contain acids which attack stainless steel
Gradient formation	High-pressure binary mixing	
Delay volume	As low as 45 µL (10 µL without mixer)	
Composition range	0 – 100 %	

Table 3 Performance Specifications G7120A

Type	Specification	Comments
Composition precision	<0.15 % RSD or 0.01 min SD, whichever is greater	
Composition accuracy	±0.35 % absolute	
Number of solvents	2 out of maximum 26 solvents	
Solvent selection valve	Internal 4-solvent selection valve included. External 2x 12 solvent valve as option, fully integrated in the pump control interface.	
Integrated degassing unit	Number of channels: 2 Internal volume per channel: 1.5 mL	
Materials in contact with solvent	TFE/PDD copolymer, FEP, PEEK, PPS, stainless steel, polyimide	
Automatic purge valve	Included	
Active Seal Wash	Included	
Intelligent System Emulation Technology (ISET)	Included	
Instrument control	LC & CE Drivers A.02.11 or above Instrument Control Framework (ICF) A.02.03 or above InfinityLab LC Companion (G7108AA) with firmware D.07.25 or above Instant Pilot (G4208A) with firmware B.02.17 or above Lab Advisor software B.02.06 or above	For details about supported software versions refer to the compatibility matrix of your version of the LC & CE Drivers
Communication	Controller Area Network (CAN), RS232C, APG remote: ready, start, stop, and shutdown signals, LAN	

Table 3 Performance Specifications G7120A

Type	Specification	Comments
Safety features and maintenance	Leak detection, safe leak handling, leak output signal for shutdown of the pumping system. Low voltage in major maintenance areas. Extensive diagnostics, error detection and display with Agilent Lab Advisor software.	
GLP feature	Early maintenance feedback (EMF) for continuous tracking of instrument usage in terms of seal wear and volume of pumped mobile phase with pre-defined and user settable limits and feedback messages. Electronic records of maintenance and errors.	
Housing	All materials are recyclable	

Performance Specifications Agilent 1290 Infinity II Bio High-Speed Pump (G7132A)

Table 4 Performance specifications G7132A

Type	Specification	Comments
Hydraulic system	Two dual pistons in series pump with proprietary servo-controlled variable stroke design and smooth motion control for active damping.	
Pump resolution step size	300 pL	
Flow range	Settable: 0.001 – 5 mL/min, in 0.001 mL/min increments (executed in 300/step increments)	
Flow precision	≤ 0.07 % RSD or 0.005 min SD, whichever is greater	Based on retention time at constant temperature
Flow accuracy	±1 % or ±10 µL/min, whichever is greater	
Pressure operating range	Up to 130 MPa (1300 bar) at 0 – 2 mL/min ramping down to 80 MPa (800 bar) at 5 mL/min	
Pressure pulsation	< 1 % amplitude or < 0.5 MPa (5 bar), whichever is greater	
Compressibility compensation	Automatic	
Recommended pH range	pH 1 – 12.5, short term pH 13 (for flushing)	
Gradient formation	High-pressure binary mixing	
Delay volume	As low as 45 µL (10 µL without mixer)	
Composition range	0 – 100 %	
Composition precision	< 0.15 % RSD or 0.01 min SD, whichever is greater	
Composition accuracy	±0.35 % absolute	
Number of solvents	2 out of maximum 26 solvents	

Table 4 Performance specifications G7132A

Type	Specification	Comments
Solvent selection valve	Internal 4-solvent selection valve included. External 2 x 12 solvent valve as option, fully integrated in the pump control interface.	
Integrated degassing unit	Number of channels: 2 Internal volume per channel: 1.5 mL	
Materials in contact with solvent	TFE/PDD copolymer, FEP, PEEK, PPS, MP35N	
Automatic purge valve	Included	
Active Seal Wash	Included	
Intelligent System Emulation Technology (ISET)	Included	
Instrument control	LC & CE Drivers Rev. 3.3 or above Instrument Control Framework (ICF) A.02.03 or above in Emulation Mode only InfinityLab Companion (G7108AA) with firmware D.07.33 or above Lab Advisor software B.02.16 or above	For details about supported software versions refer to the compatibility matrix of your version of the LC & CE Drivers
Communication	Controller Area Network (CAN), RS232C, APG remote: ready, start, stop, and shutdown signals, LAN	
Safety features and maintenance	Leak detection, safe leak handling, leak output signal for shutdown of the pumping system. Low voltage in major maintenance areas. Extensive diagnostics, error detection and display with Agilent Lab Advisor software.	

Table 4 Performance specifications G7132A

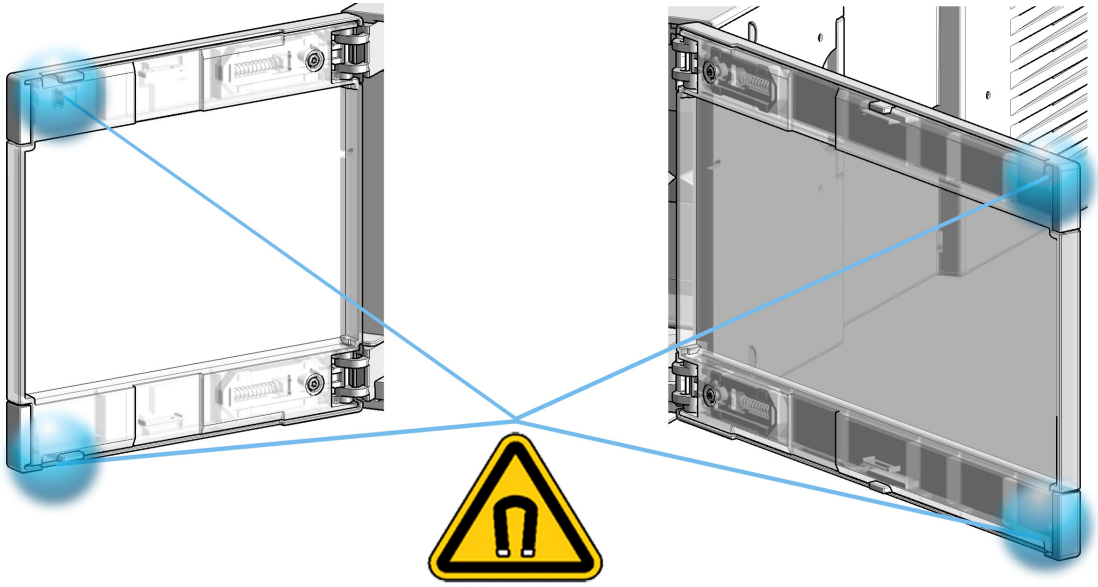
Type	Specification	Comments
GLP features	Early maintenance feedback (EMF) for continuous tracking of instrument usage in terms of seal wear and volume of pumped mobile phase with pre-defined and user settable limits and feedback messages. Electronic records of maintenance and errors.	
Housing	All materials are recyclable.	

3 Using the Pump

This chapter explains the operational parameters of the Agilent 1290 Infinity II High-Speed Pumps.

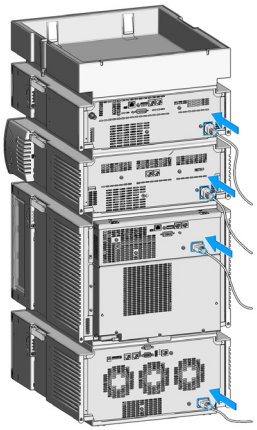
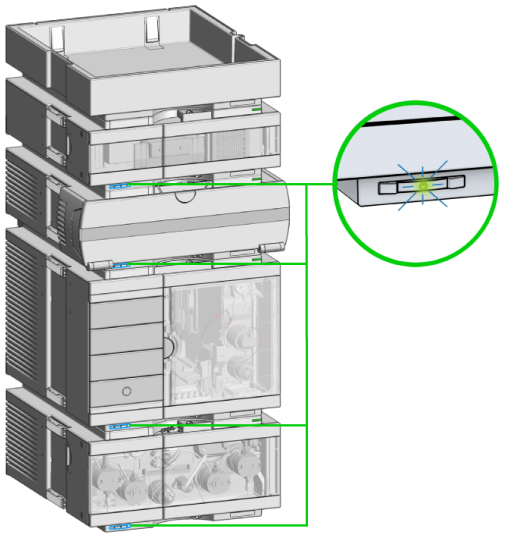
Magnets

1 Magnets in doors of pumps, autosamplers, detectors, and fraction collectors.

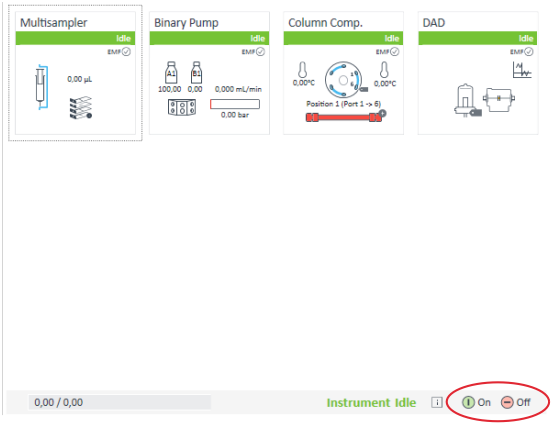


Turn on/off

This procedure exemplarily shows an arbitrary LC stack configuration.

1	2
	 Power switch: On

3 Turn instrument **On/Off** with the control software.



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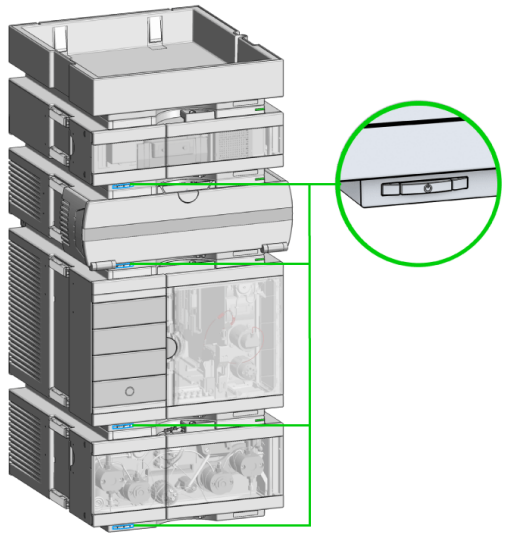
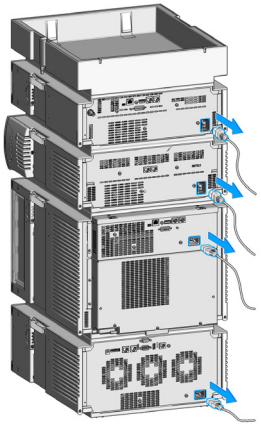


Power switch: Off

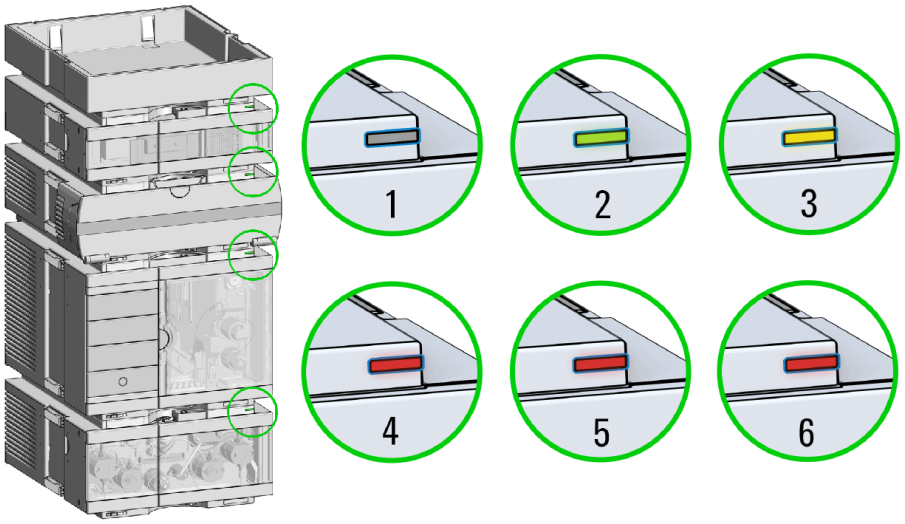
5



Status Indicators

This procedure exemplarily shows an arbitrary LC stack configuration.

1 The module status indicator indicates one of six possible module conditions:



Status indicators

1. Idle
2. Run mode
3. Not-ready. Waiting for a specific pre-run condition to be reached or completed.
4. Error mode - interrupts the analysis and requires attention (for example, a leak or defective internal components).
5. Resident mode (blinking) - for example, during update of main firmware.
6. Bootloader mode (fast blinking). Try to re-boot the module or try a cold-start. Then try a firmware update.

Best Practices

Daily / Weekly tasks

Daily Tasks

- Replace solvents and solvent bottles for mobile phases based on water/buffer.
- Replace solvents and solvent bottles for organic mobile phase latest every second day.
- Check presence of seal wash solvent.
- Purge each channel with fresh solvent at 2.5 – 3 mL/min for 5 min before operation.
- Equilibrate the system with composition and flow rate of subsequent method.

Weekly Tasks

- Change seal wash solvent (10 % isopropanol in water) and bottle.
- If applications with salts were used, flush all channels with water and remove possible salt deposits manually.
- Inspect solvent filters for dirt or blockages. Exchange if no flow is coming out of the solvent line when removed from the degasser inlet.

Power up / Shut-down the pump

Prepare the Pump

- Use fresh or different mobile phase (as required).
- Purge each channel with 2.5 – 3 mL/min for 5 min. Open the manual purge valve or use the purge command, depending on the pump type.

Shut Down the System

- Flush the column with the appropriate solvents and store it according to column manual instructions (be sure that the flushing solvent is compatible with the solvent present in the system to avoid precipitation).
- Install a union or a restriction capillary and flush the system extensively with water, especially after using buffers. For details, see "Flushing Procedure" on page 48.
- Flush and store the system in 50 % methanol or 50 % isopropanol in water, without additives.
- Remove all samples from the autosampler and store them according to good laboratory practices.
- Power off all modules.

Prepare the Pump

The Agilent 1290 Infinity and 1290 Infinity II Pumps are equipped with automatic purge valves. This enables a variety of additional functions not available in Agilent Pumps with manual purge valves. It is possible to prepare the pump (set paramaters and start the functions **Purge**, **Condition**, or **Prime**) with the software.

Purge

Use the Purge function to:

- Fill the system with fresh or different solvent.
  - Ensure that the new solvent is miscible with the previous solvent.
  - Prevent damage to the degasser or pump by using an intermediate step with a co-miscible solvent, if necessary.
- Remove air bubbles in tubes and pump heads.
  - After the pump has been idle for a few hours or more (air may have diffused into the solvent lines).

As soon as the purge procedure ends the module automatically switches to analytical conditions again.

Condition

If micro air bubbles persist in the pump head, the overall pump performance may be compromised and flow accuracy / precision may be negatively affected. This may be visible as increased pressure and / or detector baseline ripple. A reliable indicator of such situation is a strongly negative but slowly increasing tuning signal value (below –1). To remove the air efficiently, the Condition function can be used. During conditioning, the pump is delivering flow into the system (column) and the last used method settings, like flow, composition and max pressure are used. It is not possible to perform sample analysis while conditioning.

Use a reasonable flow rate (for example 1.5 mL/min), composition setting (for example A: 50 % B: 50 %) and backpressure (>200 bar) to ensure efficient air bubble removal from all pump heads.

Condition the pump if you see:

- Excessive pressure ripple.
- Excessive composition ripple (baseline noise/mixing noise – noise level changes with the composition), when you are sure that the solvent type is correctly set, and there is no evidence of a leak in the pump.

Conditioning may be necessary:

- After a long period of standby
- After running out of solvent
- After service or repair

CAUTION

Filling empty solvent lines

Damage to the seals

✓ **Use a syringe or the Purge function to fill empty solvent lines.**

✓ **Do not use the Prime procedure to fill empty solvent lines.**

Prime

The Prime function is helpful if air has entered the pump heads and cannot be removed by conditioning for 15 minutes. The module draws solvent at a high speed with all pump drives simultaneously and dispenses it into the waste position of the automatic purge valve. This is done 20 times and is stressful to the valve and rotor seal. Therefore, it should be performed only as a last resource, before forcefully filling the pump heads with a syringe or attempting to repair the pump heads.

Use the Prime function to:

- Free a potentially stuck valve.

The described functions can be triggered from the driver interface:

- 1290 Infinity and 1290 Infinity II

NOTE

For parameter settings, see *Best Practices for Using an Agilent LC System Technical Note*.

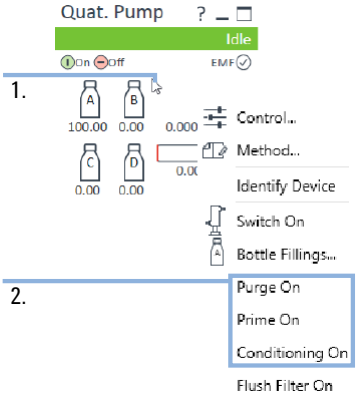


Figure 6 Prepare the pump (1290 Infinity).

1.	Right click on the module dashboard
2.	Select the appropriate function to start the procedure

The user-optimized Prepare Pump context menu replaces the classical menu:

- 1290 Infinity II Pumps

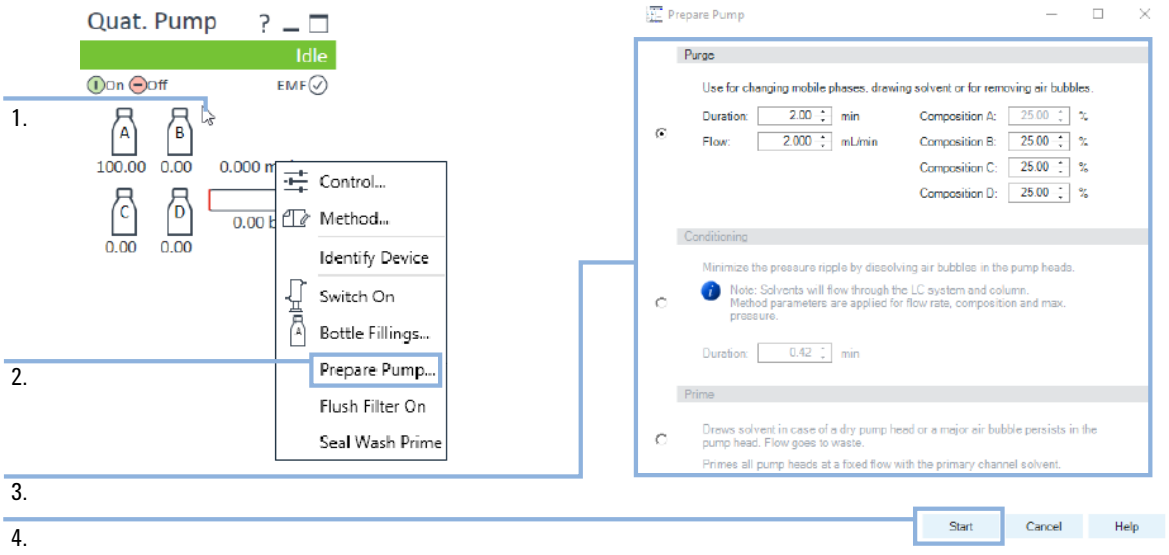


Figure 7 Prepare the pump (1290 Infinity II pumps)

1.	Right click on the module dashboard
2.	Select **Prepare Pump...**
3.	Select the procedure and fill in adequate parameters
4.	Click **Start** to run the selected procedure

Seal Wash

Seal Wash guarantees a maximum seal life time. Use Seal Wash:

- When using buffers with elevated salt concentrations
- When using volatile solvents with non-volatile additives

CAUTION

Contaminated seal wash solvent

✓ **Do not recycle seal wash solvent to avoid contamination.**

✓ **Weekly exchange seal wash solvent.**

How to deal with solvents

- Use clean bottles only.
- Exchange water-based solvents daily.
- Select solvent volume to be used up within 1 – 2 days.
- Use only HPLC-grade solvents and water filtered through 0.2 µm filters.
- Label bottles correctly with bottle content, and filling date / expiry date.
- Use solvent inlet filters.
- Reduce risk of algae growth: use brown bottles for aqueous solvents, avoid direct sunlight.

Purging the Pump

When the solvents have been exchanged or the pumping system has been turned off for a certain time (for example, overnight) oxygen will re-diffuse into the solvent channel between the solvent reservoir, vacuum degassing unit (when available in the system) and the pump. Solvents containing volatile ingredients will slightly lose these. Therefore purging of the pumping system is required before starting an application.

1. Initiate a purge in the controlling software with a Purge flow set to 3 mL/min per channel.
2. Flush all tubes with at least 15 mL of solvent.

Table 5 Choice of Priming Solvents for Different Purposes

Activity	Solvent	Comments
After an installation	Isopropanol	Best solvent to flush air out of the system
When switching between reverse phase and normal phase (both times)	Isopropanol	Isopropanol is miscible with both normal phase and reverse phase solvents.
After an installation	Ethanol or Methanol	Alternative to Isopropanol (second choice) if no Isopropanol is available
To clean the system when using buffers	Bidistilled water	Best solvent to re-dissolve buffer crystals
After a solvent change	Bidistilled water	Best solvent to re-dissolve buffer crystals
Before turning off system for an extended period of time	50 % methanol or 50 % isopropanol in water, without additives	

NOTE The pump should never be used for priming/purging empty tubings (never let the pump run dry). Use a syringe to draw enough solvent for completely filling the tubings to the pump inlet before continuing to purge with the pump.

If the system has been run dry or air has diffused into the pump it might require additional steps to get rid of the air again. Following the procedure below will give the best and fastest results.

1. Change solvents to isopropanol.
2. Purge the system with 3 mL/min, composition 50/50 and for 10 min.
3. Attach a column suitable for isopropanol and set the Max. pressure limit to the limit of the column.
4. Run the system at composition 50/50 and a flow rate that gives a pressure close to the limit of the column. Turn on the **Conditioning** function.
5. Observe the pressure fluctuations. The system is air free as soon as the pressure is stable.
6. Change solvents and column according to the analytical conditions and purge the system to change solvents.

Recommendations for Bio-Compatible and Bio-Inert Systems

- Make sure all supplies (fittings, capillaries, inline filters, columns, etc.) are bio-inert / bio-compatible.
  - Be aware that some columns for bio-related applications have a stainless steel case and can introduce iron and other metal ions in the flow path. This may lead to adsorption of susceptible samples like phosphorylated nucleotides. In this case, use PEEK-lined columns.
- After using the system with high salt concentrations, flush it extensively with water to prevent blockages caused by salt crystals.
- Reliable operation of 1290 pumps during analysis cannot be guaranteed if pressure falls below 20 bar. For optimal results, pressure should be at least 50 bar continuously. Therefore, when using columns that create low backpressure (<50 bar, such as SEC columns with 1290 LC systems), install a restriction capillary between the pump and the sampler, to achieve at least 50 bar.
- Perform daily flush of the Multisampler with water if the Multiwash option is installed (see *Best Practices for Using an Agilent LC System Technical Note*)

CAUTION

Agilent Bio-inert and Bio LC systems should not be subject to passivation or similar procedures

This can cause irreversible damage to the system's internal surfaces

✓ **Do not perform passivation or similar procedures on bio-inert and bio-compatible systems.**

Flushing Procedure

- ✓ This procedure should be used when salt-containing mobile phases are used. It has to be performed regularly, at least once a week, or prior a long standby or off time, to remove salt deposits from the flow path and surfaces in contact with the solvents. How to prepare the system for shutdown see "Shut Down the System" on page 39.
- ✓ The procedure is mandatory for switching from salt-containing mobile phase to reversed phase applications (or any applications running with high organics), where the precipitation of salt can occur.
- Flush the column with recommended storage solvent, be sure that this solvent is compatible with current mobile phase and cannot cause precipitation.
- Replace the column with a union, replace the salt-containing solvent bottle with a new bottle of HPLC-grade water at room temperature.
- Clean the bottle head assembly using lint-free wipes to minimize carryover of remaining salt solution into the new water bottle.
- Autosampler: perform at least 15 min purge with water to remove salt residues from all lines, both needle wash and seat backflush for Multiwash option, visually control needle/seat/washport for salt residues, if necessary manually clean needle/seat/washport.
- Purge each pump channel that has pumped buffer separately, for at least 10 min at 5 mL/min.
- Flush the entire system flow path with water for at least 10 min at 2 mL/min. During this step, switch the injection valve and the column selection valve (if installed) position every 1 min, and repeat this until every position has been selected for at least 5 times.
- Replace water with fresh solvent bottles to minimize salt carryover.

Recommendations for Degassers

CAUTION

Liquid inside the degasser

In case a low boiling point solvent condensates or there is a leak, liquid can accumulate inside the degasser chambers, and this will compromise performance.

When this happens,

- ✓ **Purge all solvent channels with isopropanol.**
- ✓ **Keep unused channels filled with isopropanol.**

- Check compatibility of solvents with degasser and application
  - Use the standalone standard degassers (G1322A or G7122A) for RI applications, flow rates higher than 5 mL/min, with low boiling point solvents (<60 °C) and with hexane, tetrahydrofuran and any halogenated solvents.
  - Use integrated or a standalone high-performance degasser (G4225A) for all other applications.
- If enough vacuum for the optimal degassing performance cannot be reached or maintained (as indicated by yellow or red status LED in standalone degassers, or specific error messages on integrated degassers), power cycle the module.
- If, after power cycling, vacuum still cannot be reached or maintained on integrated degassers, use the **Evacuation Mode**, available in the instrument control screen of Agilent Lab Advisor.

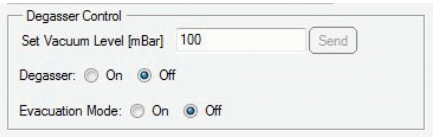


Figure 8 Degasser Control for internal degassers in Agilent Lab Advisor

NOTE

Follow the instructions prompted on the screen when starting the **Evacuation Mode**.

Solvent Information

Observe the following recommendations on the use of solvents.

- Follow recommendations for avoiding the growth of algae, see "Algae Growth in HPLC Systems" on page 64.
- Small particles can permanently block capillaries and valves. Therefore, always filter solvents through 0.22 µm filters.
- Avoid or minimize the use of solvents that may corrode parts in the flow path. Consider specifications for the pH range given for different materials like flow cells, valve materials etc. and recommendations in subsequent sections.

Materials in Flow Path (G7120A)

Following materials are used in the flow path of this module:

Table 6 Materials in flow path (G7120A)

Part	Materials
Degasser chamber	TFE/PDD copolymer, PFA (internal tubings); PEEK (inlets); FEP (tubings); ETFE (fittings)
Ultra clean tubings[1]	PFA (tubings), PEEK (fittings)
Microfluidic structures[2]	SST
SSV	FFKM, PEEK
Passive inlet valve	SST, gold, ruby, ZrO_2-based ceramic, tantalum
Outlet valve	SST, gold, ruby, ZrO_2-based ceramic, tantalum
Pump head	SST
Pistons	ZrO_2-based ceramic
Piston/wash seals	UHMW-PE, SST
Pressure sensor	SST
Automatic purge valve	Polyimide, SST, DLC

[1] Ultra clean tubings are available for the use with high-end MS detectors. They are also compatible to THF.

[2] Jet Weaver, Heat Exchanger

Materials in Flow Path (G7132A)

Following materials are used in the flow path of this module:

Table 7 Materials in flow path (G7132A)

Part	Materials
Degasser chamber	TFE/PDD copolymer, PFA (internal tubings); PEEK (inlets); FEP (tubings); ETFE (fittings)
Ultra clean tubings[1]	PFA (tubings), PEEK (fittings)
Microfluidic structures[2]	SST and Bio-Compatible coating
Solvent Selection Valve	FFKM and PEEK
Passive inlet valve	Gold, Ruby, MP35N, tantalum
Outlet valve	Gold, Ruby, MP35N, tantalum
Pump heads	MP35N
Heat exchanger	MP35N and Gold (fittings)
Pistons	ZrO_2 ceramic
Seals	Gold and UHMW-PE
Pressure sensor	MP35N
Purge valve	DLC coated MP35N and PEEK-based rotor seal

[1] Ultra clean tubings are available for the use with high-end MS detectors. They are also compatible to THF.

[2] Jet Weaver, Heat Exchanger

General Information about Solvent/Material Compatibility

Materials in the flow path are carefully selected based on Agilent's experiences in developing highest-quality instruments for HPLC analysis over several decades. These materials exhibit excellent robustness under typical HPLC conditions. For any special condition, please consult the material information section or contact Agilent.

Disclaimer

Subsequent data was collected from external resources and is meant as a reference. Agilent cannot guarantee the correctness and completeness of such information. Data is based on compatibility libraries, which are not specific for estimating the long-term life time under specific but highly variable conditions of UHPLC systems, solvents, solvent mixtures and samples. Information can also not be generalized due to catalytic effects of impurities like metal ions, complexing agents, oxygen etc. Apart from pure chemical corrosion, other effects like electro corrosion, electrostatic charging (especially for non-conductive organic solvents), swelling of polymer parts etc. need to be considered. Most data available refers to room temperature (typically 20 – 25 °C, 68 – 77 °F). If corrosion is possible, it usually accelerates at higher temperatures. If in doubt, please consult technical literature on chemical compatibility of materials.

MP35N

MP35N is a nonmagnetic, nickel-cobalt-chromium-molybdenum alloy demonstrating excellent corrosion resistance (for example, against nitric and sulfuric acids, sodium hydroxide, and seawater) over a wide range of concentrations and temperatures. In addition, this alloy shows exceptional resistance to high-temperature oxidation. Due to excellent chemical resistance and toughness, the alloy is used in diverse applications: dental products, medical devices, nonmagnetic electrical components, chemical and food processing equipment, marine equipment. Treatment of MP35N alloy samples with 10 % NaCl in HCl (pH 2.0) does not reveal any detectable corrosion. MP35N also demonstrates excellent corrosion resistance in a humid environment. Although the influence of a broad variety of solvents and conditions has been tested, users should keep in mind that multiple factors can affect corrosion rates, such as temperature, concentration, pH, impurities, stress, surface finish, and dissimilar metal contacts.

Polyphenylene Sulfide (PPS)

Polyphenylene sulfide has outstanding stability even at elevated temperatures. It is resistant to dilute solutions of most inorganic acids, but it can be attacked by some organic compounds and oxidizing reagents. Nonoxidizing inorganic acids, such as sulfuric acid and phosphoric acid, have little effect on polyphenylene sulfide, but at high concentrations and temperatures, they can still cause material damage. Nonoxidizing organic chemicals generally have little effect on polyphenylene sulfide stability, but amines, aromatic compounds, and halogenated compounds may cause some swelling and softening over extended periods of time at elevated temperatures. Strong oxidizing acids, such as nitric acid (> 0.1 %), hydrogen halides (> 0.1 %), peroxy acids (> 1 %), or chlorosulfuric acid degrade polyphenylene sulfide. It is not recommended to use polyphenylene sulfide with oxidizing material, such as sodium hypochlorite and hydrogen peroxide. However, under mild environmental conditions, at low concentrations and for short exposure times, polyphenylene sulfide can withstand these chemicals, for example, as ingredients of common disinfectant solutions.

PEEK

PEEK (Polyether-Ether Ketones) combines excellent properties regarding biocompatibility, chemical resistance, mechanical and thermal stability. PEEK is therefore the material of choice for UHPLC and biochemical instrumentation.

It is stable in the specified pH range (for the Bio-Inert LC system: pH 1 – 13, see bio-inert module manuals for details), and inert to many common solvents.

There is still a number of known incompatibilities with chemicals such as chloroform, methylene chloride, THF, DMSO, strong acids (nitric acid > 10 %, sulfuric acid > 10 %, sulfonic acids, trichloroacetic acid), halogens or aqueous halogen solutions, phenol and derivatives (cresols, salicylic acid, and so on).

When used above room temperature, PEEK is sensitive to bases and various organic solvents, which can cause it to swell. Under such conditions, normal PEEK capillaries are sensitive to high pressure. Therefore, Agilent uses stainless steel cladded PEEK capillaries in bio-inert systems. The use of stainless steel cladded PEEK capillaries keeps the flow path free of steel and ensures pressure stability up to 600 bar. If in doubt, consult the available literature about the chemical compatibility of PEEK.

Polyimide

Agilent uses semi-crystalline polyimide for rotor seals in valves and needle seats in autosamplers. One supplier of polyimide is DuPont, which brands polyimide as Vespel, which is also used by Agilent.

Polyimide is stable in a pH range between 1 and 10 and in most organic solvents. It is incompatible with concentrated mineral acids (e.g. sulphuric acid), glacial acetic acid, DMSO and THF. It is also degraded by nucleophilic substances like ammonia (e.g. ammonium salts in basic conditions) or acetates.

Polyethylene (PE)

Agilent uses UHMW (ultra-high molecular weight)-PE/PTFE blends for yellow piston and wash seals, which are used in 1290 Infinity pumps, 1290 Infinity II pumps, the G7104C and for normal phase applications in 1260 Infinity pumps.

Polyethylene has a good stability for most common inorganic solvents including acids and bases in a pH range of 1 to 12.5. It is compatible with many organic solvents used in chromatographic systems like methanol, acetonitrile and isopropanol. It has limited stability with aliphatic, aromatic and halogenated hydrocarbons, THF, phenol and derivatives, concentrated acids and bases. For normal phase applications, the maximum pressure should be limited to 200 bar.

Tantalum (Ta)

Tantalum is inert to most common HPLC solvents and almost all acids except fluoric acid and acids with free sulfur trioxide. It can be corroded by strong bases (e.g. hydroxide solutions > 10 %, diethylamine). It is not recommended for the use with fluoric acid and fluorides.

Stainless Steel (SST)

Stainless steel is inert against many common solvents. It is stable in the presence of acids and bases in a pH range of 1 to 12.5. It can be corroded by acids below pH 2.3. It can also corrode in following solvents:

- Solutions of alkali halides, their respective acids (for example, lithium iodide, potassium chloride, and so on) and aqueous solutions of halogens.
- High concentrations of inorganic acids like nitric acid, sulfuric acid and organic solvents especially at higher temperatures (replace, if your chromatography method allows, 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:

  $2\ CHCl_3 + O_2 \rightarrow 2\ COCl_2 + 2\ HCl$

  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, diisopropylether). Such ethers should be filtered through dry aluminium oxide which adsorbs the peroxides.
- Solutions of organic acids (acetic acid, formic acid, and so on) in organic solvents. For example, a 1 % solution of acetic acid in methanol will attack steel.
- Solutions containing strong complexing agents (for example, EDTA, ethylene diamine tetra-acetic acid).
- Mixtures of carbon tetrachloride with isopropanol or THF.

Titanium (Ti)

Titanium is highly resistant to oxidizing acids (for example, nitric, perchloric and hypochlorous acid) over a wide range of concentrations and temperatures. This is due to a thin oxide layer on the surface, which is stabilized by oxidizing compounds. Non-oxidizing acids (for example, hydrochloric, sulfuric and phosphoric acid) can cause slight corrosion, which increases with acid concentration and temperature. For example, the corrosion rate with 3 % HCl (about pH 0.1) at room temperature is about 13 µm/year. At room temperature, titanium is resistant to concentrations of about 5 % sulfuric acid (about pH 0.3). Addition of nitric acid to hydrochloric or sulfuric acids significantly reduces corrosion rates. Titanium is sensitive to acidic metal chlorides like $FeCl_3$ or $CuCl_2$. Titanium is subject to corrosion in anhydrous methanol, which can be avoided by adding a small amount of water (about 3 %). Slight corrosion is possible with ammonia > 10 %.

Diamond-Like Carbon (DLC)

Diamond-Like Carbon is inert to almost all common acids, bases and solvents. There are no documented incompatibilities for HPLC applications.

Fused silica and Quartz (SiO_2)

Fused silica is used in Max Light Cartridges. Quartz is used for classical flow cell windows. It is inert against all common solvents and acids except hydrofluoric acid and acidic solvents containing fluorides. It is corroded by strong bases and should not be used above pH 12 at room temperature. The corrosion of flow cell windows can negatively affect measurement results. For a pH greater than 12, the use of flow cells with sapphire windows is recommended.

Gold

Gold is inert to all common HPLC solvents, acids and bases within the specified pH range. It can be corroded by complexing cyanides and concentrated acids like aqua regia.

Zirconium Oxide (ZrO_2)

Zirconium Oxide is inert to almost all common acids, bases and solvents. There are no documented incompatibilities for HPLC applications.

Platinum/Iridium

Platinum/Iridium is inert to almost all common acids, bases and solvents. There are no documented incompatibilities for HPLC applications.

Fluorinated polymers (PTFE, PFA, FEP, FFKM, PVDF)

Fluorinated polymers like PTFE (polytetrafluorethylene), PFA (perfluoroalkoxy), and FEP (fluorinated ethylene propylene) are inert to almost all common acids, bases, and solvents. FFKM is perfluorinated rubber, which is also resistant to most chemicals. As an elastomer, it may swell in some organic solvents like halogenated hydrocarbons.

TFE/PDD copolymer tubings, which are used in all Agilent degassers except G1322A/G7122A, are not compatible with fluorinated solvents like Freon, Fluorinert, or Vertrel. They have limited life time in the presence of hexafluoroisopropanol (HFIP). To ensure the longest possible life with HFIP, it is best to dedicate a particular chamber to this solvent, not to switch solvents, and not to let dry out the chamber. For optimizing the life of the pressure sensor, do not leave HFIP in the chamber when the unit is off.

The tubing of the leak sensor is made of PVDF (polyvinylidene fluoride), which is incompatible with the solvent DMF (dimethyl formamide).

Sapphire, Ruby and Al_2O_3-based ceramics

Sapphire, ruby and ceramics based on aluminum oxide Al_2O_3 are inert to almost all common acids, bases and solvents. There are no documented incompatibilities for HPLC applications.

Solvent Recommendation for Agilent 1290 Infinity and 1290 Infinity II and 1260 Infinity II Flexible Pumps

While the Agilent 1290 Infinity, 1290 Infinity II, and 1260 Infinity II Flexible Pumps guarantee a high performance with a wide variety of solvents, other solvents may cause harm to the pump or to the (U)HPLC system. No modifications are necessary when using standard reversed phase applications with water and other polar protic solvents in combination with most polar aprotic solvents. Normal phase applications work well with the modifications detailed in the section "Normal Phase Applications" on page 59.

Corrosion can occur in stainless steel systems if free halides, hydroperoxides, free radicals or strong, oxidizing acids are present. There are several solvents where, under nonideal conditions, reactions can occur and these harmful compounds are generated. Prevent formation of reactive substances when using the following 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
- Halogenated organic solvents or mixtures which form radicals and/or acids (for example, chloroform, methylene chloride)
- Chromatographic grade ethers, which can contain peroxides (for example, THF, dioxane, di-isopropylether)
- Solvents containing strong complexing agents (for example, EDTA).

All these solvents can be used in Agilent (U)HPLC systems. Refer to the Technical Note *Best Practices for Addressing Problems Associated With Unstable Solvents in an (U)HPLC Environment* (01200-90092), for recommendations on how to avoid damage to the instrument or separation column when working with these solvents.

Normal Phase Applications

Valves for Normal Phase Applications (G7120A)

Current passive inlet valves and outlet ball valves used with Agilent Infinity and Infinity II pumps do not work well while running nonpolar solvents for normal phase applications (for example, hexane and heptane). With such applications, pressure drops could be observed. They are the result of particles in insulating solvents, electrostatically charging up, and sticking to the nonconductive ruby balls inside the standard valves, such that the valves no longer close properly (could take just hours). For normal phase applications, a second type of valve is available. These valves use a new material for valve balls, which is a conductive ceramic. The ceramic balls do not charge up electrostatically and show good performance in normal phase applications. The valves are marked with "N" to stand for normal phase. Agilent recommends using these valves for (and only for) normal phase applications.

To avoid changing to the Type N valves when running critical solvents, it is possible to increase the conductivity of the mobile phase, by adding 5 % of a miscible, polar solvent. In general, isopropanol is a good choice.

No design change has been done for active inlet valves, which have already been used successfully for normal phase applications in 1260 Infinity I/II pumps.

Seals for Normal Phase Applications

For running normal phase applications on Agilent Infinity and Infinity II pumps, yellow PE seals are required as piston seals. By default, 1290 Infinity, 1290 Infinity II, and 1260 Infinity II Flexible Pumps use ceramic pistons and yellow PE seals as piston seals. 1260 Infinity I/II pumps use sapphire pistons and black PTFE piston seals in a standard configuration. If using black PTFE seals with normal phase applications, the black PTFE seals wear and generate small particles. Such particles can clog valves and other parts in the flow path. When running normal phase applications on 1260 Infinity I/II pumps, the piston seals have to be changed to yellow PE seals. For optimum performance, PE seals should be replaced during preventive maintenance.

Table 8 Recommended valves for normal phase applications

	Binary or High-Speed Pumps (G7120A)	Quaternary or Flexible Pumps
Inlet valves	1290 Infinity Inlet Valve Type N (G4220-60122)	1290 Infinity Quat Inlet Valve Type N (G4204-60122)
Outlet valves	1290 Infinity Outlet Valve Type N (G4220-60128)	1290 Infinity Outlet Valve Type N (G4220-60128)

CAUTION

Corrosion of valves

Normal phase balls/valves corrode quickly in aqueous solutions and acids (at or below pH 7).

✓ **Do not use normal phase valves in applications running with aqueous solutions.**

Solvent Handling

Handling of Normal Phase Solvents

Observe the following recommendations when using normal phase solvents:

- Always use fresh, filtered solvents. Exchange solvents every second day.
- Prevent reactions caused by heat, light and oxygen. Use brown, firmly closed bottles.
- Whenever possible, use stabilizers, e.g. butylated hydroxytoluene (BHT) for ethyl ether.
- Use isopropanol (IPA) to flush out the previous solvent when converting a system from normal phase to reverse phase, or vice versa.
- Store all unused channels in IPA.
- Don't turn off the pump while it is filled with solvents with low boiling points. Generate a small flow throughout the used channels when the pump is not in use.

Handling of Buffers

The following recommendations should be observed when using buffer solutions:

- Buffers and aqueous solutions are possible sources of algae contamination, for avoiding related problems, please read "Algae Growth in HPLC Systems" on page 64.
- For buffer concentrations of 0.1 M or higher using the seal wash function periodically with a runtime of 0.3 min every 3 min is strongly recommended.
- Filter buffer solutions to avoid increased wear or blockages that are caused by undissolved crystals. Always use solvent inlet filters.
- Avoid conditions where mixing of buffers and organic solvents may cause precipitation, as this impairs the reproducibility of chromatographic experiments and may also reduce the system life time. For example in reversed phase chromatography, avoid buffers (especially phosphate buffers) with a concentration higher than 20 mmol/L. For phosphate buffers, avoid compositions containing more than 65 % acetonitrile or other organic solvents.

- Use a minimum flow rate of 5 µL/min or 1 % composition per solvent channel (whatever is greater) to avoid cross-flow. Cross-flow can be caused by micro leaks in pump heads and can result in buffer precipitation in pump heads, channel blocking, or reduced pump head life time through wear of seals and pistons.
- Consider using an inline filter, for example Inline filter (G1311-60006).
- Never leave buffers in a system without flow. Before shutting down a system, flush it extensively with warm water to avoid clogging of valves, capillaries, or flow cells or reducing the life time of your column. If the system is not used for some time, for example more than a day depending on lab temperature, fill all solvent lines with organic solvent or water with at least 10 % isopropanol.
- Regularly maintain the LC system.

Handling of Acetonitrile

Acetonitrile is a solvent that is frequently used in reversed-phase chromatography. Despite of its common use, it can be a source of issues if not handled correctly.

As Acetonitrile ages, some residue can get stuck on internal pump surfaces which can cause issues with valve performance and therefore affect retention time precision.

When using acetonitrile:

- Use high-quality solvents from renowned suppliers.
- Use fresh solvents and filter them.
- Minimize exposure to light and air/oxygen.
- Choose a bottle size which fits to your application and usage.
- Acids accelerate solvent aging. If possible avoid such additives or refresh solvents more frequently.
- Pure acetonitrile ages faster. If your application allows, add about 5 % water and adjust gradient compositions.
- Do not leave acetonitrile in unused systems to avoid aging. If not in use, flush all solvent lines with a mixture of water and 10 % isopropanol.
- In case of blocked valves, flush the system with hot water. Knock at valves, flush them (see "Release a Stuck Inlet Valve" on page 157) or ultrasonicate them, for example in methanol.

Handling of Acids

Acids can corrode stainless steel and other materials in the flow path of LC systems. For stainless steel, the minimum pH is 2.3 for corrosive acids and pH 1 for non-corrosive acids.

Please note that for non-volatile acids like phosphoric acid or perchloric acid concentrations increase after evaporation of water. This means that originally diluted acids can damage parts over time, e.g. because of liquid, which has left the solvent path through micro leaks. Such systems should be flushed regularly with pure water and may require shorter maintenance cycles. Using the seal wash function should be considered for protecting pump heads.

Please also refer to *TechNote 01200-90090*, which can be downloaded from our website **www.agilent.com**.

Algae Growth in HPLC Systems

The presence of algae in HPLC systems can cause a variety of problems that may be incorrectly diagnosed as instrument or application problems. Algae grow in aqueous media, preferably in a pH range of 4-8. Their growth is accelerated by buffers, for example phosphate or acetate. Since algae grow through photosynthesis, light will also stimulate their growth. Even in distilled water small-sized algae grow after some time.

Instrumental Problems Associated With Algae

Algae deposit and grow everywhere within the HPLC system, causing the followng problems:

- Blocked solvent filters, or deposits on inlet or outlet valves, resulting in unstable flow, composition or gradient problems, or a complete failure of the pump.
- Plugging of small-pore, high-pressure solvent filters, usually placed before the injector, resulting in high system pressure.
- Blockage of PTFE frits, leading to increased system pressure.
- Plugging of column filters, giving high system pressure.
- Dirty flow cell windows of detectors, resulting in higher noise levels (since the detector is the last module in the flow path, this problem is less common).

How to Prevent and-or Reduce the Algae Problem

- Always use freshly prepared solvents, especially use demineralized water which was filtered through 0.2 µm filters.
- Never leave mobile phase in the instrument for several days without flow.
- Always discard old mobile phase.
- Use the amber solvent bottle (Solvent bottle, amber, 1000 mL (9301-6526)) supplied with the instrument for your aqueous mobile phase.
- If possible add a few mg/L sodium azide or a few percent organic solvent to the aqueous mobile phase.

Setting up the Pump with the Instrument Control Interface

Overview

Parameters described in following sections are offered by the instrument control interface and can usually be accessed through Agilent instrument control software. For details, please refer to manuals and online help of respective user interfaces.

Instrument Configuration

Use the **Instrument Configuration** dialog box to examine and, if necessary, modify your instrument configuration. The **Configurable Modules** panel contains a list of all modules available for configuration. The **Selected Modules** panel contains the list of configured modules.

Auto Configuration: Under **Communication settings**, select either the **Host Name** option or the **IP address** option and enter the appropriate value for the host computer to enable automatic detection of the hardware configuration. The system configures the instrument automatically with no further manual configuration necessary.

The High-Speed Pump configuration parameters are in two sections:

- **Communication**
- **Options**

Communication: The parameters in this dialog box are detected automatically during autoconfiguration.

- **Device name**,
- **Type ID**,
- **Serial number**,
- **Firmware revision**,
- Button **Connection settings**

Options:

- **Pressure Unit**:

  Select the pressure units from the drop-down list (bar, psi, or MPa).

- **Installed mixer**:

  The installed mixer is detected during auto configuration. For manual configuration, click the down-arrow and select the installed mixer from the list. If you select a **Custom Mixer**, specify the custom mixer type in the **Custom mixer** field.

- **ISET installed**:

  This check box is marked to indicate that ISET is installed. Click **ISET Configurations** to open the **ISET Configuration** dialog box, which allows you to configure a sampler for the ISET emulation.

Configure Solvent Type Catalogs: Displays the **Solvent Type Catalogs** dialog box, which allows you to import and export solvent calibration data. See "How to Import the Latest Solvent Calibration Tables" on page 91.

Please see the online help of your user interface for more detailed information.

The Pump User Interface (Dashboard Panel)

Module Graphic

The items in the pump graphic have the following meaning and function:

Indicates that an External Contacts board is installed.

The level of solvent in the bottle is denoted by the green area; when the solvent level falls below the specified volume, the area turns yellow; when the bottle is empty, the area turns red. Clicking on the solvent bottle displays the **Bottle Fillings** dialog box. The tooltip for the bottle shows the solvent name.

Indicates that the ISET option is installed but with no active method (light gray) or installed and active (dark gray).

Indicates the presence of a solvent selection valve. Click the graphic to switch the valve; the animation shows when the valve is switched.

The pressure setpoints. The red line shows the current maximum pressure limit; the gray area shows the current pressure (also shown as text).

The current solvent flow rate (in mL/min) is displayed above the pressure display.

Instrument Signals

The following pump signals are displayed:

Flow	The current solvent flow rate (in mL/min).
Pressure	The current pump ressure (in bar, psi or MPa, see "Instrument Configuration" on page 65).
Pressure Limit	The current maximum pressure limit.
Composition A:B	The current solvent composition. When a solvent selection valve is fitted, the channels are shown in the graphic.
Tuning	The signal represents the current effort the pump needs to maintain the current system settings.

Context Menu

The context menu of the dashboard panel contains the following commands:

Control Displays the pump's **Control** dialog box.

Method Displays the pump's **Method Setup** dialog box.

Set Error Method Sets the method that is loaded if an error occurs to the method that is currently available in the hardware.

Identify Device Causes the LED on the front of the module to blink for a few seconds.

Switch Pump On/Off Toggles the status of the pump, on or off.

Switch solvent selection Valve A allows you to switch the solvent inlet line for channel A from inlet line 1 to 2.

Bottle Fillings Displays the **Bottle Fillings** dialog box.

Prepare Pump Allows you to control the Purge, Condition or the Prime function.

Seal Wash Purge Allows you to refill the Seal Wash lines once the Seal Wash solvent has been changed.

Prepare Pump Dialog

Table 9 Prepare Pump dialog

Parameter	Limits	Description
Purge	**Time**: 0 – 100.00 min in steps of 0.01 . **Flow**: 0.000 – 5.000 mL/min for each channel, in steps of 0.001	Setup and activation of **Purge** parameters. The automatic purge valve can be used for purging the system. The process has been automated for ease of use. • **Off**: Turns off the purge. • **On**: The device is purged. • **Purge Flow**, **Time** and **Composition** during purge have to be defined. As soon as the duration time of the purge ends, the module automatically switches to analytical conditions again.
Prime		Select **On** to start priming, **Off** to turn priming off. The **Prime** function is helpful if air has entered the pump heads. The module draws solvent at high speed with all four pump drives simultaneously, and dispenses it against the waste position of the automatic purge valve. This is done 20 times, before the process comes to an end. It should only be used when purging is not successful in removing stuck air bubbles from the pump head, and under no circumstances to fill the solvent lines when they are completely empty.
Conditioning	at least 200 bar (> 500 bar is better).	Use this function if you see excessive pressure or composition ripple, and you are sure that the solvent type (aqueous/organic or specific solvent/solvent mix) is correctly set, and there is no evidence of leakage in the pump. Conditioning may be necessary if the pump contains air, for example, after running out of solvent, after a long period of standby or after service or repair.

Control Settings

The pump control parameters are in two sections:

- **Pump**
- **Automatic Turn On**

Table 10 Pump control parameters

Parameter	Description
Pump	Enables you to switch the pump **On**, **Off** or to a **Standby** condition. In the **Standby** condition, the pump motor is still active, and when the pump is switched on again, it does not need to be re-initialized.
Automatic Turn On	Module can be turned on at a specified date/time. This feature can only be used if the module power switch is turned on.

Method Parameter Settings

The High-Speed Pump method setup parameters are in eight sections:

- **Flow**
- **Solvents A and B**
- **Stoptime**
- **Posttime**
- **Pressure Limits**
- **Timetable**
- **Advanced**
- **External Contacts**

Table 11 Method parameters

Parameter	Limits	Description
Flow	0.00 – 5.00 mL/min in steps of 0.001 . Recommended flow range: 0.05 – 5.00 mL/min .	The flow is the rate of movement of eluent along the column. It is important that the flow rate is kept constant to ensure precise retention time and peak measurements. Variations in flow rate can occur as a result of the partial failure of the pumping system, air in the pumping system, a change in the mobile phase viscosity or a temperature change.
Solvents A and B		For each channel, you can select which of the two solvents to deliver. You can set the percentage of solvent B to any value from 0 through 100 % . Solvent A always delivers the remaining volume: 100 - %B. The solvent B check boxes allow you to turn the solvent B channels on (checked) or off (cleared). When the **Use solvent types** check box in the **Compressibility** section is checked (see "Advanced Settings" on page 73), you click the down arrow and select either a **Generic** solvent or a calibrated **Solvent**.
Stoptime	0.01 – 99999 min or **As Injector/No Limit** (an infinite run time).	The stoptime sets a time limit for your analysis. After the stoptime, all gradients are stopped and the pump parameters return to their initial values. The pump can be used as a stoptime master for the complete analytical system. The pump also stops the detectors if they have a **No Limit** stoptime setting. If no limit is given, a method will have to be stopped manually.
Posttime	0.01 – 99999 min or **Off** (0.0 min).	Your instrument remains in a not ready state during the posttime to delay the start of the next analysis. You can use the **Posttime** to allow your column to equilibrate after changes in solvent composition (for example, after gradient elution).

Table 11 Method parameters

Parameter	Limits	Description
Pressure Limits	**Max**: 1300 bar (18850 psi) for flow rates up to 2 mL/min . For flow rates between 2 mL/min and 5 mL/min , the maximum pressure ramps down to 800 bar (11600 psi). **Min**: any value between 0 and the upper pressure limit setting.	Sets the maximum and minimum pressure limits for the pump. • **Max** is the maximum pressure limit at which the pump will switch itself off, protecting the analytical system against over-pressure. • **Min** is the minimum limit at which the pump will switch itself off. For example, if any solvent reservoir is empty, this prevents damage by pumping of air.
Timetable		See "Timetable Settings" on page 74
Advanced		See "Advanced Settings" on page 73
External Contacts		The **External Contacts** section enables you to set up the switching of the external contacts. NOTE The **External Contacts** section is present only when a BCD/external contacts board is installed.

Advanced Settings

The High-Speed Pump advanced method setup parameters are in three sections:

- **Minimum Stroke**
- **Compressibility**
- **Maximum Flow Gradient**

Table 12 Advanced method parameters

Parameter	Limits	Description
Minimum Stroke	20 – 100 µL	The stroke volume is used for optimizing between performance of the module and seal life time. For performance, a low stroke volume is beneficial, as it divides disturbances into smaller packages, but a larger volume extends the lifetime of the pump seals. If **Automatic** is selected, the pump tries to achieve an optimized stroke volume for the Jet Weaver geometry. **Synchronized**: Select this option to synchronize the strokes for both channels; the values for Channel B are set to the same as those for Channel A. This is done to avoid floating disturbances affecting instrument performance.
Compressibility		The compressibility of the mobile phase affects the performance of the pump. For best flow accuracy and mixing performance, you can set the parameter according to the mobile phase being used. **Use solvent types**: • Clear this check box to display the compressibility fields, which allow you to enter compressibility values. • When the check box is selected, the compressibility fields are not displayed, and the enhanced compressibility calibration is enabled. Select the required calibrated solvents from the drop-down lists using the combo boxes in the **Solvents** section.
Maximum Flow Gradient	1.000 – 1000.000 mL/min/min in steps of 0.001 mL/min/min Default value: 100.000 mL/min/min	You can set a limit on the rate of change of the solvent flow to protect your analytical column. You can set individual values for **Flow ramp up** and **Flow ramp down**.

Timetable Settings

Use the **Timetable** to program changes in the pump parameters during the analysis by entering a time in the **Time** field and appropriate values in the following fields of the timetable. Changes in flow rate occur linearly from either time zero or the time of the last defined change; other parameters change instantaneously at the time defined in the timetable.

Show **Advanced Timetable** toggles the timetable display between standard mode and advanced mode.

The following parameters can be changed:

- **Change Contacts**
- **Change Flow**
- **Change Max. Pressure Limit**
- **Change Solvent Composition** - You can only use solvents, which have been enabled in the solvents section.
- **Function centric view** - This check box allows you to display parameter changes instead of a time table.

Agilent Local Control Modules

Agilent InfinityLab Companion G7108AA

The Agilent InfinityLab Companion gives you complete control, system monitoring, signal plotting, and diagnostic capabilities for a wide range of LC system modules.

The instrument control solution is available as full package including all hardware and accessories, but can also be used on your own mobile devices like tablets, mobile phones and other electronic equipment.

Combining the conveniences of the Agilent Instant Pilot features with state-of-the-art mobile technology, the Agilent InfinityLab Companion gives you maximum flexibility and ease of use to control and monitor your LC system modules.

Features:

- Complete local control and monitoring of Agilent Infinity II LC modules
- Excellent usability and ease of use through a user interface specifically tailored for mobile devices - simple, intuitive touch-enabled, and visual controllable.
- High flexibility through a modern “Bring your own device” approach. Connection between LC module and mobile device either wireless via Wi-Fi or wired over USB cable (with full package).
- Convenient, ergonomic operation either handheld or attached to a module at the stack with newly developed, secure tablet holder (included in the full package).
- Preconfigured tablet with all required software already installed (included in the full package).
- Centerpiece of the solution is a USB dongle that activates the complete intelligence of the InfinityLab Companion on the instrument stack.

The InfinityLab Companion provides:

- fast and direct control in front of the instrument
- a clear overview of the system status
- control functionalities
- access to method parameters and sequences
- a logbook showing events from the modules
- diagnostic tests

4 Preparing the Pump

This chapter provides information on how to set up the module for an analysis and explains the basic settings.

Capillary Coding Guide

Syntax for Capillary Description

The tables below are your guide to identifying the proper specifications for your capillary. On all capillaries, dimensions are noted in id (mm), length (mm) and, where applicable, volume (µL). When you receive your capillary, these abbreviations are printed on the packaging.

Using the guide: This fitting is coded as *SPF*, for Swagelok, PEEK, Fingertight.

Table 13 Capillary coding guide

Type **The type gives some indication on the primary function, like a loop or a connection capillary.**		**Material** **The material indicates which raw material is used.**		**Fitting left/fitting right** **The fitting left/right indicate which fitting is used on both ends of the capillary.**	
Key	**Description**	**Key**	**Description**	**Key**	**Description**
Capillary	Connection capillaries	SS	Stainless steel	W	Swagelok + 0.8 mm Port id
Loop	Loop capillaries	Ti	Titanium	S	Swagelok + 1.6 mm Port id
Seat	Autosampler needle seats	PK	PEEK	M	Metric M4 + 0.8 mm Port id
Tube	Tubing	FS/PK	PEEK-coated fused silica[1]	E	Metric M3 + 1.6 mm Port id
Heat exchanger	Heat exchanger	PK/SS	Stainless steel-coated PEEK[2]	U	Swagelok union
		PFFE	PTFE	L	Long
		FS	Fused silica	X	Extra long
		MP35N	Nickel-cobalt-chromium-molybdenium alloy	H	Long head
				G	Small head SW 4
				N	Small head SW 5
				F	Finger-tight
				V	1200 bar
				B	Bio
				P	PEEK
				I	Intermediate

1 Fused silica in contact with solvent

2 Stainless steel-coated PEEK

At-a-Glance Color-Coding Keys

The color of your capillary will help you quickly identify the capillary id.

Table 14 Color-coding key for Agilent capillary tubing

Internal diameter in mm		Color code
0.015		Orange
0.025		Yellow
0.05		Beige
0.075		Black
0.075	MP35N	Black with orange stripe
0.1		Purple
0.12		Red
0.12	MP35N	Red with orange stripe
0.17		Green
0.17	MP35N	Green with orange stripe
0.20/0.25		Blue
0.20/0.25	MP35N	Blue with orange stripe
0.3		Grey
0.50		Bone White

HINT

As you move to smaller-volume, high efficiency columns, you'll want to use narrow id tubing, as opposed to the wider id tubing used for conventional HPLC instruments

Installing Capillaries

Capillaries and connections depend on which system is installed.

Table 15 Capillary connections for 1260 Infinity II systems

p/n	From	To
Bottle Head Assembly (G7120-60007)	Solvent Bottle	Infinity II Pump
Capillary ST 0.17 mm x 500 mm SI/SI (5500-1246)	Pump	Sampler
Capillary, ST, 0.17 mm x 900 mm SI/SX (5500-1217)	Pump	Vialsampler with ICC
Capillary ST 0.17 mm x 500 mm SI/SI (5500-1246)	Multisampler	MCT Valve/Heat Exchanger
Capillary, ST, 0.17 mm x 400 mm SL/SL (5500-1252)	Vialsampler	MCT Valve/Heat Exchanger
Capillary ST 0.17 mm x 105 mm SL/SL (5500-1240)	Vialsampler	ICC Heat Exchanger
Capillary, ST, 0.17 mm x 120 mm SL/SL, long socket (5500-1250)	ICC Heat Exchanger	Column
InfinityLab Quick Turn Capillary ST 0.17 mm x 105 mm, long socket (5500-1193)	MCT Heat Exchanger	Column
InfinityLab Quick Turn Capillary ST 0.12 mm x 280 mm, long socket (5500-1191)	Column/MCT Valve	Detector
Waste accessory kit (5062-8535)	VWD	Waste
Tube PTFE 0.7 mm x 5 m, 1.6 mm od (5062-2462)	DAD/FLD	Waste
Analytical tubing kit 0.25 mm i.d. PTFE-ESD (G5664-68712)	Detector	Fraction Collector

Table 16 Capillary connections for 1290 Infinity II systems

p/n	From	To
Bottle Head Assembly (G7120-60007)	Solvent Bottle	Infinity II Pump
Capillary ST 0.17 mm x 400 mm SI/SI (5500-1245)	Pump	Sampler
Capillary, ST, 0.17 mm x 900 mm SI/SX (5500-1217)	Pump	Vialsampler with ICC
Capillary ST, 0.12 mm x 500 mm SL/S (5500-1157)	Multisampler	MCT Valve/Heat Exchanger
Capillary ST 0.12 mmX 400 mm SL/SL (5500-1251)	Vialsampler	MCT Valve/Heat Exchanger
Capillary ST 0.12 mm x 105 mm SL/SL (5500-1238)	Vialsampler	ICC Heat Exchanger
Capillary ST 0.12 mm x 120 mm SL/SL, long socket (5500-1249)	ICC Heat Exchanger	Column
Capillary ST 0.12 mm x 105 mm SL/ (5500-1201)	MCT Heat Exchanger	Column
InfinityLab Quick Turn Capillary ST 0.12 mm x 280 mm, long socket (5500-1191)	Column/MCT Valve	Detector
Waste accessory kit (5062-8535)	VWD	Waste
Tube PTFE 0.7 mm x 5 m, 1.6 mm od (5062-2462)	DAD/FLD	Waste
Analytical tubing kit 0.25 mm i.d. PTFE-ESD (G5664-68712)	Detector	Fraction Collector

Table 17 Capillary connections for 1260 Infinity II Bio-inert LC

p/n	From	To
Bottle Head Assembly (G7120-60007)	Solvent Bottle	Infinity II Pump
Capillary Ti 0.17 mm x 500 mm, SL/SLV (5500-1264)	Pump	Multisampler
Capillary PK/ST 0.17 mm x 500 mm, RLO/RLO (Bio-inert) (G5667-81005)	Multisampler	MCT
ZDV union (Bio-inert) (5067-4741)	Capillary	Bio-inert Heat Exchanger
Quick Connect Heat Exchanger Bio-inert (G7116-60041)		
Capillary Kit Flow Cells BIO includes Capillary PK 0.18 mm x 1.5 m and PEEK Fittings 10/PK (p/n 5063-6591) (G5615-68755)	Column/MCT Valve	Detector
Waste accessory kit (5062-8535)	VWD	Waste
Tube PTFE 0.7 mm x 5 m, 1.6 mm od (5062-2462)	DAD/FLD	Waste
Analytical tubing kit 0.25 mm i.d. PTFE-ESD (G5664-68712)	Detector	Fraction Collector

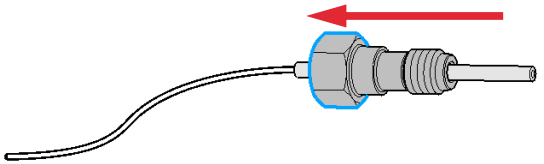
Table 18 Capillary connections for 1290 Infinity II Bio LC

p/n	From	To
Bottle Head Assembly (G7120-60007)	Solvent Bottle	Infinity II Pump
Capillary MP35N 0.17 mm x 500 mm, SI/SI (5500-1419)	Pump	Multisampler
Capillary MP35N 0.12 mm x 500 mm SI/SI (5500-1279)	Multisampler	MCT
Quick Connect Capillary MP35N 0.12 mm x 105 mm (5500-1578)	MCT Heat Exchanger	Column
Quick Turn Capillary MP35N 0.12 mm x 280 mm (5500-1596)	Column/MCT Valve	Detector
Waste accessory kit (5062-8535)	VWD	Waste
Tube PTFE 0.7 mm x 5 m, 1.6 mm od (5062-2462)	DAD/FLD	Waste
Analytical tubing kit 0.25 mm i.d. PTFE-ESD (G5664-68712)	Detector	Fraction Collector

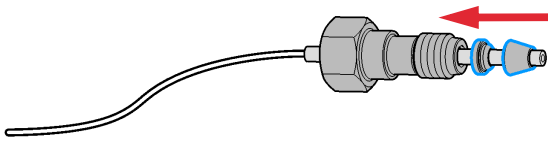
For correct installation of capillary connections it's important to choose the correct fittings, see "Syntax for Capillary Description" on page 77.

1 Select a nut that is long enough for the fitting you'll be using.

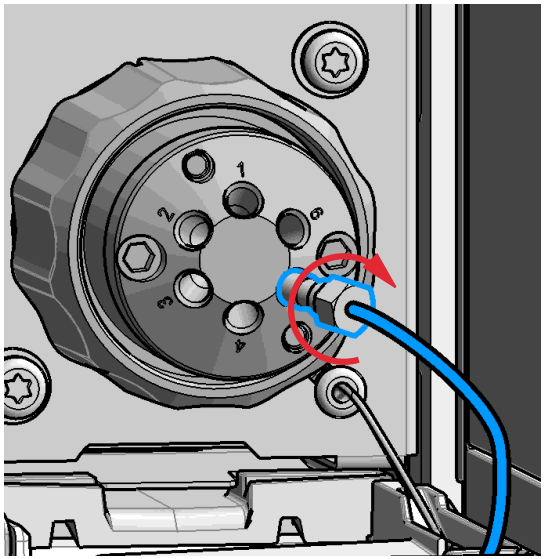
2 Slide the nut over the end of the tubing or capillary.



3 Carefully slide the ferrule components on after the nut and then finger-tighten the assembly while ensuring that the tubing is completely seated in the bottom of the end fitting.

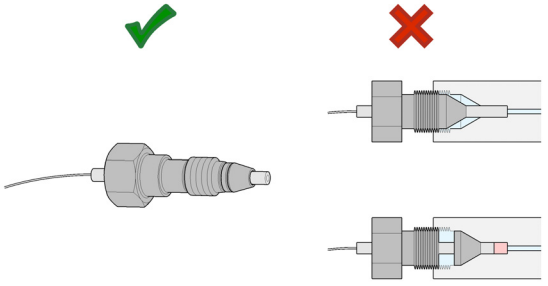


4 Use a column or injection valve to gently tighten the fitting which forces the ferrule to seat onto the tubing or capillary.



NOTE

Don't overtighten. Overtightening will shorten the lifetime of the fitting.

5 Loosen the nut and verify that the ferrule is correctly positioned on the tubing or capillary. 	

NOTE

The first time that the swagelock fitting is used on a column or an injection valve, the position of the ferrule is permanently set. If changing from a column or an injection valve to another, the fitting may leak or decrease the quality of the separation by contributing to band broadening.

5 Optimizing Performance

This chapter gives hints on how to optimize performance or use additional devices.

Delay Volume and Extra-Column Volume

The *delay volume* is defined as the system volume between the point of mixing in the pump and the front of the column.

The *extra-column volume* is defined as the volume between the injection point and the detection point, excluding the volume in the column.

Delay Volume

In gradient separations, this volume causes a delay between the mixture changing in the pump and that change reaching the column. The delay depends on the flow rate and the delay volume of the system. In effect, this means that in every HPLC system there is an additional isocratic segment in the gradient profile at the start of every run. Usually the gradient profile is reported in terms of the mixture settings at the pump and the delay volume is not quoted even though this will have an effect on the chromatography. This effect becomes more significant at low flow rates and small column volumes and can have a large impact on the transferability of gradient methods. It is important, therefore, for fast gradient separations to have small delay volumes, especially with narrow bore columns (e.g., 2.1 mm i.d.) as often used with mass spectrometric detection.

The delay volume in a system includes the volume in the pump from the point of mixing, connections between pump and autosampler, volume of the flow path through the autosampler and connections between autosampler and column.

How to Configure the Optimum Delay Volume

The physical delay volume of the pump depends primarily on the use of the Jet Weaver mixer. For UV detection, the Jet Weaver should always be used but for mass spectrometric detection the user can decide to bypass the Jet Weaver to reduce the delay volume. This only makes sense for ultrafast gradient operation (less than 0.5 min) or for use with very small volume columns. If the Jet Weaver is bypassed, the connection tubing to the autosampler is routed directly from the purge valve.

NOTE

Before disconnecting a Jet Weaver from the flow path, flush it with organic solvent (50 % isopropanol in water). Avoid leaving water or buffers inside the Jet Weaver, which may cause the growth of micro-organisms like algae or bacteria.

Sometimes it may be advisable to increase the delay volume in the pump. Specifically this can be the case when UV detection is employed and a strongly UV-absorbing compound has been added to the mobile phase. This can have the effect of emphasizing any pump noise and the most common example is the use of trifluoroacetic acid (TFA) in the analysis of proteins and peptides. The effect can be mitigated by increasing the mixer volume.

The following different Jet Weaver configurations are available:

- The Jet Weaver (Jet Weaver 35 µL/ 100 µL (G7120-68135) or Jet Weaver 35 µL/ 100 µL Bio-Compatible (G7132-68135)) has two alternative volumes in the same unit.
  The switch from the lower volume, 35 µL, to the higher volume, 100 µL, is done by uninstalling it, turning it around from front to back and re-installing it, see "Change Configuration or Replace the Jet Weaver" on page 149. The delay volume increases by approximately 31 µL and the baseline performance with additives like TFA improves. The configuration of the Jet Weaver is logged automatically by an attached RFID tag.
- The 380 µL Jet Weaver high-performance mixer (Jet Weaver 380 µL (G7120-68380) or Jet Weaver 380 µL Bio-Compatible (G7132-68380)) is optionally available for demanding applications, which use solvents in different channels (for example A versus B), that differ strongly in their UV-Vis absorption. For example, it can be installed when using trifluoroacetic acid (TFA) as a modifier, which has a high absorbance.
  Solvent packages created by the pump may persist until the solvent reaches the detector flow cell. Absorption fluctuations can then show up as baseline noise, also referred to as mixing noise. Applications like impurity quantitation or lowest level compound detection require minimizing this noise. The 380 µL Jet Weaver strongly improves mixing and therefore reduces baseline noise and improves sensitivity in detection. Patented Agilent microfluidic technology offers high mixing performance at a low internal volume of 380 µL.

How to Achieve Higher Resolution

Increased resolution in a separation will improve the qualitative and quantitative data analysis, allow more peaks to be separated or offer further scope for speeding up the separation. This section explains how resolution can be increased by examining the following points:

- Optimizing selectivity
- Smaller particle-size packing
- Longer Columns
- Shallower gradients, faster flow

Resolution between two peaks is described by the resolution equation:

$$Rs = \frac{1}{4}\sqrt{N}\,\frac{(\alpha - 1)}{\alpha}\,\frac{(k_2 + 1)}{k_2}$$

where

- R_s=resolution,
- N=plate count (measure of column efficiency),
- α=selectivity (between two peaks),
- k_2=retention factor of second peak (formerly called capacity factor).

The term that has the most significant effect on resolution is the selectivity, α, and practically varying this term involves changing the type of stationary phase (C18, C8, phenyl, nitrile etc.), the mobile phase and temperature to maximize the selectivity differences between the solutes to be separated. This is a substantial piece of work which is best done with an automated method development system which allows a wide range of conditions on different columns and mobile phases to be assessed in an ordered scouting protocol. This section considers how to get higher resolution with any chosen stationary and mobile phases. If an automated method development system was used in the decision on phases it is likely that short columns were used for fast analysis in each step of the scouting.

The resolution equation shows that the next most significant term is the plate count or efficiency, N, and this can be optimized in a number of ways. N is inversely proportional to the particle size and directly proportional to the length of a column and so smaller particle size and a longer column will give a higher plate number. The pressure rises with the inverse square of the particle size and

proportionally with the length of the column. Resolution increases with the square root of N so doubling the length of the column will increase resolution by a factor of 1.4. What is achievable depends on the viscosity of the mobile phase as this relates directly to the pressure. Methanol mixtures will generate more back pressure than acetonitrile mixtures. Acetonitrile is often preferred because peak shapes are better and narrower in addition to the lower viscosity but methanol generally yields better selectivity (certainly for small molecules less than about 500 Da). The viscosity can be reduced by increasing the temperature but it should be remembered that this can change the selectivity of the separation. Experiments will show if this leads to increase or decrease in selectivity. As flow and pressure are increased it should be remembered that frictional heating inside the column will increase and that can lead to slightly increased dispersion and possibly a small selectivity change both of which could be seen as a reduction in resolution. The latter case might be offset by reducing the temperature of the thermostat by a few degrees and again experiment will reveal the answer.

The van Deemter curve shows that the optimum flow rate through an STM column is higher than for larger particles and is fairly flat as the flow rate increases. Typical, close to optimum, flow rates for STM columns are: 2 ml/min for 4.6 mm i.d.; and 0.4 ml/min for 2.1 mm i.d. columns.

In isocratic separations, increasing the retention factor, k, results in better resolution because the solute is retained longer. In gradient separations the retention is described by k^* in the following equation:

$$k^* = \frac{t_G}{\Delta\%B} \cdot \frac{F}{V_m} \cdot \frac{100}{S}$$

where:

- k^* = mean k value,
- t_G= time length of gradient (or segment of gradient) (min),
- F = flow (ml/min),
- V_m = column delay volume,
- Δ%B = change in fraction of solvent B during the gradient,
- S = constant (ca. 4-5 for small molecules).

This shows that k and hence resolution can be increased by having shallower gradients (2 to 5 %/min change is a guideline), higher flow rates and smaller volume columns. This equation also shows how to speed up an existing gradient – if the flow is doubled but the gradient time is halved, k^* remains constant and the separation looks the same but happens in half the time. Recently published research has shown how a shorter STM column (at temperatures above 40 °C) can generate higher peak capacity than a longer STM column by virtue of running it faster. (Refer to *Petersson et al., J.Sep.Sci, 31, 2346-2357, 2008, Maximizing peak capacity and separation speed in liquid chromatography*).

Using Solvent Calibration Tables

Agilent Solvent Calibration Tables provide an algorithm for the pump to automatically determine the correct compressibility associated with the current system pressure.

Solvent definition tables for most common solvents are now available for download.

https://www.agilent.com/en-us/firmwareDownload?whid=62265.

How it Works

The compressibility of the mobile phase has an effect on the performance of the pump. For best flow accuracy and mixing performance, the compressibility parameter in the Method Settings of the pump shall be chosen according to the mobile phase being used. This method setting activates the algorithm associated with the Agilent Solvent Calibration Tables.

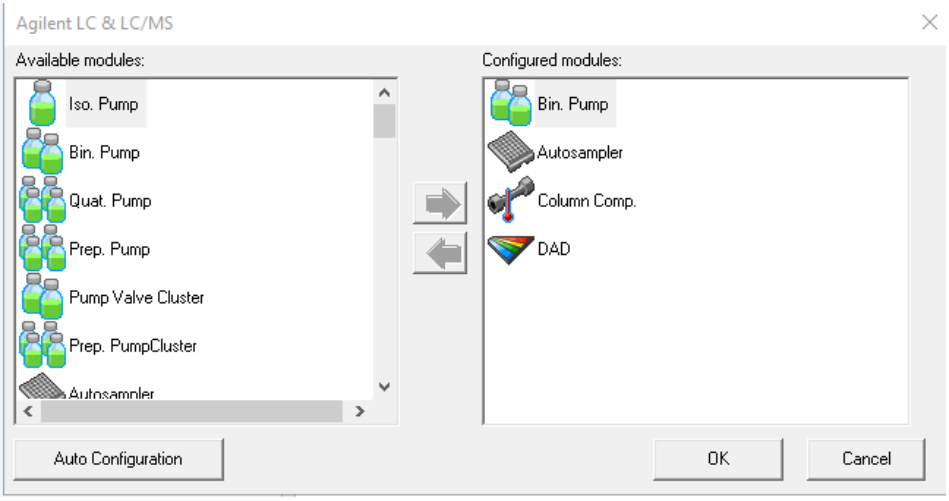
If your solvent is neither available in the user interface nor in the library, please use generic solvents. "Generic aqueous" gives good results for most solvent mixtures with at least 50 % water, which have similar properties as pure water. For other solvents with high organic percentage, "Generic organic" gives a good approximation.

How to Import the Latest Solvent Calibration Tables

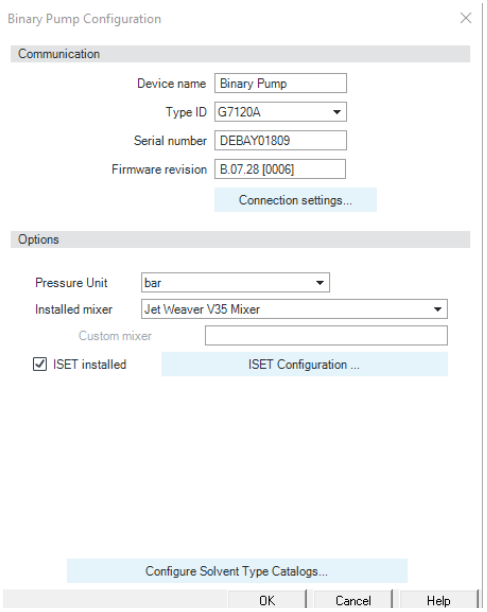
It might be necessary to import new Agilent Solvent Calibration tables that were not previously available with the system. This will then provide the most accurate algorithm in determining the compressibility of the mobile phase.

The procedure for importing the latest solvent calibration tables is as follows:

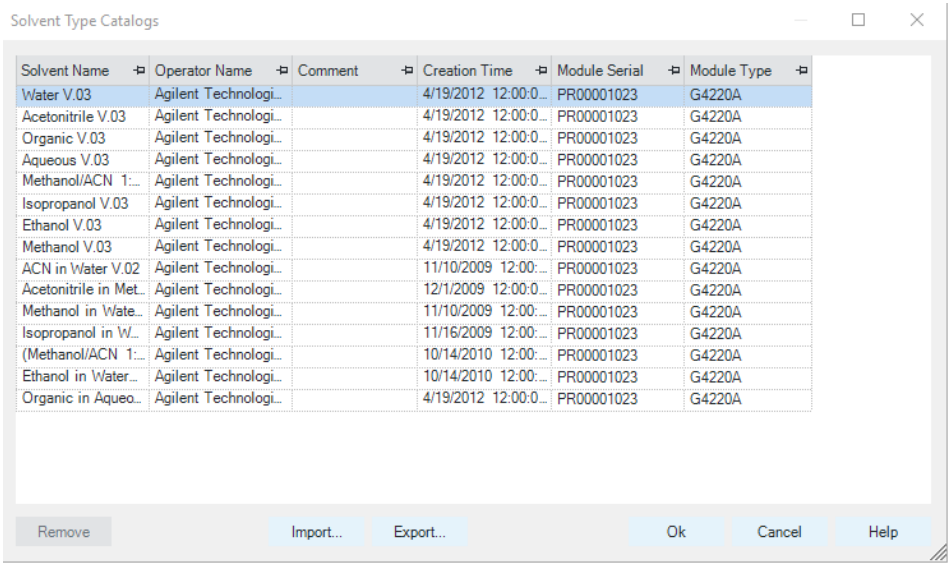
1 Enter the Instrument configuration of the Agilent LC Driver.



2 Click on the module that needs the latest solvent calibration table (i.e. G7120A). Then choose configure, launching the additional configuration of the pump module.

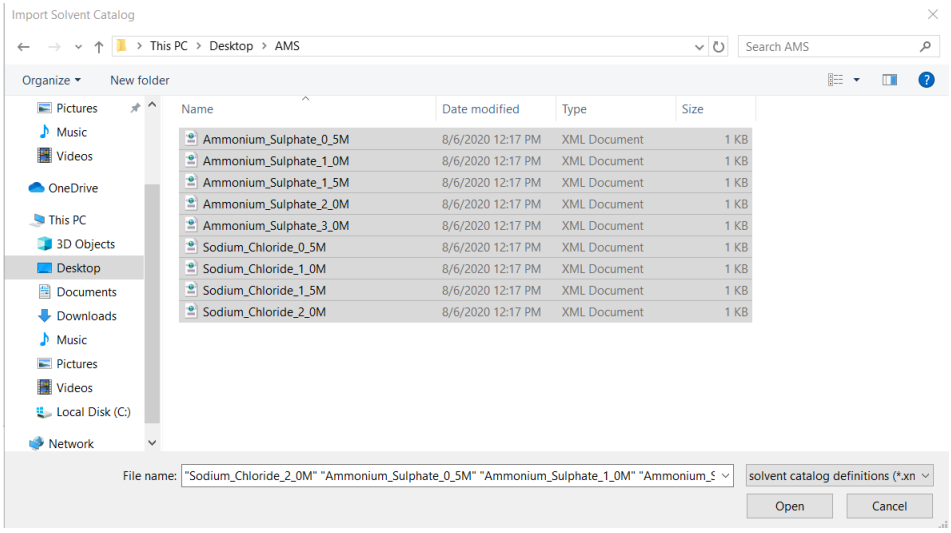


3 In the additional configuration of the pump module, choose **Configure Solvent Type Catalogs...**

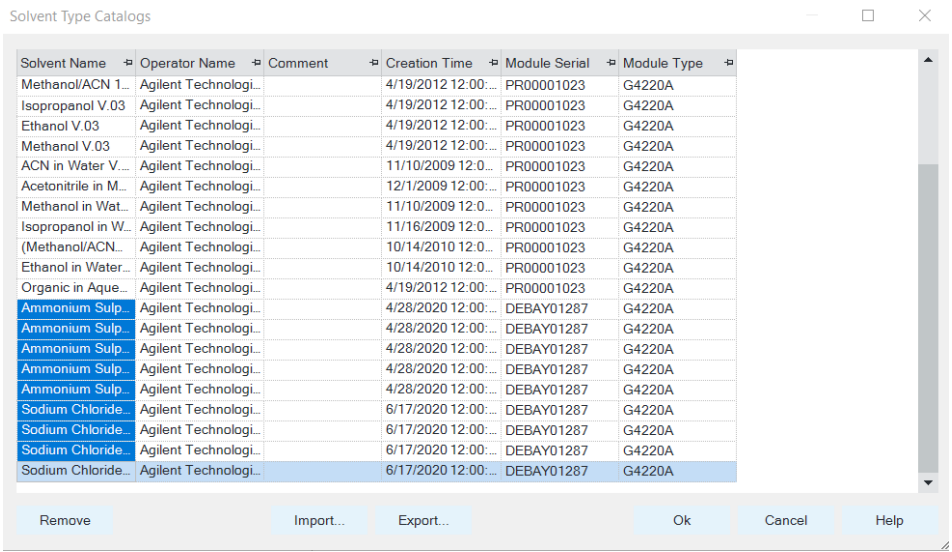


4 In the **Solvent Type Catalogs**, press the **Import** button.

5 Navigate to the location of the downloaded **Agilent Solvent Calibration Table** and click the **Open** button. Keep in mind multiple solvent calibration tables may be imported at the same time.



6 The imported solvent table will now appear in the **Solvent Type Catalogs**.

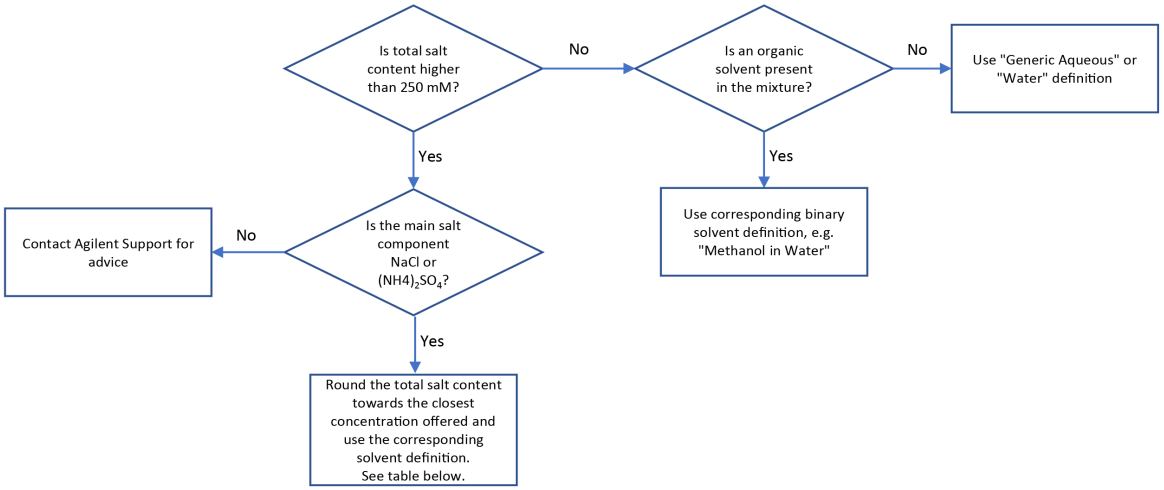


The imported solvent table is now available for selection in the Method Settings of the pump module.

Recommendations for Setting up Methods Using Salt-Containing Eluents

With the 1290 Infinity II Bio LC System Agilent offers a dedicated instrument for running applications that are typical for the (Bio)pharma market, such as IEX (Ion Exchange Chromatography)or HIC (Hydrophobic Interaction Chromatography), and applications in Academia, Government and Applied Markets, using concentrated salt solutions as eluents.

After you have imported the solvent tables, you may choose the solvent definition most suiting your solvent according to the chart below:



Main salt component	Total salt content (c, mol/L)	Select solvent definition
NaCl	0.25 < c ≤ 0.75	Sodium Chloride 0.5M V.03
	0.75 < c ≤ 1.25	Sodium Chloride 1.0M V.03
	1.25 < c ≤ 1.75	Sodium Chloride 1.5M V.03
	c > 1.75	Sodium Chloride 2.0M V.03
$(NH_4)_2SO_4$	0.25 < c ≤ 0.75	Ammonium Sulphate 0.5M V.03
	0.75 < c ≤ 1.25	Ammonium Sulphate 1.0M V.03
	1.25 < c ≤ 1.75	Ammonium Sulphate 1.5M V.03
	1.75 < c ≤ 2.5	Ammonium Sulphate 2.0M V.03
	c >2.5	Ammonium Sulphate 3.0M V.03

6 Troubleshooting and Diagnostics

Overview about the troubleshooting and diagnostic features.

User Interfaces

- Depending on the user interface, the available tests and the screens/reports may vary.
- The preferred tool for troubleshooting and diagnostics should be Agilent Lab Advisor Software, see "Agilent Lab Advisor Software" on page 97.
- The Agilent OpenLab ChemStation C.01.03 and above do not include any maintenance/test functions.
- Screenshots used within these procedures are based on the Agilent Lab Advisor Software.

Agilent Lab Advisor Software

The Agilent Lab Advisor Software (basic license, shipped with an Agilent LC pump) is a standalone product that can be used with or without a chromatographic data system. Agilent Lab Advisor helps to manage the lab for high-quality chromatographic results by providing a detailed system overview of all connected analytical instruments with instrument status, Early Maintenance Feedback counters (EMF), instrument configuration information, and diagnostic tests. With the push of a button, a detailed diagnostic report can be generated. Upon request, the user can send this report to Agilent for a significantly improved troubleshooting and repair process.

The Agilent Lab Advisor software is available in two versions:

- Lab Advisor Basic
- Lab Advisor Advanced

Lab Advisor Basic is included with every Agilent 1200 Infinity Series and Agilent InfinityLab LC Series instrument.

The Lab Advisor Advanced features can be unlocked by purchasing a license key, and include real-time monitoring of instrument actuals, all various instrument signals, and state machines. In addition, all diagnostic test results, calibration results, and acquired signal data can be uploaded to a shared network folder. The Review Client included in Lab Advisor Advanced allows to load and examine the uploaded data no matter on which instrument it was generated. This makes Data Sharing an ideal tool for internal support groups and users who want to track the instrument history of their analytical systems.

The optional Agilent Maintenance Wizard Add-on provides an easy-to-use, step-by-step multimedia guide for performing preventive maintenance on Agilent 1200 Infinity LC Series instrument.

The tests and diagnostic features that are provided by the Agilent Lab Advisor software may differ from the descriptions in this manual. For details, refer to the Agilent Lab Advisor software help files.

Pump Leak Rate Test

The **Pump Leak Rate Test** is a diagnostic test to check the integrity and tightness of the pump components. The test is started from the **Services & Diagnostics** section in the Agilent Lab Advisor Software. The test is first evaluating the tightness from the outlet valve downstream to the purge valve. First, the pistons are positioned; afterwards, the purge valve is switched to the closed position. By moving the secondary piston into the pump chamber, the system is pressurized to 1000 bar (or 800 bar for G7104C). The flow rate to keep the pressure stable is the corresponding leak rate.

The second part of the test is designed to verify the tightness along the piston. Any irregularity on the piston surface (for example, scratches or deposits) will be detected. During this test, all components from the inlet valve downstream to the blocked purge valve are tested.

Now the primary piston is moving to deliver and generate pressure, and the secondary piston is retracting. The pressure is kept constant at 800 bar. The process is repeated for the second pump head, if applicable.

The **Pump Leak Rate Test** can also be performed at various pressures comparable to the pressure used during analysis. The procedure above describes the test using **High Pressure**. Other pressures available for the **Pump Leak Rate Test** are: **Mid Pressure** (600 bar secondary leak rate test, 600 bar primary leak rate test (N/A for G7104C)) and **Low Pressure** (200 bar secondary leak rate test, 200 bar primary leak rate test).

Preparations:

1. Flush the system with HPLC grade water for several minutes from any solvent channel.
2. Start the **Pump Leak Rate Test** from Lab Advisor.
3. Choose the channel with HPLC grade water and if you want to include or skip an additional purging step.
4. Click **OK** and follow the instructions.

   The test runs automatically without any further user interaction.

Evaluation:

The result as well as the applied limits are displayed after the automatic evaluation. The limits are:

- The allowed leak limit for the secondary piston is ≤3 µL/min
- The allowed leak limit for the primary piston is ≤30 µL/min

A report can be displayed, saved or printed by opening it with the **Print Result** button at the lower right of the screen.

If the test does not pass, check the system for leaks or call a local Agilent representative.

Figure 9 on page 99 and Figure 10 on page 100 show a typical test run.

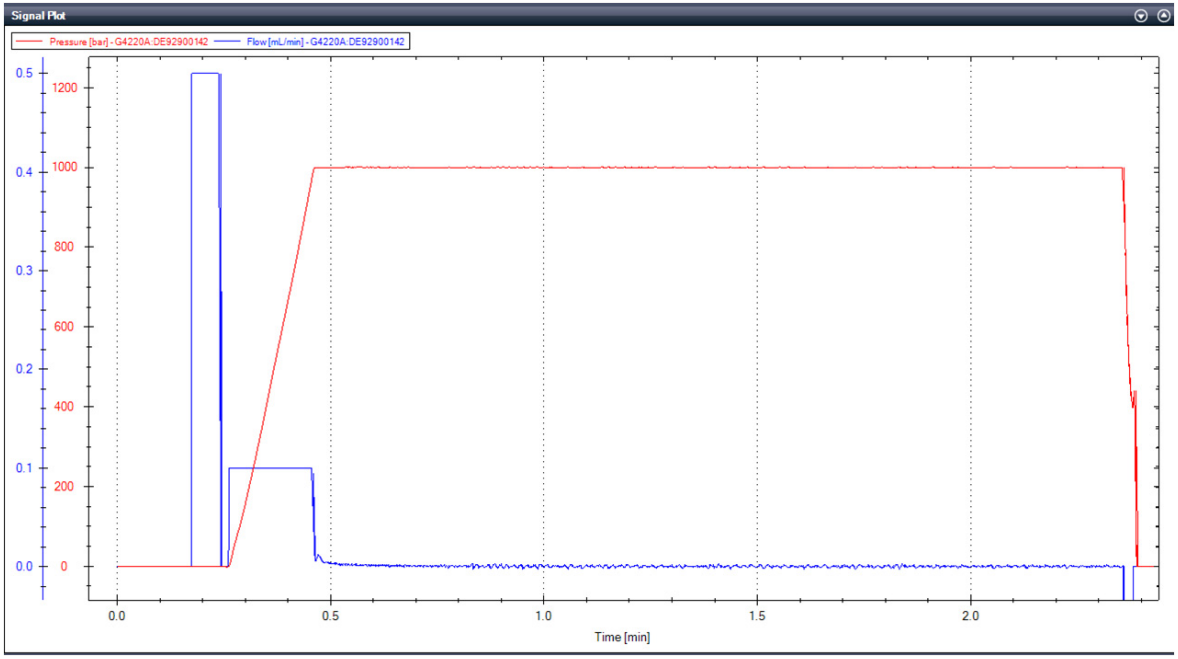


Figure 9 Static (secondary) Leak Test

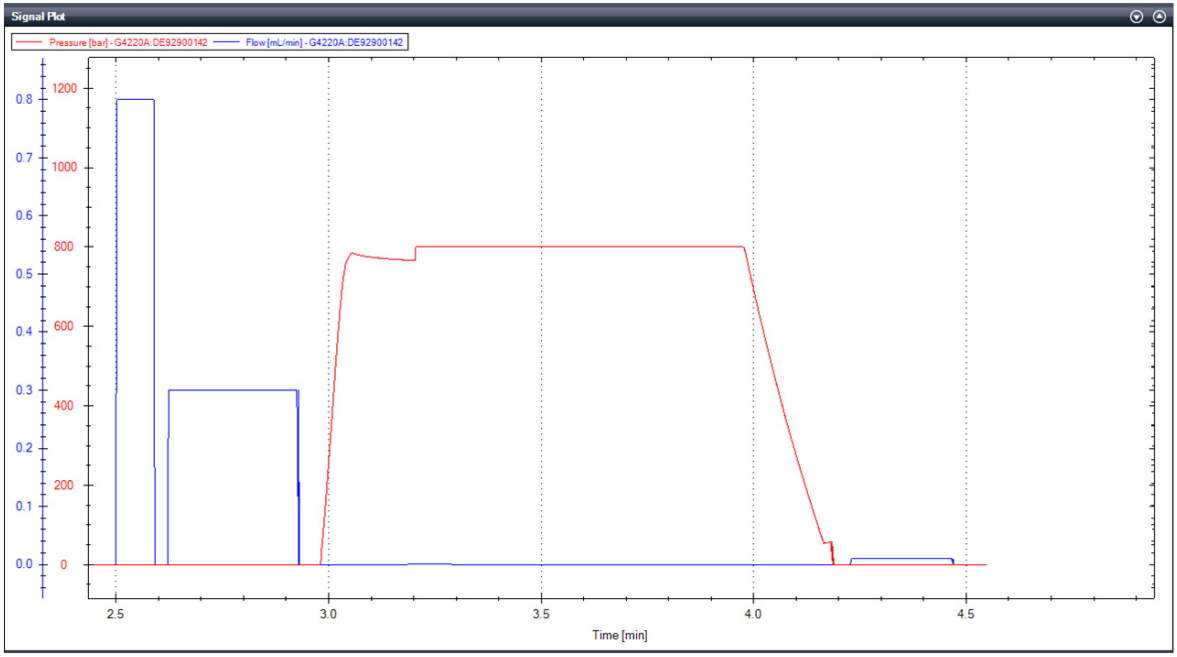


Figure 10 Dynamic (primary) Leak Test

Troubleshooting the Pump Leak Rate Test

Secondary Leak > 3 µL/min

- Leak between the OBV and automatic purge valve
  - Check for visible leaks on fittings and connectors
    - Connector not fixed / tight enough
    - Connector damaged
    - Leaky filter frit assembly
  - Remove the seal wash tubes from the support ring and check for leak into the seal wash path
    - Main seal leaking/damaged
    - Piston damaged
  - Remove waste lines from the automatic purge valve
    - Damage to rotor seal and/or stator head
- Outlet valve not properly assembled
  - Re-tighten the outlet valve
    - Check the position of the gold seal

Dynamic Leak > 30 µL/min or Dynamic Leak Rate Test fails

- Air in the primary pump chamber
  - Check for air in the solvent inlet lines and the **Tuning** signal
    - Purge the lines, condition and if necessary prime the pump head
- Abort due to over pressure
  - Check solvent and solvent settings
    - Purge and condition the pump head with water
- Leak in inlet valve
  - Check for moving air bubbles in tubing directly to the inlet valve
    - Purge the lines with water to remove dirt
    - Knock at the valve, clean it or replace it
- Outlet valve not properly assembled
  - Retighten the outlet valve
    - Check the position of the gold seal
- Leaky piston seals and/or position-dependent leaks on the piston
  - Remove the SW tubes from the support ring and check for leaks
  - Replace the piston seals and clean the pistons
    - Ensure that seals are lubricated when pushed in
    - Use abrasive mesh >5000 grit

System Pressure Test

The **System Pressure Test** is performed to evaluate the leak tightness of the system up to the point where the system is capped off. The test is started from the Services & Diagnostics section in the Agilent Lab Advisor Software or in the Local Controller. Modules such as pump, sampler, column compartments as well as accessories like valves or columns can be included into the flow path for this test.

Preparations:

1. Flush the system with HPLC grade water for several minutes from any solvent channel.
2. Start the **System Pressure Test** and choose the pressure you want to test the system with. Consider pressure limits of modules or accessories included into the flow path.
3. Choose the channel with HPLC grade water and if you want to include or skip an additional purging step.
4. Click **OK** and follow the instructions: Place a blank nut into the port up to which you want to test the leak tightness of the system.

   The test runs automatically without any further user interaction.

Evaluation:

The result as well as the applied limits are displayed after the automatic evaluation. The limits are:

- For a pressure setting ≤1000 bar, the allowed leak limit is ≤5 µL/min
- For a pressure setting >1000 bar, the allowed leak limit is ≤15 µL/min

A report can be displayed, saved or printed by opening it with the **Print Result** button at the lower right of the screen.

If the test does not pass, check the system for leaks or call a local Agilent representative.

Figure 11 on page 104 shows a typical test run.

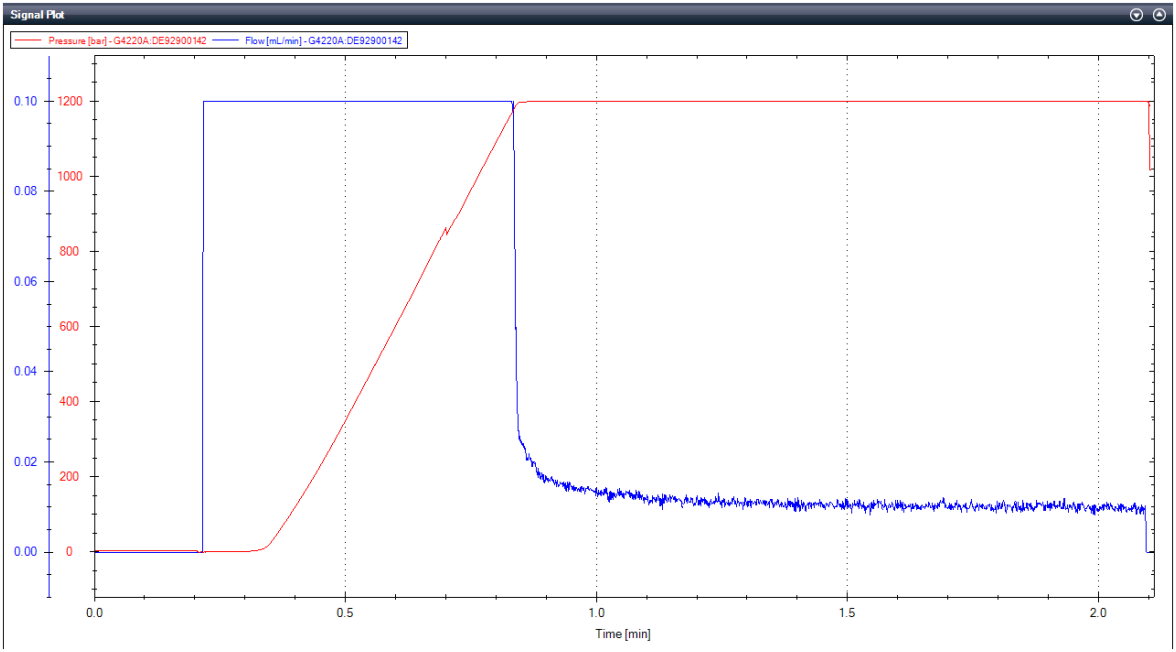


Figure 11 System Pressure Test

7 Error Information

This chapter describes the meaning of error messages, and provides information on probable causes and suggested actions how to recover from error conditions.

What Are Error Messages

Error messages are displayed in the user interface when an electronic, mechanical, or hydraulic (flow path) failure occurs which requires attention before the analysis can be continued (for example, repair, or exchange of consumables is necessary). In the event of such a failure, the red status indicator at the front of the module is switched on, and an entry is written into the module logbook.

If an error occurs outside a method run, other modules will not be informed about this error. If it occurs within a method run, all connected modules will get a notification, all LEDs get red and the run will be stopped. Depending on the module type, this stop is implemented differently. For example, for a pump the flow will be stopped for safety reasons. For a detector, the lamp will stay on in order to avoid equilibration time. Depending on the error type, the next run can only be started, if the error has been resolved, for example liquid from a leak has been dried. Errors for presumably single time events can be recovered by switching on the system in the user interface.

Special handling is done in case of a leak. As a leak is a potential safety issue and may have occurred at a different module from where it has been observed, a leak always causes a shutdown of all modules, even outside a method run.

In all cases, error propagation is done via the CAN bus or via an APG/ERI remote cable (see documentation for the APG/ERI interface).

General Error Messages

General error messages are generic to all Agilent series HPLC modules and may show up on other modules as well.

Timeout

Error ID: 0062

The timeout threshold was exceeded.

Probable cause	Suggested actions
1 The analysis was completed successfully, and the timeout function switched off the module as requested.	Check the logbook for the occurrence and source of a not-ready condition. Restart the analysis where required.
2 A not-ready condition was present during a sequence or multiple-injection run for a period longer than the timeout threshold.	Check the logbook for the occurrence and source of a not-ready condition. Restart the analysis where required.

Shutdown

Error ID: 0063

An external instrument has generated a shutdown signal on the remote line.

The module continually monitors the remote input connectors for status signals. A LOW signal input on pin 4 of the remote connector generates the error message.

Probable cause		Suggested actions
1	Leak detected in another module with a CAN connection to the system.	Fix the leak in the external instrument before restarting the module.
2	Leak detected in an external instrument with a remote connection to the system.	Fix the leak in the external instrument before restarting the module.
3	Shut-down in an external instrument with a remote connection to the system.	Check external instruments for a shut-down condition.
4	The degasser failed to generate sufficient vacuum for solvent degassing.	Check the vacuum degasser for an error condition. Refer to the *Service Manual* for the degasser or the pump that has the degasser built-in.

Remote Timeout

Error ID: 0070

A not-ready condition is still present on the remote input. When an analysis is started, the system expects all not-ready conditions (for example, a not-ready condition during detector balance) to switch to run conditions within one minute of starting the analysis. If a not-ready condition is still present on the remote line after one minute the error message is generated.

Probable cause	Suggested actions
1 Not-ready condition in one of the instruments connected to the remote line.	Ensure the instrument showing the not-ready condition is installed correctly, and is set up correctly for analysis.
2 Defective remote cable.	Exchange the remote cable.
3 Defective components in the instrument showing the not-ready condition.	Check the instrument for defects (refer to the instrument's documentation).

Lost CAN Partner

Error ID: 0071

During an analysis, the internal synchronization or communication between one or more of the modules in the system has failed.

The system processors continually monitor the system configuration. If one or more of the modules is no longer recognized as being connected to the system, the error message is generated.

Probable cause	Suggested actions
1 CAN cable disconnected.	• Ensure all the CAN cables are connected correctly. • Ensure all CAN cables are installed correctly.
2 Defective CAN cable.	Exchange the CAN cable.
3 Defective mainboard in another module.	Switch off the system. Restart the system, and determine which module or modules are not recognized by the system.

Leak Sensor Short

Error ID: 0082

The leak sensor in the module has failed (short circuit).

The current through the leak sensor is dependent on temperature. A leak is detected when solvent cools the leak sensor, causing the leak sensor current to change within defined limits. If the current increases above the upper limit, the error message is generated.

Probable cause	Suggested actions
1 Defective leak sensor.	Please contact your Agilent service representative.
2 Leak sensor incorrectly routed, being pinched by a metal component.	Please contact your Agilent service representative.
3 Power switch assembly defective	Please contact your Agilent service representative.
4 Cable or contact problem.	Please contact your Agilent service representative.

Leak Sensor Open

Error ID: 0083

The leak sensor in the module has failed (open circuit).

The current through the leak sensor is dependent on temperature. A leak is detected when solvent cools the leak sensor, causing the leak sensor current to change within defined limits. If the current falls outside the lower limit, the error message is generated.

Probable cause	Suggested actions
1 Leak sensor not connected to the power switch board.	Please contact your Agilent service representative.
2 Defective leak sensor.	Please contact your Agilent service representative.
3 Leak sensor incorrectly routed, being pinched by a metal component.	Please contact your Agilent service representative.
4 Power switch assembly defective	Please contact your Agilent service representative.

Compensation Sensor Open

Error ID: 0081

The ambient-compensation sensor (NTC) on the power switch board in the module has failed (open circuit).

The resistance across the temperature compensation sensor (NTC) on the power switch board is dependent on ambient temperature. The change in resistance is used by the leak circuit to compensate for ambient temperature changes. If the resistance across the sensor increases above the upper limit, the error message is generated.

Probable cause	Suggested actions
1 Loose connection between the power switch board and the mainboard	Please contact your Agilent service representative.
2 Defective power switch assembly	Please contact your Agilent service representative.

Compensation Sensor Short

Error ID: 0080

The ambient-compensation sensor (NTC) on the power switch board in the module has failed (open circuit).

The resistance across the temperature compensation sensor (NTC) on the power switch board is dependent on ambient temperature. The change in resistance is used by the leak circuit to compensate for ambient temperature changes. If the resistance across the sensor falls below the lower limit, the error message is generated.

Probable cause	Suggested actions
1 Defective power switch assembly	Please contact your Agilent service representative.
2 Loose connection between the power switch board and the mainboard	Please contact your Agilent service representative.

Fan Failed

Error ID: 0068

The cooling fan in the module has failed.

The hall sensor on the fan shaft is used by the mainboard to monitor the fan speed. If the fan speed falls below a certain limit for a certain length of time, the error message is generated.

This limit is given by 2 revolutions/second for longer than 5 seconds.

Depending on the module, assemblies (e.g. the lamp in the detector) are turned off to assure that the module does not overheat inside.

Probable cause	Suggested actions
1 Fan cable disconnected.	Please contact your Agilent service representative.
2 Defective fan.	Please contact your Agilent service representative.
3 Defective mainboard.	Please contact your Agilent service representative.

Leak

Error ID: 0064

A leak was detected in the module.

The signals from the two temperature sensors (leak sensor and board-mounted temperature-compensation sensor) are used by the leak algorithm to determine whether a leak is present. When a leak occurs, the leak sensor is cooled by the solvent. This changes the resistance of the leak sensor which is sensed by the leak sensor circuit on the main board.

Probable cause	Suggested actions
1 Loose fittings.	Ensure all fittings are tight.
2 Broken capillary.	Exchange defective capillaries.
3 Loose or leaking purge valve, inlet valve, or outlet valve.	Ensure pump components are seated correctly. If there are still signs of a leak, exchange the appropriate seal (purge valve, inlet valve, outlet valve).
4 Defective pump seals.	Exchange the pump seals.

Open Cover

Error ID: 0205

The top foam has been removed.

The sensor on the main board detects when the top foam is in place. If the foam is removed, the fan is switched off, and the error message is generated.

Probable cause	Suggested actions
1 The top foam was removed during operation.	Please contact your Agilent service representative.
2 Foam not activating the sensor.	Please contact your Agilent service representative.
3 Defective sensor or main board.	Please contact your Agilent service representative.
4 Rear of the module is exposed to strong direct sunlight.	Ensure that the rear of module is not directly exposed to strong sunlight.

Cover Violation

Error ID: 7461

The top foam has been removed.

The sensor on the main board detects when the top foam is in place. If the foam is removed while the lamps are on (or if an attempt is made to switch on for example the lamps with the foam removed), the lamps are switched off, and the error message is generated.

Probable cause	Suggested actions
1 The top foam was removed during operation.	Please contact your Agilent service representative.
2 Foam not activating the sensor.	Please contact your Agilent service representative.

Pump Error Messages

These errors are pump specific.

Pressure of binary pump above upper limit

Error ID: 22014

The pressure has exceeded the upper pressure limit.

- Parameter: Measured pressure

Probable cause	Suggested actions
1 Blockage in flow path after the pressure sensor.	• Check for blockages in the LC system, e.g. purge valve, Jet Weaver, degraded column, column frits, needle, needle seat, capillaries etc. • Check for particles in the solvent.
2 Inappropriate settings (pressure limit, flow rate).	• Decrease flow rate. • Increase pressure limit.

Pressure below lower limit

Error ID: 22015

The pressure has dropped below the lower limit.

- Parameter: None

Probable cause		Suggested actions
1	Leak	Check for leaks.
2	Bottle empty	Check bottle filling.
3	Wrong solvent (viscosity)	Check solvent.
4	Inappropriate setting	Check flow rate and lower pressure limit.
5	Column degradation	Replace column.

Target pressure not reached for binary pump degasser

Error ID: 22031

The target pressure of the binary pump degasser has not been reached within the expected time.

- Parameter: Pressure in mbar

Probable cause		Suggested actions
1	Condensation in degasser chamber due to temperature fluctuation.	Equilibrate and restart module. Use Evacuation Mode if necessary.
2	Degasser is defect.	Please contact your Agilent service representative.

Degasser's pressure limit violation

Error ID: 22032

Pressure too far above the limit.

Probable cause	Suggested actions
1 Leak in degasser chamber or degasser tubing.	Please contact your Agilent service representative.
2 Defect vacuum pump.	Please contact your Agilent service representative.
3 Degasser chamber empty or connected to air.	Block unused degasser channels.

Solvent counter exceeded limit

Error ID: 22055

The counter for the solvent volume has exceeded the limit, which has been set in the user interface.

Parameter:

- Without Solvent Selection Valve:
  0 for channel A, 1 for channel B
- With Solvent Selection Valve:
  2 for channel A1, 3 for channel B1, 4 for channel A2, 5 for channel B2

Probable cause	Suggested actions
1 No solvent present.	Refill solvent bottle.
2 Inappropriate setting.	Check solvent counter setting in user interface.

Waste counter limit exceeded

Error ID: 22056

The counter for the waste volume has exceeded the limit, which has been set in the user interface.

- Parameter: None

Probable cause	Suggested actions
1 The waste container is full.	Empty waste container.
2 Inappropriate setting for waste counter.	• Reset waste counter. • Adjust waste counter limit.

Flow rate limit exceeded

Error ID: 22064

The flow rate of the binary pump has exceeded the limit, while the pump runs in pressure controlled mode, e.g. during a pressure test.

- Parameter: None

Probable cause	Suggested actions
1 Leak	Check for leaks in the pump and flow path.
2 Bottle empty.	Fill solvent bottle.
3 Shutoff valve closed.	Open shutoff valve.
4 Drift of pressure sensor (unlikely for short tests taking only minutes).	Replace pressure sensor.

Binary pump shutdown during analysis

Error ID: 22065

The binary pump has been shut down by the control software or control module during an analysis.

- Parameter: 0 for off, 1 for standby.

Probable cause	Suggested actions
1 Pump has been shut down.	Restart pump.

Reading the pump encoder tag failed

Error ID: 22402

Reading the pump encoder tag has failed.

- Parameter: 1 – 4 referring to pump drive

Probable cause	Suggested actions
1 Defect connection between encoder and main board.	Please contact your Agilent service representative.
2 Missing or defect tag Defect connection between tag and encoder.	Please contact your Agilent service representative.

Writing the pump encoder tag failed

Error ID: 22405

Writing the pump encoder tag has failed.

- Parameter: 1 – 4 referring to pump drive

Probable cause	Suggested actions
1 Defect connection between encoder and main board.	Please contact your Agilent service representative.
2 Defect tag.	Please contact your Agilent service representative.

Pump drive blocked or encoder failed

Error ID: 22406

Pump drive blocked or encoder failed.

- Parameter: None

Probable cause	Suggested actions
1 Blockage of system before pressure sensor.	Check for blockage of e.g. outlet valve filter frit, purge valve, heat exchanger.
2 Drive encoder failed.	Please contact your Agilent service representative.

Drive current too low

Error ID: 22407

The current consumption of the pump drive is too low.

- Parameter: 1 – 4 referring to pump drive

Probable cause	Suggested actions
1 Drive motor defect.	Please contact your Agilent service representative.
2 Wrong/missing connection of pump drive to main board.	Please contact your Agilent service representative.

Drive Encoder failed

Error ID: 22408

Drive encoder failed during pump drive calibration.

Probable cause	Suggested actions
1 Internal error.	Contact Agilent support.

Drive current too high

Error ID: 22409

The current consumption of the pump drive is too high.

- Parameter: 1 – 4 referring to pump drive

Probable cause	Suggested actions
1 Blockage of system before pressure sensor.	Check for blockage of e.g. outlet valve filter frit, purge valve, heat exchanger.
2 Drive motor defect.	Please contact your Agilent service representative.

Drive timeout

Error ID: 22410

Drive is blocked mechanically, fails during initialization.

- Parameter: 1 – 4 referring to pump drive

Probable cause		Suggested actions
1	Blockage of system before pressure sensor.	Check for blockage of e.g. outlet valve filter frit, purge valve, heat exchanger.
2	Drive encoder failed.	Please contact your Agilent service representative.

Overcurrent of pump drive

Error ID: 22411

The current consumption of the pump drive is too high.

- Parameter: 1 – 4 referring to pump drive

Probable cause		Suggested actions
1	Blockage of system before pressure sensor.	Check for blockage of e.g. outlet valve filter frit, purge valve, heat exchanger.
2	Drive motor defect.	Please contact your Agilent service representative.

Overcurrent of solvent selection valve (SSV)

Error ID: 22412

Overcurrent of solvent selection valve (SSV).

- Parameter: None

Probable cause		Suggested actions
1	Valve defect.	Replace the solvent selection valve.

Deliver underrun

Error ID: 22413

Internal error.

- Parameter: None

Probable cause	Suggested actions
1 Internal error.	Please contact your Agilent service representative.

Defect connection between main board and pump drive encoder

Error ID: 22414

Defect connection between main board and pump drive encoder.

- Parameter: 1 – 4 referring to pump drive

Probable cause	Suggested actions
1 Defect connection between main board and pump drive encoder.	Please contact your Agilent service representative.
2 Defect encoder.	Please contact your Agilent service representative.

Pump drive encoder defect

Error ID: 22415

Defect pump drive encoder.

- Parameter: 1 – 4 referring to pump drive

Probable cause	Suggested actions
1 Defect encoder.	Please contact your Agilent service representative.

Purge valve failed

Error ID: 22417

Lost steps of the purge valve encoder.

- Parameter: None

Probable cause	Suggested actions
1 Purge valve drive mechanically blocked or defect.	• Check installation of purge valve head. • Please contact your Agilent service representative.

Reading of purge valve tag failed

Error ID: 22420

Reading the purge valve tag failed.

- Parameter: None

Probable cause	Suggested actions
1 Reading of purge valve tag failed.	Check cable connection.
2 Purge valve head tag defect or empty.	Replace purge valve head.
3 Purge valve tag reader is defect.	Please contact your Agilent service representative.

Pump drive encoder rollover

Error ID: 22424

Invalid pump drive encoder signals have been detected.

- Parameter: 1 – 4 referring to pump drive

Probable cause	Suggested actions
1 Pump drive encoder is defect.	Please contact your Agilent service representative.

Drive position limit

Error ID: 22425

Internal error.

- Parameter: 1 – 4 referring to pump drive

Probable cause	Suggested actions
1 Internal error.	Please contact your Agilent service representative.

Insufficient power of drive encoder LED

Error ID: 22426

Insufficient power of drive encoder LED.

- Parameter: 1 – 4 referring to pump drive

Probable cause	Suggested actions
1 Pump drive encoder is defect.	Please contact your Agilent service representative.

Drive encoder error

Error ID: 22427- 22430

An error has occurred for the pump drive encoder.

- Parameter: 1 – 4 referring to pump drive

Probable cause	Suggested actions
1 Pump drive encoder is defect.	Please contact your Agilent service representative.

Writing the purge valve tag failed

Error ID: 22431

Writing the purge valve tag failed.

- Parameter: None

Probable cause	Suggested actions
1 Purge valve head tag defect.	Replace purge valve head.
2 Purge valve tag reader is defect.	Please contact your Agilent service representative.

Current of primary pump drive too high

Error ID: 22433

The current of the primary pump drive is too high.

- Parameter: 1 or 4 referring to pump drive.

Probable cause	Suggested actions
1 Blockage of flow path between primary pump head and pressure sensor, e.g. of the heat exchanger.	• Check for blockages in flow path. • Please contact your Agilent service representative.
2 Primary pump drive is defect.	Please contact your Agilent service representative.

Current of secondary pump drive too high

Error ID: 22434

The current of the secondary pump drive is too high.

- Parameter: 2 or 3 referring to pump drive

Probable cause	Suggested actions
1 Blockage of flow path between secondary pump head and pressure sensor, e.g. of the heat exchanger.	• Check for blockages in the flow path. • Please contact your Agilent service representative.
2 Secondary pump drive is defect.	Please contact your Agilent service representative.

Unknown purge valve type

Error ID: 22435

The type information of the purge valve is invalid.

- Parameter: None

Probable cause	Suggested actions
1 Wrong valve head installed.	Check or replace purge valve head.
2 Valve head has invalid RFID tag content.	Check or replace purge valve head.

Pump drive encoder error

Error ID: 22437

The pump drive encoder has generated no signal.

- Parameter: 1 – 4 referring to pump drive

Probable cause	Suggested actions
1 Pump drive encoder is defect.	Please contact your Agilent service representative.

Pump drive error

Error ID: 22438, 22439

The pump drive failed during calibration.

- Parameter: 1 – 4 referring to pump drive

Probable cause	Suggested actions
1 Pump drive motor defect or mechanically blocked.	Please contact your Agilent service representative.

Pump drive stroke blocked

Error ID: 22441

During initialization the pump defines the operation position of the pump drives and therefore the pistons. First the pump drive moves backwards to find a mechanical stop within the ball screw. Afterwards, pistons move forwards for finding the maximum available stroke volume. These values are expected within a pre-defined range. "Maximum stroke too short" means that the outer drive position is too close. This can be caused by a drive initialization without pump head or if the pump head has not been installed properly (screws are loose).

- Parameter: 1 – 4 referring to pump drive

Probable cause	Suggested actions
1 Wiper shifted	Please contact your Agilent service representative.
2 Pump head blocks piston movement	Replace, clean or repair pump head.
3 Pump drive motor is mechanically blocked.	Please contact your Agilent service representative.

Pump drive stop not found

Error ID: 22442

The maximum stroke is too long.

- Parameter: 1 – 4 referring to pump drive

Probable cause	Suggested actions
1 Wiper shifted	Please contact your Agilent service representative.
2 Pump drive spindle is defect.	Please contact your Agilent service representative.

Pressure sensor calibration wrong or missing

Error ID: 22443

Pressure sensor calibration wrong or missing.

- Parameter: None

Probable cause	Suggested actions
1 Pressure sensor calibration wrong or missing.	• Replace pressure sensor. • Please contact your Agilent service representative.

Seal wash pump was missing when tried to turn on

Error ID: 22499

The seal wash pump has not been detected (while being configured or detected before)

Probable cause	Suggested actions
1 Defect cable connection to seal wash pump.	Check cable connection.
2 Defect seal wash pump motor.	Please contact your Agilent service representative.
3 Defective mainboard.	Please contact your Agilent service representative.

Invalid degasser pressure signal

Error ID: 29253

The degasser pressure signal is invalid.

Probable cause	Suggested actions
1 Degasser might be disconnected	Please contact your Agilent service representative.
2 Pressure sensor might be defective	Please contact your Agilent service representative.

8 Maintenance

This chapter describes the maintenance of the Agilent 1290 Infinity II High-Speed Pumps.

Introduction to Maintenance

Figure 12 on page 134 and Figure 13 on page 135 show the main user accessible assemblies of the Agilent 1290 Infinity II High-Speed Pump (G7120A) and Agilent 1290 Infinity II Bio High-Speed Pump (G7132A). These parts can be accessed from the front (simple repairs) and don't require to remove the pump from the system stack.

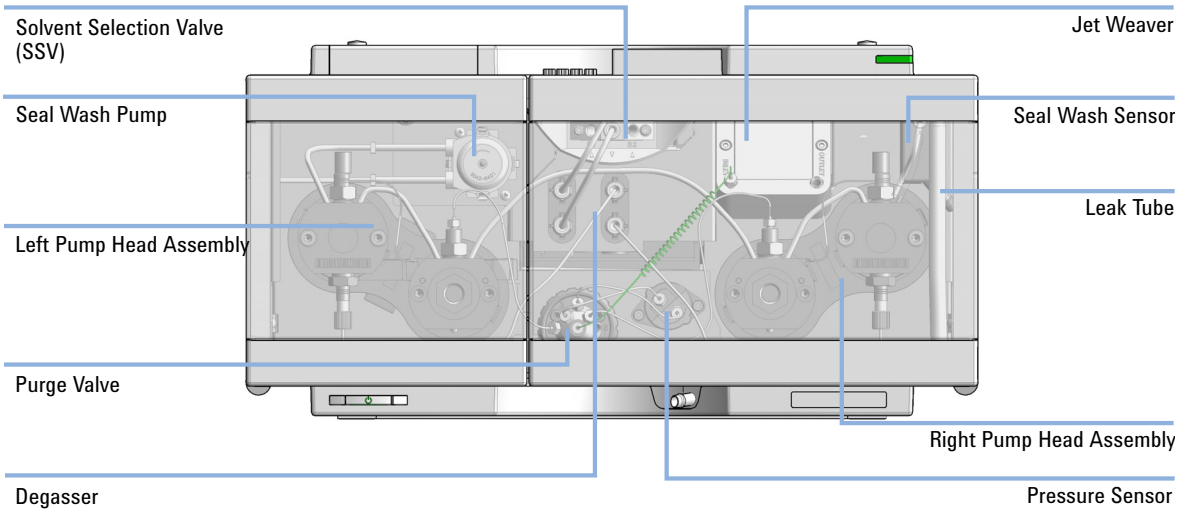


Figure 12 Maintenance parts (G7120A)

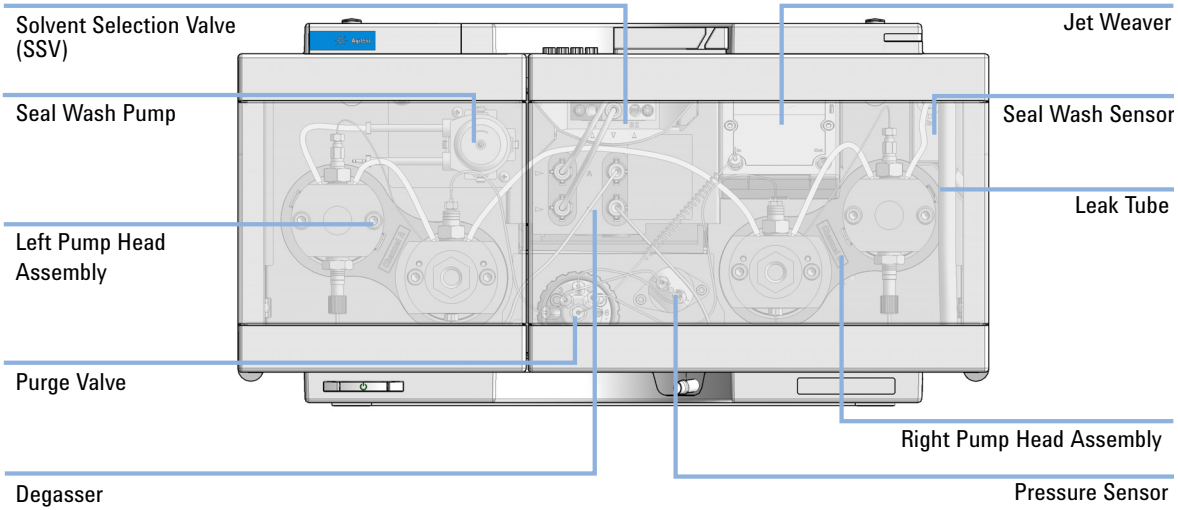


Figure 13 Maintenance parts (G7132A)

Figure 14 on page 136 shows the flow connections between these main assemblies.

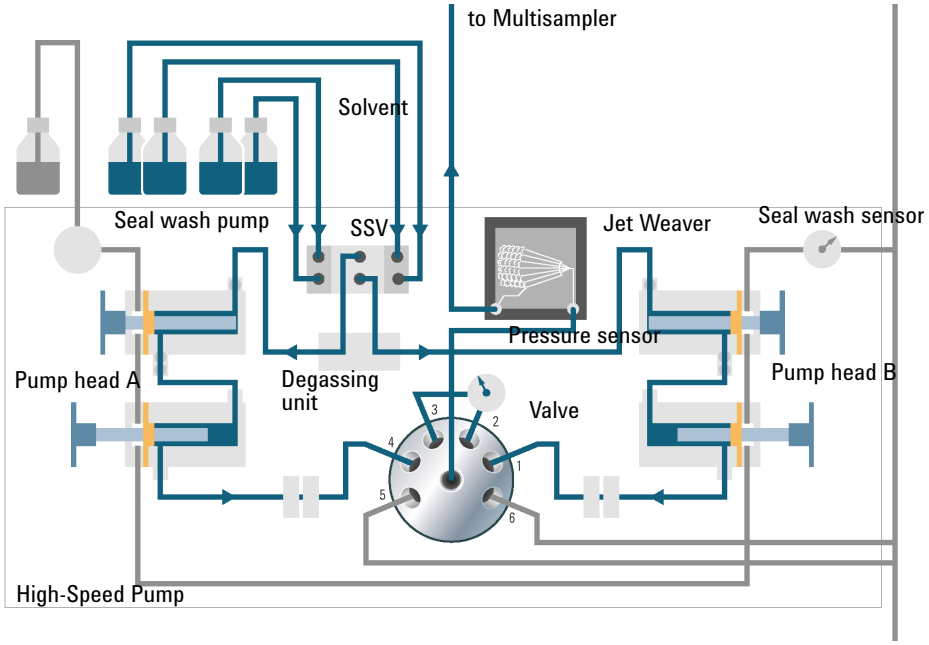


Figure 14 The hydraulic path

Recommended Interval for Preventive Maintenance

The recommended interval for preventive maintenance is:

- 100 L (150 L for Long Life Technology) or 1 year (whichever comes first).

This recommendation is valid for LC instruments on which “typical” applications are running.

A “typical” application can be characterized as follows:

- pressure range 100 – 800 bar,
- flow rates 0.5 – 3.5 mL/min,
- typical solvents used in reversed phase LC.

Warnings and Cautions

WARNING

Toxic, flammable and hazardous solvents, samples and reagents

The handling of solvents, samples and reagents can hold health and safety risks.

- ✓ **When working with these substances observe appropriate safety procedures (for example by wearing goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the vendor, and follow good laboratory practice.**
- ✓ **The volume of substances should be reduced to the minimum required for the analysis.**
- ✓ **Do not operate the instrument in an explosive atmosphere.**

WARNING

Electrical shock

Repair work at the module can lead to personal injuries, e.g. shock hazard, when the cover is opened.

- ✓ **Do not remove the cover of the module.**
- ✓ **Only certified persons are authorized to carry out repairs inside the module.**

WARNING

Personal injury or damage to the product

Agilent is not responsible for any damages caused, in whole or in part, by improper use of the products, unauthorized alterations, adjustments or modifications to the products, failure to comply with procedures in Agilent product user guides, or use of the products in violation of applicable laws, rules or regulations.

- ✓ **Use your Agilent products only in the manner described in the Agilent product user guides.**

WARNING

Heavy weight

The module is heavy.

- ✓ **Carry the module at least with 2 people.**
- ✓ **Avoid back strain or injury by following all precautions for lifting heavy objects.**
- ✓ **Ensure that the load is as close to your body as possible.**
- ✓ **Ensure that you can cope with the weight of your load.**

CAUTION

Safety standards for external equipment

- ✓ **If you connect external equipment to the instrument, make sure that you only use accessory units tested and approved according to the safety standards appropriate for the type of external equipment.**

Overview of Maintenance

The following pages describe maintenance (simple repairs) of the module that can be carried out without opening the main cover.

Cleaning the Module

To keep the module case clean, use a soft cloth slightly dampened with water, or a solution of water and mild detergent. Avoid using organic solvents for cleaning purposes. They can cause damage to plastic parts.

WARNING

Liquid dripping into the electronic compartment of your module can cause shock hazard and damage the module

- ✓ **Do not use an excessively damp cloth during cleaning.**
- ✓ **Drain all solvent lines before opening any connections in the flow path.**

NOTE

A solution of 70 % isopropanol and 30 % water might be used if the surface of the module needs to be disinfected.

Install Fittings and Capillaries

WARNING

Solvent can spray under high pressure.

✓ **Observe appropriate safety procedures (for example, goggles, safety gloves and protective clothing), when opening flow path.**

CAUTION

Deformation of fittings and seals

Liquid drops under high pressure act like solid parts. Tightening connections under high pressure can deform or destroy fittings and seals.

✓ **Never tighten flow connections under pressure.**

NOTE

The lifetime of a fitting depends on how firmly it has been tightened; firm tightening reduces the lifetime.

If fitting has been overtightened, replace it.

1 Install fittings and capillaries.
2 Tighten fittings and capillaries.

Remove and Install Doors

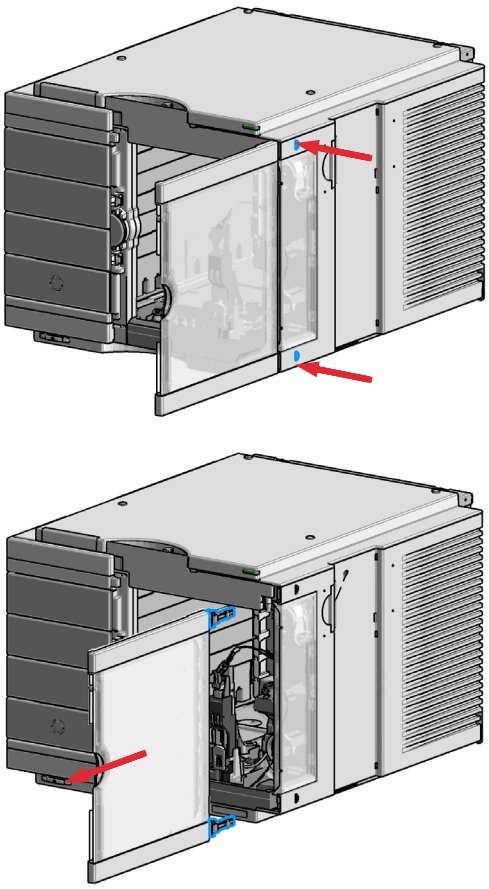
Parts required	p/n	Description
	5067-5767	Door assy 200 left IF II
	5067-5768	Door assy 200 right IF II

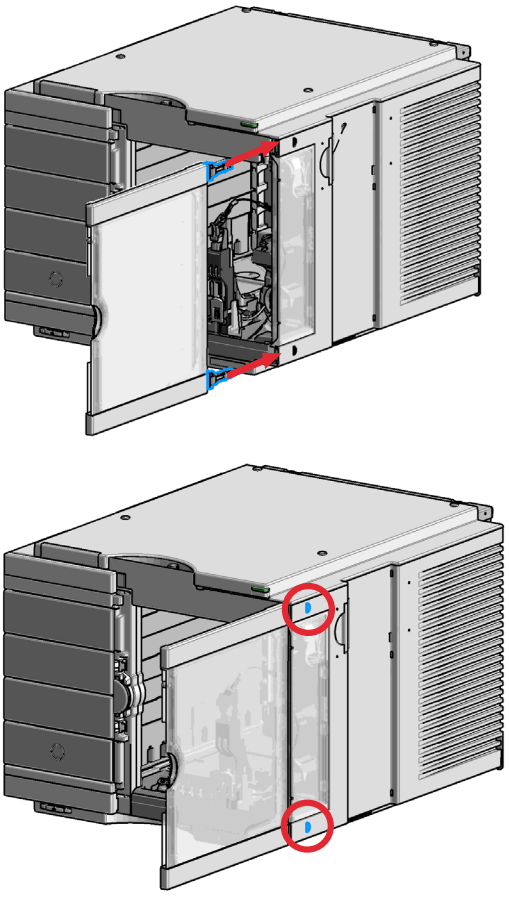
NOTE

The figures shown in this procedure exemplarily show the Infinity II Multisampler module.

The principle of how to remove and/or install doors works in the same way for all Infinity II modules.

1 Press the release buttons and pull the front door out.	2 For the Installation of the front door. Insert the hinges into their guides and move the door in until the release buttons click into their final position.





Replace the Shutoff Valve Panel

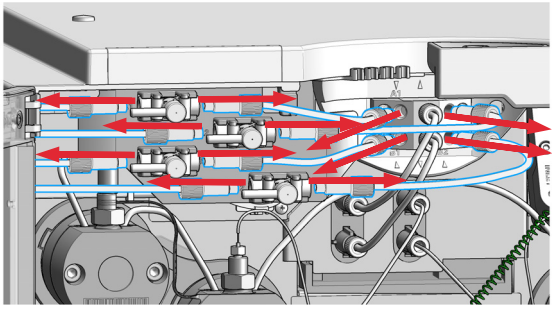
When If a shutoff valve is damaged or the panel needs to be removed for other repair procedures.

Parts required

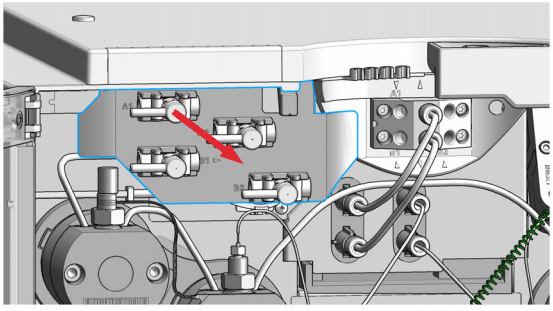
#	p/n	Description
4	5067-4124	Shutoff valve
1	G7120-40004	Valve Holder Left
1	G4220-60035	Tubing kit 140 mm, 2/pk SSV to shutoff valve or degassing unit

Preparations Remove tubings from the solvent bottles to avoid leaks.

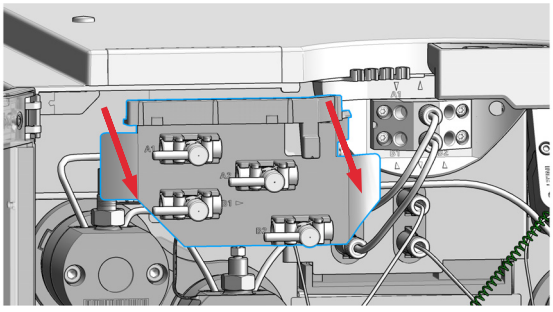
1 Unscrew tubing connections between shutoff valves, solvent bottles and the solvent selection valve.



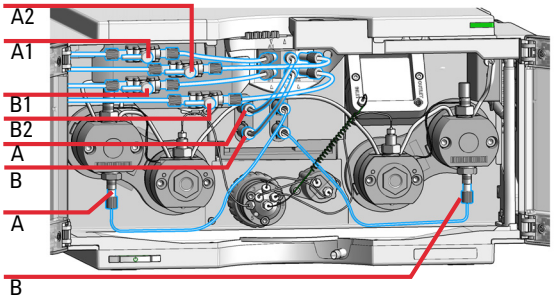
2 If a single valve shall be replaced, it can be pulled to the front for removing it from its mounting.



3 Remove the shutoff valve panel by pulling it downwards.



4 After replacing the panel or after completion of other maintenance, re-install the panel and all flow connections.



Replace the Pressure Sensor

When No or invalid pressure signal

Tools required

p/n	Description
8710-2412	Hex key 2.5 mm, 15 cm long, straight handle
8710-0510	Open-end wrench 1/4 — 5/16 inch
	Screwdriver

Parts required

p/n	Description
5067-6791	Pressure sensor 1300 bar
5067-7010	Pressure sensor Bio-Compatible 1300 bar

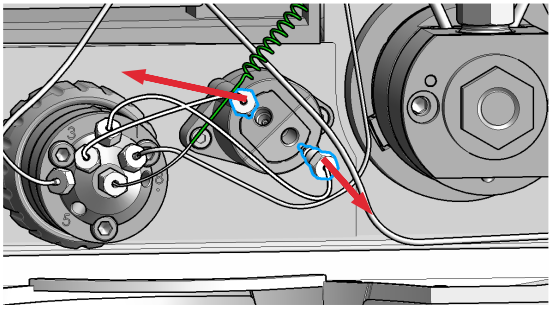
Preparations Turn off pump flow, switch off pump

NOTE

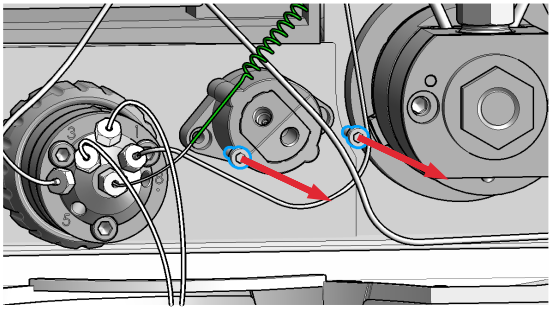
This procedure describes how to replace the pressure sensor.

In case the cable to the sensor shall be replaced as well, please contact your Agilent service representative.

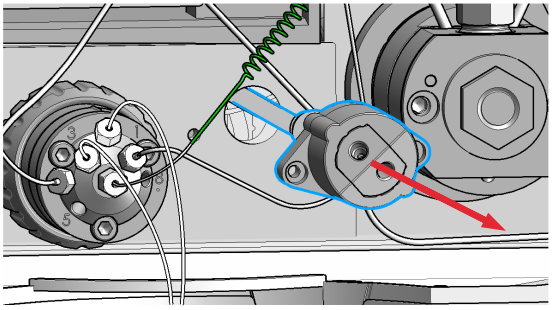
1 Remove capillary connections between the pressure sensor and purge valve.



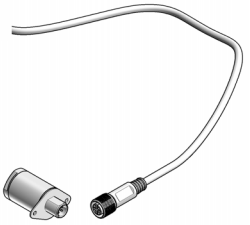
2 Remove the screws that fix the pressure sensor to the chassis.



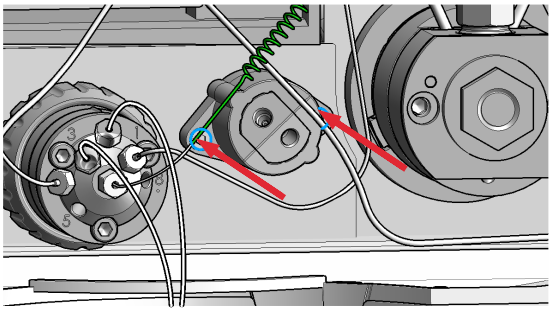
3 Carefully pull out the pressure sensor for about 2 cm. Then unscrew the cable from the pressure sensor.



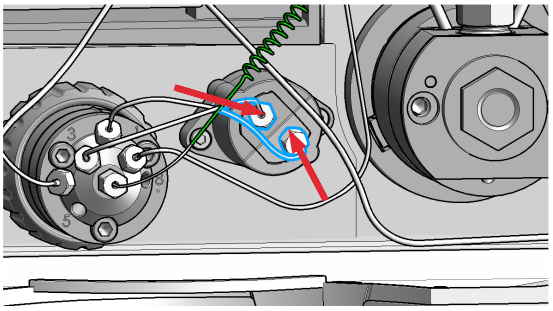
4 Connect the new pressure sensor to the pressure sensor connector.



5 Fix the pressure sensor to the instrument chassis.



6 Connect the capillaries from the valve to the pressure sensor: connect port 3 to the pressure sensor inlet and port 2 to the outlet.



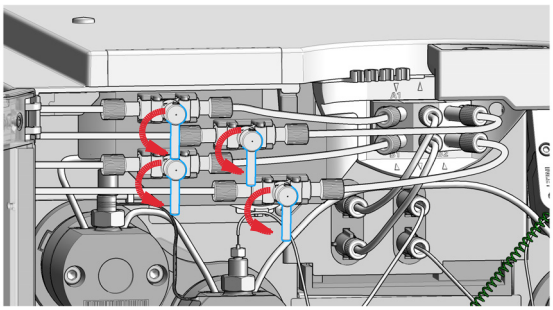
Replace the Solvent Selection Valve (SSV)

When In case of problems with the solvent selection valve

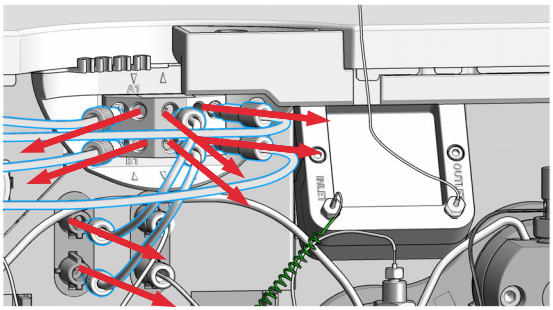
Parts required

#	p/n	Description
1	G7120-60029	SSV Valve Assembly
2	G4220-60035	Tubing kit 140 mm, 2/pk SSV to shutoff valve or degassing unit

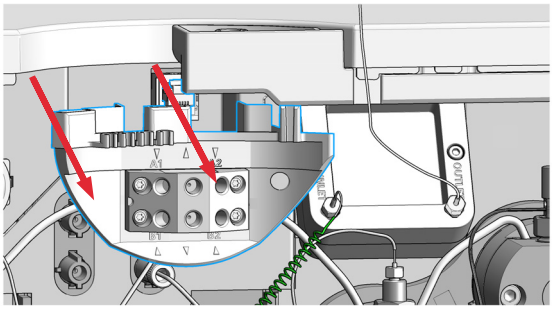
1 Close the shutoff valves.



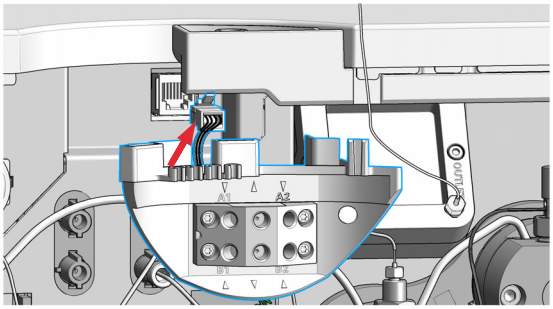
2 Remove tubing connections between the SSV and the solvent shutoff valves and between the SSV and the degassing unit inlets.

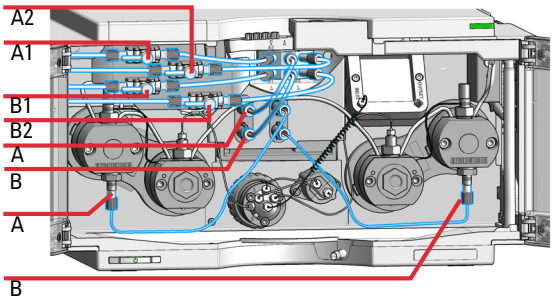


3 Push down the SSV panel for removing it.



4 Remove the connector by pushing up the small clip at the bottom of the connector.



5 Install a new SSV by inserting the connector and clipping the SSV panel to the module top panel. Then reinstall all tubing connections, and open the shutoff valves. 	

Change Configuration or Replace the Jet Weaver

When

For optimizing the pump configuration to mixing performance or low delay volumes/fast gradients, see chapter *Optimizing Performance*.

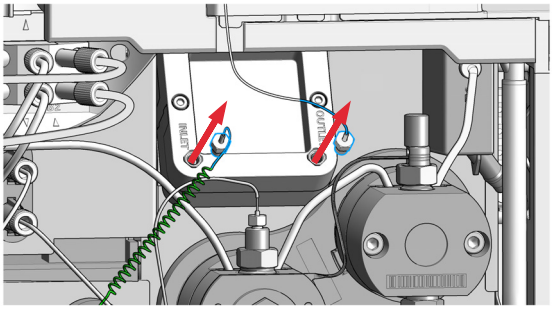
Tools required

p/n	Description
8710-0510	¼ inch wrench
	3 mm hex key

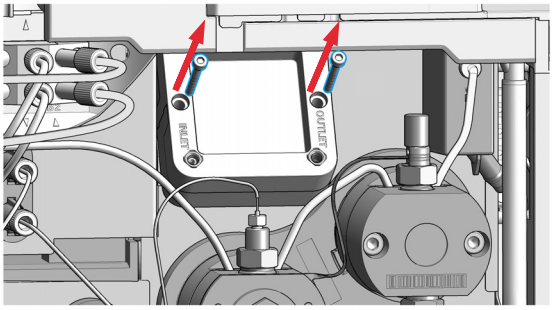
Parts required

#	p/n	Description
1	G7120-68135	Jet Weaver 35 µL/100 µL
1	G7120-68380	Jet Weaver 380 µL (Optional for G7120A)
1	G7132-68135	Jet Weaver 35 µL/100 µL Bio-Compatible
1	G7132-68380	Jet Weaver 380 µL Bio-Compatible (Optional for G7132A)
1	G4220-87000	Capillary ST 0.17 mm x 300 mm Valve to Jet Weaver
1	G7132-60002	Bio-Compatible capillary MP35N 0.17 mm x 300 mm Valve to Jet Weaver

1 Remove capillary connections from the Jet Weaver.



2 Remove the hex screws that fix the Jet Weaver to the pump housing.

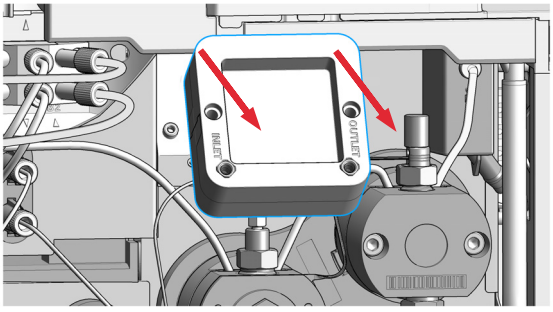


NOTE

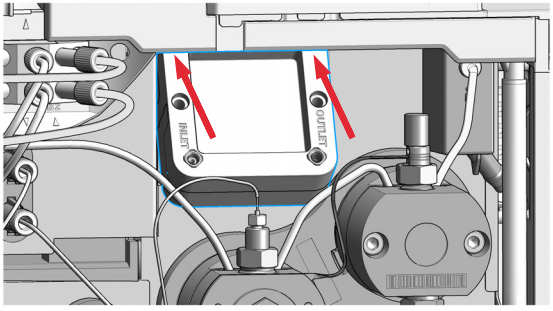
The standard Jet Weavers (Jet Weaver 35 µL/ 100 µL (G7120-68135) and Jet Weaver 35 µL/ 100 µL Bio-Compatible (G7132-68135)) have a front and a rear side with different internal volumes (35 / 100 µL) that are optimized for a low delay volume or best mixing performance.

The optional Jet Weaver (Jet Weaver 380 µL (G7120-68380), not to be used with Bio pumps, or Jet Weaver 380 µL Bio-Compatible (G7132-68380)) is recommended for applications, which are challenging regarding mixing noise (e.g. TFA applications) and has just one side.

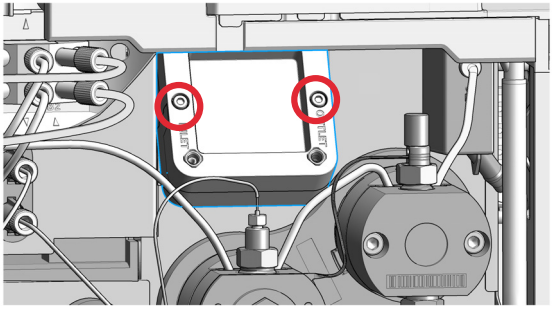
3 Remove the Jet Weaver.



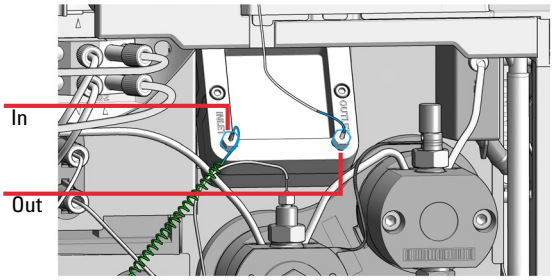
4 Install the new Jet Weaver or flip the Jet Weaver to the other side.



5 Fix the Jet Weaver with the screws.



6 Reinstall the capillary connections.



The inlet at the left side of the Jet Weaver is connected to the central port of the pump valve by a capillary (length 300 mm, 0.17 mm i.d.). The outlet at the right side is connected to the autosampler.

Replace the Seal Wash Pump

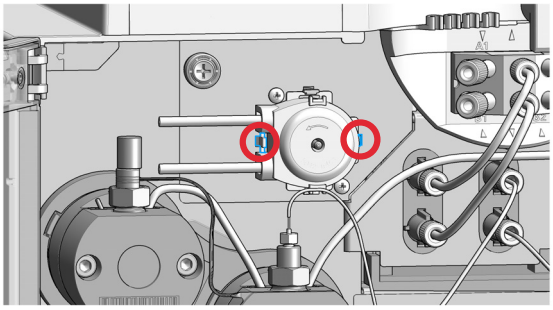
When In case of seal wash pump wear

Parts required

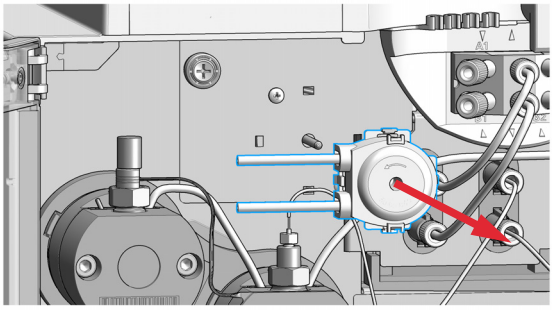
p/n	Description
5065-4445	Peristaltic pump with PharMed tubing
5065-9978	Tubing, 1 mm i.d., 3 mm o.d., silicone, 5 m

Preparations Remove the flow connections from and to the seal wash pump

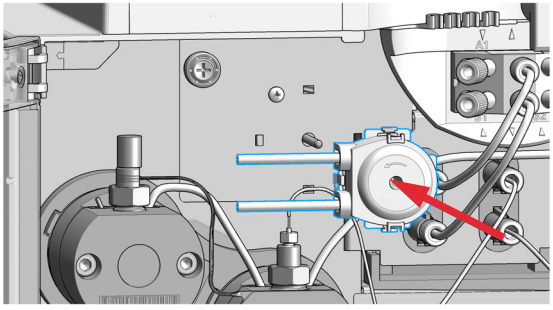
1 Press the clips.



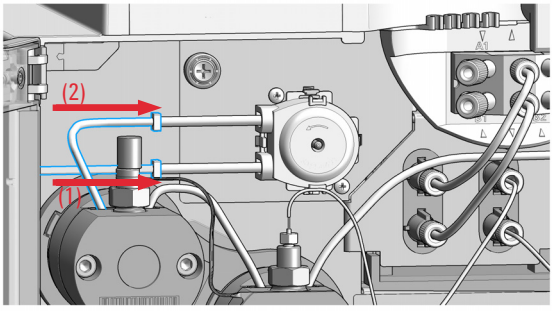
2 Pull the pump to the front.



3 Insert the pump clips to the holes in the pump housing.



4 Fix the seal wash tubings to the peristaltic pump inlet (1) and from the peristaltic pump outlet to the primary pump head inlet (2).



Replace the Inlet Valve (G7120A)

When If Inlet valve is defective.

Tools required

p/n	Description
	Wrench, 14 mm
5067-5688	Torque wrench 1 – 25 Nm with 14 mm wrench

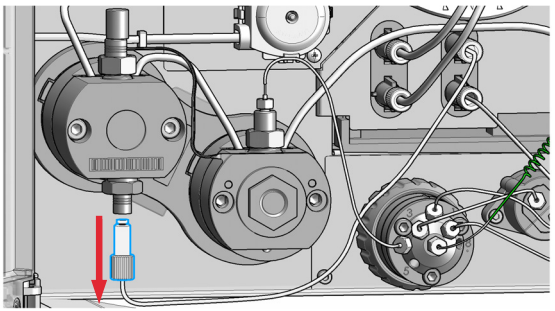
Parts required

p/n	Description
G4220-60022	Inlet valve (primary pump head)

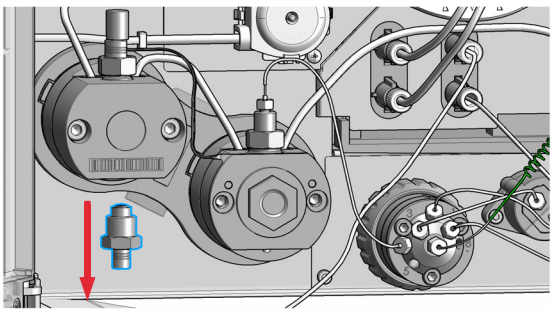
NOTE For best performance, lifetime and to avoid leaks, use a torque wrench set to approx. 10 Nm for fixing the inlet valve.

1 Close the shutoff valves to avoid solvent leaks.

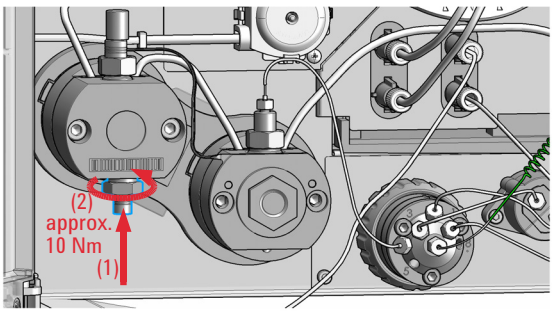
2 Unscrew the tubing at the inlet valve.

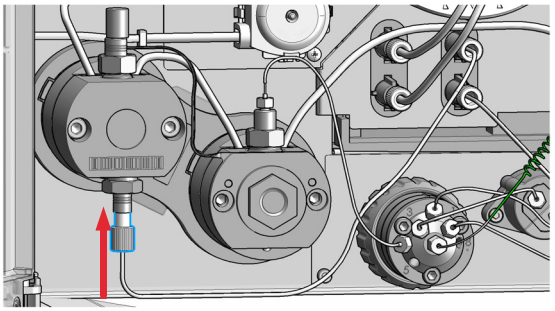


3 With a 14 mm wrench, unscrew the inlet valve and remove it.



4 Install inlet valve and tighten it at approx. 10 Nm with a torque wrench (14 mm).



5 Attach the inlet tubing to the inlet valve. 	**6** Open the shutoff valves and purge the system to remove air.

Replace the Inlet Valve (G7132A)

When If Inlet valve is defective.

Tools required

p/n	Description
	Wrench, 14 mm
5067-5688	Torque wrench 1 – 25 Nm with 14 mm wrench

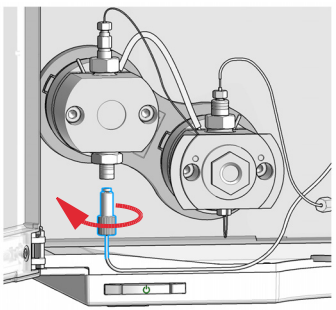
Parts required

p/n	Description
G7131-60021	Inlet Valve Bio-Compatible (primary pump head)

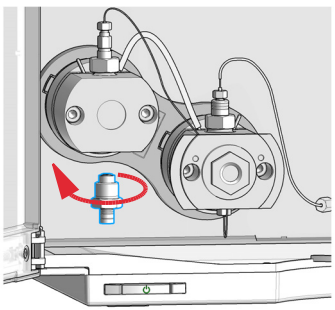
NOTE For best performance, lifetime and to avoid leaks, use a torque wrench set to approx. 10 Nm for fixing the inlet valve.

1 Close the shut off valves to avoid solvent leaks.

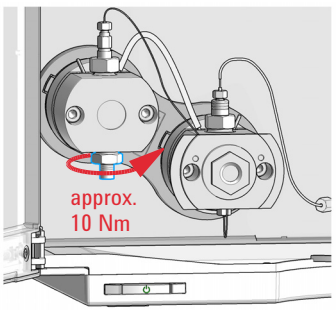
2 Unscrew the tubing at the inlet valve.

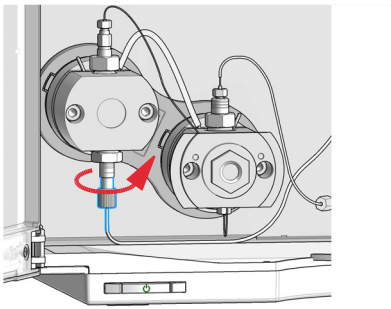


3 With a 14 mm wrench, unscrew the inlet valve and remove it.



4 Install inlet valve and tighten it at approx. 10 Nm with a torque wrench (14 mm).



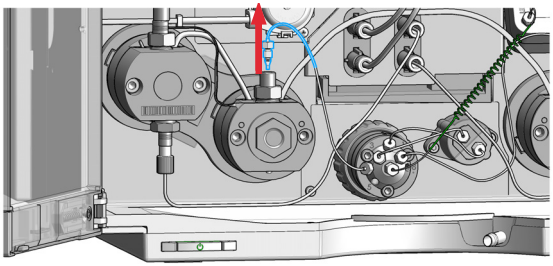
5 Attach the inlet tubing at the inlet valve. 	**6** Open the shut off valves and purge the system to remove air.

Release a Stuck Inlet Valve

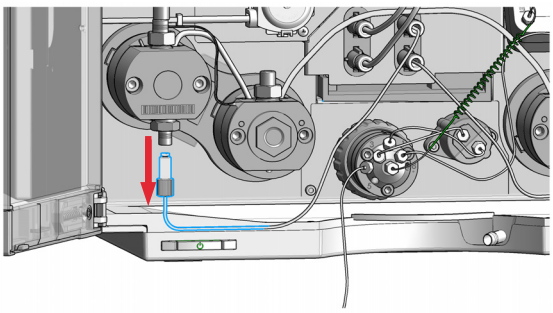
When If inlet valve is stuck, or if pump is not generating pressure after being turned off for an extended period of time.

NOTE Before the system is turned off for an extended period of time, it should be flushed with at least 10 % isopropanol to prevent inlet valves from getting stuck.

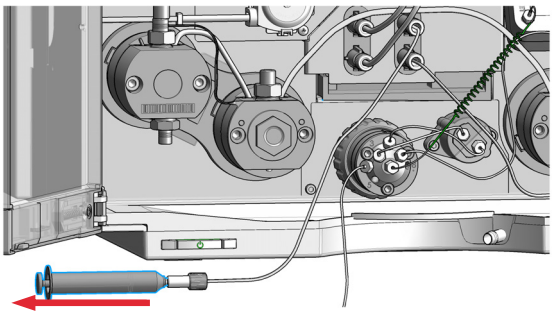
1 Remove the capillary connection from the outlet of the secondary pump head.



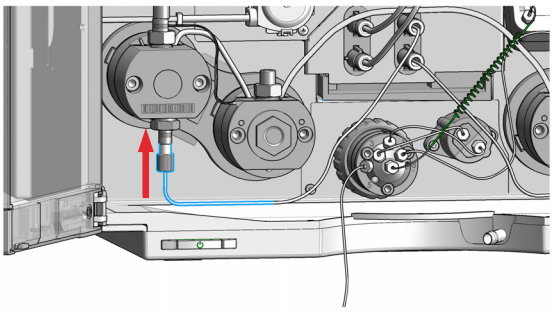
2 Unscrew the tubing from the inlet valve.



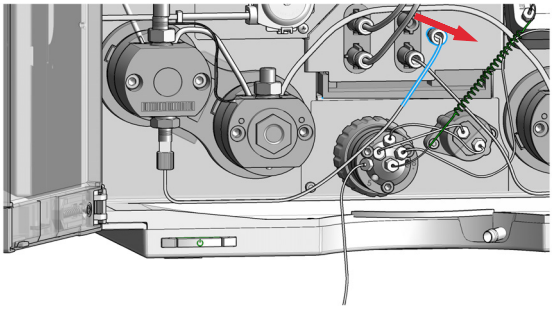
3 Attach a Luer lock syringe with adapter to the tubing and fill it with solvent.



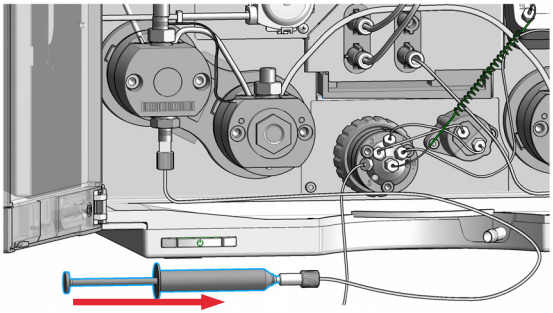
4 Reconnect tubing to inlet valve.



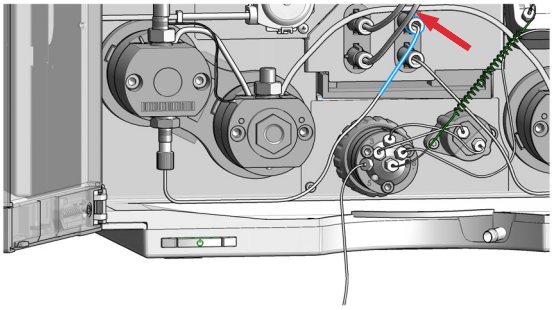
5 Unscrew tubing at degassing unit and attach the syringe to it.



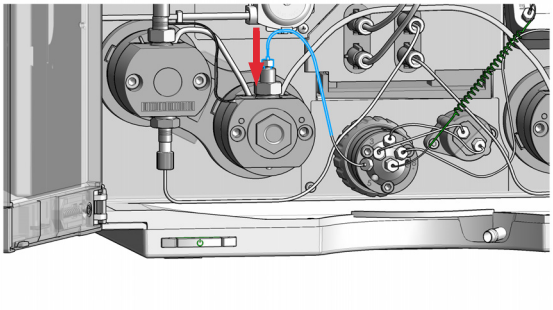
6 Push solvent with syringe until it comes out at the top of the High Pressure Filter Assembly.



7 Detach the syringe and reconnect the tubing into the degassing unit.



8 Reinstall the capillary connection to the High Pressure Filter Assembly.



9 Purge the system to remove air.

Remove the Pump Head Assembly (G7120A)

Tools required	p/n	Description
	G7120-68708	HPLC System Tool Kit-Infinity-II

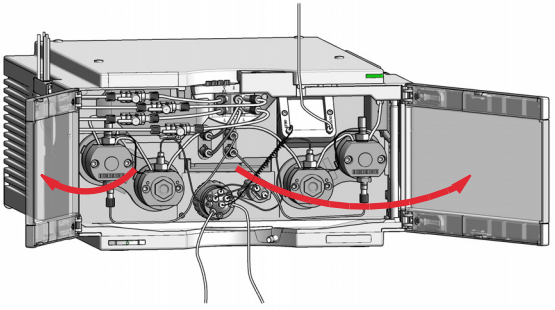
NOTE

This procedure describes the replacement of the left pump head assembly (channel A). Similarly, the right pump head assembly (channel B) can be replaced.

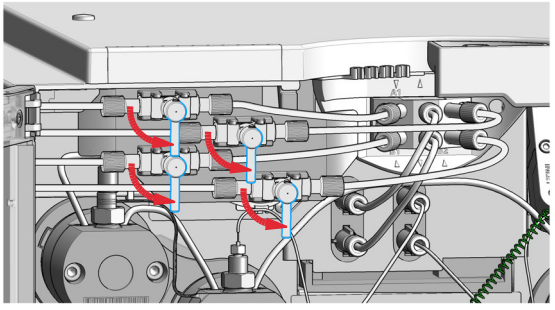
One pump head assembly consists of two pump heads, which are both removed at the same time.

1 In Lab Advisor go to **Service & Diagnostics > Remove/Install Pump Head** and follow instructions given on the screen.

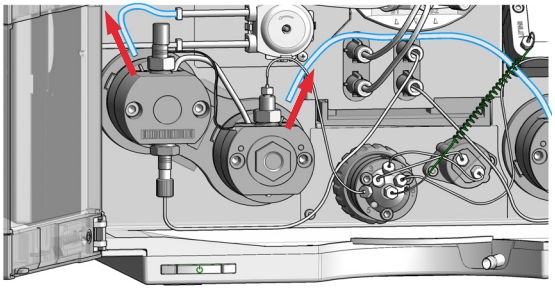
2 Open the doors.



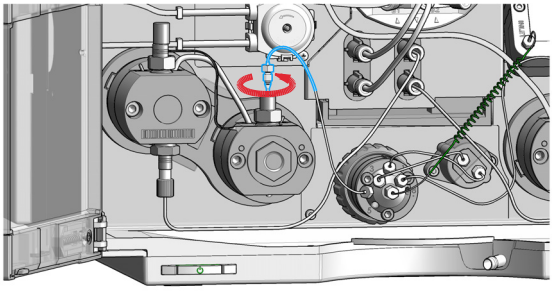
3 Close all shutoff valves.



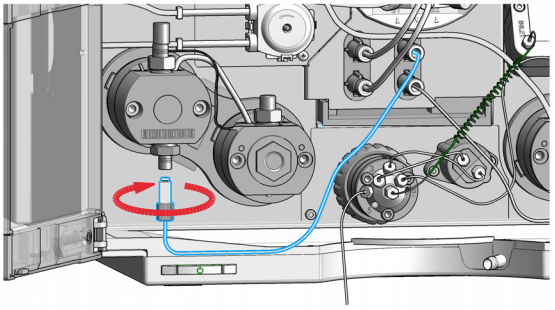
4 Remove the seal wash tubes.



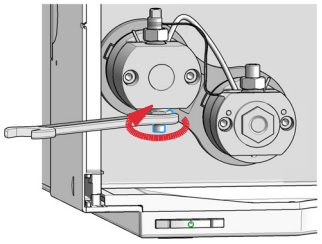
5 Remove the capillary connection at the top of the secondary pump head to the pump valve.



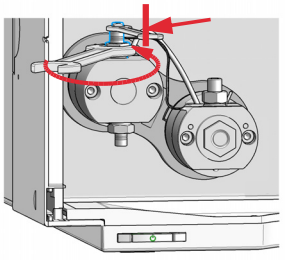
6 Remove the flow connection between the degassing unit and the primary pump head inlet.



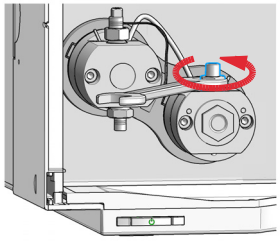
7 Loosen the inlet valve. Keep the inlet valve installed to the pump head assembly.



8 Counter the lock screw of the heat exchanger capillary while loosening the outlet valve. Keep the outlet valve installed to the pump head assembly.



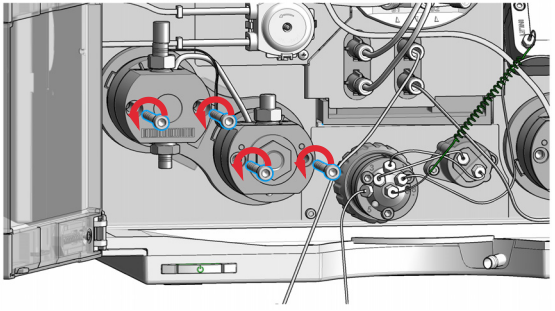
9 Loosen the high pressure filter. Keep the filter installed to the pump head assembly.

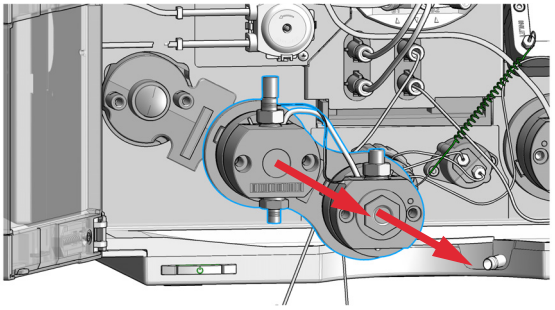
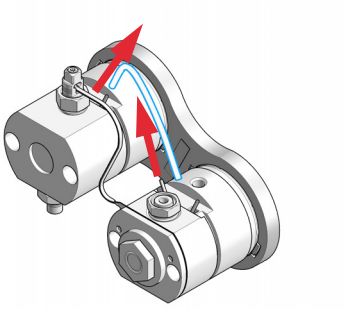


10 Open the four screws holding the pump heads.

NOTE

Open the screws step by step, not screw by screw.



11 Remove the complete pump head assembly by holding both heads and pulling it to the front. 	**12** Remove the seal wash tubing interconnecting the two pump heads. 

Remove the Pump Head Assembly (G7132A)

Tools required	p/n	Description
	G7120-68708	HPLC System Tool Kit-Infinity-II

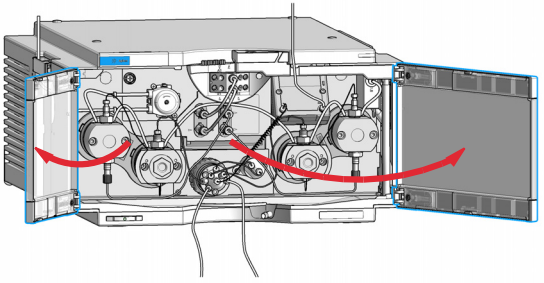
NOTE

This procedure describes the replacement of the left pump head assembly (channel A). Similarly, the right pump head assembly (channel B) can be replaced.

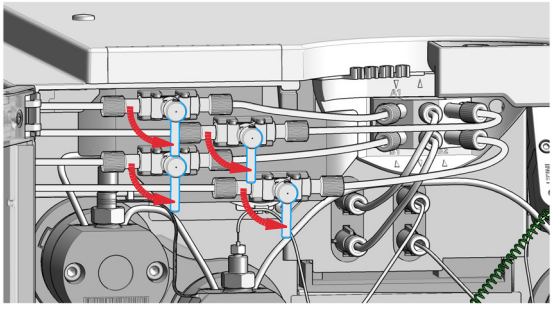
One pump head assembly consists of two pump heads, which are both removed at the same time.

1 In Lab Advisor go to **Service & Diagnostics > Remove/Install Pump Head** and follow instructions given on the screen.

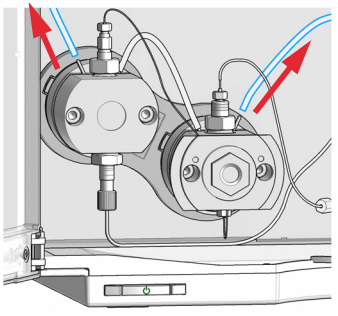
2 Open the doors.



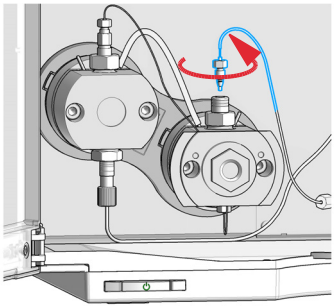
3 Close all shutoff valves.



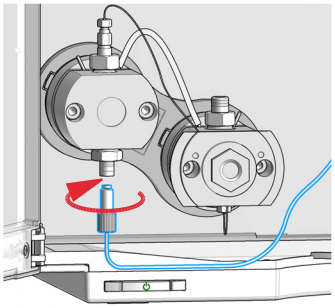
4 Remove the sealwash tubes.



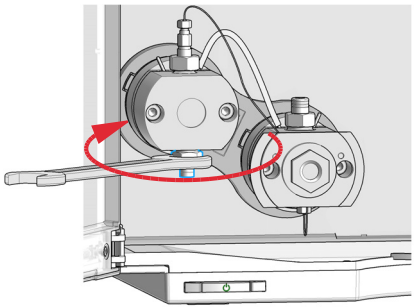
5 Remove the capillary connection at the top of the secondary pump head to the pump valve.



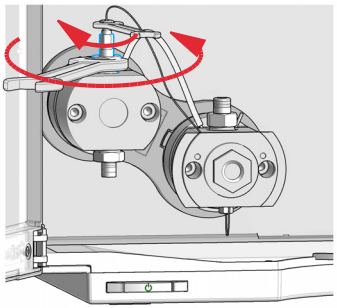
6 Remove the flow connection between the degassing unit and the primary pump head inlet.



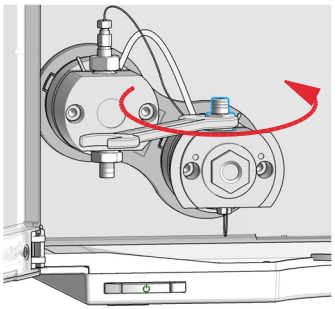
7 Loosen the inlet valve. Keep the inlet valve installed to the pump head assembly.



8 Counter the lock screw of the heat exchanger capillary while loosening the outlet valve. Keep the outlet valve installed to the pump head assembly.



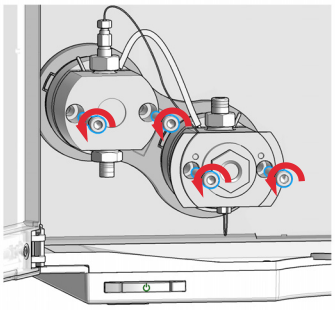
9 Loosen the high-pressure filter. Keep the filter installed to the pump head assembly.

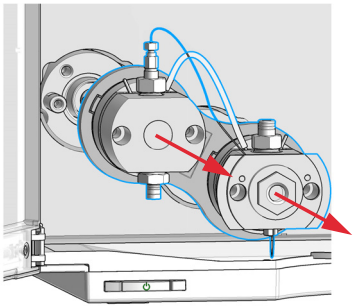
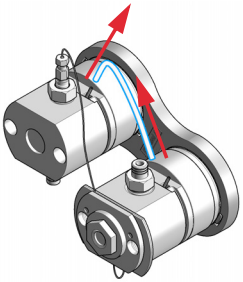


10 Open the four screws holding the pump heads.

NOTE

Open the screws step by step, not screw by screw.



11 Remove the complete pump head assembly by holding both heads and pulling it to the front. 	**12** Remove the seal wash tubing interconnecting the two pump heads. 

Pump Head Maintenance (Tool Free)

Infinity II Flexible Pumps (G7104A/C) and 1290 Infinity II High-Speed Pumps (G7120A and G7132A) are equipped with Long Life Pump Heads.

Long Life Pump Heads offer a significantly increased lifetime of pistons and seals compared to other pump heads.

Maintenance of Long Life Pump Heads requires no special tool.

The following procedures explain the maintenance of Long Life Pump Heads.

Please refer to Agilent 1290 Infinity II Easy Maintenance Pump Head Technical Note (01200-90120) for instructions on maintenance of Easy Maintenance Pump Heads, or to Agilent 1290 Infinity Pump Head Maintenance Technical Note (G4220-90122) for instructions on maintenance of classical pump heads.

Disassemble LongLife Pump Heads (G7120A)

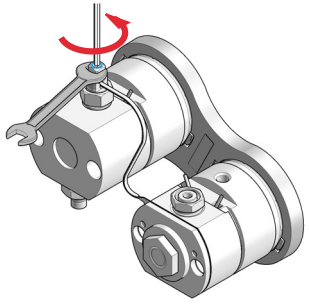
This procedure shows how to open the pump head assembly, exchange seals, and clean pistons.

Exchanging seals and cleaning pistons is exemplarily shown for the primary pump head, but works in the same way for the secondary pump head.

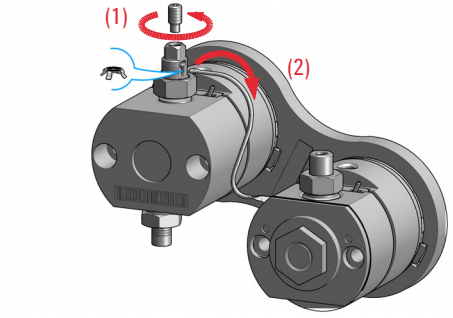
Tools required	p/n	Description
	G7120-68708	HPLC System Tool Kit-Infinity-II
	5043-1400	Pump Head Holder
	5067-6197	Seal Handling Device
	8660-0852	Abrasive mesh
		Isopropanol

NOTE Seals must be exchanged and pistons must be cleaned in both primary and secondary pump heads.

1 Counter the outlet valve while opening the lock screw of the heat exchanger capillary.



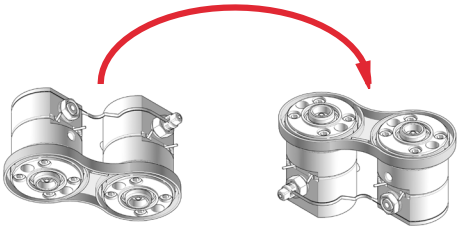
2 Remove the heat exchanger capillary by pushing the connector up and pulling it out of the valve.



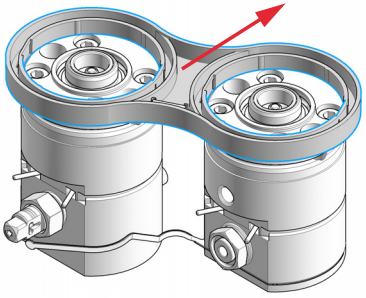
NOTE

A gold seal between outlet valve and heat exchanger capillary is used for a tight connection.

3 Turn the pump head assembly upside down.

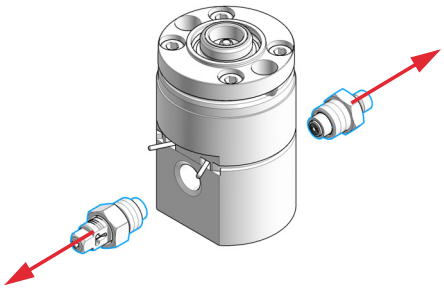


4 Remove the link plate by gently pulling it off the pump head assembly.



The two pump chambers are now isolated.

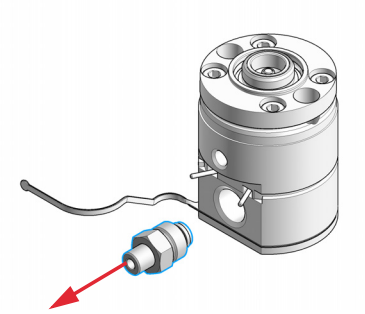
5 Remove the inlet valve and the outlet valve from the primary pump head.



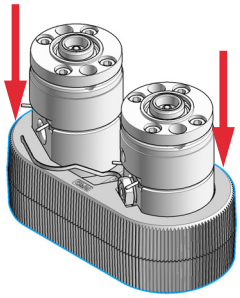
NOTE

Clean the valves by sonication, if appropriate. A good cleaning solution is 50 % isopropanol in water.

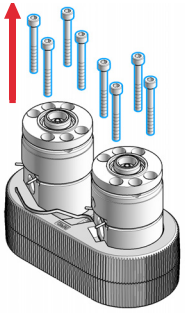
6 Binary/High-Speed Pumps only: Remove the high pressure filter from the secondary pump head.



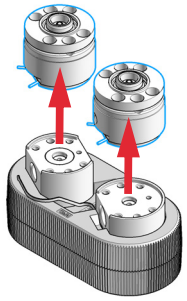
7 Place the two pump heads in the Pump Head Holder.



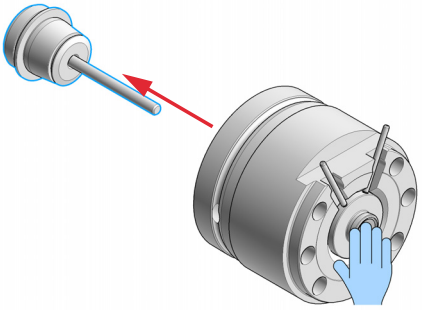
8 Remove the pump head screws from the back of the pump heads.



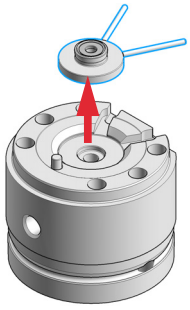
9 Open the pump heads and remove the piston housings from the pump chambers.



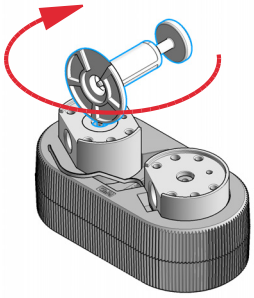
10 Remove the piston by pressing it out of the seal holder with a finger.



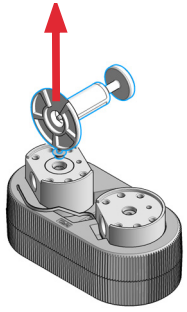
11 Remove the seal holder from the spring housing.



12 Screw the pin of the Seal Handling Device into the piston seal.



13 Pull out the Seal Handling Device with the piston seal in a straight movement with only gentle force.

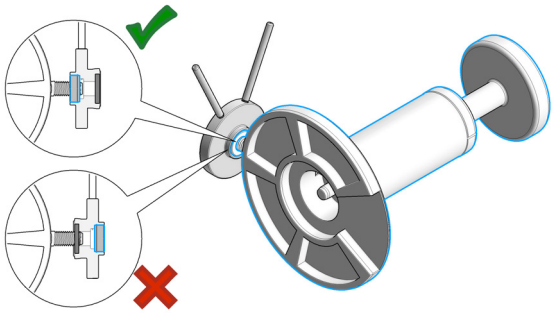


14 Repeat for the other pump chamber.

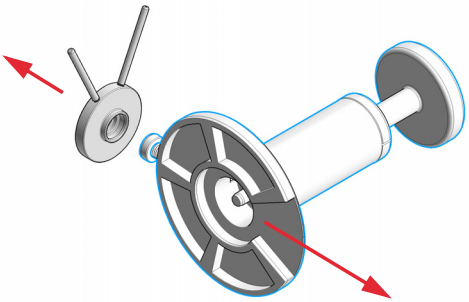
15 Screw the pin of the Seal Handling Device into the wash seal.

NOTE

The seal holder has two different sides. The black backup ring is supporting the piston seal and must not be removed. The side with the backup ring has a bigger diameter and a sharp edge to hold the piston seal. The other side has no sharp edge and holds the smaller wash seal.

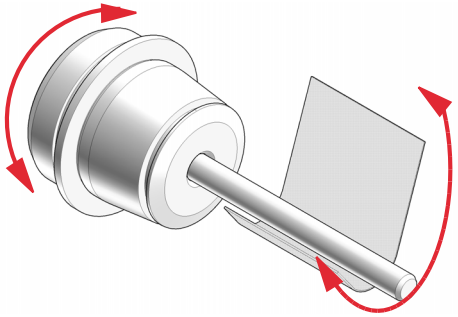


16 Pull out the Seal Handling Device with the wash seal in a straight movement with only gentle force.



17 Repeat for the other seal holder.

18 Clean the piston with abrasive paper.



19 Rinse pump heads and pistons with isopropanol.

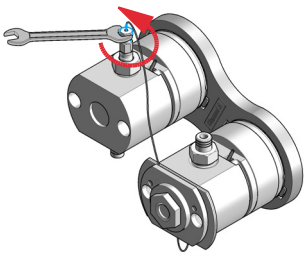
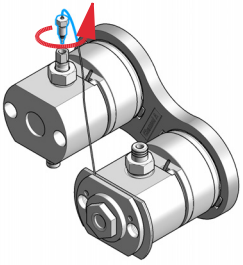
Disassemble LongLife Pump Heads (G7132A)

This procedure shows how to open the pump head assembly, exchange seals, and clean pistons.

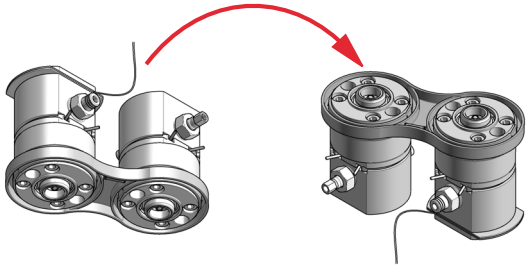
Exchanging seals and cleaning pistons is exemplarily shown for the primary pump head, but works in the same way for the secondary pump head.

Tools required	p/n	Description
	G7120-68708	HPLC System Tool Kit-Infinity-II
	G7132-42000	Bio Pump Head Holder
	5067-6197	Seal Handling Device
	8660-0852	Abrasive mesh
		Isopropanol

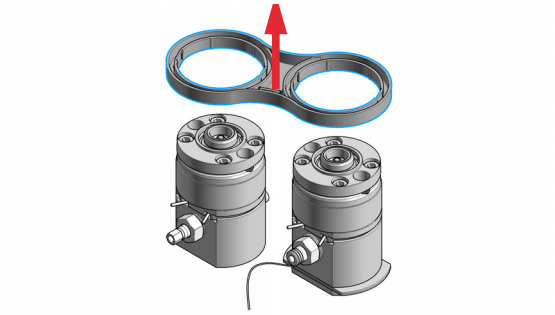
NOTE Seals must be exchanged and pistons must be cleaned in both primary and secondary pump heads.

1 Counter the outlet valve while opening the lock screw of the heat exchanger capillary. 	**2** Remove the heat exchanger capillary from the valve. 

3 Turn the pump head assembly upside down.

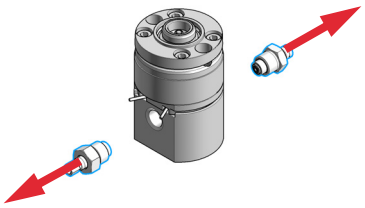


4 Remove the link plate by gently pulling it off the pump head assembly.



The two pump chambers are now isolated.

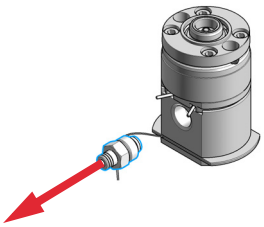
5 Remove the inlet valve and the outlet valve from the primary pump head.



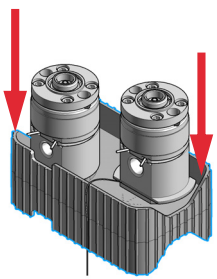
NOTE

Clean the valves by sonication, if appropriate. A good cleaning solution is 50 % isopropanol in water.

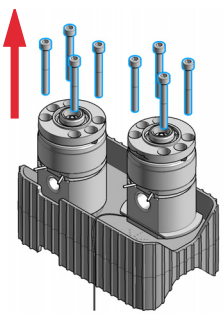
6 Binary/High-Speed Pumps only: Remove the high-pressure filter from the secondary pump head.



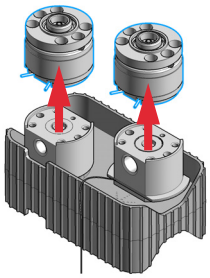
7 Place the two pump heads in the pump head holder.



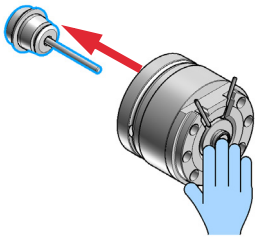
8 Remove the pump head screws from the back of the pump heads.



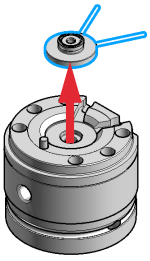
9 Open the pump heads and remove the piston housings from the pump chambers.



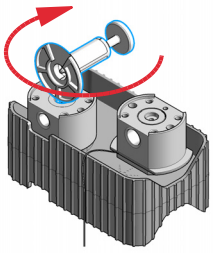
10 Remove the piston by pressing it out of the seal holder with a finger.



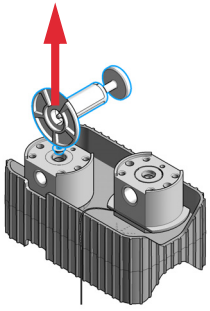
11 Remove the seal holder from the spring housing.



12 Screw the pin of the Seal Handling Device into the piston seal.



13 Pull out the Seal Handling Device with the piston seal in a straight movement with only gentle force.

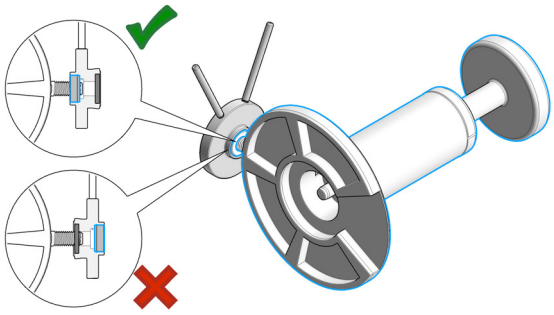


14 Repeat for the other pump chamber.

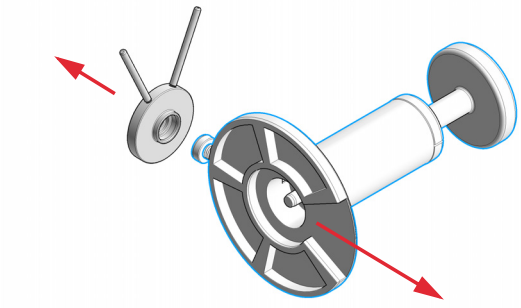
15 Screw the pin of the Seal Handling Device into the wash seal.

NOTE

The seal holder has two different sides. The black backup ring is supporting the piston seal and must not be removed. The side with the backup ring has a bigger diameter and a sharp edge to hold the piston seal. The other side has no sharp edge and holds the smaller wash seal.

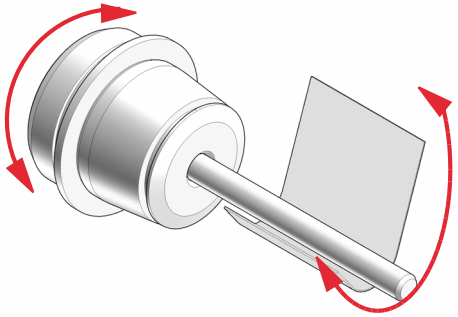


16 Pull out the Seal Handling Device with the wash seal in a straight movement with only gentle force.



17 Repeat for the other seal holder.

18 Clean the piston with abrasive paper.



19 Rinse pump heads and pistons with isopropanol.

Replace the Heat Exchanger (G7120A)

Tools required	p/n	Description
		Wrench, 19 mm
	5023-2501	Screwdriver Torx-T10
	5067-5688	Torque wrench 1 – 25 Nm with 14 mm wrench
	G4220-20013	4 mm hex bit
	G4220-20015	Adapter ¼ in square to hex
	G4220-20041	Bit Torx 10x25 mm

Parts required	#	p/n	Description
	1	G4220-81013	Heat Exchanger Channel A (secondary pump head only)
OR	1	G4220-81012	Heat Exchanger Channel B (secondary pump head only)

Preparations

- Remove the pump head assembly from the pump
- Remove the secondary pump head from the link plate

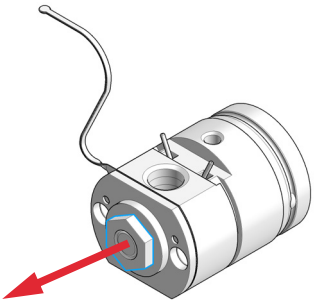
CAUTION

Loss of small spacer fitting

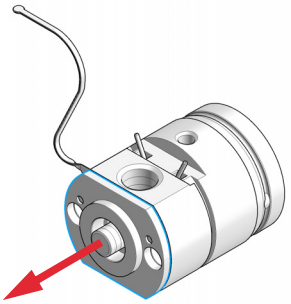
Inside the secondary pump head is a small spacer fitting, which can be dropped easily when removing the heat exchanger.

✓ **The heat exchanger does not need to be removed for pump head maintenance.**

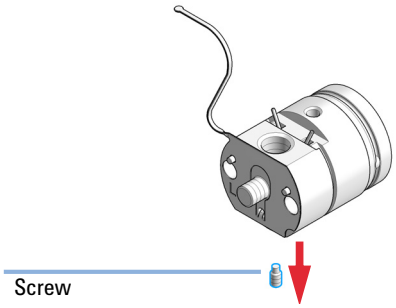
1 Remove the 19 mm screw at the front of the secondary pump head.



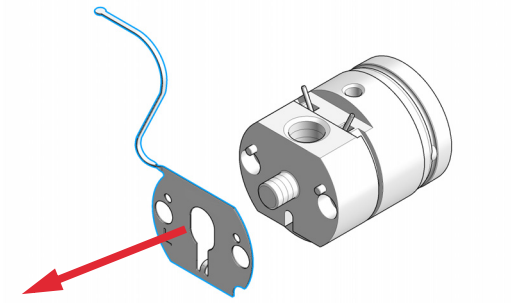
2 Remove the front plate.



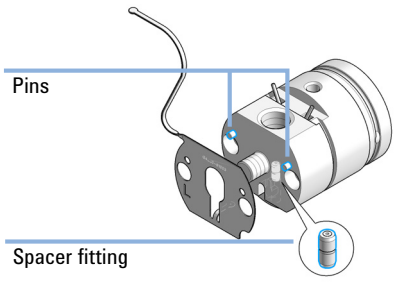
3 Remove the screw at the bottom of the pump head. Do not drop the golden spacer fitting.



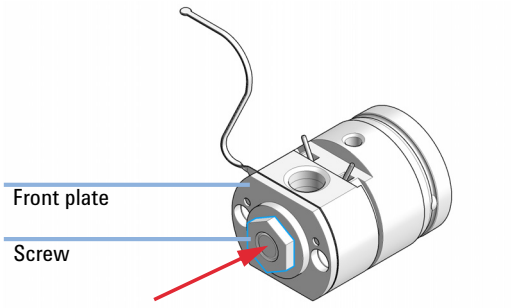
4 Lift out the heat exchanger.



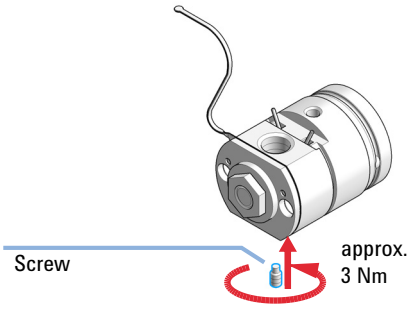
5 If removed, first insert the spacer fitting. Then insert the new heat exchanger to the opening in the pump head and lift it over the pins.



6 Use the 19 mm screw for fixing the front plate.



7 Insert and fix the screw.



Replace the Heat Exchanger (G7132A)

BIO

For 1290 Infinity II Bio LC modules, use bio / bio-compatible parts only.
Do not mix parts between 1260 Infinity II Bio-Inert LC modules and 1290 Infinity II Bio LC modules.

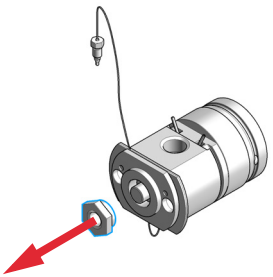
Tools required	p/n	Description
		Wrench, 19 mm
	5023-2501	Screwdriver Torx-T10
	5067-5688	Torque wrench 1 – 25 Nm with 14 mm wrench
	G4220-20013	4 mm hex bit
	G4220-20015	Adapter ¼ in square to hex
	G4220-20041	Bit Torx 10x25 mm

Parts required	p/n	Description
	G7131-60005	Heat Exchanger for Bio-Compatible Pump

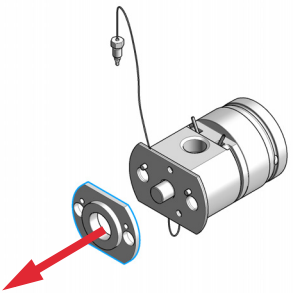
Preparations

- Remove the pump head assembly from the pump
- Remove the secondary pump head from the link plate

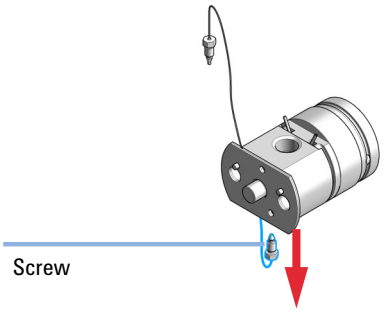
1 Remove the 19 mm screw at the front of the secondary pump head.



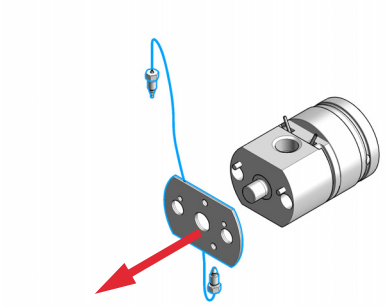
2 Remove the front plate.



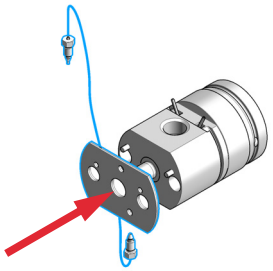
3 Remove the screw at the bottom of the pump head.



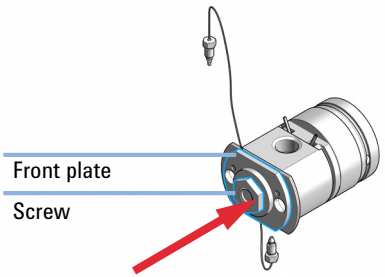
4 Lift out the heat exchanger.



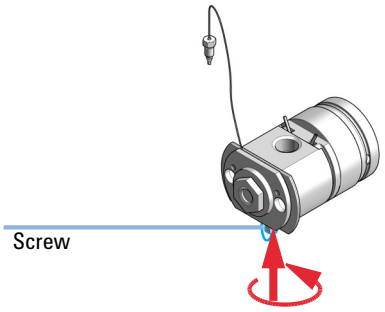
5 Insert the new heat exchanger into the opening of the pump head and lift it over the pins.



6 Use the 19 mm screw for fixing the front plate.



7 Insert and fix the screw.



Assemble LongLife Pump Heads (G7120A)

This procedure shows how to exchange seals, and reassemble the pump head assembly.

Exchanging seals is exemplarily shown for the primary pump head, but works in the same way for the secondary pump head.

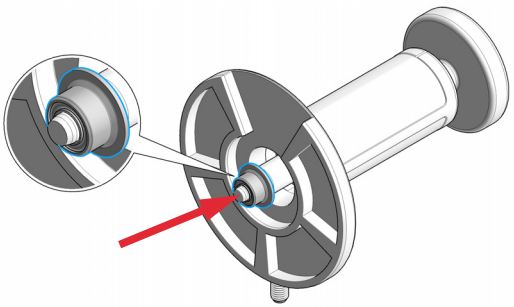
Tools required

p/n	Description
G7120-68708	HPLC System Tool Kit-Infinity-II
5067-5688	Torque wrench 1 – 25 Nm with 14 mm wrench
G4220-20013	4 mm hex bit
G4220-20015	Adapter ¼ in square to hex
G4220-20041	Bit Torx 10x25 mm
5043-1400	Pump Head Holder
5067-6197	Seal Handling Device
	Isopropanol

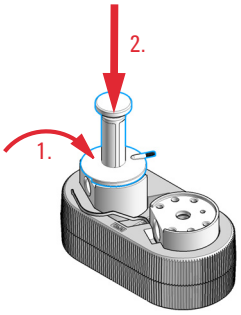
Parts required

#	p/n	Description
2	0905-1719	PE Seal
2	0905-1175	Wash seal (PTFE)

NOTE Seals must be exchanged in both primary and secondary pump heads.

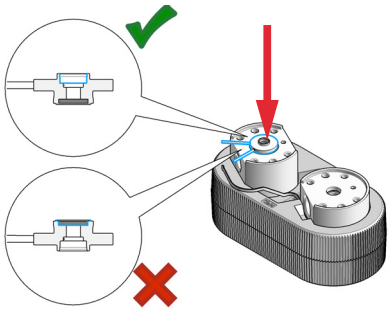
1 Lubricate the seals, the seal holder, and the pump chambers with isopropanol.	**2** Place the piston seal onto the designated nose of the Seal Handling Device. The metal spring of the piston seal must be visible. 

3 Take care that the Seal Handling Device is seating flush and press the seal into the pump chamber.



4 Repeat for the other pump chamber.

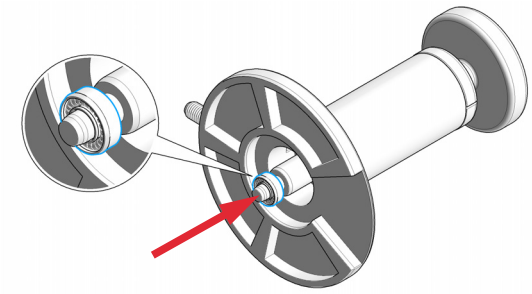
5 Place the seal holder onto the pump chamber.



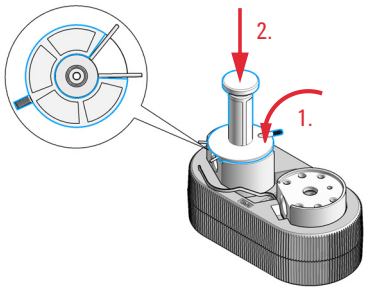
NOTE

Mind the correct orientation of the seal holder. The backup ring must face down.

6 Place the wash seal onto the designated nose of the Seal Handling Device. The metal spring of the wash seal must be visible.



7 Take care that the Seal Handling Device is seating flush and press the wash seal into the seal holder.

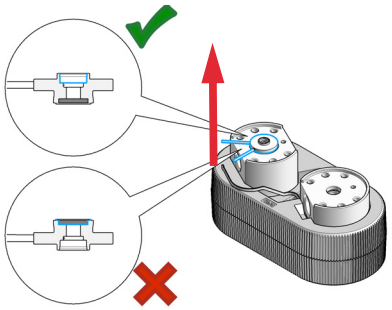


NOTE

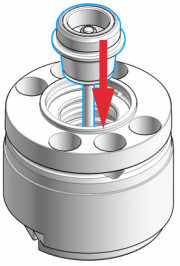
The Seal Handling Device has a cavity to fit over the pins of the seal wash tubings.

8 Repeat for the other seal holder.

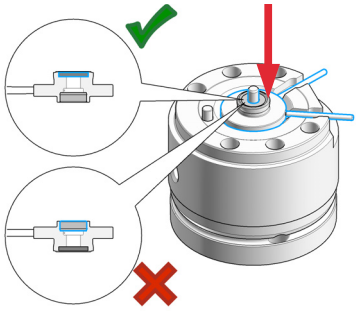
9 Remove the seal holders from the pump chambers.



10 Lubricate the piston with isopropanol and place it into the spring housing.



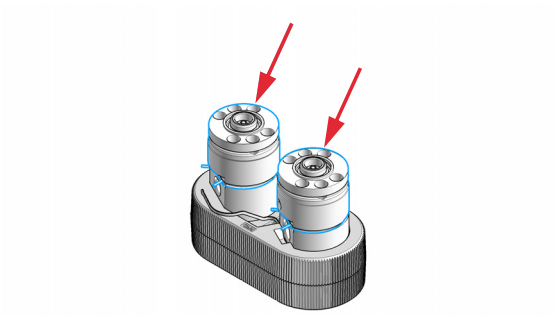
11 Place the seal holder onto the spring housing.



NOTE

Mind the correct orientation: The backup ring must face upwards and the seal holder must sit correctly.

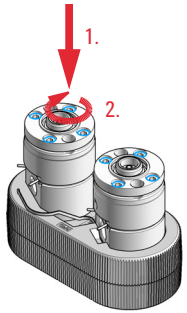
12 Place the assembled spring housings on top of the pump chambers.



NOTE

Both spring housings are identical, there is no risk when mixing them, but make sure that the seal holder is oriented correctly.

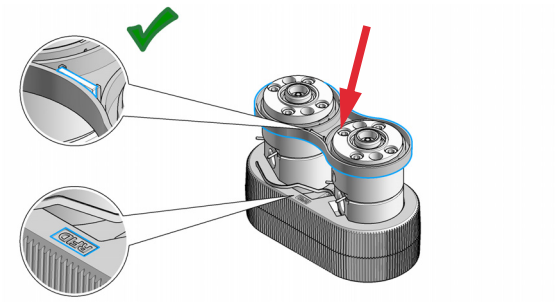
13 Place the screws into the pump heads and loosely tighten them in a crosswise manner.



NOTE

The spring housing will tilt slightly when the first screw is hand tightened. Stop at this point and continue to tighten the three other screws in a crosswise manner.

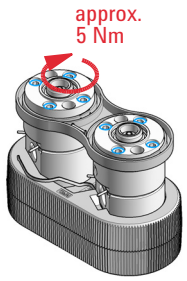
14 Mind the correct orientation of the link plate and click it into place.



NOTE

The Pump Head Holder has a marker to illustrate the correct placement of the link plate. The link plate holds an identification tag; this has to be placed onto the correct position to be readable by the pump.

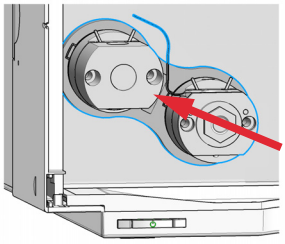
15 Tighten the pump head screws with a torque wrench set to approx. 5 Nm in a crosswise manner.



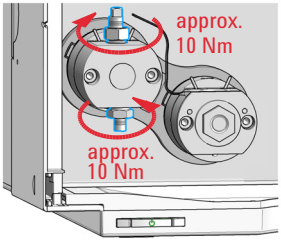
NOTE

When the wrench clicks, the set torque is reached. Do not overtighten the screws.

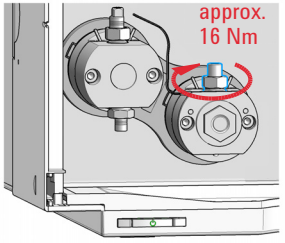
16 Mount the pump head to the module. Do not fix the screws at this stage!



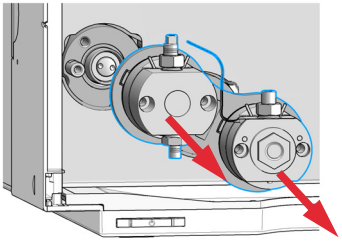
17 Screw in the inlet valve and the outlet valve and fix them with a torque wrench set to approx. 10 Nm.



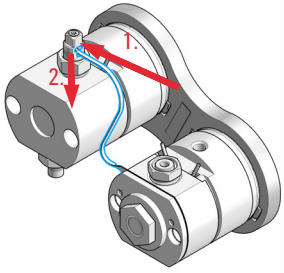
18 Binary/High-Speed Pumps only: Screw in the high pressure filter and fix it with a torque wrench set to approx. 16 Nm.



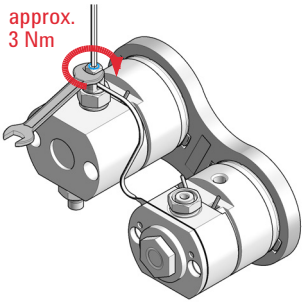
19 Remove the pump head from the module again.



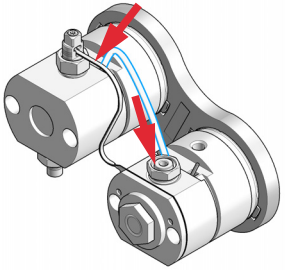
20 Position the entrance slit for the heat exchanger capillary to face exactly to it, and then seat the heat exchanger capillary back into the outlet valve by moving it into the valve and pressing it down.



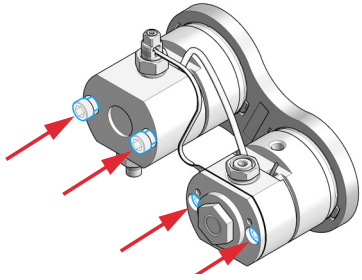
21 Counter the outlet valve and tighten the lock screw of the heat exchanger capillary with a torque wrench set to approx. 3 Nm.



22 Attach the seal wash tubing interconnecting the two pump heads.



23 Insert the screws that later fix the pump head assembly to the module housing.



Assemble LongLife Pump Heads (G7132A)

For 1290 Infinity II Bio LC modules, use bio / bio-compatible parts only.
Do not mix parts between 1260 Infinity II Bio-Inert LC modules and 1290 Infinity II Bio LC modules.

This procedure shows how to exchange seals, and reassemble the pump head assembly.

Exchanging seals is exemplarily shown for the primary pump head, but works in the same way for the secondary pump head.

Tools required

p/n	Description
G7120-68708	HPLC System Tool Kit-Infinity-II
G4220-20013	4 mm hex bit
G4220-20015	Adapter ¼ in square to hex
G4220-20041	Bit Torx 10x25 mm
G7132-42000	Bio Pump Head Holder
5067-6197	Seal Handling Device
	Isopropanol

Parts required

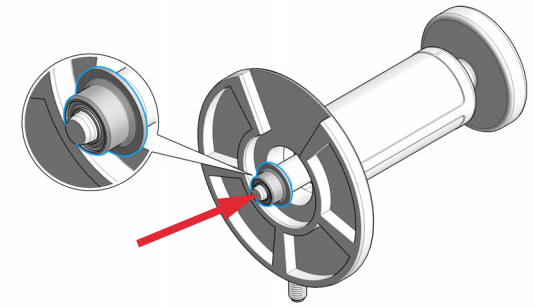
#	p/n	Description
2	G7131-20009	Seal Bio-Compatible
2	0905-1731	Bio-Inert Wash Seal

NOTE

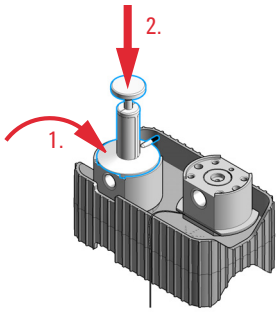
Seals must be exchanged in both primary and secondary pump heads.

1 Lubricate the seals, the seal holder, and the pump chambers with isopropanol.

2 Place the piston seal onto the designated nose of the Seal Handling Device. The metal spring of the piston seal must be visible.

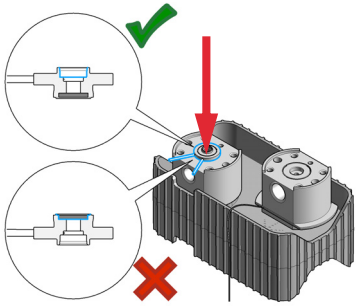


3 Take care that the Seal Handling Device is seating flush and press the seal into the pump chamber.



4 Repeat for the other pump chamber.

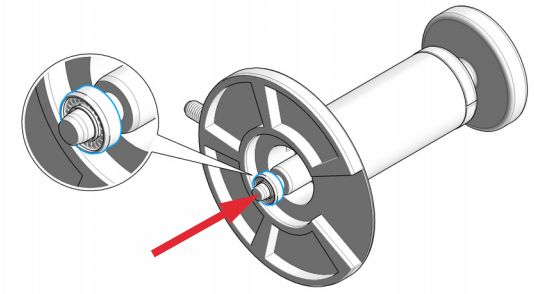
5 Place the seal holder onto the pump chamber.



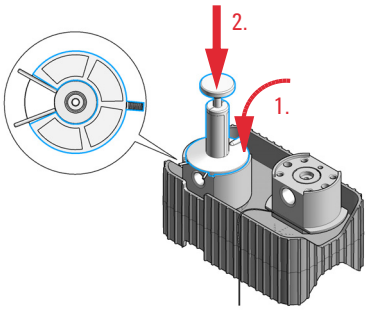
NOTE

Mind the correct orientation of the seal holder. The backup ring must face down.

6 Place the wash seal onto the designated nose of the Seal Handling Device. The metal spring of the wash seal must be visible.



7 Take care that the Seal Handling Device is seating flush and press the wash seal into the seal holder.

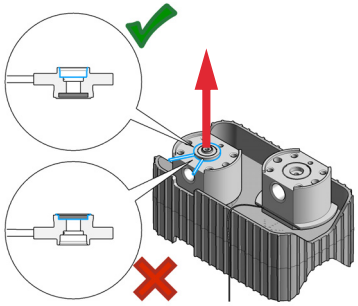


NOTE

The Seal Handling Device has a cavity to fit over the pins of the seal wash tubings.

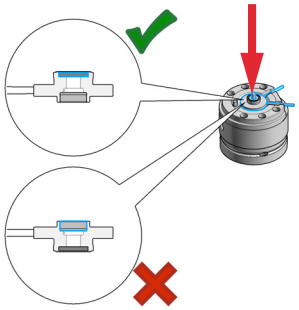
8 Repeat for the other seal holder.

9 Remove the seal holders from the pump chambers.



10 Lubricate the piston with isopropanol and place it into the spring housing.

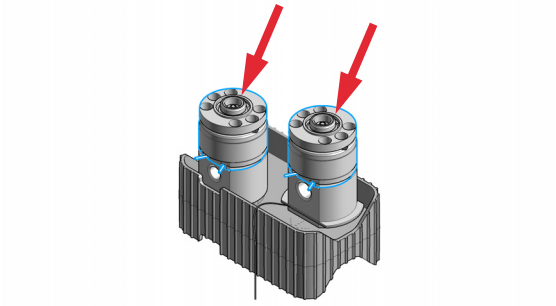
11 Place the seal holder onto the spring housing.



NOTE

Mind the correct orientation: The backup ring must face upwards and the seal holder must sit correctly.

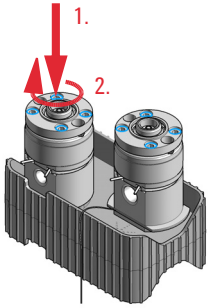
12 Place the assembled spring housings on top of the pump chambers.



NOTE

Both spring housings are identical, there is no risk when mixing them, but make sure that the seal holder is oriented correctly.

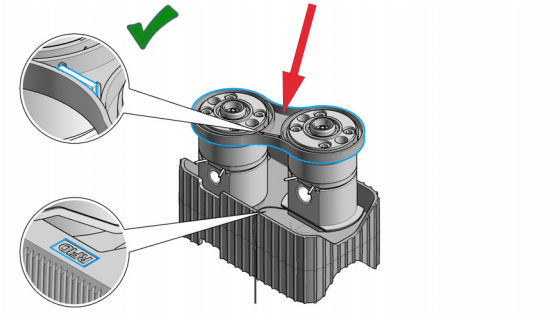
13 Place the screws into the pump heads and loosely tighten them in a crosswise manner.



NOTE

The spring housing will tilt slightly when the first screw is hand tightened. Stop at this point and continue to tighten the three other screws in a crosswise manner.

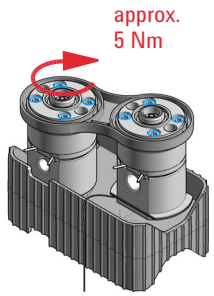
14 Mind the correct orientation of the link plate and click it into place.



NOTE

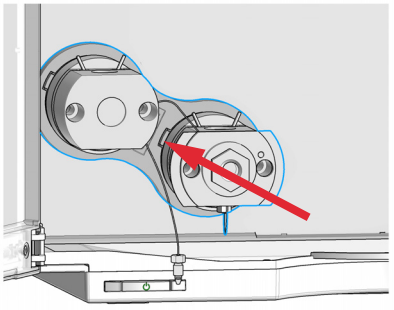
The pump head holder has a marker to illustrate the correct placement of the link plate. The link plate holds an identification tag that has to be placed onto the correct position to be readable by the pump.

15 Tighten the pump head screws with a torque wrench set to approx. 5 Nm in a crosswise manner.

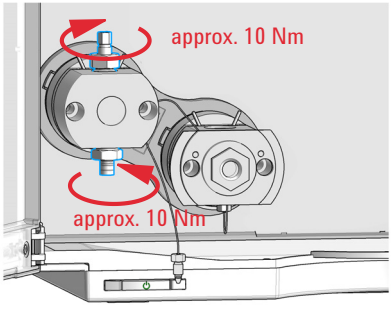


When the wrench clicks, the set torque is reached. Do not overtighten the screws.

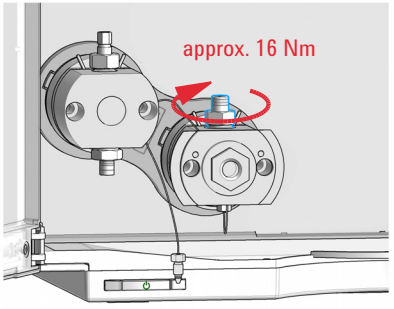
16 Mount the pump head to the module. Do not fix the screws at this stage!



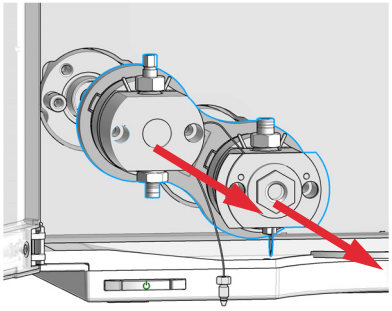
17 Screw in the inlet valve and the outlet valve and fix them with a torque wrench set to approximately 10 Nm.



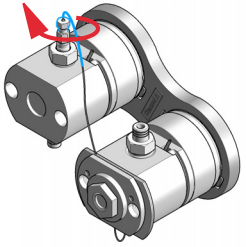
18 Screw in the high-pressure filter and fix it with a torque wrench set to approximately 16 Nm.



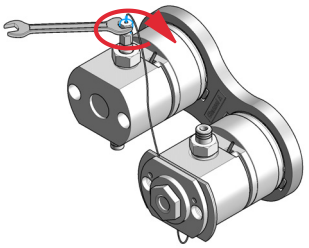
19 Remove the pump head from the module again.



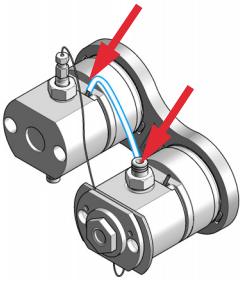
20 Seat the heat exchanger capillary back into the outlet valve.



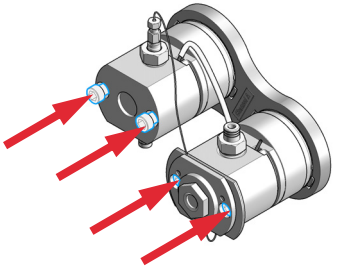
21 Counter the outlet valve and tighten the lock screw of the heat exchanger capillary with a torque wrench set to approximately 3 Nm.



22 Attach the seal wash tubing interconnecting the two pump heads.



23 Insert the screws that later fix the pump head assembly to the module housing.



Install the Pump Head Assembly (G7120A)

Tools required	p/n	Description
	G7120-68708	HPLC System Tool Kit-Infinity-II
	5067-5688	Torque wrench 1 – 25 Nm with 14 mm wrench
	G4220-20013	4 mm hex bit
	G4220-20015	Adapter ¼ in square to hex

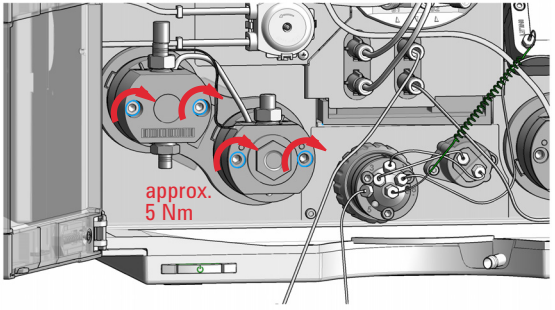
1 Bring the pump drive to the maintenance position using the Lab Advisor user interface: Go to **Service & Diagnostics > Remove/Install Pump Head** and follow instructions given on the screen. Both pump drives must be retracted.

CAUTION

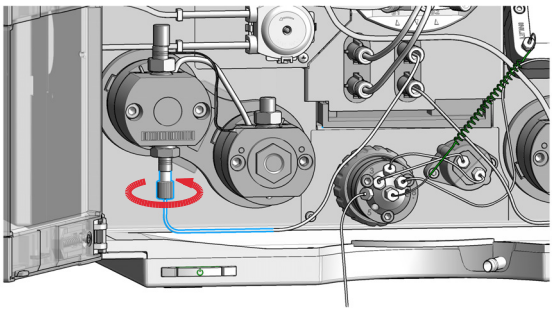
Damage to the pump head
Using a wrong torque will damage the pump head.

✓ **For handling the torque wrench, setting and applying the right torque, consult the manual of your torque wrench.**

2 Install the pump head assembly by tightening the screws step by step to approx. 5 Nm.



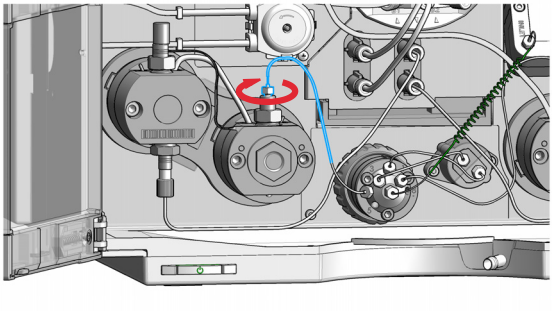
3 Connect the degassing unit outlet to the inlet of the primary pump head.



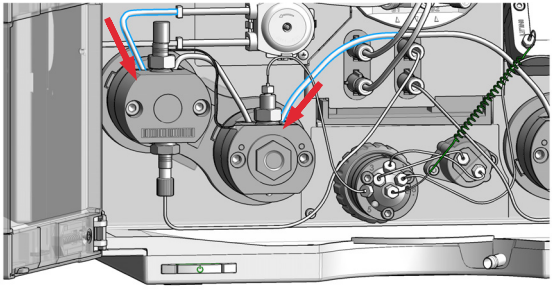
4 Connect the outlet of the secondary pump head to the inlet of the purge valve.

NOTE

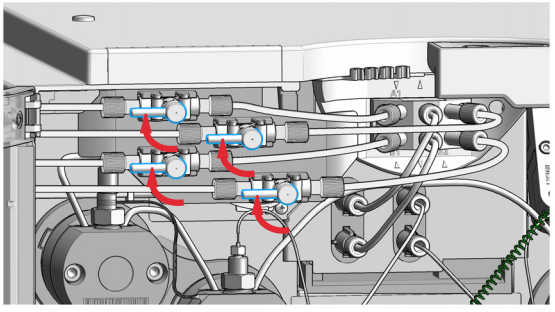
Channel A (left pump head assembly) is connected to port 4, channel B (right pump head assembly) to port 1 of the purge valve.



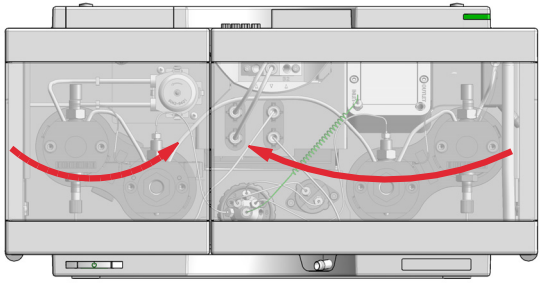
5 Reinstall the seal wash tubes.



6 Open the shutoff valves.



7 Close the doors.



8 Perform a Pump Leak Rate Test.

Install the Pump Head Assembly (G7132A)

BIO

For 1290 Infinity II Bio LC modules, use bio / bio-compatible parts only.
Do not mix parts between 1260 Infinity II Bio-Inert LC modules and 1290 Infinity II Bio LC modules.

Tools required	p/n	Description
	G7120-68708	HPLC System Tool Kit-Infinity-II
	5067-5688	Torque wrench 1 – 25 Nm with 14 mm wrench
	G4220-20013	4 mm hex bit
	G4220-20015	Adapter ¼ in square to hex

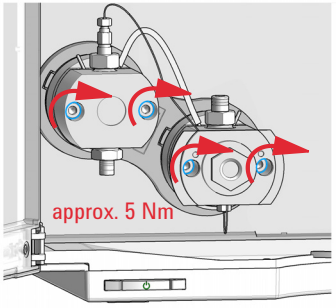
1 Bring the pump drive to the maintenance position using the Lab Advisor user interface: Go to **Service & Diagnostics > Remove/Install Pump Head** and follow instructions given on the screen. Both pump drives must be retracted.

CAUTION

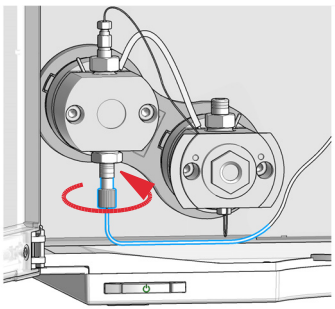
Damage to the pump head
Using a wrong torque will damage the pump head.

✓ **For handling the torque wrench, setting and applying the right torque, consult the manual of your torque wrench.**

2 Install the pump head assembly by tightening the screws step by step to approx. 5 Nm.



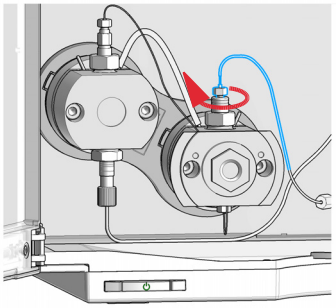
3 Connect the degassing unit outlet to the inlet of the primary pump head.



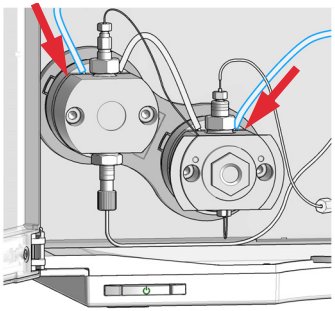
4 Connect the outlet of the secondary pump head to the inlet of the purge valve.

NOTE

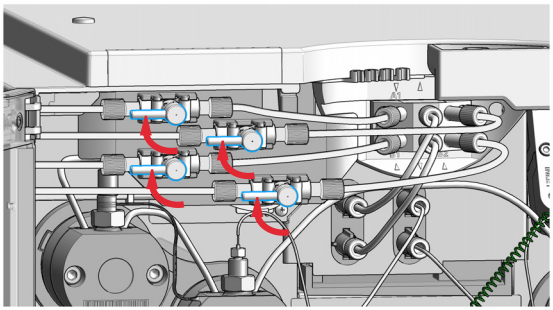
Channel A (left pump head assembly) is connected to port 4, channel B (right pump head assembly) to port 1 of the purge valve.



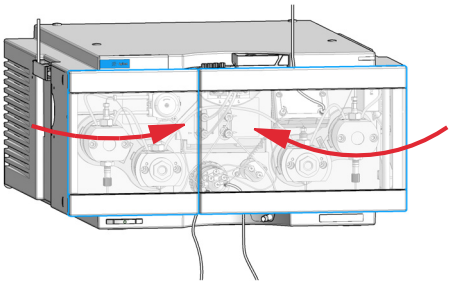
5 Replace the sealwash tubes.



6 Open the shutoff valves.



7 Close the doors.



8 Perform a **Pump Leak Rate Test**.

Replace the Outlet Valve (G7120A)

When If Outlet valve is defective.

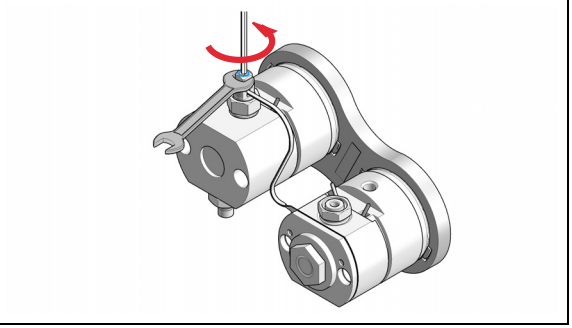
Tools required

p/n	Description
8710-0510	Open-end wrench 1/4 — 5/16 inch
	Spanner-double open ended 14 mm

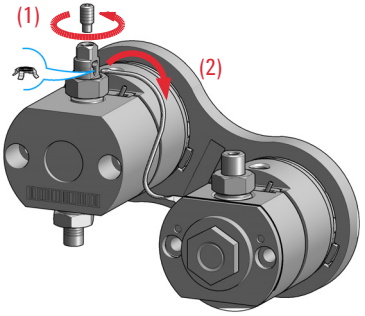
Parts required

p/n	Description
G4220-60028	Outlet valve (primary pump head)
G4220-20020	Internal gold seal for Outlet Valve

Preparations Remove the pump head assembly.

1 Remove the cap from the outlet valve.	**2** Counter the outlet valve while opening the lock screw of the heat exchanger capillary. 

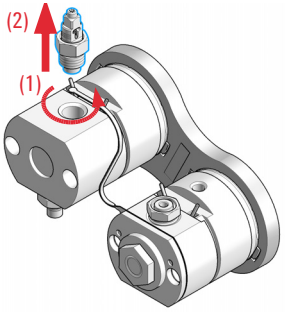
3 Remove the heat exchanger capillary by pushing the connector up and pulling it out of the valve.



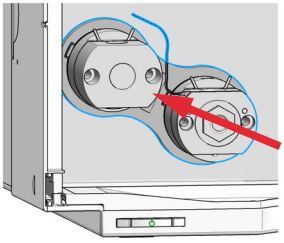
NOTE

A gold seal between outlet valve and heat exchanger capillary is used for a tight connection.

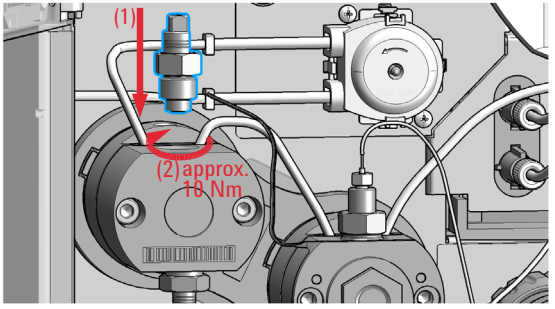
4 Unscrew the outlet valve with a 14 mm wrench (1) and remove it (2).



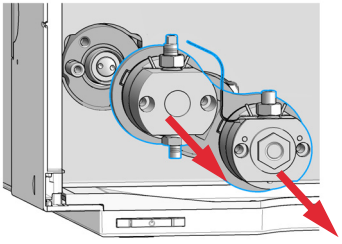
5 Mount the pump head to the module. Do not fix the screws at this stage!



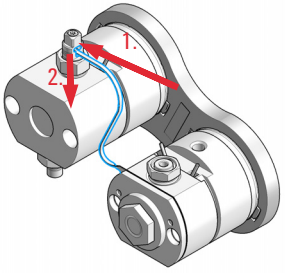
6 Insert the outlet valve into the pump head (1). Using a torque wrench, set approx. 10 Nm and close the outlet valve (2).

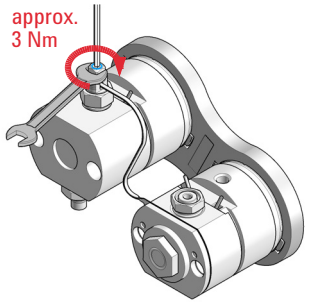


7 Remove the pump head from the module again.



8 Position the entrance slit for the heat exchanger capillary to face exactly to it, and then seat the heat exchanger capillary back into the outlet valve by moving it into the valve and pressing it down.



9 Counter the outlet valve and tighten the lock screw of the heat exchanger capillary with a torque wrench set to approx. 3 Nm.  	**Next Steps:** **10** Place the cap on the Outlet Valve. **11** Install the pump head assembly, reconnect all hydraulic connections, and power up the pump. **12** Open the shutoff valves and purge the system to remove air.

Replace the Outlet Valve (G7132A)

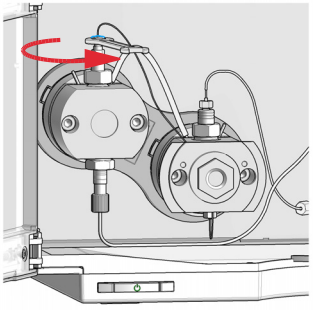
When If Outlet valve is defective.

Tools required	**p/n**	**Description**
	8710-0510	Open-end wrench 1/4 — 5/16 inch
		Spanner-double open ended 14 mm

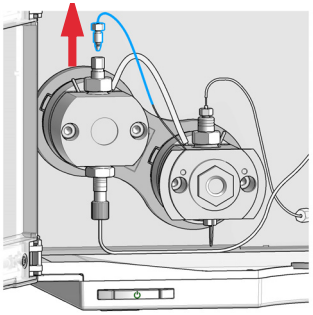
Parts required	**p/n**	**Description**
	G7131-60028	Outlet Valve Bio-Compatible

1 Close the shut off valves to avoid solvent leaks.

2 Open the lock screw of the heat exchanger capillary.



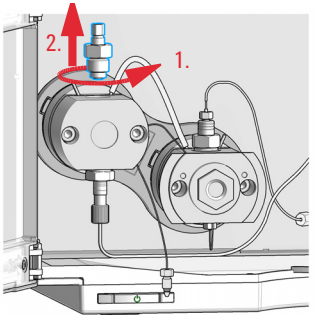
3 Remove the heat exchanger capillary from the outlet valve.



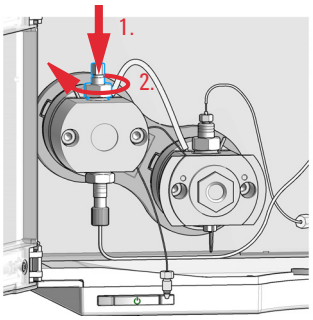
NOTE

A gold seal between outlet valve and heat exchanger capillary is used for a tight connection.

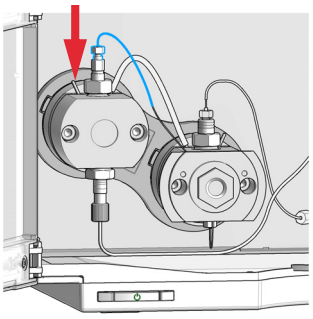
4 Unscrew the outlet valve with a 14 mm wrench (1) and remove it (2).



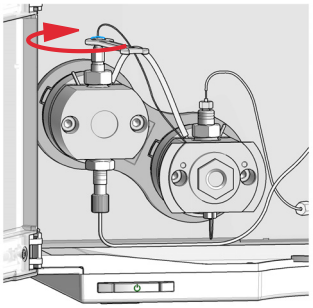
5 Insert the outlet valve into the pump head (1). Using a torque wrench, set approx. 10 Nm and close the outlet valve (2).



6 Connect the heat exchanger capillary to the outlet valve.



7 Tighten the screw of the heat exchanger capillary with a torque wrench set to approx. 3 Nm.



Next Steps:

8 Reconnect all hydraulic connections, and power up the pump.

9 Open the shutoff valves and purge the system to remove air.

Replace the Purge Valve Head

When In case of problems with the purge valve

Parts required

p/n	Description
5067-4236	Purge valve head
5067-4655	Capillary ST 0.25 mm x 250 mm
G4220-87000	Capillary ST 0.17 mm x 300 mm
01090-87308	Capillary ST 0.25 mm x 130 mm
5067-6736	Bio-Compatible purge valve head
5500-1420	Bio-Compatible capillary MP35N 0.25 mm x 250 mm
G7132-60002	Bio-Compatible capillary MP35N 0.17 mm x 300 mm
5500-1421	Bio-Compatible capillary MP35N 0.25 mm x 130 mm

Preparations Remove all capillary connections to the purge valve

CAUTION

Potential damage of valve head or malfunction of valve

When the pump is switched on, the valve tag is accessed (read/write) and used for correctly positioning the valve.

If the valve head is replaced while the pump is on, invalid information may be written to the valve head making it unusable, or positioning may be wrong resulting in wrong flow connections inside the valve potentially damaging parts.

✓ **Switch off the pump before working on the purge valve.**

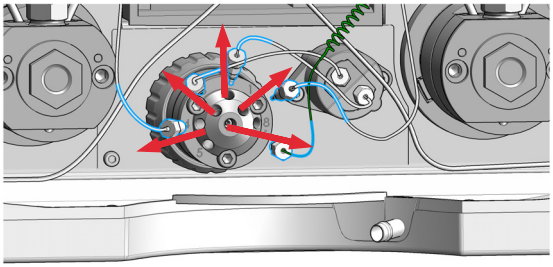
CAUTION

Bias measurement results

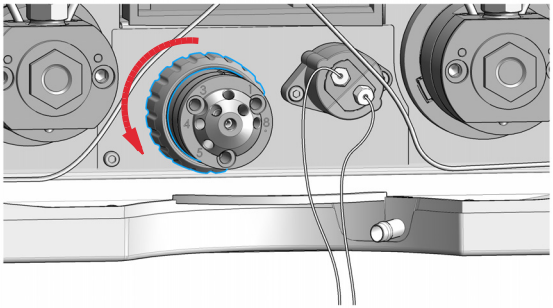
The valve drive contains sensitive optical parts. Pollution of these parts can impair the accurate selection of valve ports and therefore bias measurement results.

✓ **Protect the optical parts from dust and other pollutions.**

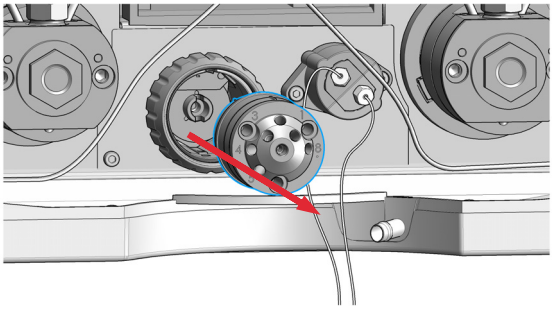
1 Remove all capillary connections.



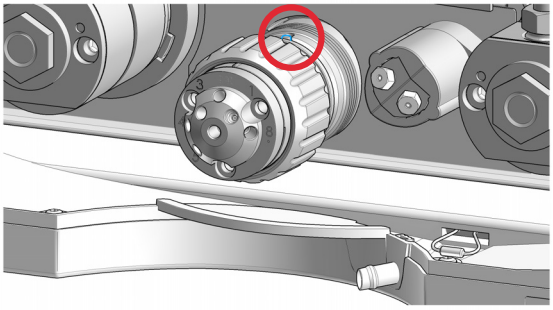
2 Unscrew the black union nut.



3 Remove the head of the purge valve by pulling it to the front.

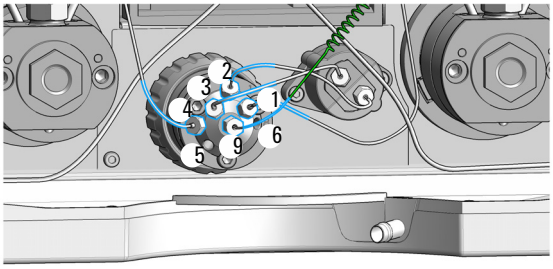


4 Put the new valve head onto the valve drive such that the lobe fits to the groove. Screw the valve head onto the valve drive using the union nut.



5 Install all flow connections:

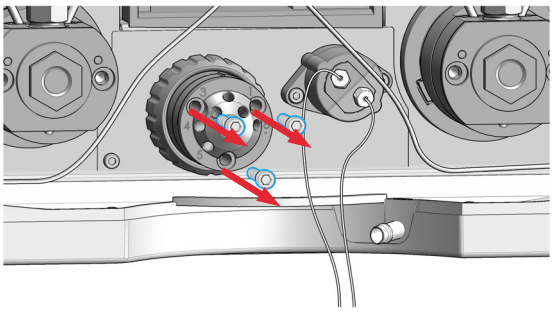
- Port 1: Channel B
- Port 2: Pressure sensor, out
- Port 3: Pressure sensor, in
- Port 4: Channel A
- Ports 5 and 6: Waste capillaries, channels A and B
- Port 9: Central port, connected to the Jet Weaver inlet



Replace Parts of the Purge Valve Head

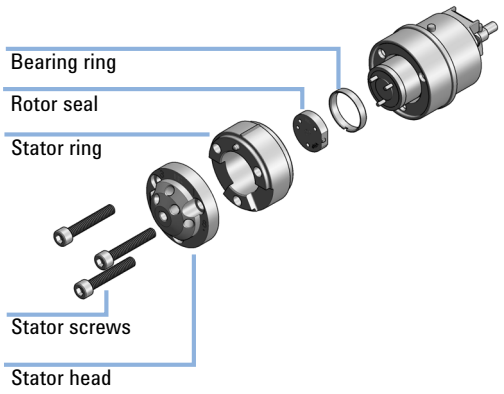
Preparations Remove all capillary connections from the purge valve head.

1 Use the 9/64 inch hex key for opening the valve head.

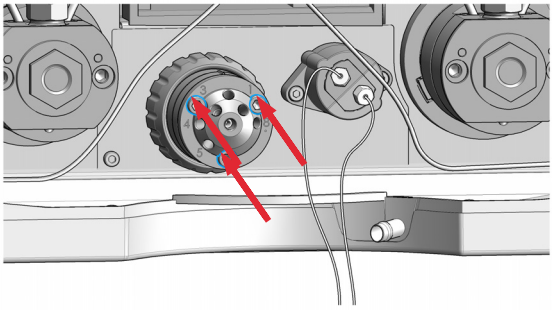


2 Replace parts as required.

3 Reassemble the valve head and mount it to the valve drive.



4 Fix the valve head with the screws.



Replace Parts of the High Pressure Filter Assembly (G7120A)

When

For removing blockages and repairing leaks in the high pressure filter assembly. The filter frit in the outlet valve should be replaced regularly depending on the system usage.

Tools required

p/n	Description
5067-5688	Torque wrench 1 – 25 Nm with 14 mm wrench
8710-0510	Open-end wrench 1/4 — 5/16 inch

Parts required

p/n	Description
5067-4728	Seal cap
01018-22707	PTFE frits (pack of 5)

CAUTION

Leakage or damaged connection

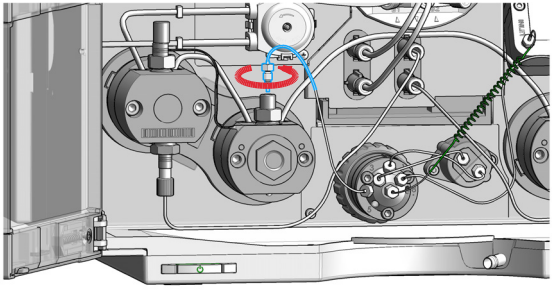
Opening the outlet of the primary pump head may cause leaks or damage the connection between the pump heads.

✓ **Do not open the outlet of the primary pump head.**

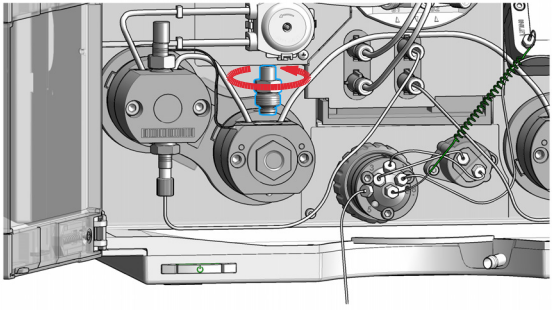
NOTE

This procedure describes replacements for channel A (left pump head assembly) and can be applied accordingly to channel B. In both cases, maintenance is done only at the secondary pump head outlet, which hosts the filter frit.

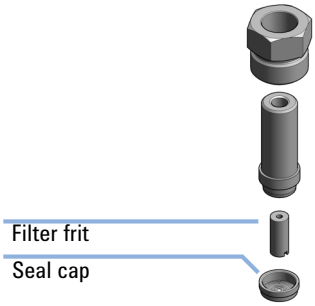
1 Remove the capillary connection from the outlet of the secondary pump head.



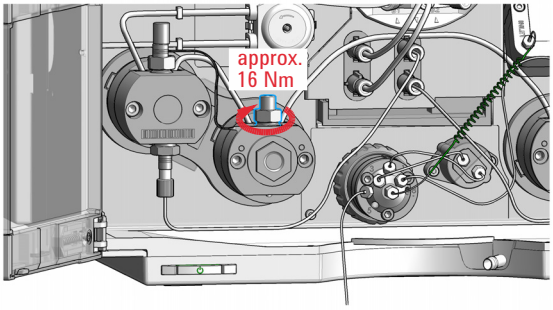
2 Use a 14 mm hex wrench for opening the filter assembly of the secondary pump head.



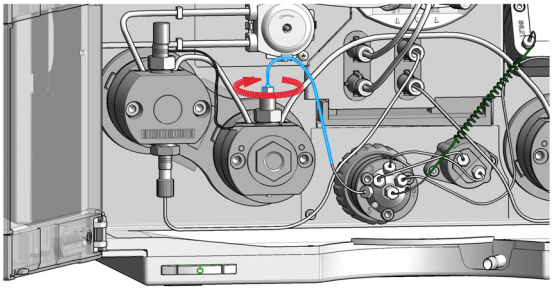
3 Replace the filter frit and seal cap as desired. Please note the correct orientation of the filter frit.



4 Re-install the filter assembly using the torque wrench (14 mm) set to approx. 16 Nm.



5 Reconnect the capillary from the purge valve to the high pressure filter assembly.



Replace Parts of the High Pressure Filter Assembly (G7132A)

When

For removing blockages and repairing leaks in the high pressure filter assembly. The filter frit in the outlet valve should be replaced regularly depending on the system usage.

Tools required

p/n	Description
5067-5688	Torque wrench 1 – 25 Nm with 14 mm wrench
8710-0510	Open-end wrench 1/4 — 5/16 inch

Parts required

p/n	Description
5067-4728	Seal cap
01018-22707	PTFE frits (pack of 5)

CAUTION

Leakage or damaged connection

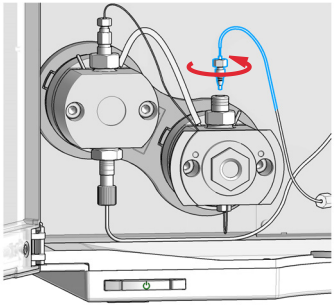
Opening the outlet of the primary pump head may cause leaks or damage the connection between the pump heads.

✓ **Do not open the outlet of the primary pump head.**

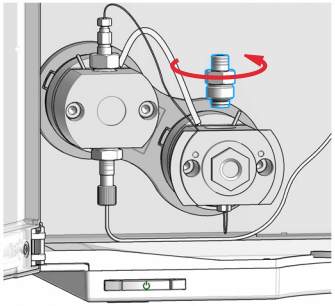
NOTE

This procedure describes replacements for channel A (left pump head assembly) and can be applied accordingly to channel B. In both cases, maintenance is done only at the secondary pump head outlet, which hosts the filter frit.

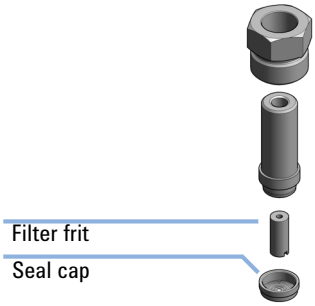
1 Remove the capillary connection from the outlet of the secondary pump head.



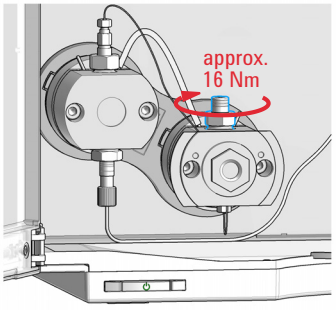
2 Use a 14 mm hex wrench for opening the filter assembly of the secondary pump head.



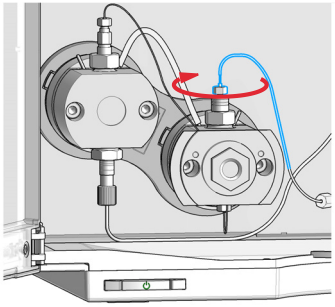
3 Replace the filter frit and seal cap as desired. Please note the correct orientation of the filter frit.



4 Reinstall the filter assembly using the torque wrench (14 mm hex bit) set to approx. 16 Nm.



5 Reconnect the capillary from the purge valve to the high-pressure filter assembly.



Replace the Module Firmware

When

The installation of newer firmware might be necessary
- if a newer version solves problems of older versions or
- to keep all systems on the same (validated) revision.

The installation of older firmware might be necessary
- to keep all systems on the same (validated) revision or
- if a new module with newer firmware is added to a system or
- if third party control software requires a special version.

Tools required

Description
Agilent Lab Advisor software

Parts required

#	Description
1	Firmware, tools and documentation from Agilent web site

Preparations

Read update documentation provided with the Firmware Update Tool.

To upgrade/downgrade the module's firmware carry out the following steps:

1. Download the required module firmware, the latest FW Update Tool and the documentation from the Agilent web.
   http://www.agilent.com/en-us/firmwareDownload?whid=69761
2. For loading the firmware into the module follow the instructions in the documentation.

Module Specific Information

There is no specific information for this module.

Prepare the Pump Module for Transport

When If the module shall be transported or shipped.

Parts required

p/n	Description
9301-0411	Syringe; Plastic
9301-1337	Syringe adapter
G7120-44000	Protective Foam

Preparations Flush both solvent channels with isopropanol, see *Best Practices for Using an Agilent LC System Technical Note*.

WARNING

Heavy weight

The module is heavy.

- ✓ **Carry the module at least with 2 people.**
- ✓ **Avoid back strain or injury by following all precautions for lifting heavy objects.**
- ✓ **Ensure that the load is as close to your body as possible.**
- ✓ **Ensure that you can cope with the weight of your load.**

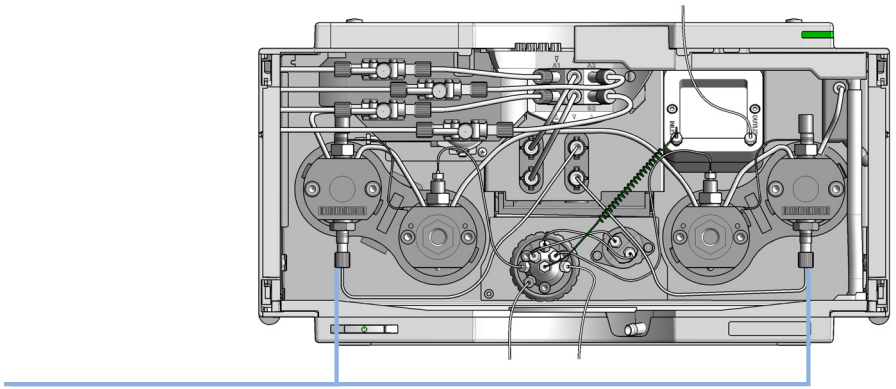
CAUTION

Mechanical damage

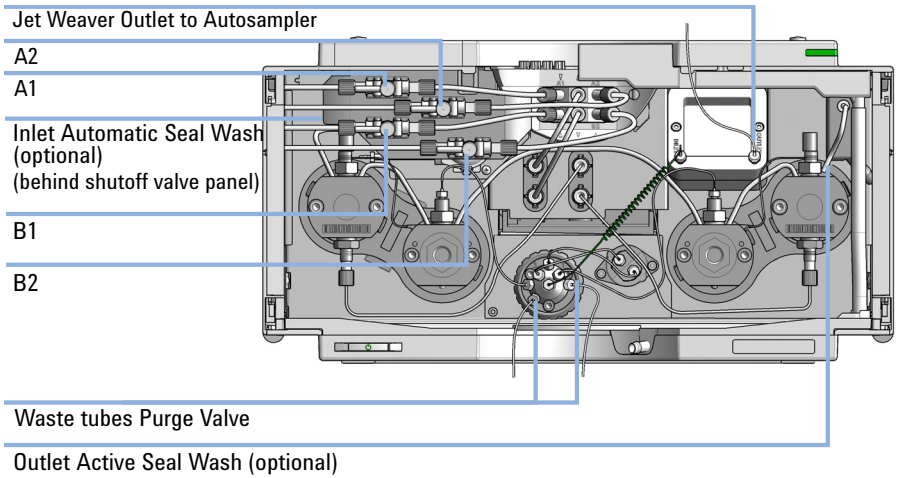
- ✓ **For shipping the module, insert the Protective Foam to protect the module from mechanical damage.**
- ✓ **Be careful not to damage tubing or capillary connections while inserting the module in the Protective Foam.**

1 Flush system with appropriate storage solution, for example 20 % isopropanol in water.

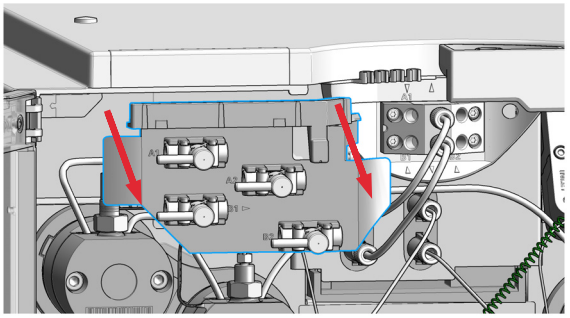
2 Remove solvent inlets from solvent reservoirs. Disconnect the solvent tubing from the inlet of primary pump heads for both solvent channels. Use a syringe for removing liquid from the solvent tubings between solvent reservoir, shutoff valve panel, solvent selection valve, degassing unit and pump inlets.



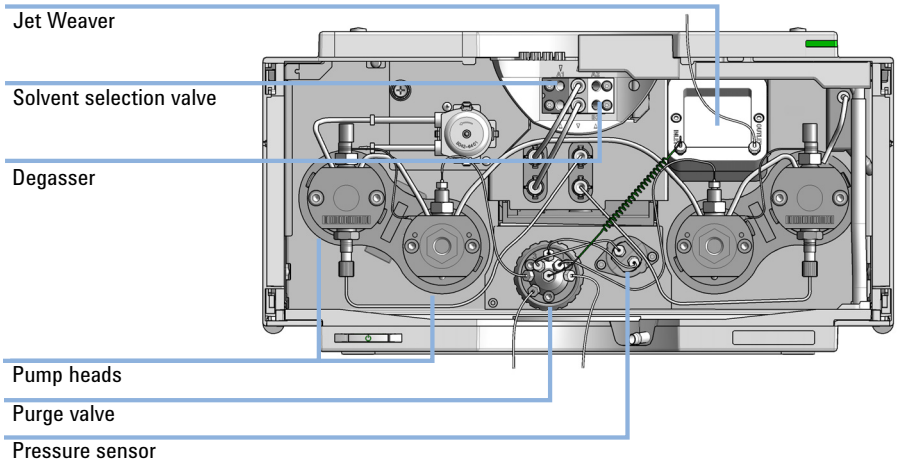
3 Remove tubing and capillary connections to other modules and the solvent cabinet.



4 Remove the shutoff valve panel by pulling it downwards.

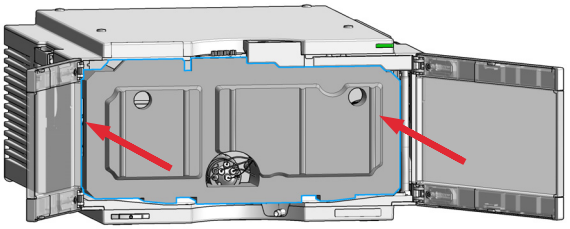


5 You may keep internal tubing and capillary connections.



6 Remove cable connections to other modules. Remove the module from the stack.

7 Carefully insert the Protective Foam to the front part of the instrument. Do not damage any tubing or capillary connections.



8 Close the front cover.

9 For transport or shipment, put the module and accessory kit in the original shipment box.

9 Parts and Materials for Maintenance

This chapter provides information on parts for maintenance.

Overview of Maintenance Parts (G7120A)

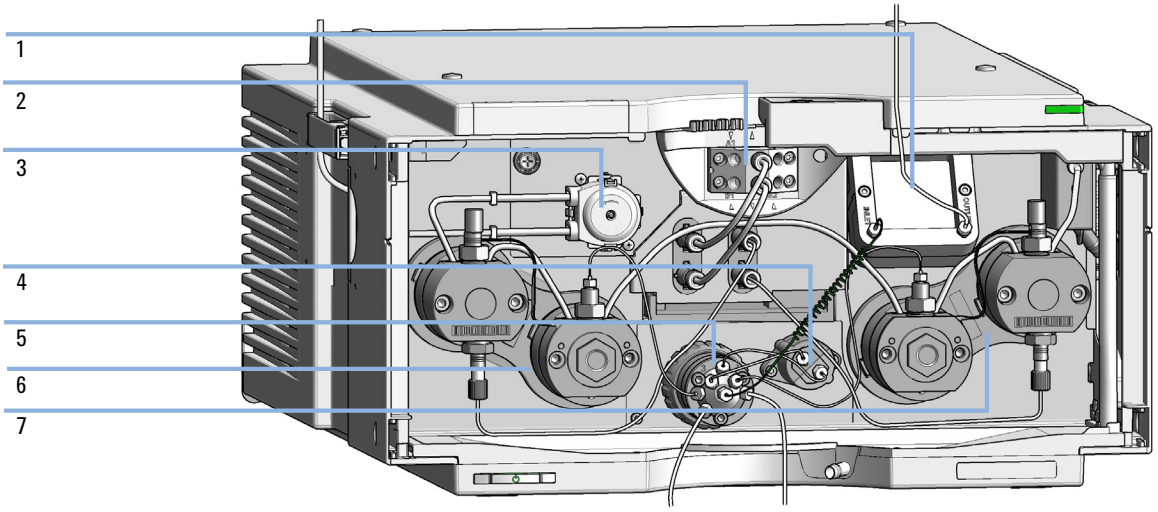


Figure 15 Overview of main assemblies (G7120A)

Item	p/n	Description
1	G7120-68135	Jet Weaver 35 µL/100 µL
1	G7120-68380	Jet Weaver 380 µL
2	G7120-60029	SSV Valve Assembly
3	5065-4445	Peristaltic pump with PharMed tubing
4	G7104-60001	Pressure sensor 1300 bar
5	5067-4236	Purge valve head
6	G4220-60350	Long Life Pump Head Channel A
7	G4220-60360	Long Life Pump Head Channel B

Overview of Maintenance Parts (G7132A)

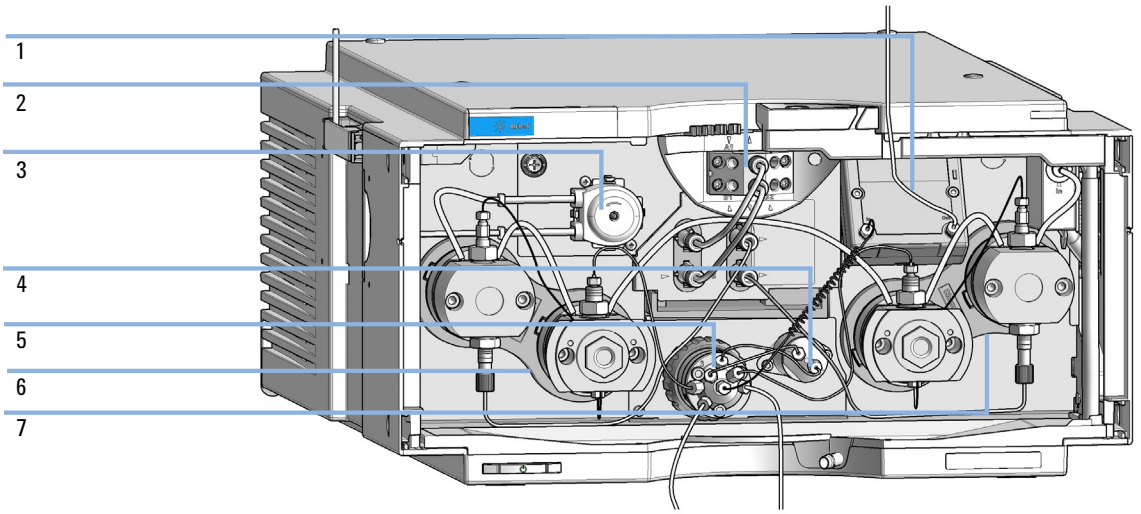


Figure 16 Overview of main assemblies (G7132A)

Item	p/n	Description
1	G7132-68135	Jet Weaver 35 µL/100 µL Bio-Compatible
2	G7120-60029	SSV Valve Assembly
3	5065-4445	Peristaltic pump with PharMed tubing
4	5067-7010	Pressure sensor Bio-Compatible 1300 bar
5	5067-6736	Bio-Compatible purge valve head
6	G4220-60350	Long Life Pump Head Channel A
7	G4220-60360	Long Life Pump Head Channel B

Flow Connections (G7120A)

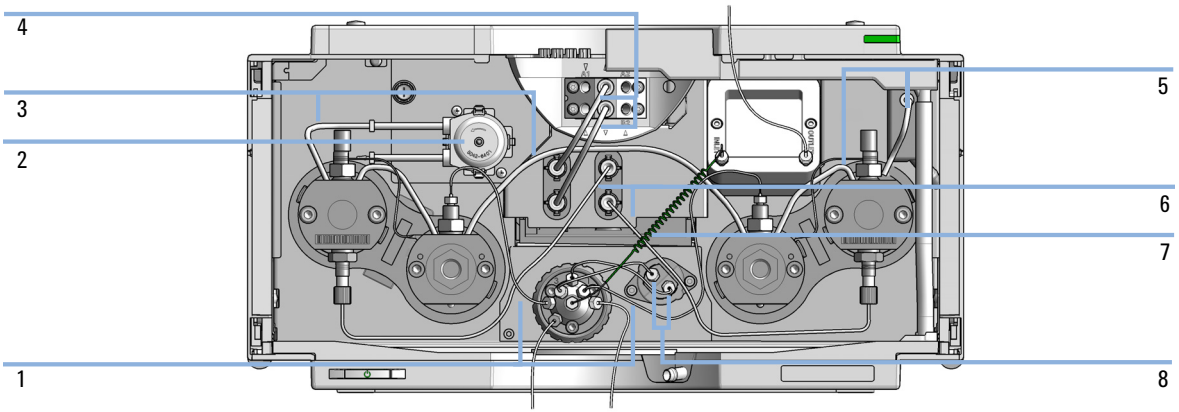


Figure 17 Flow connections of the High-Speed Pump (G7120A)

Item	#	p/n	Description
1	2	5067-4655	Capillary ST 0.25 mm x 250 mm purge valve to pump head assemblies channel A and B
2	1	5065-4445	Peristaltic pump with PharMed tubing
3, 5	1	5065-9978	Tubing, 1 mm i.d., 3 mm o.d., silicone, 5 m
4	2	G4220-60035	Tubing kit 140 mm, 2/pk SSV to shutoff valve or degassing unit
6	1	5067-4661	Tubing kit 270 mm for connection of degassing unit to inlet valve (set of 2 tubes)
7	1	G4220-87000	Capillary ST 0.17 mm x 300 mm Valve to Jet Weaver
8	2	01090-87308	Capillary ST 0.25 mm x 130 mm purge valve to pressure sensor
	1	G7120-40004	Valve Holder Left (not shown)
	4	5067-4124	Shutoff valve (not shown)
	4	G7120-60007	Bottle Head Assembly (not shown)
	1	G7120-68070	Ultra Clean Tubing Kit (includes bottle head assemblies and tubing connections within the pump)
	2	G4220-60070	Tubing Kit 140 mm - Ultra Clean Tubing (tubes from SSV to shutoff valve or degassing unit to MCGV)
	4	G7120-60017	Bottle Head Assembly Ultra Clean Tubing (bottle heads and tubing to shutoff panel / degasser)
	1	5067-6871	Solvent Cabinet Kit (not shown)

Flow Connections (G7132A)

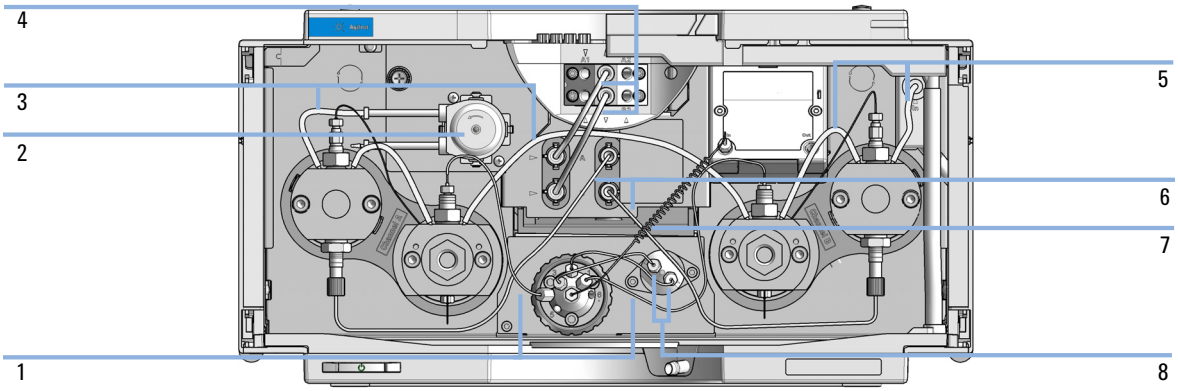


Figure 18 Flow connections of the High-Speed Pump (G7132A)

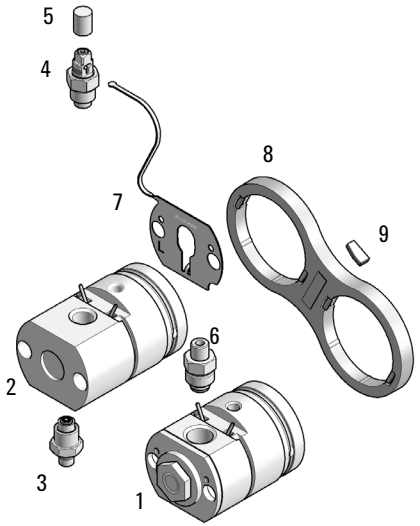
Item	#	p/n	Description
1	2	5500-1420	Bio-Compatible capillary MP35N 0.25 mm x 250 mm purge valve to pump head assemblies channel A and B
2	1	5065-4445	Peristaltic pump with PharMed tubing
3, 5	1	5065-9978	Tubing, 1 mm i.d., 3 mm o.d., silicone, 5 m
4	2	G4220-60035	Tubing kit 140 mm, 2/pk SSV to shutoff valve or degassing unit
6	1	5067-4661	Tubing kit 270 mm for connection of degassing unit to inlet valve (set of 2 tubes)
7	1	G7132-60002	Bio-Compatible capillary MP35N 0.17 mm x 300 mm Valve to Jet Weaver
8	2	5500-1421	Bio-Compatible capillary MP35N 0.25 mm x 130 mm purge valve to pressure sensor
	1	G7120-40004	Valve Holder Left (not shown)
	4	5067-4124	Shutoff valve (not shown)
	4	G7120-60007	Bottle Head Assembly (not shown)
	1	G7120-68070	Ultra Clean Tubing Kit (includes bottle head assemblies and tubing connections within the pump)
	2	G4220-60070	Tubing Kit 140 mm - Ultra Clean Tubing (tubes from SSV to shutoff valve or degassing unit to MCGV)
	4	G7120-60017	Bottle Head Assembly Ultra Clean Tubing (bottle heads and tubing to shutoff panel / degasser)
	1	5067-6871	Solvent Cabinet Kit (not shown)

Pump Heads (G7120A)

The following pages contain parts information for LongLife Pump Heads.

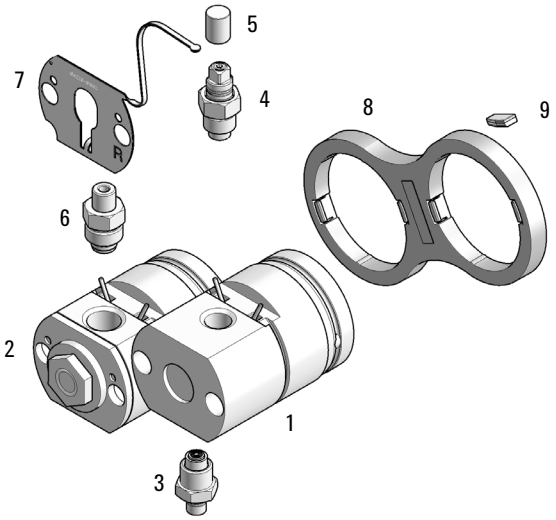
For parts information on other pump head types, please refer to Agilent 1290 Infinity II Easy Maintenance Pump Head Technical Note (01200-90120) and to Agilent 1290 Infinity Pump Head Maintenance Technical Note (G4220-90122).

Pump Head Assembly Parts



Long Life Pump Head Channel A (G4220-60350)

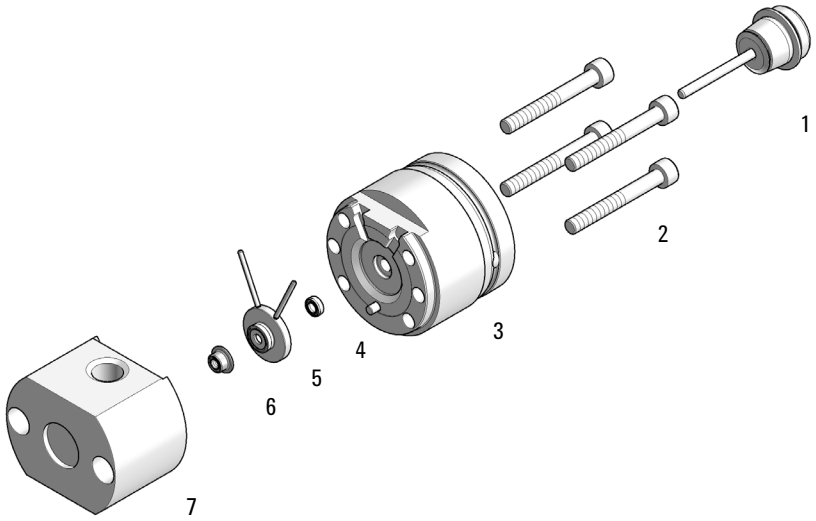
Item	p/n	Description
1	G4220-60660	Secondary Pump Head Assembly Pendulum
2	G4220-60661	Primary Pump Head Assembly Pendulum
3	G4220-60022	Inlet valve (primary pump head)
4	G4220-60028	Outlet valve (primary pump head)
5	5042-9966	Cap Outlet Valve
6	G4280-60026	High Pressure Filter Assembly (secondary pump head)
7	G4220-81013	Heat Exchanger Channel A
8	G4220-40001	Link Plate
9	0960-2971	RF Transponder



Long Life Pump Head Channel B (G4220-60360)

Item	p/n	Description
1	G4220-60660	Secondary Pump Head Assembly Pendulum
2	G4220-60661	Primary Pump Head Assembly Pendulum
3	G4220-60022	Inlet valve (primary pump head)
4	G4220-60028	Outlet valve (primary pump head)
5	5042-9966	Cap Outlet Valve
6	G4280-60026	High Pressure Filter Assembly (secondary pump head)
7	G4220-81012	Heat Exchanger Channel B
8	G4220-40001	Link Plate
9	0960-2971	RF Transponder

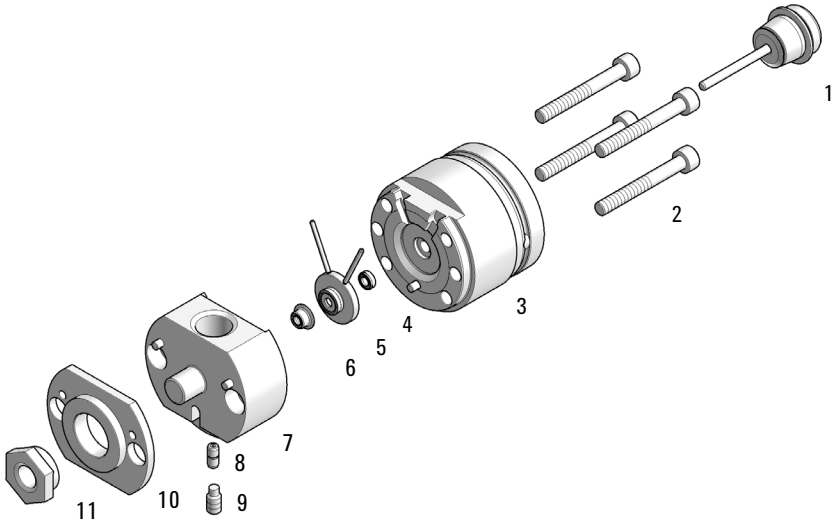
Primary Pump Head Parts



Primary Pump Head Assembly Pendulum (G4220-60661)

Item	p/n	Description
1	5067-5975	Plunger Assy ZrO_2 LL
2	5810-0009	Screw M5x40 A4-80 Lubric Silver
3	G4220-60046	Preload-Support Assembly LL
4	0905-1175	Wash seal (PTFE)
5	G4220-60616	Seal Holder Integrated Assembly EM/LL
6	0905-1719	PE Seal
7	G4220-60533	Body Head Primary EM/LL

Secondary Pump Head Parts



Secondary Pump Head Assembly Pendulum (G4220-60660)

Item	p/n	Description
1	5067-5975	Plunger Assy ZrO_2 LL
2	5810-0009	Screw M5x40 A4-80 Lubric Silver
3	G4220-60046	Preload-Support Assembly LL
4	0905-1175	Wash seal (PTFE)
5	G4220-60616	Seal Holder Integrated Assembly EM/LL
6	0905-1719	PE Seal
7	G4220-25513	Body Head Secondary EM/LL
8	G4220-20001	Spacer Fitting
9	5023-3119	Headless screw for 1290 Infinity pump heads
10	G4220-20000	LID
11	G4220-20003	Pump Head Screw

Pump Heads (G7132A)

Pump Head Assembly Parts

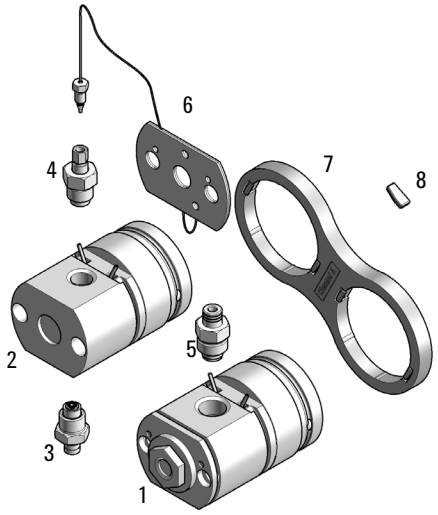


Figure 19 Bio-Compatible Pump Head Channel A

Bio-Compatible Pump Head Channel A

Item	p/n	Description
1	G7132-60640	Secondary Pump Head Assembly Bio-Compatible
2	G7131-60641	Primary Pump Head Assembly Bio-Compatible
3	G7131-60021	Inlet Valve Bio-Compatible (primary pump head)
4	G7131-60028	Outlet Valve Bio-Compatible (primary pump head)
5	G7132-60026	High Pressure Filter Assembly Bio-compatible (secondary pump head)
6	G7131-60005	Heat Exchanger for Bio-Compatible Pump
7	G4220-40001	Link Plate
8	0960-2971	RF Transponder

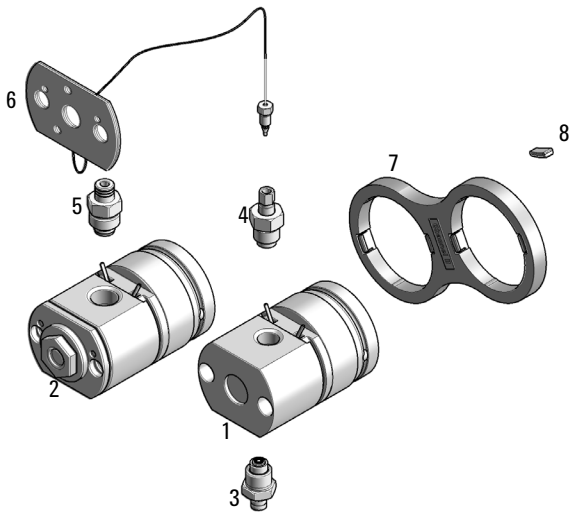


Figure 20 Bio-Compatible Pump Head Channel B

Bio-Compatible Pump Head Channel B

Item	p/n	Description
1	G7132-60640	Secondary Pump Head Assembly Bio-Compatible
2	G7131-60641	Primary Pump Head Assembly Bio-Compatible
3	G7131-60021	Inlet Valve Bio-Compatible (primary pump head)
4	G7131-60028	Outlet Valve Bio-Compatible (primary pump head)
5	G7132-60026	High Pressure Filter Assembly Bio-compatible (secondary pump head)
6	G7131-60005	Heat Exchanger for Bio-Compatible Pump
7	G4220-40001	Link Plate
8	0960-2971	RF Transponder

Primary Pump Head Parts

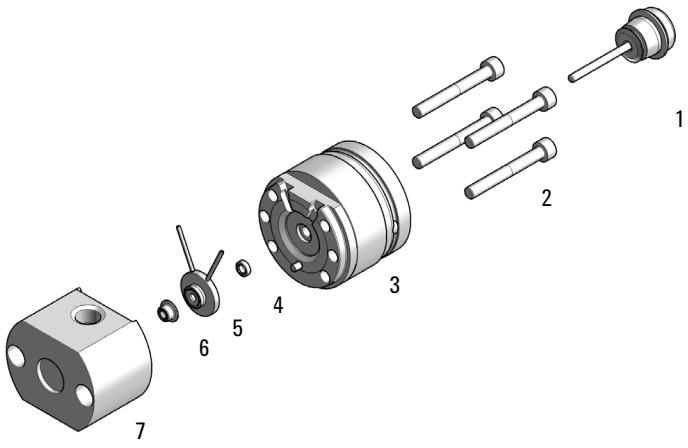


Figure 21 Primary pump head parts (G7132A)

Primary Pump Head Assembly Bio-Compatible (G7131-60641)

Item	p/n	Description
1	5067-5975	Plunger Assy ZrO_2 LL
2	5810-0009	Screw M5x40 A4-80 Lubric Silver
3	G4220-60046	Preload-Support Assembly LL
4	0905-1731	Bio-Inert Wash Seal
5	G7131-60616	Seal Holder Integrated Assembly Bio-Compatible
6	G7131-20009	Seal Bio-Compatible
7	G7131-60533	Body Head Primary Bio-Compatible

Secondary Pump Head Parts

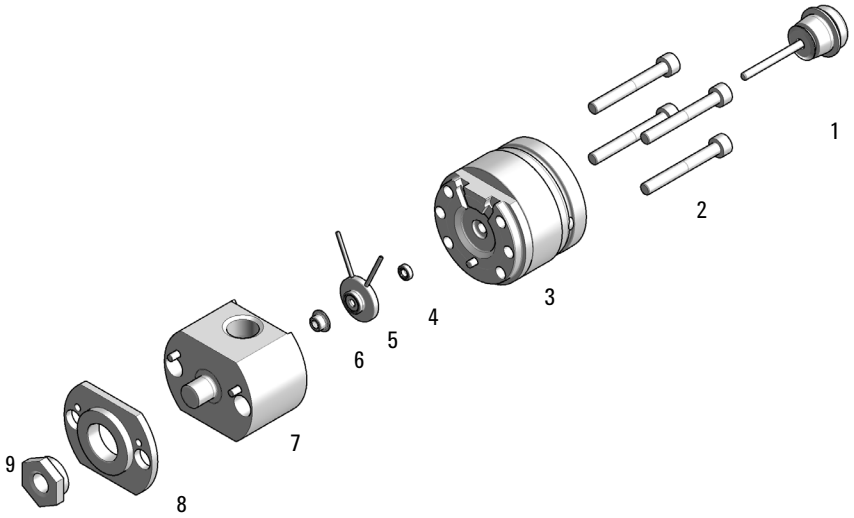
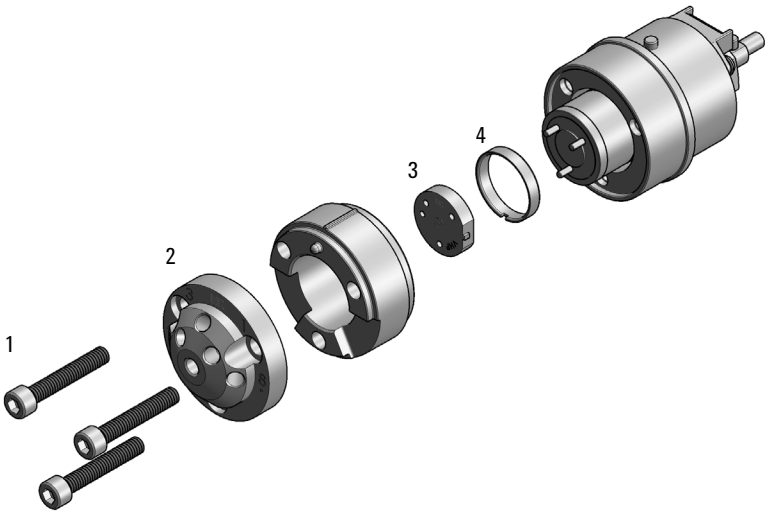


Figure 22 Secondary pump head parts (G7132A)

Secondary Pump Head Assembly Bio-Compatible (G7132-60640)

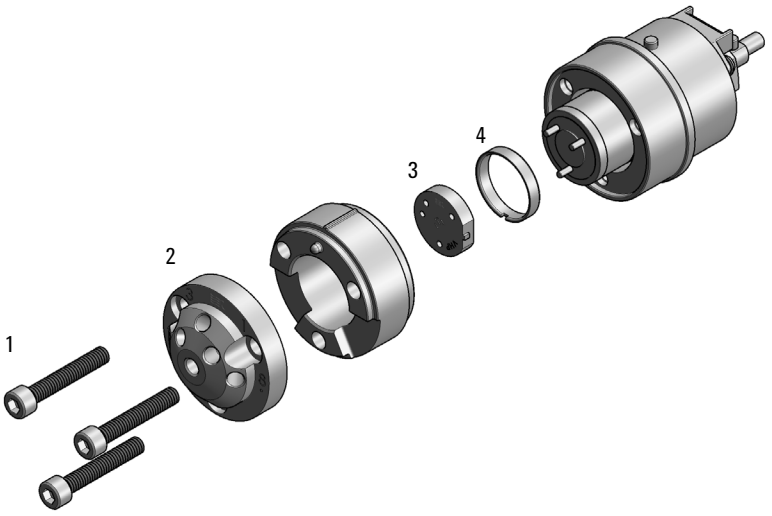
Item	p/n	Description
1	5067-5975	Plunger Assy ZrO_2 LL
2	5810-0009	Screw M5x40 A4-80 Lubric Silver
3	G4220-60046	Preload-Support Assembly LL
4	0905-1731	Bio-Inert Wash Seal
5	G7131-60616	Seal Holder Integrated Assembly Bio-Compatible
6	G7131-20009	Seal Bio-Compatible
7	G7132-60000	Body Head Secondary Bio-Compatible
8	G4220-20000	LID
9	G4220-20003	Pump Head Screw

Purge Valve (G7120A)



Item	p/n	Description
	5067-4236	Purge valve head
1	1535-4857	Stator screws
2	5068-0004	Purge Valve Stator
3	5068-0201	Purge Valve Rotor Seal, PEEK, 1300 bar
4	1535-4045	Bearing ring

Purge Valve (G7132A)



Item	p/n	Description
	5067-6736	Bio-Compatible purge valve head
1	5428-0006	Stator screws
2	5068-0376	Purge Valve Stator Bio-Compatible
3	5068-0377	Purge Valve Rotor Seal, MP35N, 1300 bar Bio-Compatible

Cover Parts

p/n	Description
G7120-68713	Cabinet Kit Infinity II 200 (including top, bottom, and side + 1260 and 1290 Name Plates)
5043-0856	Leak Adapter (not shown)
5067-5767	Door assy 200 left IF II
5067-5768	Door assy 200 right IF II

Accessory Kit (G7120A)

Accessory kit (G7120-68705) contains the following parts:

p/n	Description
G4220-67000	Waste Tubing with Fitting
5043-1013	Tubing Clip
5067-4124	Shutoff valve
5500-1246	Capillary ST 0.17 mm x 500 mm SI/SI
5181-1519	CAN cable, Agilent module to module, 1 m
5500-1155	Tube Connector, 90 degree, ID 6.4
9301-1337	Syringe adapter
9301-6476	Syringe with luerlock 5 mL Polypropylene
G4220-60035	Tubing kit 140 mm, 2/pk
5063-6527	Tubing, Silicon Rubber, 1.2 m, ID/OD 6/9 mm
5500-1156	T-Tube Connector ID6.4
5500-1169	Y Tube Connector ID 6.4
5500-1217	Capillary, ST, 0.17 mm x 900 mm SI/SX
G7120-60005	Valve Holder left assembly INF II
01200-90091	1290 Infinity Pump Quick Reference Sheet
5067-6197	Seal Handling Device
5043-1400	Pump Head Holder

Accessory Kit (G7132A)

Accessory kit Bio-Compatible (G7132-68705) contains the following parts:

p/n	Description
G4220-67000	Waste Tubing with Fitting
5043-1013	Tubing Clip
5067-4124	Shutoff valve
5500-1419	Capillary MP35N 0.17 mm x 500 mm, SI/SI
5181-1519	CAN cable, Agilent module to module, 1 m
5500-1155	Tube Connector, 90 degree, ID 6.4
9301-1337	Syringe adapter
9301-6476	Syringe with luerlock 5 mL Polypropylene
G4220-60035	Tubing kit 140 mm, 2/pk
5063-6527	Tubing, Silicon Rubber, 1.2 m, ID/OD 6/9 mm
5500-1156	T-Tube Connector ID6.4
5500-1169	Y Tube Connector ID 6.4
5500-1282	Bio-Compatible Capillary, MP35N, 0.17 mm x 900 mm SI/SX
G7120-60005	Valve Holder left assembly INF II
01200-90091	1290 Infinity Pump Quick Reference Sheet
5067-6197	Seal Handling Device
G7132-42000	Bio Pump Head Holder

HPLC System Tool Kit

10 Identifying Cables

This chapter provides information on cables used with the modules.

Cable Overview

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

Analog cables

p/n	Description
35900-60750	Agilent 35900A A/D converter
01046-60105	Analog cable (BNC to general purpose, spade lugs)

Remote cables

p/n	Description
5188-8029	ERI to general purpose
5188-8044	Remote Cable ERI – ERI
5188-8045	Remote Cable APG – ERI
5188-8059	ERI-Extension-Cable 1.2 m
5061-3378	Remote Cable to 35900 A/D converter
01046-60201	Agilent module to general purpose
5188-8057	Fraction Collection ERI remote Y-cable

CAN cables

p/n	Description
5181-1516	CAN cable, Agilent module to module, 0.5 m
5181-1519	CAN cable, Agilent module to module, 1 m

LAN cables

p/n	Description
5023-0203	Cross-over network cable, shielded, 3 m (for point to point connection)
5023-0202	Twisted pair network cable, shielded, 7 m (for point to point connection)

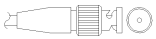
RS-232 cables (not for FUSION board)

p/n	Description
RS232-61601	RS-232 cable, 2.5 m Instrument to PC, 9-to-9 pin (female). This cable has special pin-out, and is not compatible with connecting printers and plotters. It is also called "Null Modem Cable" with full handshaking where the wiring is made between pins 1-1, 2-3, 3-2, 4-6, 5-5, 6-4, 7-8, 8-7, 9-9.
5181-1561	RS-232 cable, 8 m

USB cables

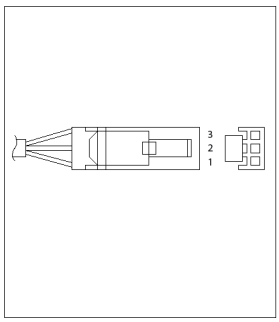
p/n	Description
5188-8050	USB A M-USB Mini B 3 m (PC-Module)
5188-8049	USB A F-USB Mini B M OTG (Module to Flash Drive)

Analog Cables

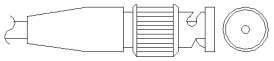


One end of these cables provides a BNC connector to be connected to Agilent modules. The other end depends on the instrument to which connection is being made.

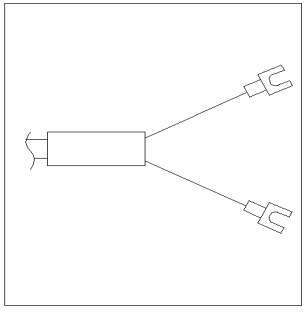
Agilent Module to 35900 A/D converters

p/n 35900-60750	35900	Pin Agilent module	Signal Name
	1		Not connected
	2	Shield	Analog -
	3	Center	Analog +

Agilent Module to BNC Connector

p/n 8120-1840	Pin BNC	Pin Agilent module	Signal Name
	Shield	Shield	Analog -
	Center	Center	Analog +

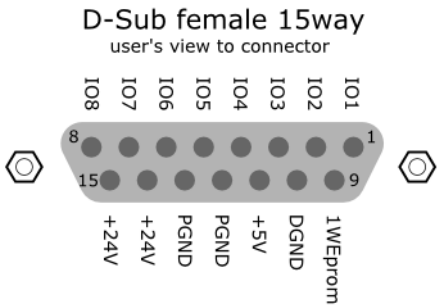
Agilent Module to General Purpose

p/n 01046-60105	Pin	Pin Agilent module	Signal Name
	1		Not connected
	2	Black	Analog -
	3	Red	Analog +

Remote Cables

ERI (Enhanced Remote Interface)

- 5188-8029 ERI to general purpose (D-Sub 15 pin male - open end)
- 5188-8044 ERI to ERI (D_Sub 15 pin male - male)
- 5188-8059 ERI-Extension-Cable 1.2 m (D-Sub15 pin male / female)

p/n 5188-8029	pin	Color code	Enhanced Remote	Classic Remote	Active (TTL)
	1	white	IO1	START REQUEST	Low
	2	brown	IO2	STOP	Low
	3	green	IO3	READY	High
	4	yellow	IO4	POWER ON	High
	5	grey	IO5	NOT USED	
	6	pink	IO6	SHUT DOWN	Low
	7	blue	IO7	START	Low
	8	red	IO8	PREPARE	Low
	9	black	1wire DATA		
	10	violet	DGND		
	11	grey-pink	+5V ERI out		
	12	red-blue	PGND		
	13	white-green	PGND		
	14	brown-green	+24V ERI out		
	15	white-yellow	+24V ERI out		
	NC	yellow-brown			

- 5188-8045 ERI to APG (Connector D_Subminiature 15 pin (ERI), Connector D_Subminiature 9 pin (APG))

p/n 5188-8045	Pin (ERI)	Signal	Pin (APG)	Active (TTL)
	10	GND	1	
	1	Start Request	9	Low
	2	Stop	8	Low
	3	Ready	7	High
	5	Power on	6	High
	4	Future	5	
	6	Shut Down	4	Low
	7	Start	3	Low
	8	Prepare	2	Low
	Ground	Cable Shielding	NC	

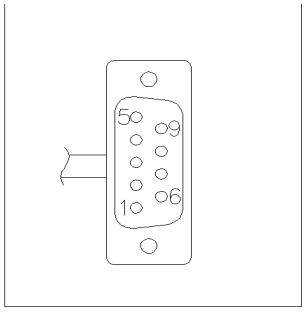
- 5188-8057 ERI to APG and RJ45 (Connector D_Subminiature 15 pin (ERI), Connector D_Subminiature 9 pin (APG), Connector plug Cat5e (RJ45))

Table 19 5188-8057 ERI to APG and RJ45

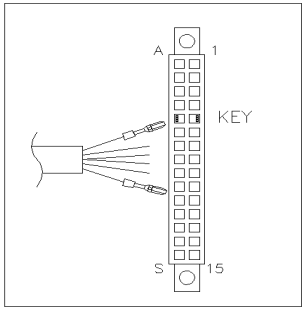
p/n 5188-8057	Pin (ERI)	Signal	Pin (APG)	Active (TTL)	Pin (RJ45)
					
	10	GND	1		5
	1	Start Request	9	High	
	2	Stop	8	High	
	3	Ready	7	High	
	4	Fraction Trig-ger	5	High	4
	5	Power on	6	High	
	6	Shut Down	4	High	
	7	Start	3	High	
	8	Prepare	2	High	
	Ground	Cable Shield-ing	NC		

One end of these cables provides a Agilent Technologies APG (Analytical Products Group) remote connector to be connected to Agilent modules. The other end depends on the instrument to be connected to.

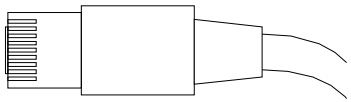
Agilent Module to Agilent 35900 A/D Converters

p/n 5061-3378	Pin 35900 A/D	Pin Agilent module	Signal Name	Active (TTL)
	1 - White	1 - White	Digital ground	
	2 - Brown	2 - Brown	Prepare run	Low
	3 - Gray	3 - Gray	Start	Low
	4 - Blue	4 - Blue	Shut down	Low
	5 - Pink	5 - Pink	Not connected	
	6 - Yellow	6 - Yellow	Power on	High
	7 - Red	7 - Red	Ready	High
	8 - Green	8 - Green	Stop	Low
	9 - Black	9 - Black	Start request	Low

Agilent Module to General Purpose

p/n 01046-60201	Wire Color	Pin Agilent module	Signal Name	Active (TTL)
	White	1	Digital ground	
	Brown	2	Prepare run	Low
	Gray	3	Start	Low
	Blue	4	Shut down	Low
	Pink	5	Not connected	
	Yellow	6	Power on	High
	Red	7	Ready	High
	Green	8	Stop	Low
	Black	9	Start request	Low

CAN/LAN Cables



Both ends of this cable provide a modular plug to be connected to Agilent modules CAN or LAN connectors.

CAN Cables

p/n	Description
5181-1516	CAN cable, Agilent module to module, 0.5 m
5181-1519	CAN cable, Agilent module to module, 1 m

LAN Cables

p/n	Description
5023-0203	Cross-over network cable, shielded, 3 m (for point to point connection)
5023-0202	Twisted pair network cable, shielded, 7 m (for point to point connection)

Agilent Module to PC

p/n	Description
RS232-61601	RS-232 cable, 2.5 m Instrument to PC, 9-to-9 pin (female). This cable has special pin-out, and is not compatible with connecting printers and plotters. It is also called "Null Modem Cable" with full handshaking where the wiring is made between pins 1-1, 2-3, 3-2, 4-6, 5-5, 6-4, 7-8, 8-7, 9-9.
5181-1561	RS-232 cable, 8 m

USB

To connect a USB Flash Drive use a USB OTG cable with Mini-B plug and A socket.

p/n	Description
5188-8050	USB A M-USB Mini B 3 m (PC-Module)
5188-8049	USB A F-USB Mini B M OTG (Module to Flash Drive)

11 Hardware Information

This chapter describes the pump in more detail on hardware and electronics.

Firmware Description

The firmware of the instrument consists of two independent sections:

- a non-instrument specific section, called *resident system*
- an instrument specific section, called *main system*

Resident System

This resident section of the firmware is identical for all Agilent 1100/1200/1220/1260/1290 series modules. Its properties are:

- the complete communication capabilities (CAN, LAN, USB and RS- 232)
- memory management
- ability to update the firmware of the 'main system'

Main System

Its properties are:

- the complete communication capabilities (CAN, LAN, USB and RS- 232)
- memory management
- ability to update the firmware of the 'resident system'

In addition the main system comprises the instrument functions that are divided into common functions like

- run synchronization through APG/ERI remote,
- error handling,
- diagnostic functions,
- or module specific functions like
  - internal events such as lamp control, filter movements,
  - raw data collection and conversion to absorbance.

Firmware Updates

Firmware updates can be done with the Agilent Lab Advisor software with files on the hard disk (latest version should be used).

Required tools, firmware and documentation are available from the Agilent web:
http://www.agilent.com/en-us/firmwareDownload?whid=69761

The file naming conventions are:

PPPP_RVVV_XXX.dlb, where

- PPPP is the product number, for example, 1315B for the G1315B DAD,
- R the firmware revision, for example, A for G1315B or B for the G1315C DAD,
- VVV is the revision number, for example 650 is revision 6.50,
- XXX is the build number of the firmware.

For instructions on firmware updates refer to section *Replacing Firmware* in chapter *"Maintenance"* or use the documentation provided with the *Firmware Update Tools*.

NOTE

Update of main system can be done in the resident system only. Update of the resident system can be done in the main system only.

Main and resident firmware must be from the same set.

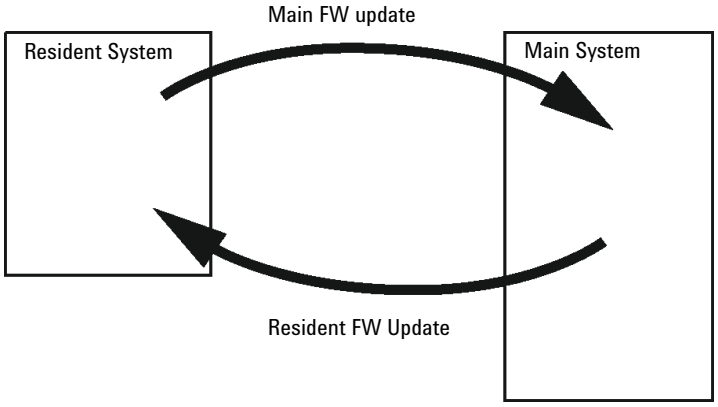


Figure 23 Firmware Update Mechanism

NOTE

Some modules are limited in downgrading due to their mainboard version or their initial firmware revision. For example, a G1315C DAD SL cannot be downgraded below firmware revision B.01.02 or to a A.xx.xx.

Some modules can be re-branded (e.g. G1314C to G1314B) to allow operation in specific control software environments. In this case, the feature set of the target type is used and the feature set of the original one is lost. After re-branding (e.g. from G1314B to G1314C), the original feature set is available again.

All this specific information is described in the documentation provided with the firmware update tools.

The firmware update tools, firmware and documentation are available from the Agilent web.

- **http://www.agilent.com/en-us/firmwareDownload?whid=69761**

Electrical Connections

- The CAN bus is a serial bus with high speed data transfer. The two connectors for the CAN bus are used for internal module data transfer and synchronization.
- The REMOTE connector may be used in combination with other analytical instruments from Agilent Technologies if you want to use features such as start, stop, common shut down, prepare, and so on.
- With the appropriate software, the RS-232C connector may be used to control the module from a computer through a RS-232C connection. This connector is activated and can be configured with the configuration switch.
- The power input socket accepts a line voltage of 100 – 240 VAC ± 10 % with a line frequency of 50 or 60 Hz. Maximum power consumption varies by module. There is no voltage selector on your module because the power supply has wide-ranging capability. There are no externally accessible fuses, because automatic electronic fuses are implemented in the power supply.

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

Serial Number Information

The serial number information on the instrument labels provide the following information:

CCXZZ00000	Format
CC	Country of manufacturing • DE = Germany • JP = Japan • CN = China
X	Alphabetic character A-Z (used by manufacturing)
ZZ	Alpha-numeric code 0-9, A-Z, where each combination unambiguously denotes a module (there can be more than one code for the same module)
00000	Serial number

Rear View of the Module

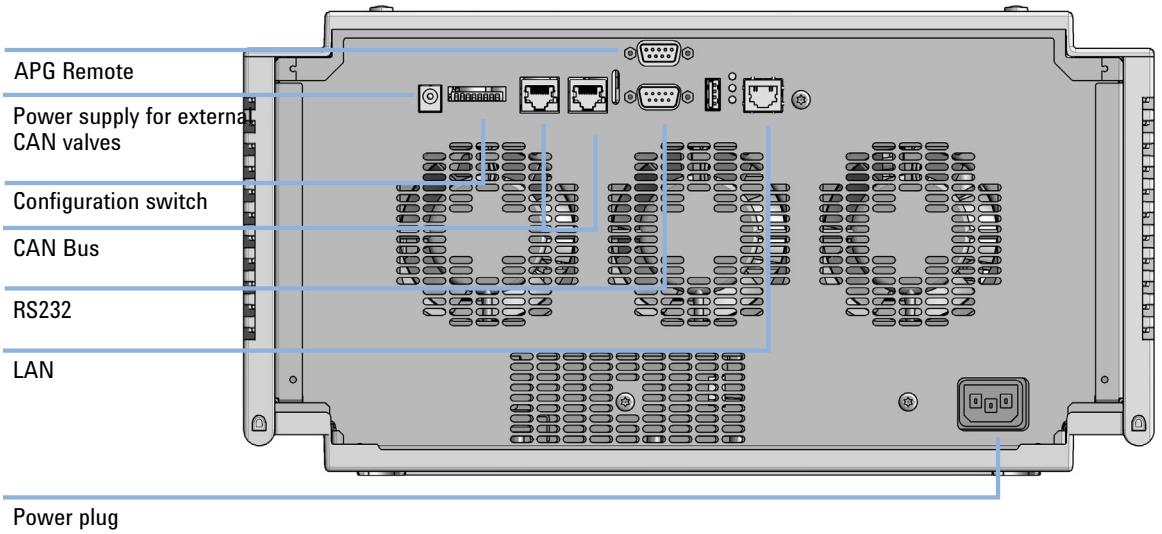


Figure 24 Rear view of the High-Speed Pump

Interfaces

The Agilent InfinityLab LC Series modules provide the following interfaces:

Table 20 Agilent InfinityLab LC Series Interfaces

Module	CAN	USB	LAN (on-board)	RS-232	Analog	APG (A) / ERI (E)	Special
Pumps							
G7104A/C	2	No	Yes	Yes	1	A	
G7110B	2	Yes	Yes	No	No	E	
G7111A/B, G5654A	2	Yes	Yes	No	No	E	
G7112B	2	Yes	Yes	No	No	E	
G7120A, G7132A	2	No	Yes	Yes	1	A	
G7161A/B	2	Yes	Yes	No	No	E	
Samplers							
G7129A/B/C	2	Yes	Yes	No	No	E	
G7167A/B, G7137A, G5668A	2	Yes	Yes	No	No	E	
G7157A	2	Yes	Yes	No	No	E	
Detectors							
G7114A/B	2	Yes	Yes	No	1	E	
G7115A	2	Yes	Yes	No	1	E	
G7117A/B/C	2	Yes	Yes	No	1	E	
G7121A/B	2	Yes	Yes	No	1	E	
G7162A/B	2	Yes	Yes	No	1	E	
G7165A	2	Yes	Yes	No	1	E	

Table 20 Agilent InfinityLab LC Series Interfaces

Module	CAN	USB	LAN (on-board)	RS-232	Analog	APG (A) / ERI (E)	Special
Fraction Collectors							
G7158B	2	Yes	Yes	No	No	E	
G7159B	2	Yes	Yes	No	No	E	
G7166A	2	No	No	No	No	No	Requires a host module with on-board LAN with minimum FW B.06.40 or C.06.40, or with additional G1369C LAN Card
G1364E/F, G5664B	2	Yes	Yes	No	No	E	THERMOSTAT for G1330B
Others							
G7116A/B	2	No	No	No	No	No	Requires a host module with on-board LAN or with additional G1369C LAN Card.
G7122A	No	No	No	Yes	No	A	
G7170B	2	No	No	No	No	No	Requires a host module with on-board LAN with minimum FW B.06.40 or C.06.40, or with additional G1369C LAN Card

NOTE The detector (DAD/MWD/FLD/VWD/RID) is the preferred access point for control via LAN. The inter-module communication is done via CAN.

- CAN connectors as interface to other modules
- LAN connector as interface to the control software
- RS-232C as interface to a computer
- USB (Universal Series Bus) as interface to a computer
- REMOTE connector as interface to other Agilent products
- Analog output connector(s) for signal output

Overview Interfaces

CAN

The CAN is inter-module communication interface. It is a 2-wire serial bus system supporting high speed data communication and real-time requirement.

LAN

The modules have either an interface slot for a LAN card (e.g. Agilent G1369B/C LAN Interface) or they have an on-board LAN interface (e.g. detectors G1315C/D DAD and G1365C/D MWD). This interface allows the control of the module/system via a PC with the appropriate control software. Some modules have neither on-board LAN nor an interface slot for a LAN card (e.g. G1170A Valve Drive or G4227A Flexible Cube). These are hosted modules and require a Host module with firmware B.06.40 or later or with additional G1369C LAN Card.

NOTE

If an Agilent detector (DAD/MWD/FLD/VWD/RID) is in the system, the LAN should be connected to the DAD/MWD/FLD/VWD/RID (due to higher data load). If no Agilent detector is part of the system, the LAN interface should be installed in the pump or autosampler.

USB

The USB interface replaces the RS-232 Serial interface in new FUSION generation modules. For details on USB refer to "USB (Universal Serial Bus)" on page 255.

Analog Signal Output

The analog signal output can be distributed to a recording device. For details refer to the description of the module's mainboard.

Remote (ERI)

The ERI (Enhanced Remote Interface) connector may be used in combination with other analytical instruments from Agilent Technologies if you want to use features as common shut down, prepare, and so on.

It allows easy connection between single instruments or systems to ensure coordinated analysis with simple coupling requirements.

The subminiature D connector is used. The module provides one remote connector which is inputs/outputs (wired- or technique).

To provide maximum safety within a distributed analysis system, one line is dedicated to **SHUT DOWN** the system's critical parts in case any module detects a serious problem. To detect whether all participating modules are switched on or properly powered, one line is defined to summarize the **POWER ON** state of all connected modules. Control of analysis is maintained by signal readiness **READY** for next analysis, followed by **START** of run and optional **STOP** of run triggered on the respective lines. In addition **PREPARE** and **START REQUEST** may be issued. The signal levels are defined as:

- standard TTL levels (0 V is logic true, + 5.0 V is false),
- fan-out is 10,
- input load is 2.2 kOhm against + 5.0 V, and
- output are open collector type, inputs/outputs (wired- or technique).

NOTE

All common TTL circuits operate with a 5 V power supply. A TTL signal is defined as "low" or L when between 0 V and 0.8 V and "high" or H when between 2.0 V and 5.0 V (with respect to the ground terminal).

Table 21 ERI signal distribution

Pin	Signal	Description
1	START REQUEST	(L) Request to start injection cycle (for example, by start key on any module). Receiver is the autosampler.
2	STOP	(L) Request to reach system ready state as soon as possible (for example, stop run, abort or finish and stop injection). Receiver is any module performing run-time controlled activities.
3	READY	(H) System is ready for next analysis. Receiver is any sequence controller.
4	POWER ON	(H) All modules connected to system are switched on. Receiver is any module relying on operation of others.
5		Not used
6	SHUT DOWN	(L) System has serious problem (for example, leak: stops pump). Receiver is any module capable to reduce safety risk.
7	START	(L) Request to start run / timetable. Receiver is any module performing run-time controlled activities.
8	PREPARE	(L) Request to prepare for analysis (for example, calibration, detector lamp on). Receiver is any module performing pre-analysis activities.

Special Interfaces

The module includes a DC-Out (24 VDC) power line that is intended to be used with certain modules that operate as CAN slaves, for example external valves. The line has a limited output of 0.5 A (1.7 A as of August 2011) and is self resetting.

USB (Universal Serial Bus)

USB (Universal Serial Bus) - replaces RS232, supports:

- a PC with control software (for example Agilent Lab Advisor)
- USB Flash Disk

Setting the 8-bit Configuration Switch

The 8-bit configuration switch is located at the rear of the module. Switch settings provide configuration parameters for LAN, serial communication protocol and instrument specific initialization procedures.

All modules with on-board LAN:

- Default is ALL switches DOWN (best settings).
  - 19200 baud, 8 data bit / 1 stop bit with no parity for RS-232
- For specific LAN modes switches 3-8 must be set as required.
- For boot/test modes switches 1+2 must be UP plus required mode.

NOTE For normal operation use the default (best) settings.

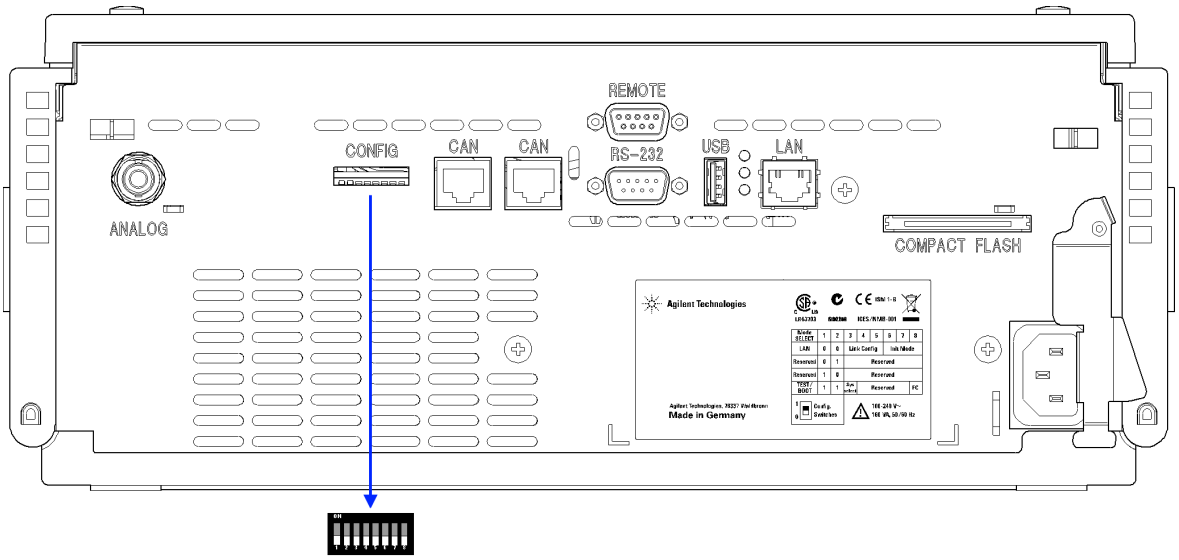


Figure 25 Location of Configuration Switch (example shows a G4212A DAD)

NOTE To perform any LAN configuration, SW1 and SW2 must be set to OFF. For details on the LAN settings/configuration refer to chapter LAN Configuration.

Table 22 8-bit Configuration Switch (with on-board LAN)

	Mode		Function					
	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8
LAN	*0*	*0*	Link Configuration			Init Mode Selection		
Auto-negotiation			*0*	x	x	x	x	x
10 MBit, half-duplex			1	*0*	*0*	x	x	x
10 MBit, full-duplex			1	*0*	1	x	x	x
100 MBit, half-duplex			1	1	*0*	x	x	x
100 MBit, full-duplex			1	1	1	x	x	x
Using Stored			x	x	x	*0*	1	*0*
DHCP			x	x	x	1	*0*	*0*
Using Default			x	x	x	*0*	1	1
TEST	1	1	System					NVRAM
Boot Resident System			1					x
Revert to Default Data (Coldstart)			x	x	x			1

Legend:

0 (switch down), 1 (switch up), x (any position)

NOTE When selecting the mode TEST, the LAN settings are: Auto-Negotiation & Using Stored.

NOTE For explanation of "Boot Resident System" and "Revert to Default Data (Coldstart)" refer to “Special Settings” on page 258.

Special Settings

The special settings are required for specific actions (normally in a service case).

NOTE The tables include both settings for modules – with on-board LAN and without on-board LAN. They are identified as LAN and no LAN.

Boot-Resident

Firmware update procedures may require this mode in case of firmware loading errors (main firmware part).

If you use the following switch settings and power the instrument up again, the instrument firmware stays in the resident mode. It is not operable as a module. It only uses basic functions of the operating system for example, for communication. In this mode the main firmware can be loaded (using update utilities).

Table 23 Boot Resident Settings (On-board LAN)

Mode Select	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
TEST/BOOT	1	1	1	0	0	0	0	0

Forced Cold Start

A forced cold start can be used to bring the module into a defined mode with default parameter settings.

CAUTION

Loss of data

Forced cold start erases all methods and data stored in the non-volatile memory. Exceptions are calibration settings, diagnosis and repair log books which will not be erased.

✓ **Save your methods and data before executing a forced cold start.**

If you use the following switch settings and power the instrument up again, a forced cold start has been completed.

Table 24 Forced Cold Start Settings (On-board LAN)

Mode Select	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
TEST/BOOT	1	1	0	0	0	0	0	1

Early Maintenance Feedback

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

EMF Counters

EMF counters increment with use and can be assigned a maximum limit which provides visual feedback in the user interface when the limit is exceeded. Some counters can be reset to zero after the required maintenance procedure.

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 useful maintenance cycle is dependent on the requirements for use. 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 the default **EMF** limits should be set. When instrument performance indicates maintenance is necessary, take note of the values displayed by the **EMF 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.

Instrument Layout

The industrial design of the module incorporates several innovative features. It uses Agilent's E-PAC concept for the packaging of electronics and mechanical assemblies. This concept is based upon the use of expanded polypropylene (EPP) layers of foam plastic spacers in which the mechanical and electronic boards components of the module are placed. This pack is then housed in a metal inner cabinet which is enclosed by a plastic external cabinet. The advantages of this packaging technology are:

- virtual elimination of fixing screws, bolts or ties, reducing the number of components and increasing the speed of assembly/disassembly,
- the plastic layers have air channels molded into them so that cooling air can be guided exactly to the required locations,
- the plastic layers help cushion the electronic and mechanical parts from physical shock, and
- the metal inner cabinet shields the internal electronics from electromagnetic interference and also helps to reduce or eliminate radio frequency emissions from the instrument itself.

12 LAN Configuration

This chapter provides information on connecting the module to the Agilent ChemStation PC.

What You Have to Do First

The module has an on-board LAN communication interface.

1 Note the MAC (Media Access Control) address for further reference. The MAC or hardware address of the LAN interfaces is a world wide unique identifier. No other network device will have the same hardware address. The MAC address can be found on a label at the rear of the module (see Figure 27 on page 262).

Part number of the pump main board
Revision Code, Vendor, Year and Week of assembly
MAC address
Country of Origin

Figure 26 MAC-Label

2 Connect the instrument's LAN interface (see Figure 27 on page 262) to
- the PC network card using a crossover network cable (point-to-point) or
- a hub or switch using a standard LAN cable.

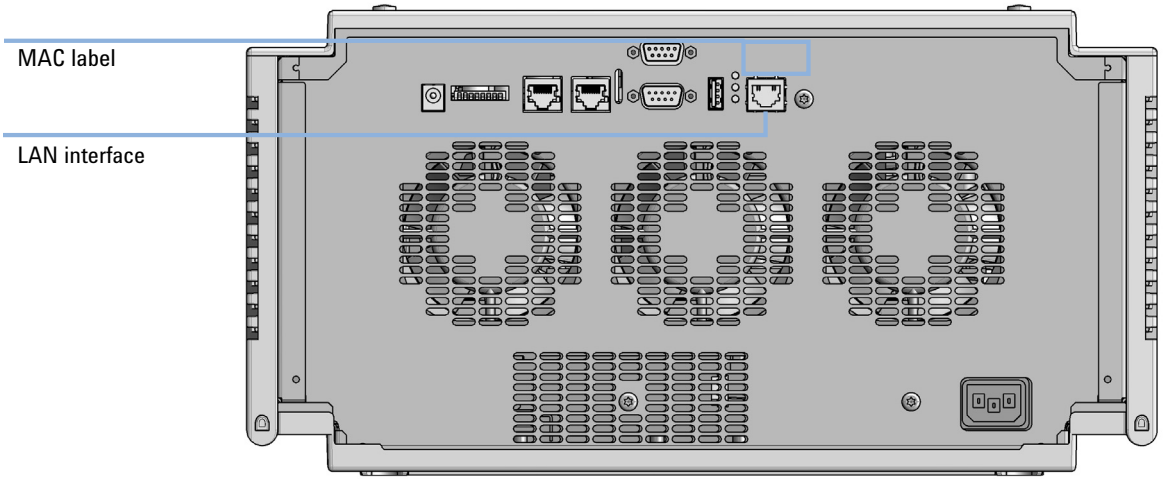


Figure 27 Location of LAN interface and MAC label

TCP/IP parameter configuration

To operate properly in a network environment, the LAN interface must be configured with valid TCP/IP network parameters. These parameters are:

- IP address
- Subnet Mask
- Default Gateway

The TCP/IP parameters can be configured by the following methods:

- by automatically requesting the parameters from a network-based DHCP Server (using the so-called Dynamic Host Configuration Protocol). This mode requires a LAN-onboard Module or a G1369C LAN Interface card, see "Setup (DHCP)" on page 268
- by manually setting the parameters using Telnet
- by manually setting the parameters using the Instant Pilot (G4208A)

The LAN interface differentiates between several initialization modes. The initialization mode (short form 'init mode') defines how to determine the active TCP/IP parameters after power-on. The parameters may be derived from non-volatile memory or initialized with known default values. The initialization mode is selected by the configuration switch, see Table 26 on page 265.

Configuration Switch

The configuration switch can be accessed at the rear of the module.

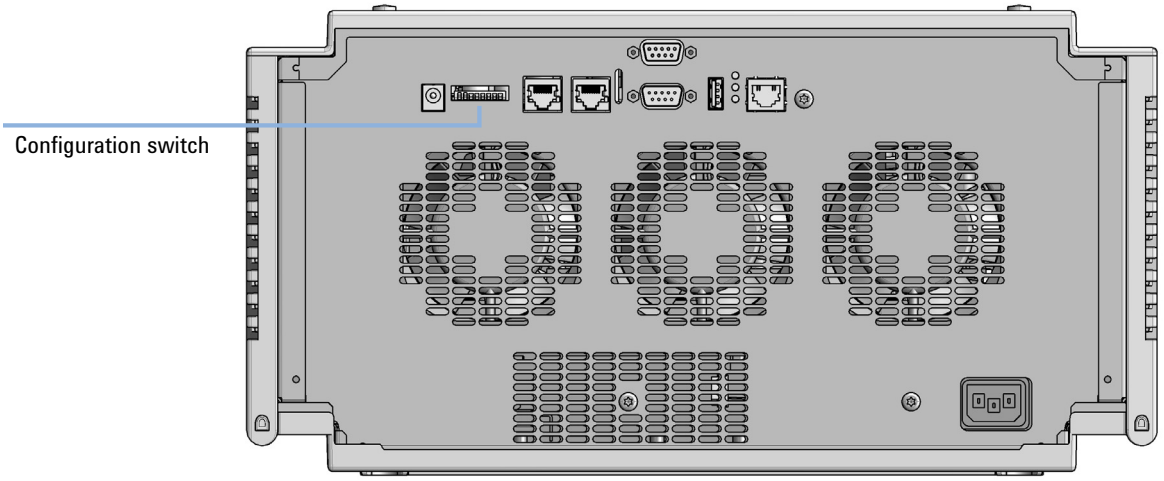


Figure 28 Location of Configuration Switch

The module is shipped with all switches set to OFF, as shown above.

NOTE

To perform any LAN configuration, SW1 and SW2 must be set to OFF.

Table 25 Factory Default Settings

Link Configuration	speed and duplex mode determined by auto-negotiation, for details see "Link configuration selection" on page 270

Initialization mode selection

The following initialization (init) modes are selectable:

Table 26 Initialization Mode Switches

	SW 6	SW 7	SW 8	Init Mode
	OFF	ON	OFF	Using Stored
	OFF	ON	ON	Using Default
	ON	OFF	OFF	DHCP [1]

[1] Requires firmware B.06.40 or above. Modules without LAN on board, see G1369C LAN Interface Card

Using Stored

When initialization mode **Using Stored** is selected, the parameters are taken from the non-volatile memory of the module. The TCP/IP connection will be established using these parameters. The parameters were configured previously by one of the described methods.

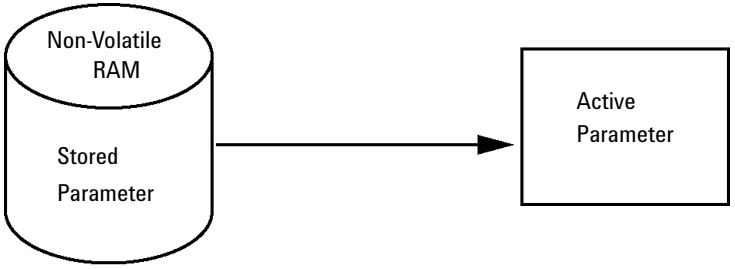


Figure 29 Using Stored (Principle)

Using Default

When **Using Default** is selected, the factory default parameters are taken instead. These parameters enable a TCP/IP connection to the LAN interface without further configuration, see Table 27 on page 266.

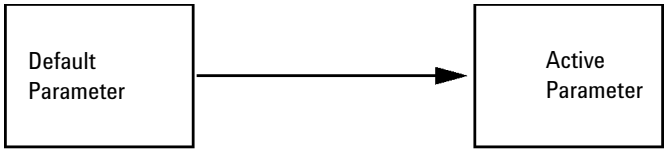


Figure 30 Using Default (Principle)

NOTE

Using the default address in your local area network may result in network problems. Take care and change it to a valid address immediately.

Table 27 Using Default Parameters

IP address:	192.168.254.11
Subnet Mask:	255.255.255.0
Default Gateway	not specified

Since the default IP address is a so-called local address, it will not be routed by any network device. Thus, the PC and the module must reside in the same subnet.

The user may open a Telnet session using the default IP address and change the parameters stored in the non-volatile memory of the module. He may then close the session, select the initialization mode Using Stored, power-on again and establish the TCP/IP connection using the new parameters.

When the module is wired to the PC directly (e.g. using a cross-over cable or a local hub), separated from the local area network, the user may simply keep the default parameters to establish the TCP/IP connection.

NOTE

In the **Using Default** mode, the parameters stored in the memory of the module are not cleared automatically. If not changed by the user, they are still available, when switching back to the mode Using Stored.

Dynamic Host Configuration Protocol (DHCP)

General Information (DHCP)

The Dynamic Host Configuration Protocol (DHCP) is an auto configuration protocol used on IP networks. The DHCP functionality is available on all Agilent HPLC modules with on-board LAN Interface or LAN Interface Card G1369C, and “B”-firmware (B.06.40 or above) or modules with "D"-firmware. All modules should use latest firmware from the same set.

When the initialization mode “DHCP” is selected, the card tries to download the parameters from a DHCP Server. The parameters obtained become the active parameters immediately. They are not stored to the non-volatile memory of the card.

Besides requesting the network parameters, the card also submits its hostname to the DHCP Server. The hostname equals the MAC address of the card, e.g. *0030d3177321*. It is the DHCP server's responsibility to forward the hostname/address information to the Domain Name Server. The card does not offer any services for hostname resolution (e.g. NetBIOS).

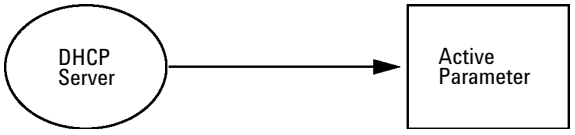


Figure 31 DHCP (Principle)

NOTE

1. It may take some time until the DHCP server has updated the DNS server with the hostname information.
2. It may be necessary to fully qualify the hostname with the DNS suffix, e.g. *0030d3177321.country.company.com*.
3. The DHCP server may reject the hostname proposed by the card and assign a name following local naming conventions.

Setup (DHCP)

The DHCP functionality is available on all Agilent HPLC modules with on-board LAN Interface or LAN Interface Card G1369C, and "B"-firmware (B.06.40 or above) or modules with "D"-firmware. All modules should use latest firmware from the same set.

1 Note the MAC address of the LAN interface (provided with G1369C LAN Interface Card or mainboard). This MAC address is on a label on the card or at the rear of the mainboard, for example, *0030d3177321*.

On the Local Controller the MAC address can be found under **Details** in the LAN section.

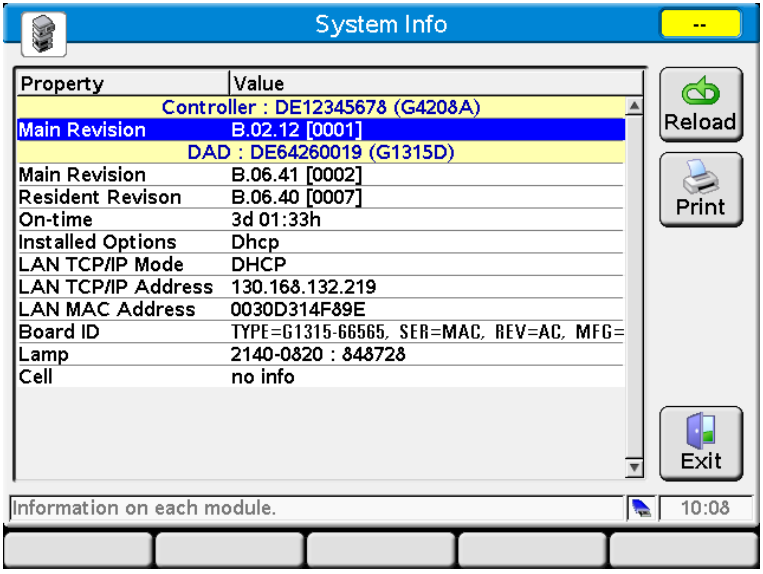


Figure 32 LAN Setting on Instant Pilot

2 Set the configuration switch to DHCP either on the G1369C LAN Interface Card or the mainboard of above mentioned modules.

Table 28 G1369C LAN Interface Card (configuration switch on the card)

SW 4	SW 5	SW 6	SW 7	SW 8	Initialization Mode
ON	OFF	OFF	OFF	OFF	DHCP

Table 29 LC Modules with 8-bit configuration switch (B-firmware) (configuration switch at rear of the instrument)

SW 6	SW 7	SW 8	Initialization Mode
ON	OFF	OFF	DHCP

3 Turn on the module that hosts the LAN interface.

4 Configure your Control Software (e.g. OpenLAB CDS ChemStation Edition, Lab Advisor, Firmware Update Tool) and use MAC address as host name, e.g. *0030d3177321*.

The LC system should become visible in the control software (see Note in section "General Information (DHCP)" on page 267).

Link configuration selection

The LAN interface supports 10 or 100 Mbps operation in full- or half-duplex modes. In most cases, full-duplex is supported when the connecting network device - such as a network switch or hub - supports IEEE 802.3u auto-negotiation specifications.

When connecting to network devices that do not support auto-negotiation, the LAN interface will configure itself for 10- or 100-Mbps half-duplex operation.

For example, when connected to a non-negotiating 10-Mbps hub, the LAN interface will be automatically set to operate at 10-Mbps half-duplex.

If the module is not able to connect to the network through auto-negotiation, you can manually set the link operating mode using link configuration switches on the module.

Table 30 Link Configuration Switches

	SW 3	SW 4	SW 5	Link Configuration
	OFF	-	-	speed and duplex mode determined by auto-negotiation
	ON	OFF	OFF	manually set to 10 Mbps, half-duplex
	ON	OFF	ON	manually set to 10 Mbps, full-duplex
	ON	ON	OFF	manually set to 100 Mbps, half-duplex
	ON	ON	ON	manually set to 100 Mbps, full-duplex

Manual Configuration

Manual configuration only alters the set of parameters stored in the non-volatile memory of the module. It never affects the currently active parameters. Therefore, manual configuration can be done at any time. A power cycle is mandatory to make the stored parameters become the active parameters, given that the initialization mode selection switches are allowing it.

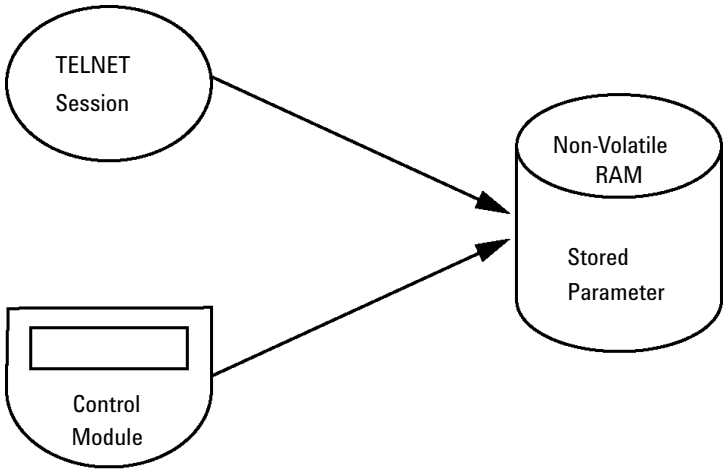


Figure 33 Manual Configuration (Principle)

With Telnet

Whenever a TCP/IP connection to the module is possible (TCP/IP parameters set by any method), the parameters may be altered by opening a Telnet session.

1 Open the system (DOS) prompt window by clicking on Windows **START** button and select **"Run..."**. Type "cmd" and press OK.

2 Type the following at the system (DOS) prompt:

- `c:\>telnet <IP address>` or
- `c:\>telnet <host name>`

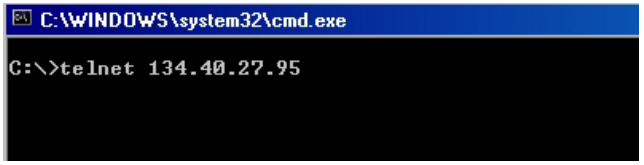


Figure 34 Telnet - Starting a session

where <IP address> may be the assigned address from a Bootp cycle, a configuration session with the Handheld Controller, or the default IP address (see "Configuration Switch" on page 264).

When the connection was established successfully, the module responds with the following:

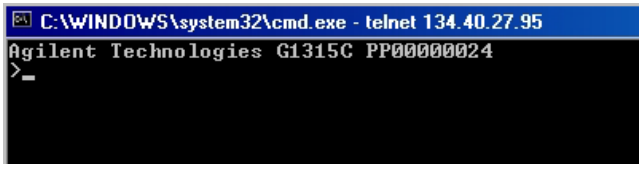


Figure 35 A connection to the module is made

3 Type
? and press enter to see the available commands.

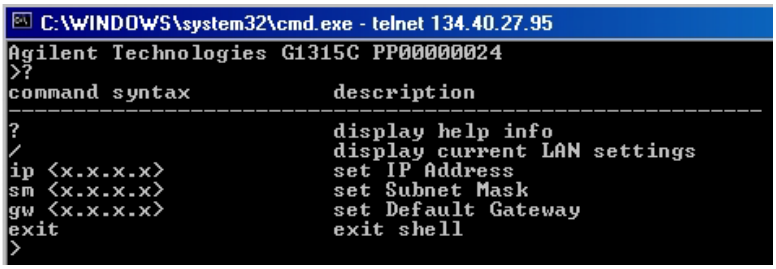


Figure 36 Telnet Commands

Table 31 Telnet Commands

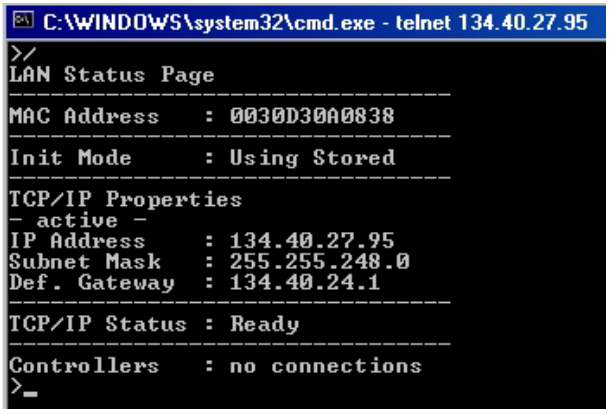
Value	Description
?	displays syntax and descriptions of commands
/	displays current LAN settings
ip <x.x.x.x>	sets new ip address
sm <x.x.x.x>	sets new subnet mask
gw <x.x.x.x>	sets new default gateway
exit	exits shell and saves all changes

4 To change a parameter follows the style:

- parameter value, for example:
  `ip 134.40.27.230`

Then press [Enter], where parameter refers to the configuration parameter you are defining, and value refers to the definitions you are assigning to that parameter. Each parameter entry is followed by a carriage return.

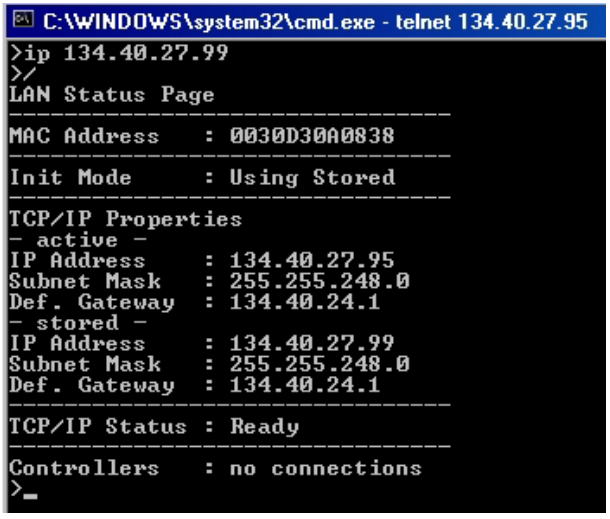
5 Use the "/" and press Enter to list the current settings.



information about the LAN interface
MAC address, initialization mode
Initialization mode is Using Stored
active TCP/IP settings
TCP/IP status - here ready
connected to PC with controller software (e.g. Agilent ChemStation), here not connected

Figure 37 Telnet - Current settings in "Using Stored" mode

6 Change the IP address (in this example 134.40.27.99) and type "/" to list current settings.



change of IP setting to
Initialization mode is Using Stored
active TCP/IP settings
stored TCP/IP settings in non-volatile memory

connected to PC with controller software (e.g. Agilent ChemStation), here not connected

Figure 38 Telnet - Change IP settings

7 When you have finished typing the configuration parameters, type `exit` and press **Enter** to exit with storing parameters.

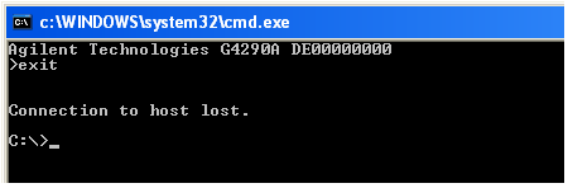


Figure 39 Closing the Telnet Session

NOTE

If the Initialization Mode Switch is changed now to “Using Stored” mode, the instrument will take the stored settings when the module is re-booted. In the example above it would be 134.40.27.99.

PC and User Interface Software Setup Setup

PC Setup for Local Configuration

This procedure describes the change of the TCP/IP settings on your PC to match the module's default parameters in a local configuration (see also "Initialization mode selection" on page 265).

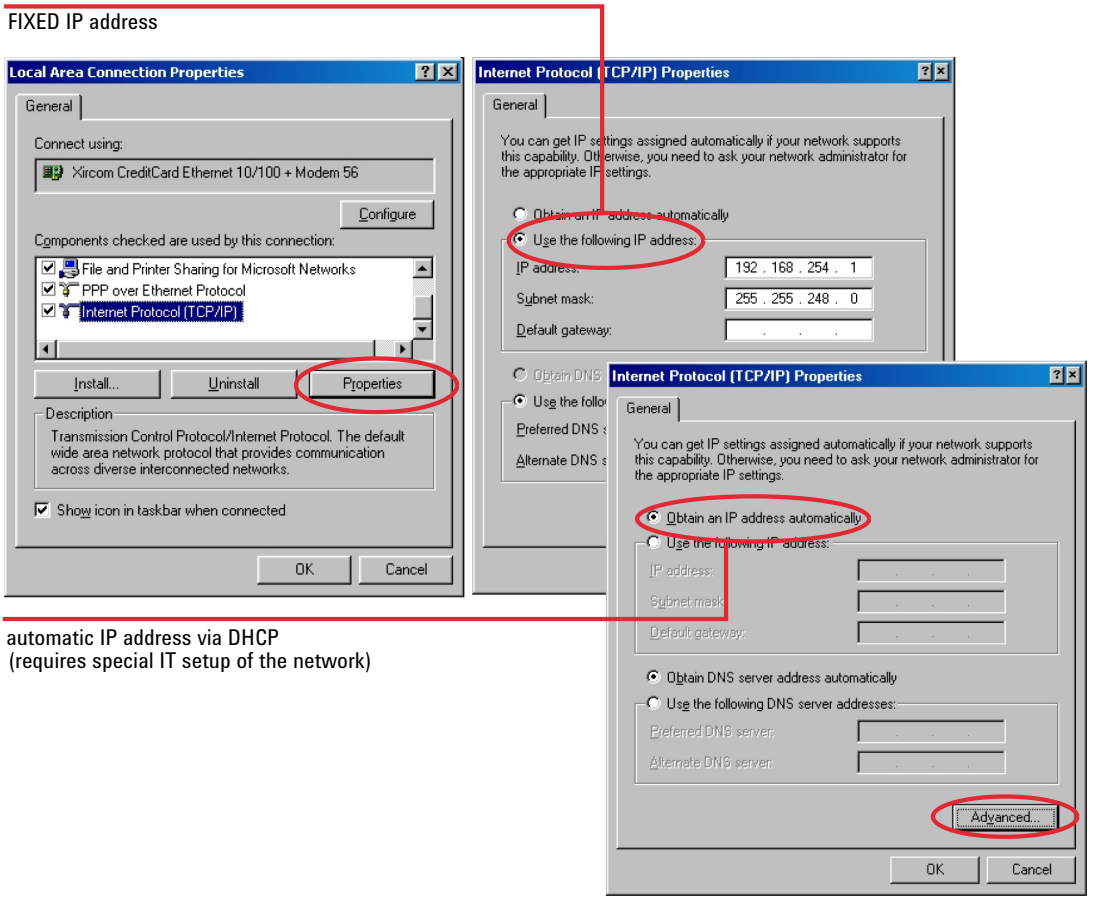


Figure 40 Changing the TCP/IP settings of the PC

User Interface Software Setup

Install you user interface software according the provided *User Interface Software Setup Guide*.

13 Appendix

This chapter provides addition information on safety, legal and web.

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. Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

WARNING

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.**

Safety Standards

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

General

Do not use this product in any manner not specified by the manufacturer. The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

Before Applying Power

WARNING

Wrong voltage range, frequency or cabling

Personal injury or damage to the instrument

- ✓ **Verify that the voltage range and frequency of your power distribution matches to the power specification of the individual instrument.**
- ✓ **Never use cables other than the ones supplied by Agilent Technologies to ensure proper functionality and compliance with safety or EMC regulations.**
- ✓ **Make all connections to the unit before applying power.**

NOTE

Note the instrument's external markings described under "Safety Symbols" on page 283.

Ground the Instrument

WARNING

Missing electrical ground

Electrical shock

- ✓ **If your product is provided with a grounding type power plug, the instrument chassis and cover must be connected to an electrical ground to minimize shock hazard.**
- ✓ **The ground pin must be firmly connected to an electrical ground (safety ground) terminal at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.**

Do Not Operate in an Explosive Atmosphere

WARNING

Presence of flammable gases or fumes

Explosion hazard

- ✓ **Do not operate the instrument in the presence of flammable gases or fumes.**

Do Not Remove the Instrument Cover

WARNING

Instrument covers removed

Electrical shock

- ✓ **Do Not Remove the Instrument Cover**
- ✓ **Only Agilent authorized personnel are allowed to remove instrument covers. Always disconnect the power cables and any external circuits before removing the instrument cover.**

Do Not Modify the Instrument

Do not install substitute parts or perform any unauthorized modification to the product. Return the product to an Agilent Sales and Service Office for service and repair to ensure that safety features are maintained.

In Case of Damage

WARNING

Damage to the module

Personal injury (for example electrical shock, intoxication)

- ✓ **Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.**

Solvents

WARNING

Toxic, flammable and hazardous solvents, samples and reagents

The handling of solvents, samples and reagents can hold health and safety risks.

- ✓ **When working with these substances observe appropriate safety procedures (for example by wearing goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the vendor, and follow good laboratory practice.**
- ✓ **Do not use solvents with an auto-ignition temperature below 200 °C (392 °F). Do not use solvents with a boiling point below 56 °C (133 °F).**
- ✓ **Avoid high vapor concentrations. Keep the solvent temperature at least 40 °C (72 °F) below the boiling point of the solvent used. This includes the solvent temperature in the sample compartment. For the solvents methanol and ethanol keep the solvent temperature at least 25 °C (45 °F) below the boiling point.**
- ✓ **Do not operate the instrument in an explosive atmosphere.**
- ✓ **Do not use solvents of ignition Class IIC according IEC 60079-20-1 (for example, carbon disulfide).**
- ✓ **Reduce the volume of substances to the minimum required for the analysis.**
- ✓ **Never exceed the maximum permissible volume of solvents (8 L) in the solvent cabinet. Do not use bottles that exceed the maximum permissible volume as specified in the usage guideline for solvent cabinet.**
- ✓ **Ground the waste container.**
- ✓ **Regularly check the filling level of the waste container. The residual free volume in the waste container must be large enough to collect the waste liquid.**
- ✓ **To achieve maximal safety, regularly check the tubing for correct installation.**

NOTE

For details, see the usage guideline for the solvent cabinet. A printed copy of the guideline has been shipped with the solvent cabinet, electronic copies are available in the Agilent Information Center or via the Internet.

Safety Symbols

Table 32 Symbols

	The apparatus is marked with this symbol when the user shall 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.
	The apparatus is marked with this symbol when hot surfaces are available and the user should not touch it when heated up.
	Sample Cooler unit is designed as vapor-compression refrigeration system. Contains fluorinated greenhouse gas (refrigerant) according to the Kyoto protocol. For specifications of refrigerant, charge capacity, carbon dioxide equivalent (CDE), and global warming potential (GWP) see instrument label.
	Flammable Material For Sample Thermostat which uses flammable refrigerant consult Agilent Information Center / User Manual before attempting to install or service this equipment. All safety precautions must be followed.
	Confirms that a manufactured product complies with all applicable European Community directives. The European Declaration of Conformity is available at: **http://regulations.corporate.agilent.com/DoC/search.htm**
	Manufacturing date.
	Power symbol indicates On/Off. The apparatus is not completely disconnected from the mains supply when the power switch is in the Off position
	Pacemaker Magnets could affect the functioning of pacemakers and implanted heart defibrillators. A pacemaker could switch into test mode and cause illness. A heart defibrillator may stop working. If you wear these devices keep at least 55 mm distance to magnets. Warn others who wear these devices from getting too close to magnets.

Table 32 Symbols

	Magnetic field Magnets produce a far-reaching, strong magnetic field. They could damage TVs and laptops, computer hard drives, credit and ATM cards, data storage media, mechanical watches, hearing aids and speakers. Keep magnets at least 25 mm away from devices and objects that could be damaged by strong magnetic fields.
	Indicates a pinching or crushing hazard
	Indicates a piercing or cutting hazard.

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, or damage of equipment.

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

Waste Electrical and Electronic Equipment (WEEE) Directive

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

NOTE

Do not dispose of in domestic household waste

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

Radio Interference

Cables supplied by Agilent Technologies are screened to provide optimized protection against radio interference. All cables are in compliance with safety or EMC regulations.

Test and Measurement

If test and measurement equipment is operated with unscreened cables, 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 Certification for Federal Republic of Germany

Sound pressure

Sound pressure Lp <70 db(A) accroding to DIN-EN 27779

Schalldruckpegel

Schalldruckpegel Lp <70 db(A) nach DIN-EN 27779

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For the latest information on products and services visit our worldwide web site on the Internet at:

http://www.agilent.com

In This Book

This manual contains technical reference information about the Agilent 1290 Infinity II High-Speed Pump (G7120A) and Agilent 1290 Infinity II Bio High-Speed Pump (G7132A).

- introduction and specifications,
- using and optimizing,
- troubleshooting and diagnose,
- maintenance,
- parts identification,
- hardware information,
- safety and related information.

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