



Agilent InfinityLab LC Series  
1290 Infinity II Flexible Pumps

**User Manual**



# Notices

## Document Information

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### CAUTION

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### 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 Flexible Pump (G7104A)
- Agilent 1290 Infinity II Bio Flexible Pump (G7131A)

## **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 Flexible 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 How to Optimize the Performance of Your Module**

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

## **6 Troubleshooting and Diagnostics**

This chapter gives an 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 on how to recover from error conditions.

## **8 Maintenance**

This chapter describes the maintenance of the Agilent 1290 Infinity II Flexible Pumps.

## **9 Parts and Materials**

This chapter provides information on parts for maintenance.

## **10 Identifying Cables**

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## **11 Hardware Information**

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# 1

## Introduction

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

## Agilent 1290 Infinity II Flexible Pump

### Product Description

The Agilent 1290 Infinity II Flexible Pump improves your efficiency by combining the performance of a high-pressure mixing UHPLC pump with the flexibility of a low-pressure mixing UHPLC pump.

The new 1290 Infinity II LC power range has a high instrument efficiency, allowing you to run any HPLC and UHPLC method. ISET enables you to transfer existing methods from different instrument modules - current Agilent systems as well as instruments from other manufacturers.

The Agilent Inlet Weaver mixer, active damping or the optional Agilent Jet Weaver mixers for additional mixing capacity achieve high analytical efficiency.

The established multipurpose valve enhances laboratory efficiency by adding useful functionalities, for example, mixer in/out switch, filter backflush or automatic purge, and BlendAssist software simplifies your workflow with accurate buffer/additive blending.

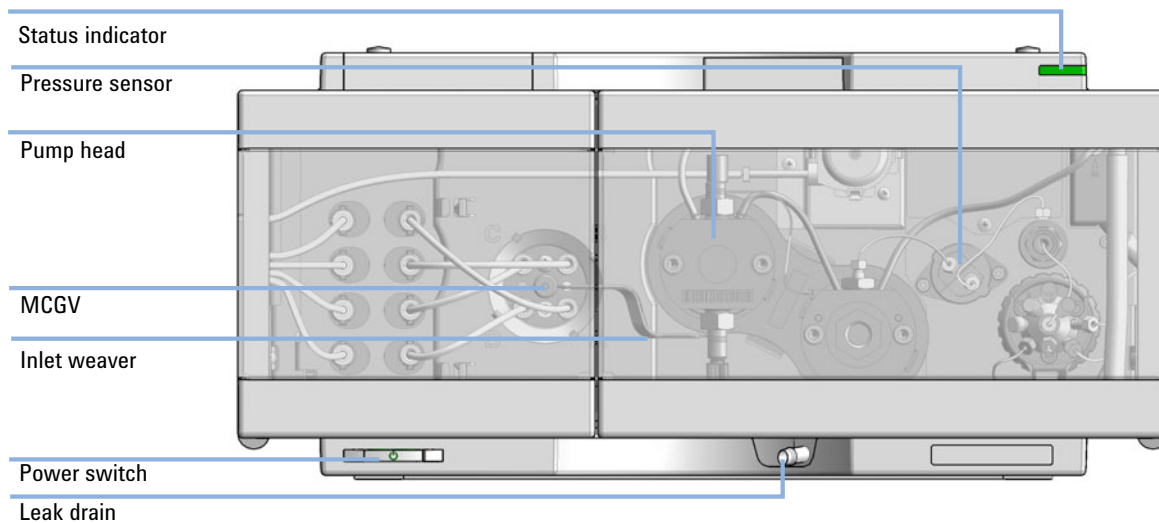


Figure 1 Overview of the Flexible Pump

## 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.
- 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.
- High solvent mixing efficiency before reaching the pump head due to the established Inlet Weaver technology.
- Active damping with independently controllable high resolution pump drives and firmware-embedded tuning algorithms significantly reduce ripples and associated UV noise.  
Switchable Jet Weaver mixers (35  $\mu$ L, 100  $\mu$ L, 380  $\mu$ L) for increased mixing performance.
- A multipurpose valve enables automatic software-embedded functionalities such as switching the optional mixer in and out, flushing back the inline filter or automatic purging.
- The unique Intelligent System Emulation Technology (ISET) enables the emulation of existing Agilent 1100, 1200 and 1260 Infinity Series instruments, as well as Waters Alliance, Waters H-Class and Shimadzu Prominence instruments.
- Precise and accurate buffer/additive blending using the new software feature BlendAssist, implemented in the pump driver.
- Built-in active seal-wash for increased uptime.

# Agilent 1290 Infinity II Bio Flexible Pump

## Product Description

The 1290 Infinity II Bio Flexible Pump is a UHPLC pump consisting of biocompatible material, designed for use in biopharma and other applications utilizing high-salt and extreme-pH conditions. It offers gradient formation from up to four solvents at pressures up to 1300 bar and flow rates up to 5 mL/min.

The 1290 Infinity II Bio Flexible Pump combines exceptional performance, method compatibility, and simplified operation with outstanding flexibility in automated gradient formation and solvent blending. Intelligent System Emulation Technology (ISET) allows you to seamlessly transfer existing methods from different instruments.

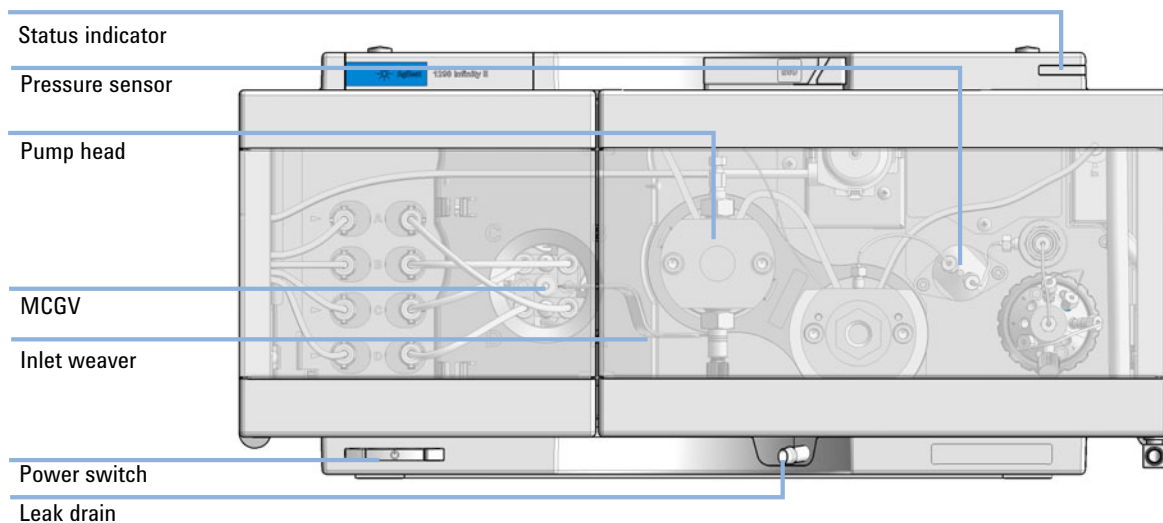


Figure 2 Overview of the Flexible Pump

## Features

- Biocompatible wetted parts in the solvent delivery unit ensure integrity of biomolecules and minimize unwanted surface interaction while increasing column lifetime
- High salt tolerance and wide pH range offer increased flexibility and instrument uptime
- Power range combines ultrahigh pressures up to 1300 bar and high analytical flow rates up to 5 mL/min for maximum chromatographic performance
- Agilent Buffer Advisor Software provides a fast and simple way to create salt and pH gradients, eliminating the tedious and error-prone method development steps of buffer preparation, buffer blending, and pH scouting
- Built-in seal wash keeps maintenance to a minimum, increases longevity, and reduces operating cost
- Bio multipurpose valve enables automated software-embedded functionality such as switching the optional mixer in and out, flushing back the inline filter, or automated purging for reduced manual interaction
- BlendAssist, a software feature in the pump driver, enables convenient, precise, and accurate buffer or additive blending
- ISET enables emulation of existing Agilent 1100, 1200, and 1260 Infinity Series instruments, as well as Waters Alliance, Waters H-Class, and Shimadzu Prominence instruments, facilitating seamless method transfer

## Operating Principle

The pump head comprises two pump chambers in series with independent high-resolution motion control. A pressure sensor in the flow path monitors the pressure. The pump control uses this signal for minimizing the pressure ripple in order to achieve highest flow precision. A stable flow can be delivered even in case of eventual small internal leaks, which can be compensated automatically. A heat exchanger between two pump chambers strongly reduces thermal effects due to solvent compression under very high pressures.

As solvents are compressed by the pump head and expand further down the flow path, for example in the column, the volumetric flow is changed depending on the compressibility of the liquid. Agilent control software allows specifying pure solvents, premixed solvents, and solvent gradients. Associated Agilent solvent libraries are used by the pump control for enhanced flow accuracy, which is required for cross-instrument or cross-system reproducibility and method compatibility.

A high-resolution encoder unit is attached to the pump drives, which divides a single turn into 65000 steps. Each step corresponds to a volume of about 300 pL, which allows an extremely precise control.

## Introduction

### Operating Principle

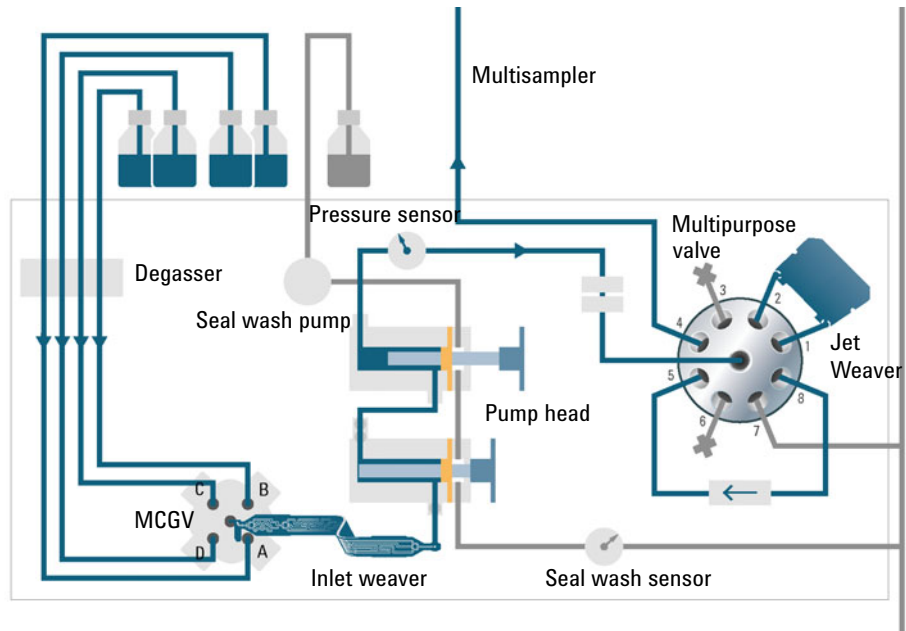


Figure 3 The hydraulic path (example of G7104A Flexible Pump installed with a G7167B Multisampler)

## Positions of the Multipurpose Valve

The Multipurpose Valve allows easy software-controlled switching between different modes of operation.

### Normal Operating Mode Without Mixer

In normal operating mode, the flow comes from the pump head, passes the pressure sensor, and arrives at the central port of the Multipurpose Valve. The flow leaves the valve through port 4 to the system (autosampler etc.).

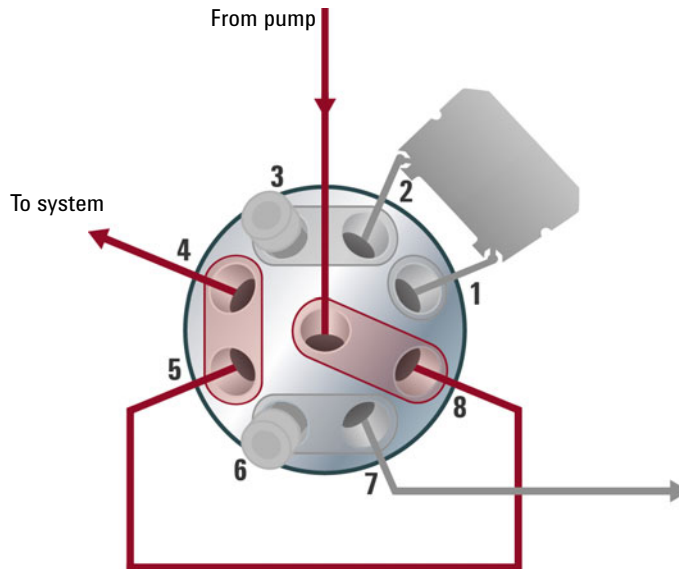


Figure 4 Valve position in normal operating mode without mixer



## Introduction

### Positions of the Multipurpose Valve

#### Purge Mode

In purge mode, the flow is diverted to the waste container.

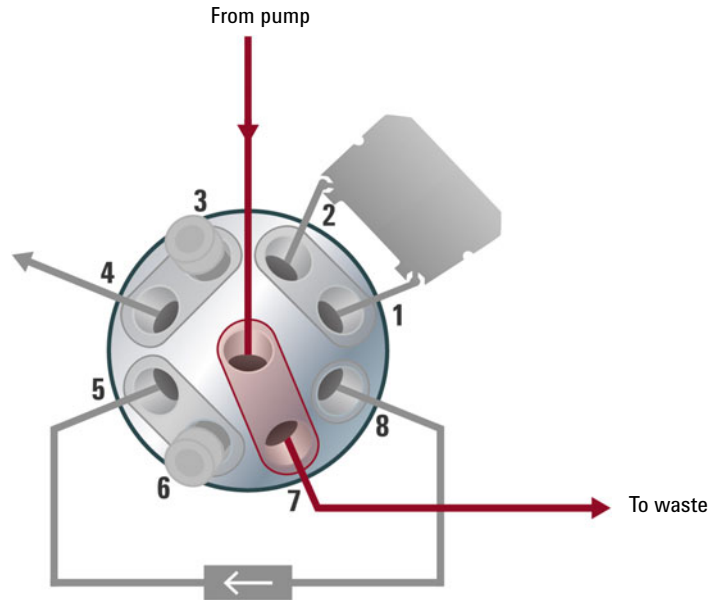


Figure 5 Valve position in purge mode

## Introduction

### Positions of the Multipurpose Valve

Normal Operating Mode With Jet Weaver and Optional Inline Filter

In this mode, the flow passes an optional Jet Weaver and the optional inline filter. This configuration is recommended for special applications, which require an increased mixing efficiency.

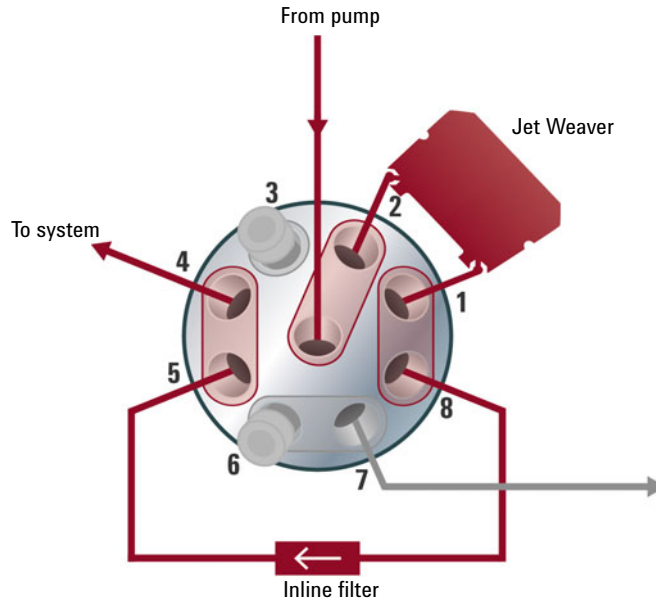


Figure 6 Valve position in normal operating mode with Jet Weaver

## Introduction

### Positions of the Multipurpose Valve

#### Filter Flush Mode

This mode is used for cleaning the inline filter by back-flushing it. The flow goes to port 5, passes the inline filter in opposite direction, and leaves to the waste through port 7.

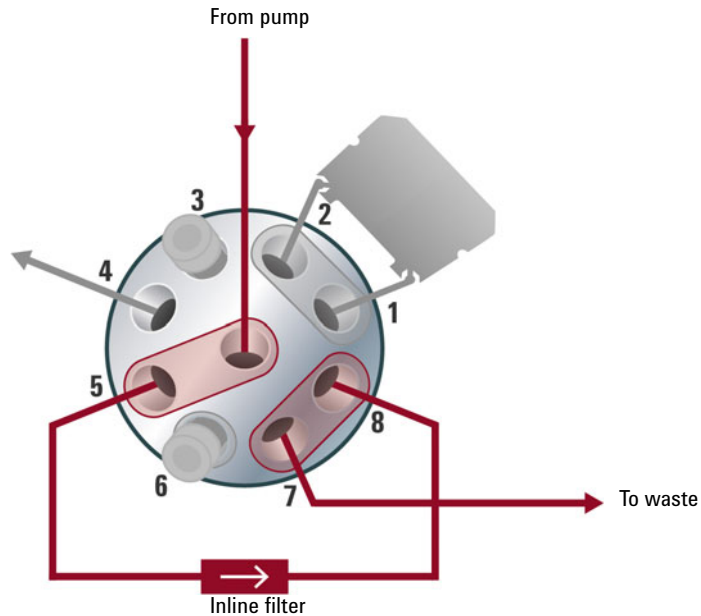


Figure 7 Valve position in filter flush mode

### CAUTION

#### Damage to the valve

- ✓ Use the filter flush mode only if the optional inline filter is installed.

## 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

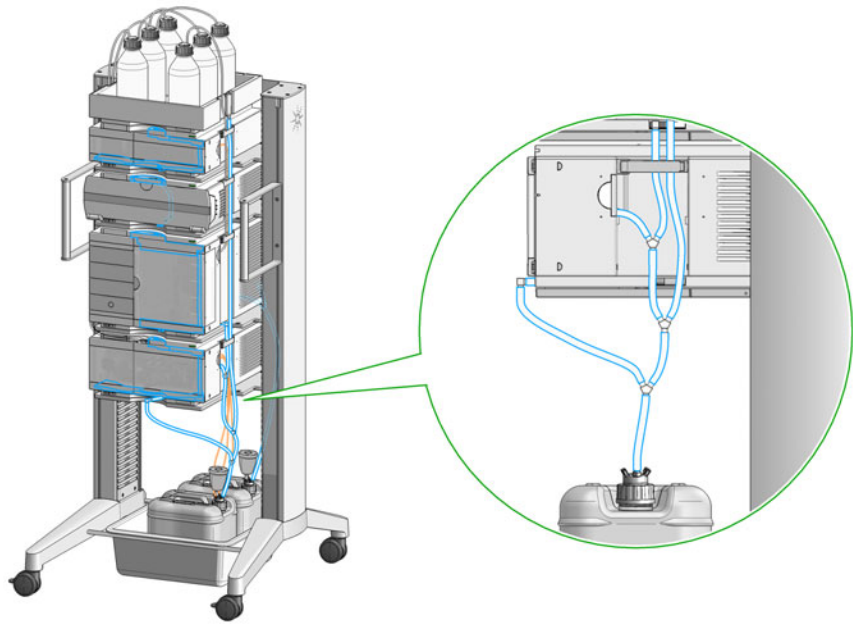


Figure 8 Infinity II Leak Waste Concept (Flex Bench installation)

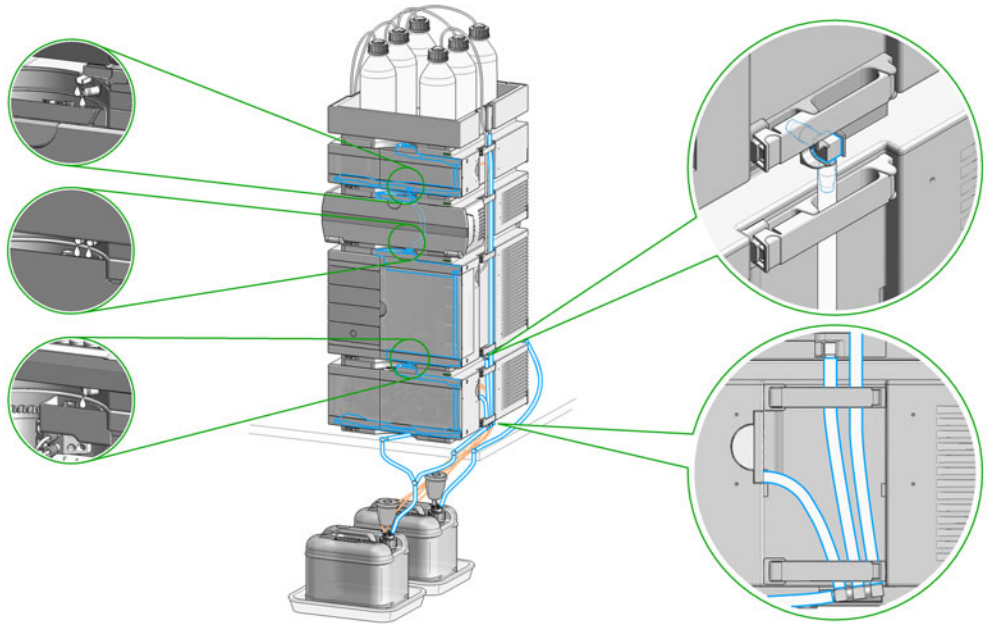


Figure 9 Infinity II Single Stack Leak Waste Concept (bench installation)

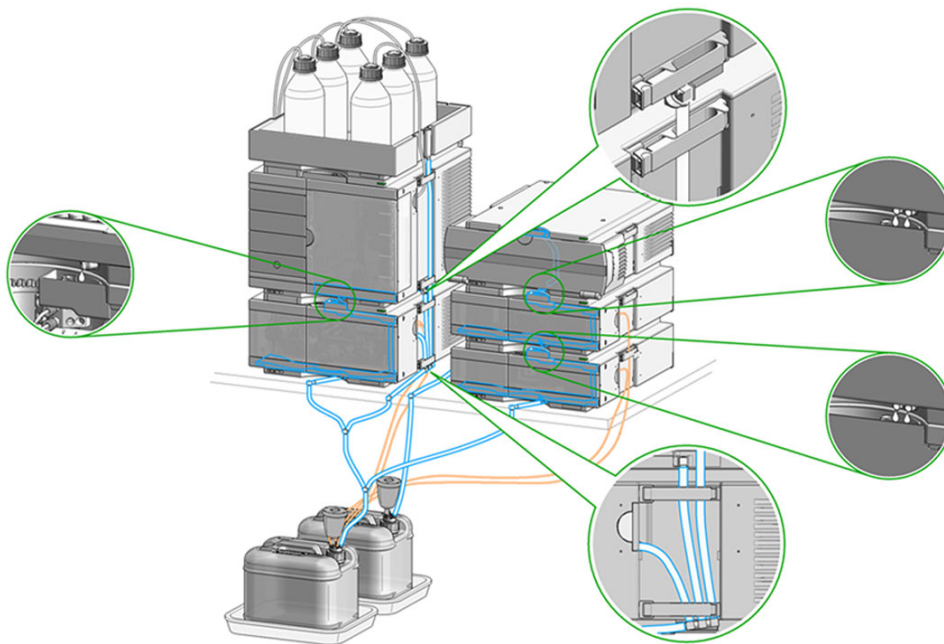


Figure 10 Infinity II Two Stack Leak Waste Concept (bench installation)

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

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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 29. 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 29) 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.

### 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 Flexible Pump (G7104A)

**Table 1** Physical Specifications G7104A

Type	Specification	Comments
Weight	16.1 kg (35.5 lbs)	
Dimensions (height × width × depth)	180 x 396 x 436 mm (7.1 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	120 VA / 110 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 Flexible Pump (G7131A)

Table 2 Physical Specifications G7131A

Type	Specification	Comments
Weight	16.8 kg (37.0 lbs)	
Dimensions (height x width x depth)	180 x 396 x 436 mm (7.1 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	120 VA / 110 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

## Performance Specifications

### Performance Specifications Agilent 1290 Infinity II Flexible Pump (G7104A)

**Table 3** Performance Specifications G7104A

Type	Specification	Comments
Hydraulic system	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
Flow precision	≤0.07 % RSD or 0.01 min SD, whichever is greater	
Flow accuracy	±1 % or ±10 µL/min, whichever is greater	Pumping degassed H <sub>2</sub> O
Pressure operating range	Up to 130 MPa (1300 bar, 18855 psi) up to 2 mL/min Ramping down to 80 MPa (800 bar, 11603 psi) at 5 mL/min	
Pressure pulsation	<1 % amplitude or <0.5 MPa (5 bar), whichever is greater	
Compressibility compensation	Automatic	When using "Solvent Types" in method
Recommended pH-range	1.0 – 12.5	Solvents with pH <2.3 should not contain acids which attack stainless steel.
Gradient formation	Low pressure quaternary mixing/gradient capability using proprietary high-speed proportioning valve	

## Site Requirements and Specifications

### Performance Specifications

**Table 3 Performance Specifications G7104A**

Type	Specification	Comments
Delay volume	≤350 µL (default configuration)	Measured with water at 1 mL/min (water/water with tracer)
Composition range	Settable: 0 – 100 % Recommended: 1 – 99 %	
Composition precision	<0.15 % RSD or 0.02 min SD, whichever is greater	
Composition accuracy	±0.4 % absolute	At 1 mL/min for water/water with tracer
Number of solvents	4	
Solvent selection valve	Internal 4-solvent gradient formation valve included. External 2x 12 solvent valve as option, fully integrated in the pump control interface.	
Integrated degassing unit	Number of channels: 4 Internal volume per channel: 1.5 mL	
Materials in contact with solvent	TFE/PDD copolymer, PFA, PEEK, FEP, ETFE, Stainless Steel, Aluminum Oxide-based Ceramic, Ruby, Sapphire, Gold, Zirconium Oxide-based Ceramic, Tantalum, UHMW-PE, Polyimide, DLC Coated Stainless Steel	
Automatic purge valve	Enables automatic software-embedded functionalities such as switching the optional mixer in and out or automatic purging.	
Active Seal wash	Included	
Intelligent System Emulation Technology (ISET)	Included	



## Site Requirements and Specifications

### Performance Specifications

**Table 3 Performance Specifications G7104A**

Type	Specification	Comments
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), LAN, RS232C, APG remote: ready, start, stop, and shutdown signals	
Safety features and maintenance	Leak detection, safe leak handling, leak output signal for shutdown of the pumping system. No hazardous voltages in major maintenance areas. Extensive diagnostics, error detection and display with Agilent Lab Advisor software.	
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.	Performance specifications determined with standard configuration (4CGV).

## Performance Specifications Agilent 1290 Infinity II Bio Flexible Pump (G7131A)

Table 4 Performance Specifications G7131A

Type	Specification	Comments
Hydraulic system	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
Flow precision	≤0.07 % RSD or 0.01 min SD, whichever is greater	
Flow accuracy	±1 % or ±10 µL/min, whichever is greater	Pumping degassed H <sub>2</sub> O
Pressure operating range	Up to 130 MPa (1300 bar, 18855 psi) up to 2 mL/min Ramping down to 80 MPa (800 bar, 11603 psi) at 5 mL/min	
Pressure pulsation	<1 % amplitude or <0.5 MPa (5 bar), whichever is greater	
Compressibility compensation	Automatic	When using "Solvent Types" in method
Recommended pH-range	pH 1 – 12.5, short term pH 13 (for flushing)	
Gradient formation	Low pressure quaternary mixing/gradient capability using proprietary high-speed proportioning valve	
Delay volume	≤350 µL (default configuration)	Measured with water at 1 mL/min (water/water with tracer)
Composition range	Settable: 0 – 100 % Recommended: 1 – 99 %	
Composition precision	<0.15 % RSD or 0.02 min SD, whichever is greater	

## Site Requirements and Specifications

### Performance Specifications

**Table 4 Performance Specifications G7131A**

Type	Specification	Comments
Composition accuracy	±0.4 % absolute	At 1 mL/min for water/water with tracer
Number of solvents	4	
Solvent selection valve	Internal 4-solvent gradient formation valve included. External 2x 12 solvent valve as option, fully integrated in the pump control interface.	
Integrated Degassing unit	Number of channels: 4 Internal volume per channel: 1.5 mL	
Materials in contact with solvent	TFE/PDD copolymer, PFA, PEEK, FEP, ETFE, Stainless Steel with Bio-Compatible Coating, FFKM, Gold, Ruby, MP35N, Tantalum, Zirconium Oxide-based Ceramic, UHMW-PE, DLC coated MP35N	
Automatic purge valve	Enables automatic software-embedded functionalities such as switching the optional mixer in and out or automatic purging.	
Active Seal wash	Included	
Intelligent System Emulation Technology (ISET)	Included	
Instrument control	LC & CE Drivers 3.4 or above Instrument Control Framework (ICF) 3.0 Update 3 or above Instrument Control Framework (ICF) A.02.03 or above in Emulation Mode Instant Pilot (G4208A) with firmware B.02.24 or above Lab Advisor software B.02.17 or above	For details about supported software versions refer to the compatibility matrix of your version of the LC & CE Drivers.

## Site Requirements and Specifications

### Performance Specifications

**Table 4 Performance Specifications G7131A**

Type	Specification	Comments
Communication	Controller Area Network (CAN), LAN, RS232C, APG remote: ready, start, stop, and shutdown signals	
Safety features and maintenance	Leak detection, safe leak handling, leak output signal for shutdown of the pumping system. No hazardous voltages in major maintenance areas. Extensive diagnostics, error detection and display with Agilent Lab Advisor software.	
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.	Performance specifications determined with standard configuration (4CGV).

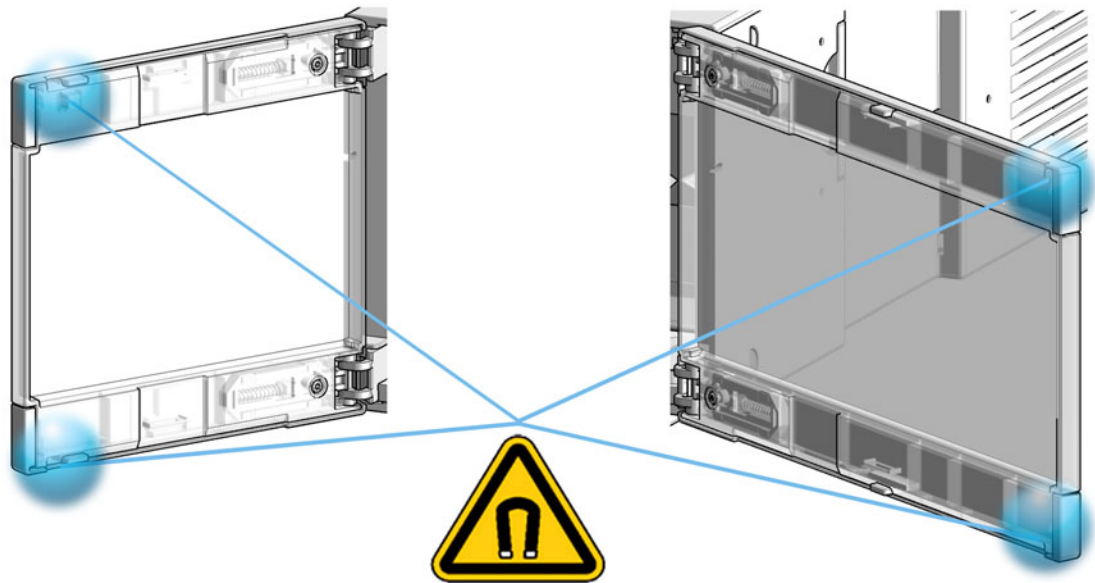
## 3 Using the Pump

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This chapter explains the operational parameters of the Agilent 1290 Infinity II Flexible Pumps.

# Magnets

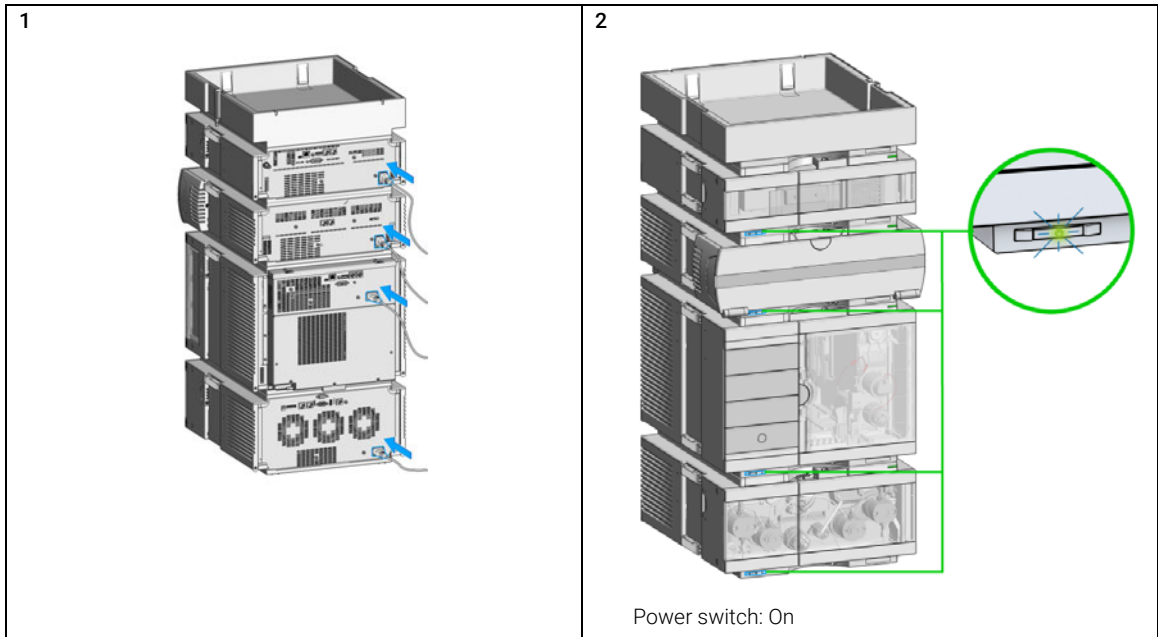
1 Magnets in doors of pumps, autosamplers, detectors, and fraction collectors.



### Using the Pump Turn on/off

## Turn on/off

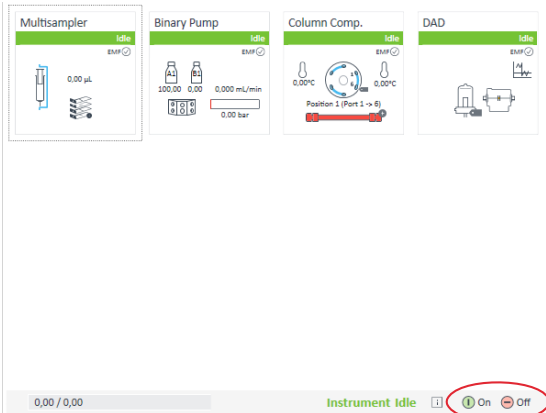
This procedure exemplarily shows an arbitrary LC stack configuration.



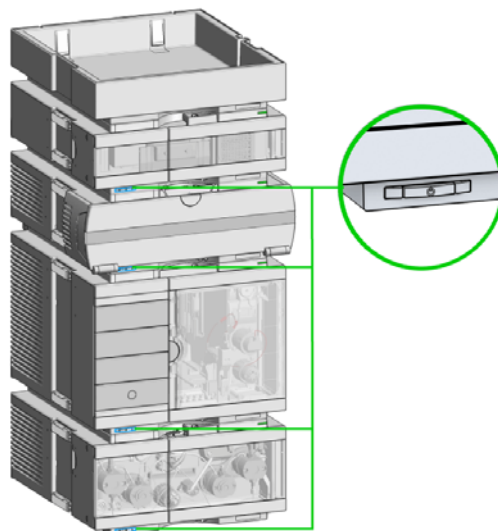
## Using the Pump

### Turn on/off

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

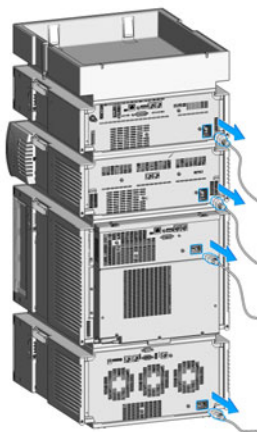


4



Power switch: Off

5

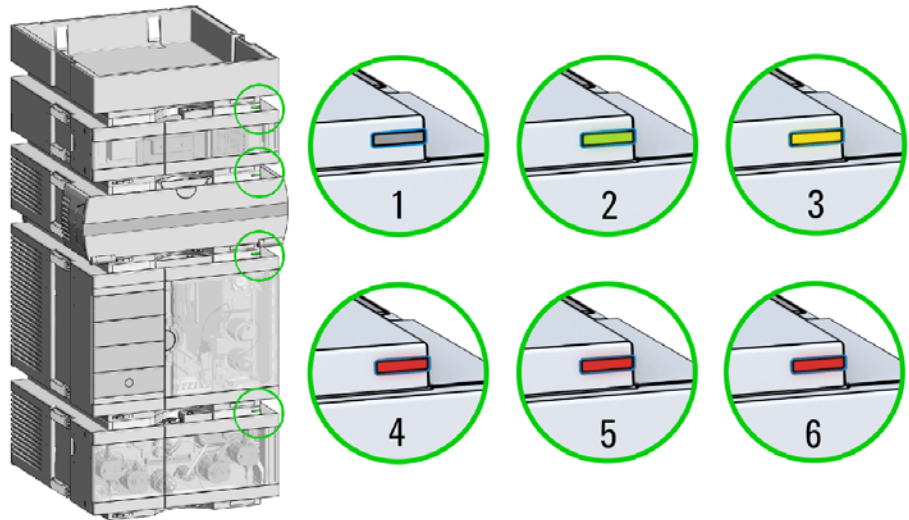




## Status Indicators

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

Please also see *TechNote SD-29000194*, which can be downloaded from our website [www.agilent.com](http://www.agilent.com).

### 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).
- Chromatographic columns used for biomolecule separations like size exclusion chromatography or ion-exchange chromatography should be stored in the presence of 0.02 % sodium azide. For more Bio LC Column user guides, see <https://www.agilent.com/en/support/liquid-chromatography/kb005960>.
- 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 56.
- 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 many extra functions not available in Agilent Pumps with manual purge valves. It is possible to prepare the pump (set parameters 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 comiscible 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).

When 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:

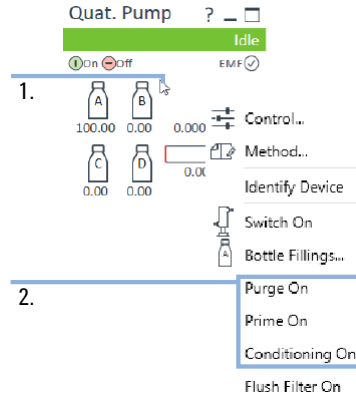
- Free a potentially stuck valve.

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 11 Prepare the pump (1290 Infinity).**

- 
1. Right click 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

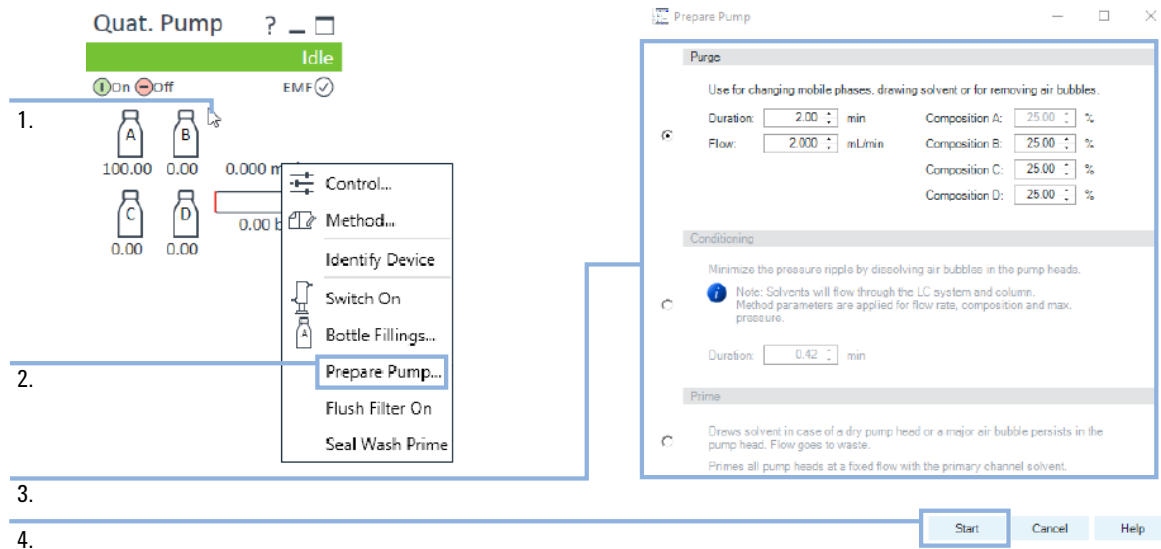


Figure 12 Prepare the pump (1290 Infinity II pumps)

1. Right click 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.

## Select channels for Multi-Channel Gradient Valve (MCGV)

- Use lower channels (A and/or D) for buffer solutions.
- Regularly flush all MCGV channels with water to remove possible salt deposits.
- Check compatibility of buffers and organic solvents to avoid precipitation.



## Optional Inline Filter

The pump can be equipped with an additional inline filter (Inline filter assembly, material: stainless steel (5067-5407) or Inline Filter Assembly biocompatible (5720-0003)) with a nominal filter pore size of 0.3  $\mu\text{L}$ .

Advantages of the inline filter:

- Very small internal volume
- Specified for working at high pressures
- Possibility of back-flushing the filter

Using the inline filter is recommended:

- to protect the downstream system from blockages,
- for solvent combinations that can form precipitation after mixing,
- for applications running with buffers.

General hints for effective use of the inline filter:

- filter solvents before use,
- follow best practices,
- back-flush the filter weekly,
- exchange the filter frit regularly.

### CAUTION

#### Damage to the valve

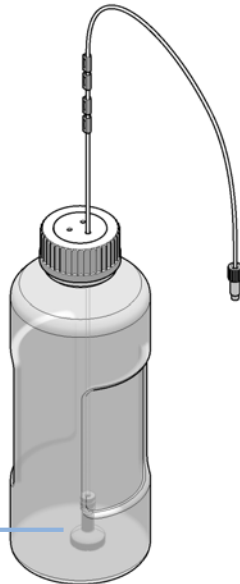
- ✓ **Use the filter flush mode only if the optional inline filter is installed.**

See Technote G7167-90130 for further reference.

## Flushing the Filter

For highest performance and robustness, the pump uses three solvent filters:

- 1 *Solvent inlet filters* (5041-2168) as part of Bottle Head Assembly (G7120-60007) have a large pore size of about 20  $\mu\text{m}$  and filter out particles before they reach the pump.



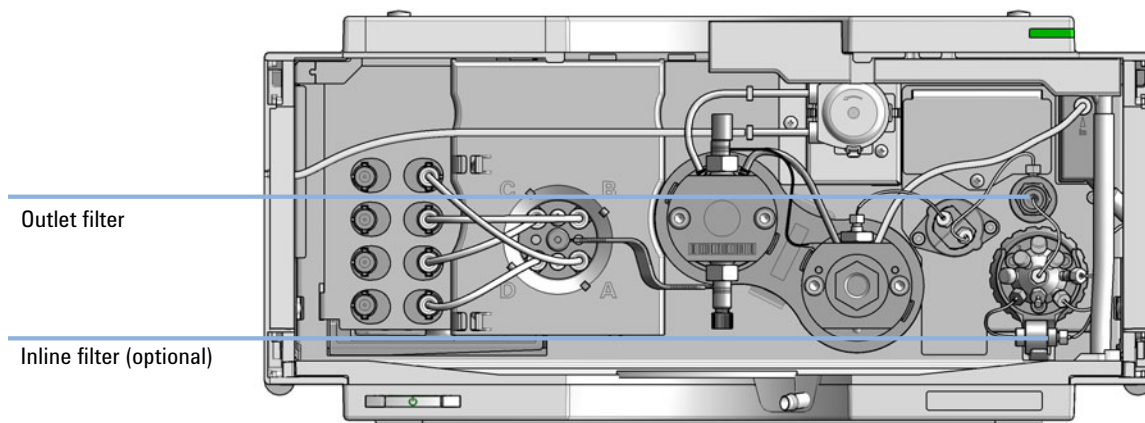
Solvent inlet filter

- 2 An *Outlet Filter* (average pore size 5  $\mu\text{m}$ ; Outlet filter Quaternary Pump/Flexible Pump (G4204-60004) or Outlet Filter Flex Biocompatible (G7131-60004)) between pressure sensor and Multipurpose valve filters out particles which may be created in the pump by wear of piston or wash seals.  
This filter or filter frits can be replaced as required (see “Replace the High Pressure Outlet Filter or Filter Frit” on page 223).

## Using the Pump

### Flushing the Filter

- 3 An optional *Inline Filter* connected to the Multipurpose Valve with a small pore size of about 0.3  $\mu\text{m}$  (Inline filter assembly, material: stainless steel (5067-5407) or Inline Filter Assembly biocompatible (5720-0003)). This filter can be flushed using the graphical user interface or replaced as required (see “[Replace Parts of the Inline Filter](#)” on page 228).



In the instrument control panel of Agilent user interfaces, use the context menu and select **Flush Filter On**, see also “[Context Menu](#)” on page 76.

## Using the Pump

### Flushing the Filter

Optional inline filter (for G7104A/C, G7131A, G4204A)

The pump can be equipped with an additional inline filter (Inline filter assembly, material: stainless steel (5067-5407) or Inline Filter Assembly, Biocompatible (5720-0003)) with a nominal filter pore size of 0.3  $\mu\text{m}$ .

Advantages of the inline filter:

- Very small internal volume
- Specified for working at high pressures
- Possibility of back flushing the filter

Using the inline filter is recommended:

- To protect the downstream system from blockages,
- For solvent combinations that can form precipitation after mixing,
- For applications running with buffers.

General hints for effective use of the inline filter:

- Filter solvents before use,
- Follow best practices,
- Back flush the filter weekly (**Flush Filter** in context menu figure),
- Exchange the filter frit regularly. (Frit 0.3  $\mu\text{m}$  for inline filter, 5/pk (5023-0271), Frit 0.3  $\mu\text{m}$  for inline filter, biocompatible, 5/pk (5320-0022))

#### NOTE

See *Technote G7167-90130* for further reference.

## 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 rediffuse into:

- the solvent channel between the solvent reservoir,
- the vacuum degassing unit (if available in the system),
- the pump.

Solvents containing volatile ingredients will slightly lose these components. Therefore, purging of the pumping system is required before starting an application.

- 1 Start 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 redissolve buffer crystals
After a solvent change	Bidistilled water	Best solvent to redissolve buffer crystals
Before turning off system for an extended period	50 % methanol or 50 % isopropanol in water, without additives	

### NOTE

Never use the pump to prime/purge 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.

## Using the Pump

### Purging the Pump

If the system has been run dry or air has diffused into the pump, it might require extra steps to get rid of the air again. The following procedure 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 when the pressure is stable.
- 6 Change solvents and column according to the analytical conditions and purge the system to change solvents.

## Recommendations for Biocompatible and Bio-Inert System

- Make sure all supplies (fittings, capillaries, inline filters, columns, etc.) are bio-inert / biocompatible.
  - 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 MP35N 0.12 mm x 2 m (5005-0046) 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 biocompatible systems.**

## Flushing Procedure

- ✓ This procedure should be used when salt-containing mobile phases are used. Perform it 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 43.
- ✓ 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: to remove salt residues from all lines, both needle wash and seat backflush for Multiwash option, perform at least 15 min purge with water. 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 until every position has been selected for at least five times.
- To minimize salt carryover, replace water with fresh solvent bottles.



# 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 13 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 71.
- 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 (G7104A)

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

Part	Materials
Degasser chamber	TFE/PDD copolymer, PFA (internal tubings); PEEK (inlets); FEP (tubings); ETFE (fittings)
Ultra clean tubings <sup>1</sup>	PFA (tubings), PEEK (fittings)
Microfluidic structures <sup>2</sup>	SST
MCGV	PEEK, FEP, PFA, Al <sub>2</sub> O <sub>3</sub> -based ceramic, ruby, sapphire, SST
Passive inlet valve	SST, gold, ruby, ZrO <sub>2</sub> -based ceramic, tantalum
Outlet valve	SST, gold, ruby, ZrO <sub>2</sub> -based ceramic, tantalum
Pump head	SST
Pistons	ZrO <sub>2</sub> -based ceramic
Piston/wash seals	UHMW-PE, SST
Pressure sensor	SST
Multipurpose Valve	Polyimide, SST, DLC

<sup>1</sup> Ultra clean tubings are available for the use with high-end MS detectors. They are also compatible to THF.

<sup>2</sup> Inlet Weaver, Jet Weaver, Heat Exchanger

## Materials in Flow Path (G7131A)

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

Part	Materials
Degasser chamber	TFE/PDD copolymer, PFA (internal tubings); PEEK (inlets); FEP (tubings); ETFE (fittings)
Ultra clean tubings <sup>1</sup>	PFA (tubings), PEEK (fittings)
Microfluidic structures <sup>2</sup>	SST and biocompatible coating
4CGV	FFKM and PEEK
Passive inlet valve	Gold, Ruby, MP35N, tantalum
Outlet valve	Gold, Ruby, MP35N, tantalum
Pump head	MP35N
Pistons	ZrO <sub>2</sub> -based ceramic
Piston/wash seals	Gold and UHMW-PE
Pressure sensor	MP35N
Multipurpose Valve	DLC coated MP35N and PEEK-based rotor seal

<sup>1</sup> Ultra clean tubings are available for the use with high-end MS detectors. They are also compatible to THF.

<sup>2</sup> Inlet Weaver, 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 also cannot 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 nonconductive 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 are still some 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 clad PEEK capillaries in bio-inert systems. The use of stainless steel clad 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.

## Using the Pump

### Solvent Information

#### 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.

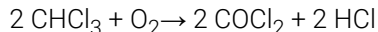
#### Tantalum (Ta)

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 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:



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, diisopropyl ether). Such ethers should be filtered through dry aluminum 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, ethylenediaminetetraacetic 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  $\mu\text{m}/\text{year}$ . 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  $\text{FeCl}_3$  or  $\text{CuCl}_2$ . 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 ( $\text{SiO}_2$ )

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 ( $\text{ZrO}_2$ )

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



## Using the Pump

### Solvent Information

#### 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 (dimethylformamide).

#### Sapphire, Ruby, and Al<sub>2</sub>O<sub>3</sub>-based ceramics

Sapphire, ruby, and ceramics based on aluminum oxide Al<sub>2</sub>O<sub>3</sub> are inert to almost all common acids, bases, and solvents. There are no documented incompatibilities for HPLC applications.

## Solvent Recommendation for Agilent 1290 Infinity, 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 67.

If free halides, hydroperoxides, free radicals or strong, oxidizing acids are present, corrosion can occur in stainless steel systems. There are several solvents with which, 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)
- 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. See 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 (G7104A/C, 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.

## Using the Pump

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

**Table 6 Recommended valves for normal phase applications**

	Binary or High-Speed Pumps (G7120A)	Quaternary or Flexible Pumps (G7104A/C)
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.

## Using the Pump

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

#### 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 71.
- 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  $\mu\text{L}/\text{min}$  or 1 % composition per solvent channel (whatever is greater) to avoid crossflow. Crossflow 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.
- When installing tubing connections to the MCGV, use lower channels (A/D) for aqueous solvents and upper channels for organic solvents. This will redissolve precipitates more easily.
- Consider using an inline filter, for example Inline filter assembly, material: stainless steel (5067-5407).
- 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.

## Using the Pump

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

#### 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 that 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 use.
- 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 177) 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 noncorrosive acids.

Please note that for nonvolatile 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 see *TechNote 01200-90090*, which can be downloaded from our website <https://www.agilent.com>.

## Algae Growth in HPLC Systems

The presence of algae in HPLC systems can cause many problems that may be incorrectly diagnosed as instrument or application problems. Algae grow in aqueous media, preferably in a pH range from 4 to 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 following 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  $\mu\text{m}$  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

The instrument control interface offers the parameters described in the following sections, and can usually be accessed through Agilent instrument control software. For details, please see 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 Quaternary 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,**
- **Connection settings**



## Using the Pump

### Setting up the Pump with the Instrument Control Interface

#### Options:

- **Pressure Unit:**

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

- **Seal wash installed:**

This check box is marked to indicate that an optional seal wash has been detected during autoconfiguration.

- **Installed mixer:**

The installed mixer is detected during autoconfiguration. For manual configuration, click the down-arrow and select the installed mixer from the list or choose **No mixer installed**.

**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 98.

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:



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



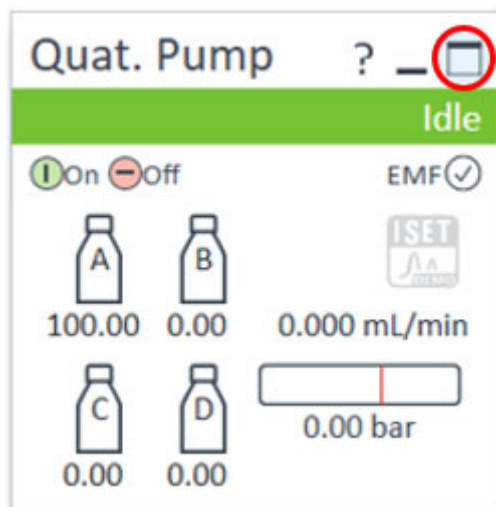
Indicates that the ISET option is installed but with no active method (light gray) or installed and active (dark gray).



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 instrument signals are displayed when clicking the icon in the upper right corner of the module dashboard. The following pump signals are displayed:

<b>Flow</b>	The current solvent flow rate (in mL/min).
<b>Pressure</b>	The current pump pressure (in bar, psi or MPa, see “Instrument Configuration” on page 72).
<b>Tuning</b>	Indicates the tuning efforts of the pump. For pumps operating as expected, the signal should stay in a range of -1 to +1 within the full-scale of -2 to +2.
<b>Pressure Limit</b>	The current maximum pressure limit.
<b>Composition A:B</b>	The contributions of channels A and B to the current solvent composition.
<b>Composition C:D</b>	The contributions of channels C and D to the current solvent composition.
<b>Valve position</b>	The current valve position.
<b>Prepare Pump</b>	The status of a prepare pump task (purge, prime, or condition).

## Context Menu

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

	<b>Control</b>	Displays the pump's <b>Control</b> dialog box.
	<b>Method</b>	Displays the pump's <b>Method Setup</b> dialog box.
	<b>Set Error Method</b>	Sets the method that is loaded if an error occurs to the method that is currently available in the hardware.
	<b>Identify Device</b>	Causes the LED on the front of the module to blink for a few seconds.
	<b>Switch Pump On/Off</b>	Toggles the status of the pump, on or off.
	<b>Bottle Fillings</b>	Displays the <b>Bottle Fillings</b> dialog box.
	<b>Prepare Pump...</b>	Displays the <b>Prepare Pump</b> dialog box.
	<b>Flush Filter On/Off</b>	Allows you to flush a clogged inline filter, which is connected to the Multipurpose Valve, see " <a href="#">Filter Flush Mode</a> " on page 19. Use the pump self-test for checking the filter backpressure. Do not use this option if no filter is installed!

## Prepare Pump Dialog

Table 7 Prepare Pump dialog box

Parameter	Limits	Description
<b>Purge</b>	<p><b>Time:</b> 0 – 100.00 min in steps of 0.01</p> <p><b>Flow:</b> 0.000 – 5.000 mL/min for each channel, in steps of 0.001</p>	<p>Setup and activation of <b>Purge</b> parameters. The automatic purge valve can be used for purging the system. The process has been automated for ease of use.</p> <ul style="list-style-type: none"> <li>• <b>Off:</b> Turns off the purge.</li> <li>• <b>On:</b> The device is purged.</li> <li>• <b>Purge Flow, Time</b> and <b>Composition</b> during purge have to be defined.</li> </ul> <p>As soon as the duration time of the purge ends, the module automatically switches to analytical conditions again.</p>
<b>Prime</b>		<p>Select <b>On</b> to start priming, <b>Off</b> to turn priming off.</p> <p>The <b>Prime</b> 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.</p>
<b>Conditioning</b>	at least 200 bar (> 500 bar is better)	<p>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.</p> <p>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.</p>

## Control Settings

The pump control parameters are in two sections:

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

Table 8 Pump control parameters

Parameter	Description
<b>Pump</b>	Enables you to switch the pump <b>On</b> , <b>Off</b> or to a <b>Standby</b> condition. In the <b>Standby</b> condition, the pump motor is still active, and when the pump is switched on again, it does not need to be re-initialized.
<b>Automatic Turn On</b>	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 Quaternary Pump method setup parameters are in nine sections:

- **Flow**
- **Solvents A to D**
- **Stoptime**
- **Posttime**
- **Pressure Limits**
- **Timetable**
- **Advanced**
- **Blend Assist**
- **ISET**

**Table 9 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.
Enable Blend Assist		Mark this check box to switch on Blend Assist, which allows you to set up solvent mixtures from stock solutions. When this check box is marked, the <b>Blend Assist</b> section of the method setup is available.
Solvents		<p><b>Blend Assist Disabled:</b> When <b>Blend Assist</b> is disabled, you can set the percentages of solvents B, C, and D to any value from 0 through 100 %. <b>Solvent A</b> always delivers the remaining volume: 100 - (%B + %C + %D). The check boxes allow you to turn on the solvent channels (checked) or off (cleared). Click the solvent name down arrow and select the solvent from the list of calibrated solvents and solvent mixtures. For solvent mixtures, specify the percentage of additive. You can enter your own name for the solvent or solvent mixture in the adjacent field.</p> <p><b>Blend Assist Enabled:</b> When <b>Blend Assist</b> is enabled, the table shows the solvent blends that have been set up in the <b>Blend Assist</b> section of the method setup.</p> <ul style="list-style-type: none"> <li>• <b>Solvent:</b> The solvent or blend of solvents as set up in the Blend Assist section.</li> <li>• <b>Used:</b> Mark this check box if you want to use this solvent or blend in the method.</li> <li>• <b>%:</b> Enter the percentage of the solvent or blend in this field.</li> <li>• <b>Name:</b> Type a name for the solvent or blend in this field.</li> </ul>
Stoptime	0.01 – 99999 min or <b>As Injector/No Limit</b> (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. If they have a <b>No Limit</b> stoptime setting, the pump also stops the detectors. If no limit is given, a method will have to be stopped manually.
Posttime	0.01 – 99999 min or <b>Off</b> (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 <b>Posttime</b> to allow your column to equilibrate after changes in solvent composition (for example after gradient elution).

Table 9 Method parameters

Parameter	Limits	Description
<b>Pressure Limits</b>	<p><b>Max:</b> 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).</p> <p><b>Min:</b> any value between 0 and the upper pressure limit setting.</p>	<p>Sets the maximum and minimum pressure limits for the pump.</p> <ul style="list-style-type: none"> <li>• <b>Max</b> is the maximum pressure limit at which the pump will switch itself off, protecting the analytical system against overpressure.</li> <li>• <b>Min</b> is the minimum limit at which the pump will switch itself off, for example, if any solvent reservoir is empty, this prevents system damage by pumping air.</li> </ul>
<b>Timetable</b>		See "Timetable Settings" on page 82
<b>Advanced</b>		See "Advanced Settings" on page 80
<b>ISET</b>		Set the ISET parameters in this dialog box. For further information on ISET, please see the Online Help or to the <i>Agilent InfinityLab LC with ISET User Manual (G7120-90310)</i> .

### Advanced Settings

The Quaternary Pump advanced method setup parameters are in five sections:

- **Minimum Stroke**
- **Compressibility**
- **Maximum Flow Gradient**
- **Primary Channel**
- **Mixer Selection**



**Table 10** Advanced method parameters

Parameter	Limits	Description
<b>Minimum Stroke</b>	20 – 100 µL	<p>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 is extending the life time of the pump seals.</p> <p>If <b>Automatic</b> is activated, the pump tries to achieve an optimized stroke volume for the Inline Weaver geometry.</p>
<b>Compressibility</b>		<p>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.</p> <p><b>Use solvent types:</b></p> <ul style="list-style-type: none"> <li>Select this check box (recommended) for using the enhanced and automatic compressibility calibration. Then select the calibrated solvent from the drop-down lists using the combo boxes in the <b>Solvents</b> section. Using this check box hides compressibility fields for manual settings.</li> <li>Clear this check box to display the compressibility fields, which allow you to enter manual compressibility values, which are constant over pressure. This setting is available for method backward compatibility, e.g. from 1260 Infinity pumps. For best performance, use solvent types.</li> </ul>
<b>Maximum Flow Gradient</b>	1.000 – 1000.000 mL/min/min in steps of 0.001 mL/min/min Default value: 100.000 mL/min/min	<p>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 <b>Flow ramp up</b> and <b>Flow ramp down</b>.</p>
<b>Primary Channel</b>		<p>Using <b>Automatic</b> is recommended.</p> <p>The primary channel can be specified as A to D for optimizing highly specific methods. It is split up to deliver the first and last solvent package created by the MCGV in order to optimize composition precision. The primary channel does not change during a gradient, as long as the channel is used. Using <b>Automatic</b> chooses the channel with the highest percentage at start conditions before a gradient.</p>
<b>Mixer Selection</b>		<p>Click the down-arrow and select the mixer to use from the list:</p> <ul style="list-style-type: none"> <li><b>Use any mixer:</b> The currently installed mixer is used, irrespective of its type.</li> <li><b>Do not use mixer:</b> The valve is set to bypass the mixer so that it is not in the flow path.</li> <li><b>&lt;Mixer Name&gt;:</b> Only the specified mixer may be used; if the mixer is not found, the pump goes into a Not Ready state.</li> </ul>

### 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 that **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.

### Blend Assist

The **Blend Assist** table allows you to blend two or more solvents or solvent mixtures from stock solutions. The blends must be of pure solvents or pure solvents with additives. For example, you can blend 100 % water with 10 % isopropanol in water.

- **Channel:** The channel name.
- **Type:** The type of solvent
  - **Solvent <n>:** Pure solvent
  - **Solvent <n> Additive:** Solvent mixture
- **Calibration:** Click the down arrow and select the solvent or solvent mixture from the list.
- **Name:** Enter a name for the solvent or solvent mixture in this field.
- **Stock conc.:** For solvent mixtures, specify the concentration of the additive in the stock solution in this field. Pure solvents are always 100 %.
- **Final conc.:** Enter the concentration of the additive that you want to achieve in this field. The pure solvent and solvent mixture will be blended to achieve the **Final conc.** For the relationship of stock concentration and concentration in the mixture, the composition accuracy needs to be considered (see [“Performance Specifications Agilent 1290 Infinity II Flexible Pump \(G7104A\)”](#) on page 31).
- **Conc. unit:** The concentration can be defined as mM (mmol/L) or as %.

## 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

Capillary Coding Guide	85
Syntax for Capillary Description	85
At-a-glance color-coding keys	86
Installing Capillaries	87

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 ( $\mu\text{L}$ ). 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 11** 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	ST	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 <sup>1</sup>	E	Metric M3 + 1.6 mm Port id
Heat exchanger	Heat exchanger	PK/ST	Stainless steel-coated PEEK <sup>2</sup>	U	Swagelok union
		PFFE	PTFE	L	Long
		FS	Fused silica	X	Extra long
		MP35N	Nickel-cobalt-chromium-molybdenum 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

<sup>1</sup> Fused silica in contact with solvent

<sup>2</sup> Stainless steel-coated PEEK

## At-a-glance color-coding keys

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

**Table 12** 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 13** 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 14 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 mm x 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 15 Capillary connections for 1260 Infinity II Bio-inert LC**

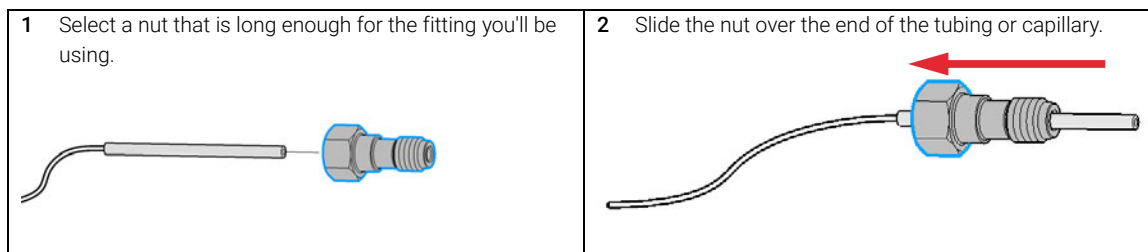
p/n	From	To
Bottle Head Assembly (G7120-60007)	Solvent Bottle	Infinity II Pump
Capillary Ti 0.17 mm x 500 mm, SL/SLV (5500-1264)	Pump	Multisampler
Capillary PK/ST 0.17 mm x 500 mm, RLO/RLO (Bio-inert) (G5667-81005)	Multisampler	MCT
ZDV union (Bio-inert) (5067-4741)	Capillary	Bio-inert Heat Exchanger
Quick Connect Heat Exchanger Bio-inert (G7116-60041)		
Capillary PEEK 0.18 mm x 1.5 m (0890-1763) and PEEK Fittings 10/PK (5063-6591)	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 Bio LC**

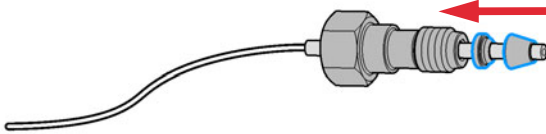
p/n	From	To
Bottle Head Assembly (G7120-60007)	Solvent Bottle	Infinity II Pump
Capillary MP35N 0.17 mm x 500 mm, SI/SI (5500-1419)	Pump	Multisampler
Capillary MP35N 0.12 mm x 500 mm SI/SI (5500-1279)	Multisampler	MCT
Quick Connect Capillary MP35N 0.12 mm x 105 mm (5500-1578)	MCT Heat Exchanger	Column
Quick Turn Capillary MP35N 0.12 mm x 280 mm (5500-1596)	Column/MCT Valve	Detector (DAD)
Quick Turn Capillary MP35N 0.12 mm x 500 mm (5500-1598)	Column/MCT Valve	Detector (VWD)
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 85.

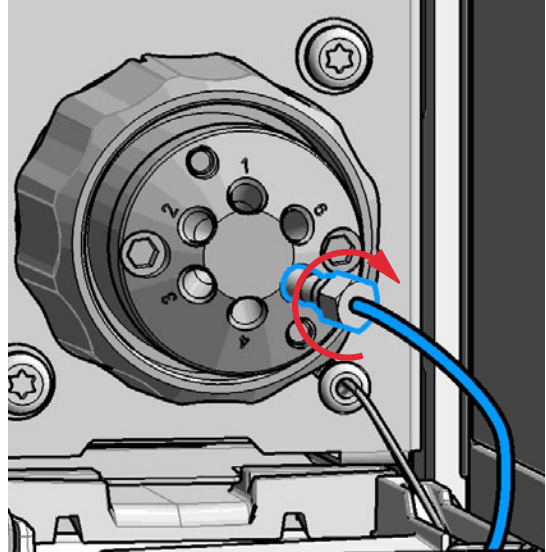


## Preparing the Pump Installing Capillaries

- 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.



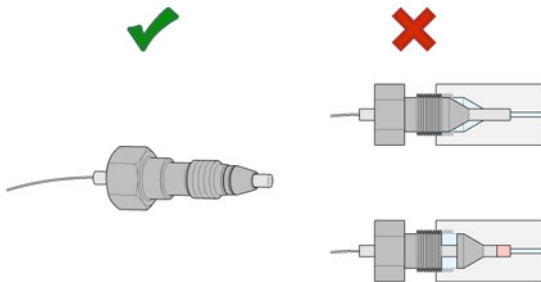
- 4 Use a column or injection valve to gently tighten the fitting, which forces the ferrule to seat onto the tubing or capillary.



### 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 Swagelok 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

## How to Optimize the Performance of Your Module

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

## Delay Volume and Extracolumn 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 *extracolumn 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.

For the Flexible Pump, all pump parts downstream the MCGV contribute to the delay volume, i.e. inlet weaver, pump heads, capillary connections, filters and the optional Jet Weaver.

## How to Configure the Optimum Delay Volume

The design of the Flexible Pump offers a strongly decreased delay volume compared to standard 600 bar pressure pumps. For the Flexible Pump, mixing is done in the multi-channel gradient valve at ambient pressure. As all pump parts in the flow path after mixing contribute to the delay volume, this also includes pump heads, flow connections, filters, mixers etc. Therefore the delay volume of a quaternary pump (Flexible Pump) is by design larger than that of a binary pump.

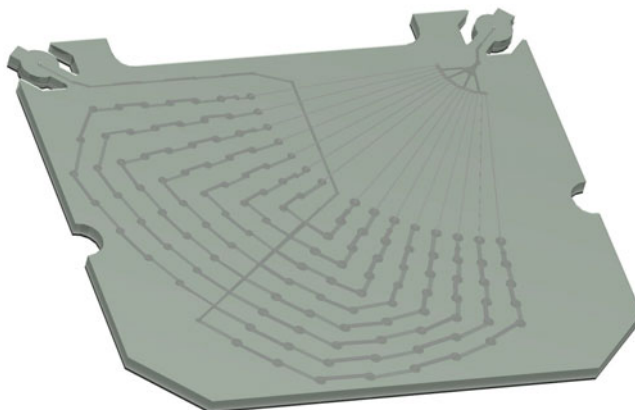
All listed components including the inlet weaver and pump heads ensure a good mixing performance resulting in excellent composition precision, and accuracy, highly reproducible retention times, and low baseline noise. This ensures best results for most applications.

Per default, the Flexible Pump does not require and include a Jet Weaver, as solvents are mixed in the MCGV and mixing is further improved in the inlet weaver, pump heads and subsequent parts in the flow path. Therefore, no Jet Weaver is required for most applications.

Jet Weaver high-performance mixers are optionally available for demanding applications, which use solvents in different channels. For example, A versus B solvents, which differ strongly in their UV-Vis absorption, e.g. 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. Jet Weavers strongly improve mixing and therefore reduce baseline noise and improve sensitivity in detection. Patented Agilent microfluidic technology offers high mixing performance at a low internal volume. For example, the physical volume of all channels for a 380  $\mu\text{L}$  mixer only contributes with 150  $\mu\text{L}$  to the pump delay volume (< 350  $\mu\text{L}$  without Jet Weaver), which is the partial mixer volume that creates a composition change corresponding to the delay volume.

## How to Optimize the Performance of Your Module

### How to Configure the Optimum Delay Volume



**Figure 14** The Jet Weaver mixer

The installation procedure is illustrated in “Install the Jet Weaver” on page 170.

# 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:

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

where

- $R_s$ =resolution,
- $N$ =plate count (measure of column efficiency),
- $\alpha$ =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,  $\alpha$ , 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,
- $\Delta\%B$  = change in fraction of solvent B during the gradient,
- $S$  = constant (ca. 4-5 for small molecules).



## How to Optimize the Performance of Your Module

### How to Achieve Higher Resolution

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

### 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.

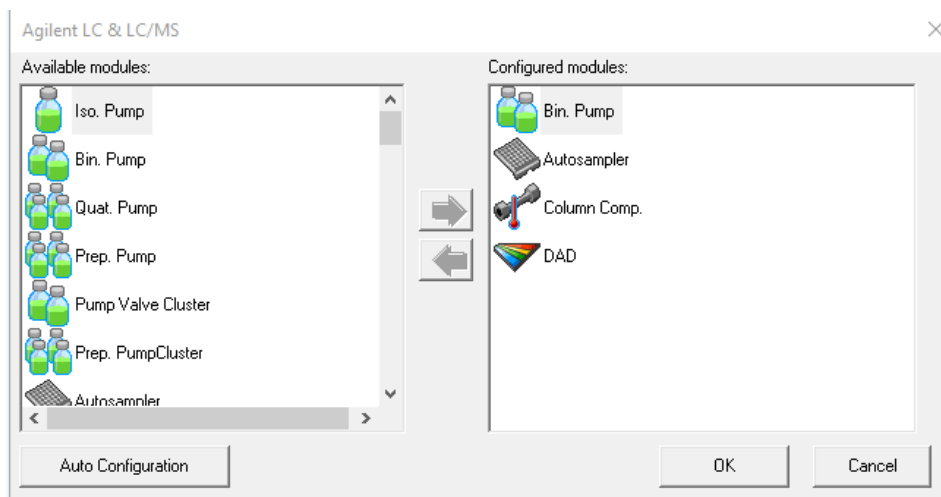
### How to Import the Latest Solvent Calibration Tables

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.

## How to Optimize the Performance of Your Module Using Solvent Calibration Tables

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

- 1 Enter the Instrument configuration of the Agilent LC Driver.



## How to Optimize the Performance of Your Module Using Solvent Calibration Tables

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

The image shows a software dialog box titled "Binary Pump Configuration" with a close button (X) in the top right corner. The dialog is divided into two main sections: "Communication" and "Options".

**Communication Section:**

- Device name: Binary Pump
- Type ID: G7120A (dropdown menu)
- Serial number: DEBAY01809
- Firmware revision: B.07.28 [0006]
- Connection settings... (button)

**Options Section:**

- Pressure Unit: bar (dropdown menu)
- Installed mixer: Jet Weaver V35 Mixer (dropdown menu)
- Custom mixer: (empty text field)
- ISET installed (checkbox)
- ISET Configuration ... (button)
- Configure Solvent Type Catalogs... (button)

At the bottom of the dialog are three buttons: OK, Cancel, and Help.

## How to Optimize the Performance of Your Module

### Using Solvent Calibration Tables

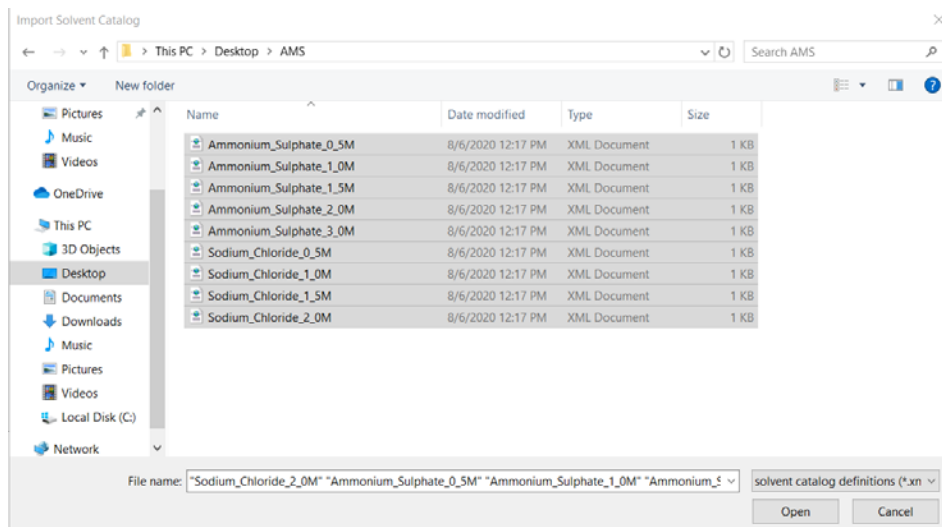
- In the additional configuration of the pump module, choose **Configure Solvent Type Catalogs...**

Solvent Type Catalogs

Solvent Name	Operator Name	Comment	Creation Time	Module Serial	Module Type
Water V.03	Agilent Technologi...		4/19/2012 12:00:0...	PR00001023	G4220A
Acetonitrile V.03	Agilent Technologi...		4/19/2012 12:00:0...	PR00001023	G4220A
Organic V.03	Agilent Technologi...		4/19/2012 12:00:0...	PR00001023	G4220A
Aqueous V.03	Agilent Technologi...		4/19/2012 12:00:0...	PR00001023	G4220A
Methanol/ACN 1...	Agilent Technologi...		4/19/2012 12:00:0...	PR00001023	G4220A
Isopropanol V.03	Agilent Technologi...		4/19/2012 12:00:0...	PR00001023	G4220A
Ethanol V.03	Agilent Technologi...		4/19/2012 12:00:0...	PR00001023	G4220A
Methanol V.03	Agilent Technologi...		4/19/2012 12:00:0...	PR00001023	G4220A
ACN in Water V.02	Agilent Technologi...		11/10/2009 12:00:...	PR00001023	G4220A
Acetonitrile in Met...	Agilent Technologi...		12/1/2009 12:00:0...	PR00001023	G4220A
Methanol in Wate...	Agilent Technologi...		11/10/2009 12:00:...	PR00001023	G4220A
Isopropanol in W...	Agilent Technologi...		11/16/2009 12:00:...	PR00001023	G4220A
(Methanol/ACN 1...	Agilent Technologi...		10/14/2010 12:00:...	PR00001023	G4220A
Ethanol in Water...	Agilent Technologi...		10/14/2010 12:00:...	PR00001023	G4220A
Organic in Aqueo...	Agilent Technologi...		4/19/2012 12:00:0...	PR00001023	G4220A

Remove Import... Export... Ok Cancel Help

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



## How to Optimize the Performance of Your Module Using Solvent Calibration Tables

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

Solvent Type Catalogs

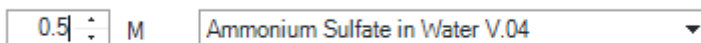
Solvent Name	Operator Name	Comment	Creation Time	Module Serial	Module Type
Methanol/ACN 1...	Agilent Technologi...		4/19/2012 12:00:...	PR00001023	G4220A
Isopropanol V.03	Agilent Technologi...		4/19/2012 12:00:...	PR00001023	G4220A
Ethanol V.03	Agilent Technologi...		4/19/2012 12:00:...	PR00001023	G4220A
Methanol V.03	Agilent Technologi...		4/19/2012 12:00:...	PR00001023	G4220A
ACN in Water V...	Agilent Technologi...		11/10/2009 12:0...	PR00001023	G4220A
Acetonitrile in M...	Agilent Technologi...		12/1/2009 12:00:...	PR00001023	G4220A
Methanol in Wat...	Agilent Technologi...		11/10/2009 12:0...	PR00001023	G4220A
Isopropanol in W...	Agilent Technologi...		11/16/2009 12:0...	PR00001023	G4220A
(Methanol/ACN...	Agilent Technologi...		10/14/2010 12:0...	PR00001023	G4220A
Ethanol in Water...	Agilent Technologi...		10/14/2010 12:0...	PR00001023	G4220A
Organic in Aque...	Agilent Technologi...		4/19/2012 12:00:...	PR00001023	G4220A
Ammonium Sulp...	Agilent Technologi...		4/28/2020 12:00:...	DEBAY01287	G4220A
Ammonium Sulp...	Agilent Technologi...		4/28/2020 12:00:...	DEBAY01287	G4220A
Ammonium Sulp...	Agilent Technologi...		4/28/2020 12:00:...	DEBAY01287	G4220A
Ammonium Sulp...	Agilent Technologi...		4/28/2020 12:00:...	DEBAY01287	G4220A
Sodium Chloride...	Agilent Technologi...		6/17/2020 12:00:...	DEBAY01287	G4220A
Sodium Chloride...	Agilent Technologi...		6/17/2020 12:00:...	DEBAY01287	G4220A
Sodium Chloride...	Agilent Technologi...		6/17/2020 12:00:...	DEBAY01287	G4220A

Remove Import... Export... Ok Cancel Help

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

For LC Drivers 3.4 or newer, please use Ammonium Sulfate in Water V.04 and Sodium Chloride in Water V.04 and manually input the molarity (0.5M-3.0M or 0.5M-2.0M respectively) as shown in the example below.



The image shows a software interface with two input fields. The first field is a text box containing the value "0.5" followed by a unit selector dropdown set to "M". The second field is a dropdown menu with the text "Ammonium Sulfate in Water V.04" and a downward-pointing arrow.

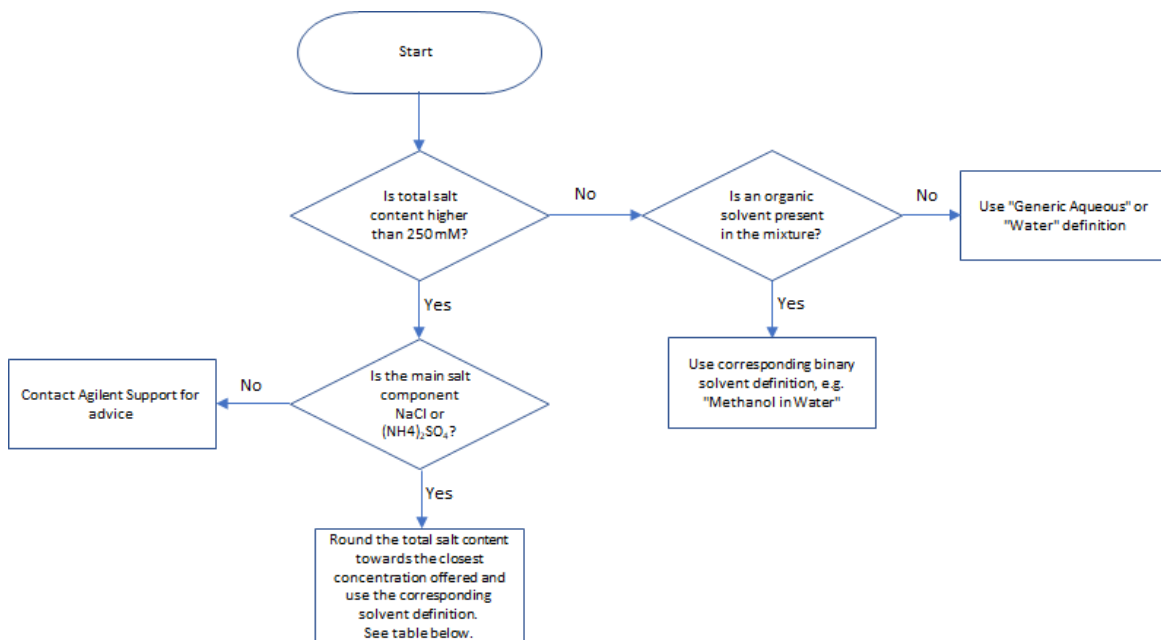
With the 1290 Infinity II Bio LC System Agilent offers a dedicated instrument for running applications that are typical for the (Bio)pharma market, such as IEX (Ion Exchange Chromatography) or HIC (Hydrophobic Interaction Chromatography), and applications in Academia, Government and Applied Markets,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

For LC Drivers 3.3 or older, please choose the solvent definition most suitable for the application according to the chart below.

### NOTE

Ammonium Sulphate V.03 and Sodium Chloride V.03 only properly characterize the G7132A High-Speed Pump. Do not use these with any quaternary/flexible pump configurations.

## How to Optimize the Performance of Your Module Using Solvent Calibration Tables



Main salt component	Total salt content (c, mol/L)	Select solvent definition
NaCl	$0.25 < c \leq 0.75$	Sodium Chloride 0.5M V.03
	$0.75 < c \leq 1.25$	Sodium Chloride 1.0M V.03
	$1.25 < c \leq 1.75$	Sodium Chloride 1.5M V.03
	$c > 1.75$	Sodium Chloride 2.0M V.03
$(\text{NH}_4)_2\text{SO}_4$	$0.25 < c \leq 0.75$	Ammonium Sulphate 0.5M V.03
	$0.75 < c \leq 1.25$	Ammonium Sulphate 1.0M V.03
	$1.25 < c \leq 1.75$	Ammonium Sulphate 1.5M V.03
	$1.75 < c \leq 2.5$	Ammonium Sulphate 2.0M V.03
	$c > 2.5$	Ammonium Sulphate 3.0M V.03





## 6 Troubleshooting and Diagnostics

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This chapter gives an 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 107.
- 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/G7131C). 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/G7131C)) 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  $\leq 3$   $\mu\text{L}/\text{min}$
- The allowed leak limit for the primary piston is  $\leq 30$   $\mu\text{L}/\text{min}$

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 15 on page 109 and Figure 16 on page 110 show a typical test run.

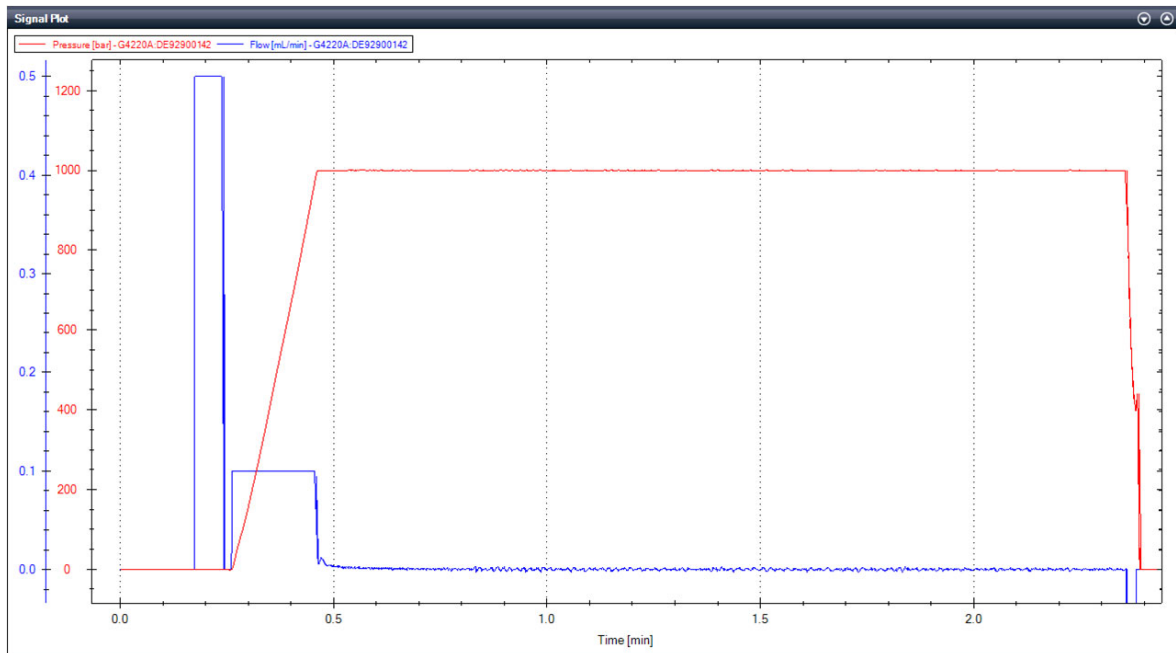


Figure 15 Static (secondary) Leak Test

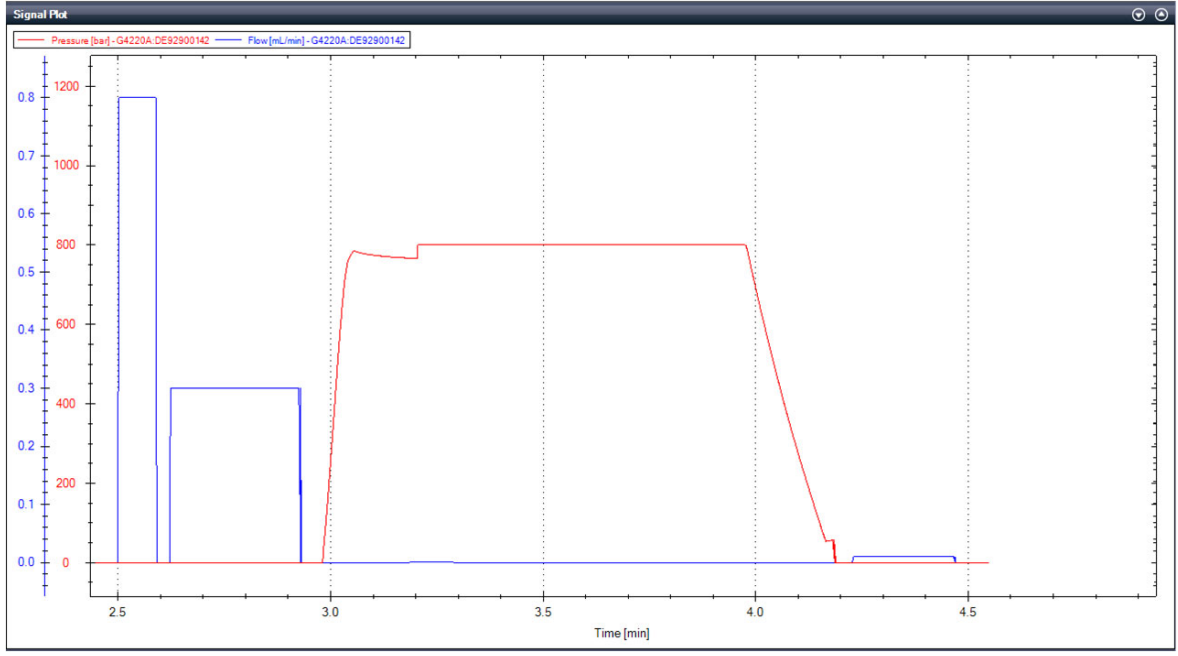


Figure 16 Dynamic (primary) Leak Test

## Troubleshooting the Pump Leak Rate Test

### Secondary Leak > 3 $\mu\text{L}/\text{min}$

- 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 $\mu\text{L}/\text{min}$ 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  $\leq 1000$  bar, the allowed leak limit is  $\leq 5$   $\mu\text{L}/\text{min}$
- For a pressure setting  $> 1000$  bar, the allowed leak limit is  $\leq 15$   $\mu\text{L}/\text{min}$

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 17 on page 114 shows a typical test run.

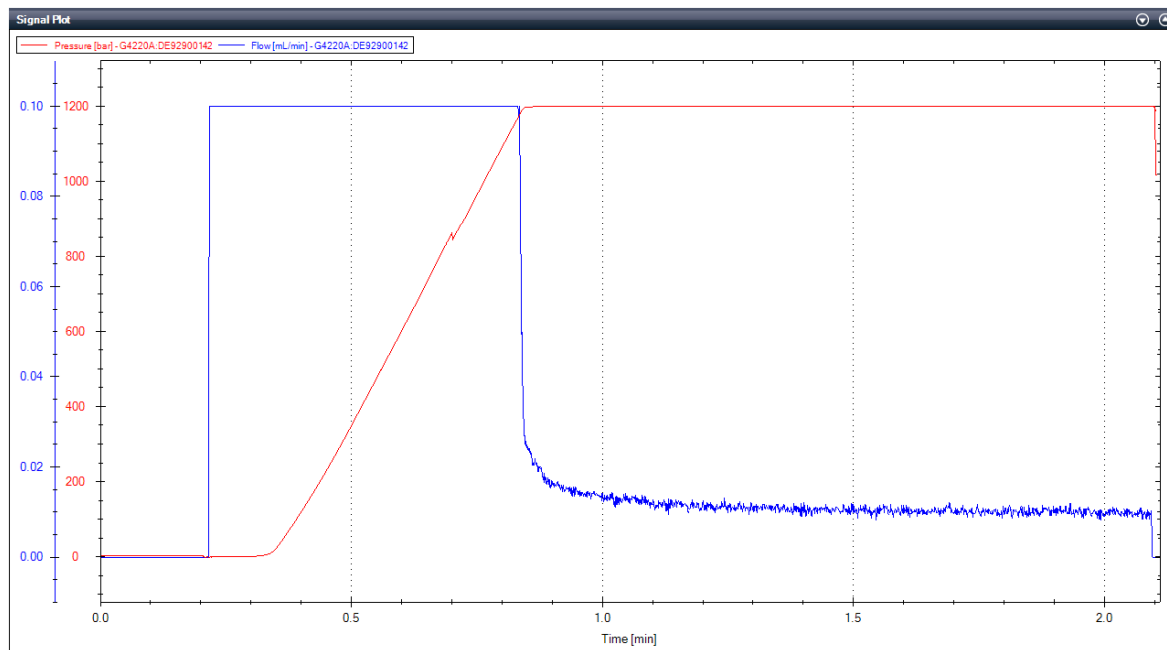


Figure 17 System Pressure Test

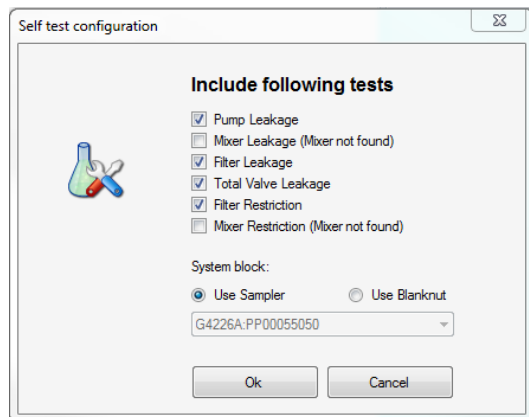
## Pump Self Test

The Pump Self Test combines a **Pump Leak Rate Test** with several consecutive **System Pressure Tests** to determine the leak rates at various positions in the flow path of the Quaternary Pump. During the test either the leak rate or the flow restriction is determined, according to the run protocol, which can be configured during the test setup. The maximum pressure is 1000 bar for G4204A, G7104A and G7131A, and 800 bar for G7104C and G7131C, or automatically limited to a lower pressure by the other components in the system.

For running the tests, either a blank nut or the blind seat of an Agilent Sampler can be used to block the system. When the **Mixer Restriction** or **Mixer Restriction** are measured, a waste line has to be connected to port 4 when prompted by Lab Advisor. If any **Leakage Test** is activated, a full **Pump Leak Rate Test** is performed. Afterwards, the total system leakage is determined without filter and mixer in the flow path. If only a **Restriction Test** is done, no leakages will be determined.

You can choose from the following tests:

- **Pump Leakage:** tests the leakage on the pump head components.
- **Mixer Leakage:** tests the leakage of the mixer and its connections.
- **Filter Leakage:** tests the leakage of the filter and its connections.
- **Total Valve Leakage:** tests the leakage of the valve, mixer (if installed) and filter.
- **Mixer Restriction:** calculates the restriction due to the mixer.
- **Filter Restriction:** calculates the restriction due to the filter.



#### **Pump Leakage:**

The pump leakage is measured when any of the other leakage tests is selected. First, a full pump leak rate test is run, which can be limited to the maximum allowed system pressure. After that a pressure test is performed.

#### **Mixer Leakage:**

Determines the leakage at the mixer (if installed). The overall leak with the mixer in the flow path is determined and the value for the secondary leak is subtracted from it.

#### **Filter Leakage:**

The Filter Leakage is calculated by subtracting the result of a system pressure test with the filter in the flow path from the result of the system leakage determined before.

#### **Total Valve Leakage:**

The overall leak of the valve is measured with the mixer (if installed) and the filter. The result is subtracted from the system leakage determined before.

#### **Filter Restriction:**

The values of the back pressure of the pump at a flow of 1 mL/min with and without filter are compared.

#### **Mixer Restriction:**

The values of the back pressure of the pump at a flow of 1 mL/min with and without mixer are compared, the result for the filter restriction is subtracted.

Preparations:

- 1 Flush the system with HPLC grade water for several minutes from any solvent channel.
- 2 Start the **Pump Self Test** and choose the test you want to test the system with. The pressure will automatically adjust to best fit your system.
- 3 Choose if you want to use a blank nut or the sampler (only certain modules) to block the pump.
- 4 Choose the channel with HPLC grade water and if you want to include or skip an additional purging step.
- 5 Click **OK** and follow the instructions.

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 and for any other leakage is  $\leq 3 \mu\text{L}/\text{min}$ .
- The allowed leak limit for the primary piston is  $\leq 30 \mu\text{L}/\text{min}$
- If the restriction for any of the filters is unreasonably high, consider exchanging the filter frits.

A report can be displayed, saved or printed by opening it with the **Print Result**.

If the test does not pass, check the system for leaks or call a local Agilent representative. [Figure 18](#) on page 118 shows a typical test run.

## Troubleshooting and Diagnostics

### Pump Self Test

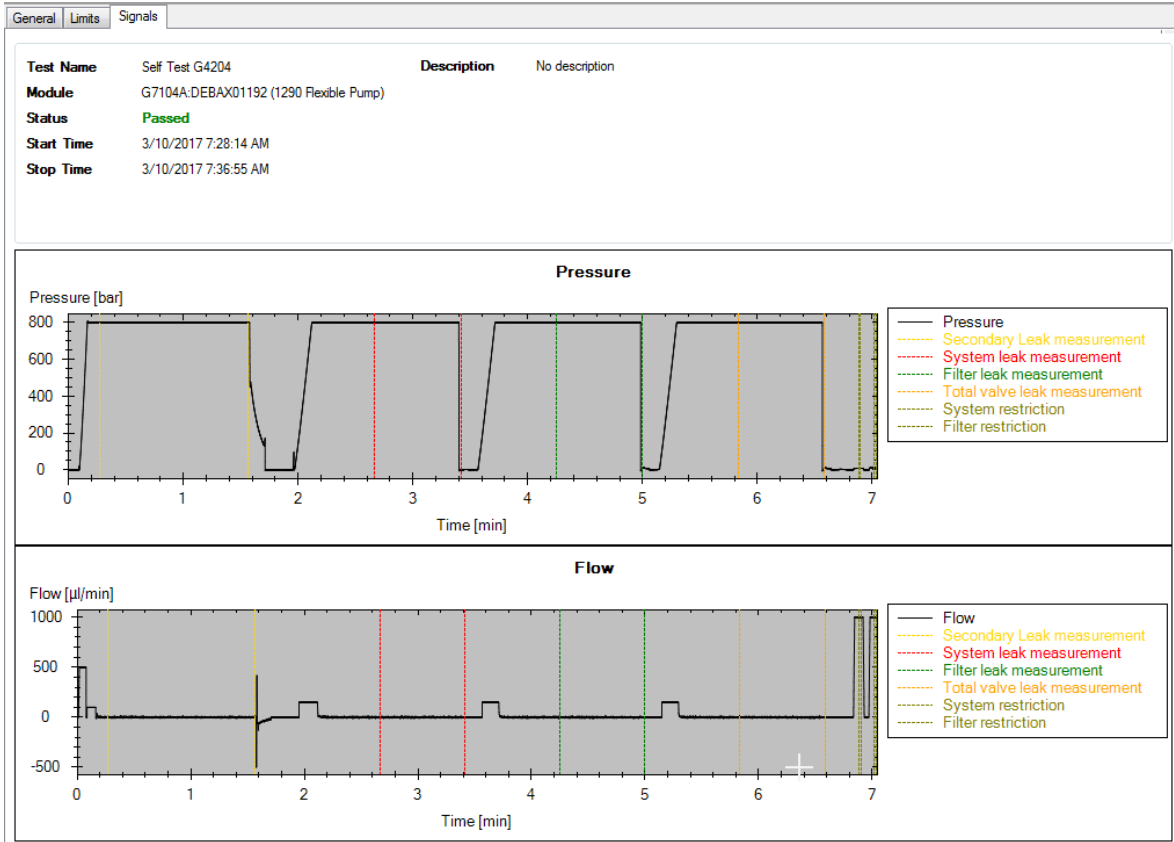


Figure 18 Pump Self Test

## Diagnostic Signals

### Tuning

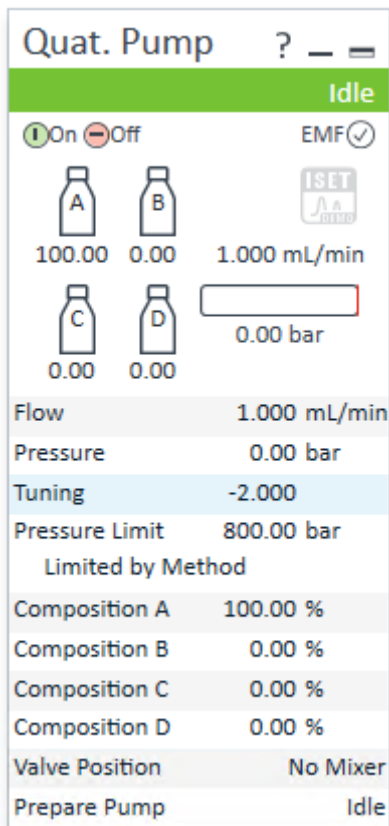
For pumps operating as expected, the signal should stay in a range of  $-1$  to  $+1$  within the full scale of  $-2$  to  $+2$ . Ideal performance is at  $0$ .

Causes for changed behavior could be:

- Gas bubbles in primary chamber
- Suboptimal compressibility settings
- Major leaks in seals or fittings
- Problems with the valves
- Blockage of filters or capillaries

**NOTE**

The tuning value does not change during the functions **Prime** or **Conditioning**.





## Troubleshooting and Diagnostics

### Diagnostic Signals

Symptom	Possible Source	Possible Fix
<b>Tuning</b> signal is negative (about -2), pressure signal is unstable.	Air in primary pump chamber.	Use a syringe to fill the solvent lines with solvent and use the prime function from your CDS. Afterwards load an appropriate method and condition the system.
<b>Tuning</b> signal is negative (about -1.5), pressure signal is stable.	Micro air bubbles in the primary pump chamber.	Load an appropriate method and condition the system.
	Wrong solvent is set in the CDS or wrong solvent is connected.	Check solvents and solvent settings.
<b>Tuning</b> signal is negative after Priming and Conditioning.	Back flow in inlet valve.	Clean and check the valves, see maintenance section in the manual. Call Agilent service if the problem persists.
	Outlet valve not properly assembled.	Clean and check the valves, see maintenance section in the manual. Call Agilent service if the problem persists.
	Leaky piston seals and/or position-dependent leaks on the piston.	Change seals in the pump head. Call Agilent service if the problem persists.
<b>Tuning</b> signal is gradually decreasing over a time period.	Air is introduced into the primary pump chamber.	Check performance of the degasser.
	Filters are starting to block.	Change filters in the system.
<b>Tuning</b> signal is positive (about +1.5), pressure signal is stable.	Wrong solvent is set in the CDS or wrong solvent is connected.	Check solvents and solvent settings.

# 7

## Error Information

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## Error Information

### Diagnostic Signals

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This chapter describes the meaning of error messages, and provides information on probable causes and suggested actions on 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
<b>1</b> 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.
<b>2</b> 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
<b>1</b> Leak detected in another module with a CAN connection to the system.	Fix the leak in the external instrument before restarting the module.
<b>2</b> Leak detected in an external instrument with a remote connection to the system.	Fix the leak in the external instrument before restarting the module.
<b>3</b> Shut-down in an external instrument with a remote connection to the system.	Check external instruments for a shut-down condition.
<b>4</b> The degasser failed to generate sufficient vacuum for solvent degassing.	Check the vacuum degasser for an error condition. Refer to the <i>Service Manual</i> 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.	<ul style="list-style-type: none"> <li>Ensure all the CAN cables are connected correctly.</li> <li>Ensure all CAN cables are installed correctly.</li> </ul>
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
<b>1</b> Defective leak sensor.	Please contact your Agilent service representative.
<b>2</b> Leak sensor incorrectly routed, being pinched by a metal component.	Please contact your Agilent service representative.
<b>3</b> Power switch assembly defective.	Please contact your Agilent service representative.
<b>4</b> 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 mainboard.

Probable cause	Suggested actions
<b>1</b> Loose fittings.	Ensure all fittings are tight.
<b>2</b> Broken capillary.	Exchange defective capillaries.
<b>3</b> 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).
<b>4</b> Defective pump seals.	Exchange the pump seals.

## Pump Error Messages

These errors are pump specific.

### Pressure of quaternary pump above upper limit

**Error ID: 29163**

The pressure has exceeded the upper pressure limit.

- Parameter: Measured pressure

Probable cause	Suggested actions
1 Blockage in flow path after the pressure sensor.	<ul style="list-style-type: none"> <li>• Check for blockages in the LC system, e.g. purge valve, Jet Weaver, degraded column, column frits, needle, needle seat, capillaries etc.</li> <li>• Check for particles in the solvent.</li> </ul>
2 Inappropriate settings (pressure limit, flow rate).	<ul style="list-style-type: none"> <li>• Decrease flow rate.</li> <li>• Increase pressure limit.</li> </ul>

### Pressure below lower limit

**Error ID: 29176**

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 quaternary pump degasser

### Error ID: 29221

The target pressure of the quaternary 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.

## Solvent counter exceeded limit

### Error ID: 29146

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

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: 29147

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.	<ul style="list-style-type: none"> <li>• Reset waste counter.</li> <li>• Adjust waste counter limit.</li> </ul>

## Flow rate limit exceeded

### Error ID: 29164

The flow rate of the quaternary 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 (if applicable).	Open shutoff valve.
4 Drift of pressure sensor (unlikely for short tests taking only minutes).	Replace pressure sensor.

## Quaternary pump shutdown during analysis

### Error ID: 29199

The quaternary 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: 29201

Reading the pump encoder tag has failed.

- Parameter: 1 – 2 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: 29200**

Writing the pump encoder tag has failed.

- Parameter: 1 – 2 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: 29214**

Pump drive blocked or encoder failed.

- Parameter: None

Probable cause	Suggested actions
1 Blockage of the system before pressure sensor.	Please contact your Agilent service representative.
2 Drive encoder failed.	Please contact your Agilent service representative.

## Drive current too low

### Error ID: 29205

The current consumption of the pump drive is too low.

- Parameter: 1 – 2 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: 29236

The current consumption of the pump drive is too high.

- Parameter: 1 – 2 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, Multipurpose Valve, heat exchanger.
2 Drive motor defect.	Please contact your Agilent service representative.

## Drive timeout

### Error ID: 29204

Movement of drive during initialization is blocked mechanically.

- Parameter: 1 – 2 referring to pump drive

Probable cause	Suggested actions
1 Blockage in flow path	Remove capillary connection to system, check outlet filter, check valves, check pump head.
2 Blockage of pump drive Drive motor defect.	Please contact your Agilent service representative.

## Overcurrent of pump drive

### Error ID: 29202

The current consumption of the pump drive is too high.

- Parameter: 1 – 2 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, Multipurpose Valve, heat exchanger.
2 Drive motor defect.	Please contact your Agilent service representative.

## Deliver underrun

### Error ID: 29233

Internal error.

- Parameter: None

Probable cause	Suggested actions
1 Internal error.	Please contact your Agilent service representative.
2 Firmware issue	Use a minimum firmware revision of B.06.55

## Defect connection between main board and pump drive encoder

### Error ID: 29208

Defect connection between main board and pump drive encoder.

- Parameter: 1 – 2 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: 29209**

Defect pump drive encoder.

- Parameter: 1 – 2 referring to pump drive

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

## Multipurpose Valve failed

**Error ID: 29231**

Lost steps of the multipurpose valve encoder.

- Parameter: None

Probable cause	Suggested actions
1 Multipurpose valve drive mechanically blocked or defect.	<ul style="list-style-type: none"> <li>• Check installation of multipurpose valve head.</li> <li>• Replace multipurpose valve head.</li> </ul>

## Reading of multipurpose valve tag failed

**Error ID: 29240**

Reading the multipurpose valve tag failed.

- Parameter: None

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

## Pump drive encoder rollover

### Error ID: 29232

Invalid pump drive encoder signals have been detected.

- Parameter: 1 – 2 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: 29234

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: 29235

Insufficient power of drive encoder LED.

- Parameter: 1 – 2 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: 29237, 29238, 29239, 29215**

An error has occurred for the pump drive encoder.

- Parameter: 1 – 2 referring to pump drive

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

## Writing the multipurpose valve tag failed

**Error ID: 29241**

Writing the multipurpose valve tag failed.

- Parameter: None

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

## Unknown multipurpose valve type

**Error ID: 29242**

The type information of the multipurpose valve is invalid.

- Parameter: None

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

## Pump drive encoder error

**Error ID: 29211**

The pump drive encoder has generated no signal.

- Parameter: 1 – 2 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: 29212, 29213**

The pump drive failed during calibration.

- Parameter: 1 – 2 referring to pump drive

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



## Maximum stroke is too short

### Error ID: 29203

The maximum stroke is too short.

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 – 2 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: 29207

The pump drive stop has not been found.

- Parameter: 1 – 2 referring to pump drive

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

## Timeout: Wait for Composition

### Error ID: 29180

A target condition (composition) has been sent to the instrument which should have been reached within an expected time frame but didn't. Either the limit, time frame or the current value of the variable has been modified later directly or indirectly.

Probable cause	Suggested actions
1 Incorrect parameters have been sent to the instrument by the control software or manual changes.	Verify control software, macros, manual commands.

## Timeout: Wait for run volume

### Error ID: 29181

A target condition (run volume, which is the volume delivered since the method run start) has been sent to the instrument which should have been reached within an expected time frame but didn't. Either the limit, time frame or the current value of the variable has been modified later directly or indirectly (for example the flow rate).

Probable cause	Suggested actions
1 Incorrect parameters have been sent to the instrument by the control software or manual changes.	Verify control software, macros, manual commands.

## Timeout: Wait for Volume

### Error ID: 29182

A target condition (volume, which is the delivered flow since the limit has been set) has been sent to the instrument which should have been reached within an expected time frame but didn't. Either the limit, time frame or the current value of the variable has been modified later directly or indirectly (for example the flow rate).

Probable cause	Suggested actions
1 Incorrect parameters have been sent to the instrument by the control software or manual changes.	Verify control software, macros, manual commands.

## Timeout: Wait for Flow

### Error ID: 29183

A target condition (flow rate) has been sent to the instrument which should have been reached within an expected time frame but didn't. Either the limit, time frame or the current value of the variable has been modified later directly or indirectly.

Probable cause	Suggested actions
1 Incorrect parameters have been sent to the instrument by the control software or manual changes.	Verify control software, macros, manual commands.

## Timeout: Wait for Pressure

### Error ID: 29185

A target condition (pressure) has been sent to the instrument which should have been reached within an expected time frame but didn't. Either the limit, time frame or the current value of the variable has been modified later directly or indirectly.

Probable cause	Suggested actions
1 Incorrect parameters have been sent to the instrument by the control software or manual changes.	Verify control software, macros, manual commands.
2 Leak	Run system pressure test for identifying and localizing the leak. Correct leak.

## Drive Encoder failed

### Error ID: 29210

Drive encoder failed during pump drive calibration.

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

## Drive phases differ too much in electric resistance

### Error ID: 29216

Pump drive calibration has failed due to a strong difference electric resistances for different motor phases.

Probable cause	Suggested actions
1 Pump drive cable defect.	Please contact your Agilent service representative.
2 Pump drive defect.	Please contact your Agilent service representative.
3 Defective mainboard.	Please contact your Agilent service representative.

## Degasser's pressure limit violation

### Error ID: 29220

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.

## Seal wash pump was missing when tried to turn on

**Error ID: 29223**

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.

## Valve hardware overcurrent (MCGV)

**Error ID: 29227**

Power consumption too high for one of the MCGV valves.

Probable cause	Suggested actions
1 Cable defect.	Replace MCGV/4CGV.
2 Valve defect	Replace MCGV/4CGV.
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.

## MCGV hardware check failed

**Error ID: 29256**

The MCGV hardware check failed.

Probable cause	Suggested actions
1 MCGV/4CGV may be disconnected.	Check MCGV/4CGV cable connection.
2 Valve defect.	Please contact your Agilent service representative.

## 8

# Maintenance

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## Maintenance

### Pump Error Messages

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This chapter describes the maintenance of the Agilent 1290 Infinity II Flexible Pumps.

## Introduction to Maintenance

Figure 19 on page 154 shows the main user-accessible assemblies of the Agilent 1290 Infinity II Flexible Pump. These parts can be accessed from the front (simple repairs) and don't require to remove the pump from the system stack.

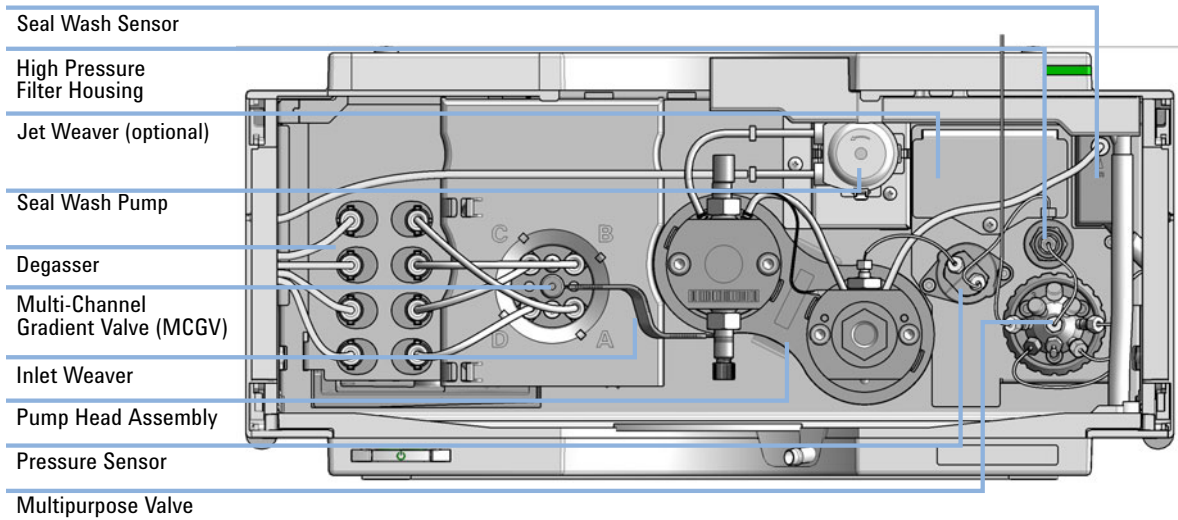
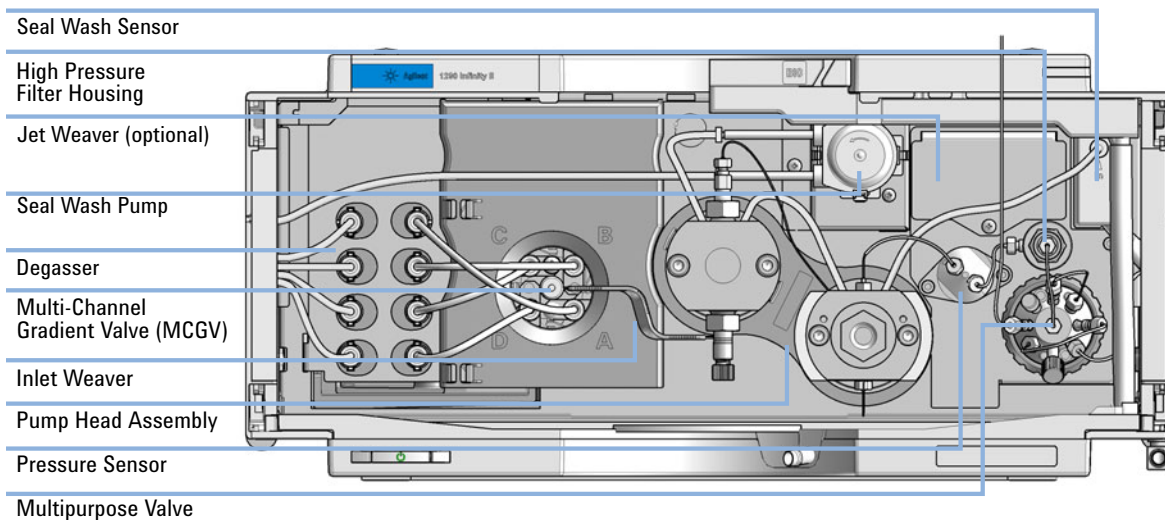


Figure 19 Overview of maintenance parts for the Flexible Pump



**Figure 20** Overview of maintenance parts for the Bio Flexible Pump

#### 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.

**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**

<b>p/n</b>	<b>Description</b>
5067-5745 	Door Assembly Infinity 180 Left
5067-5746 	Door Assembly Infinity 180 Right

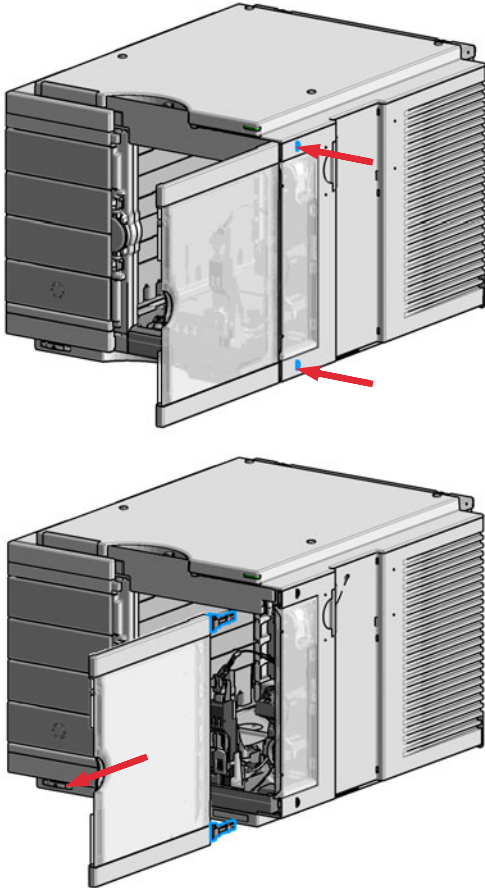
**NOTE**

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

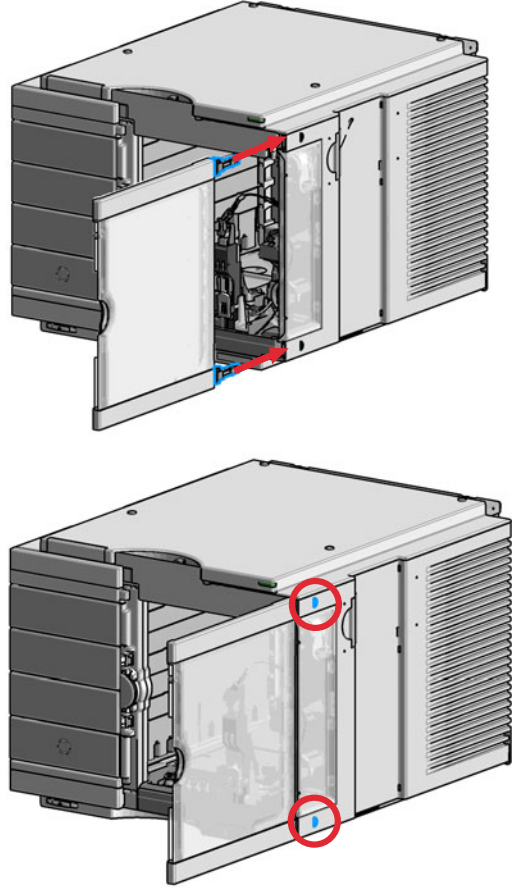
The principle of how to remove and/or install doors works in the same way for all Infinity II modules.



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 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

Parts required	p/n	Description
	5067-6791 	Pressure sensor 1300 bar
	5067-7010 	Pressure sensor biocompatible 1300 bar

**Preparations** Turn off pump flow, switch off pump

### NOTE

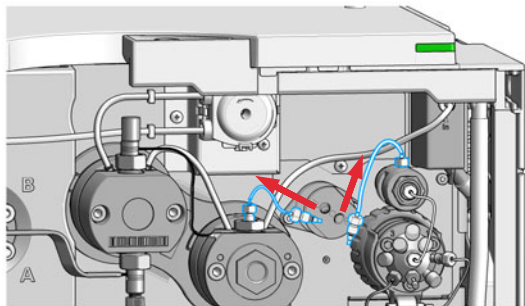
This procedure describes how to replace the pressure sensor.

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

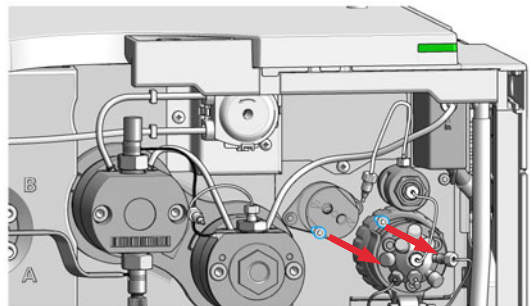
### NOTE

Working on connections to the pressure sensor may slightly change the displayed pressure. In case of a pressure offset at ambient pressure, a pressure offset calibration may be run.

- 1** Remove capillary connections between the pressure sensor and the High Pressure Filter, and between the pressure sensor and the outlet adapter of the secondary pump head, respectively.



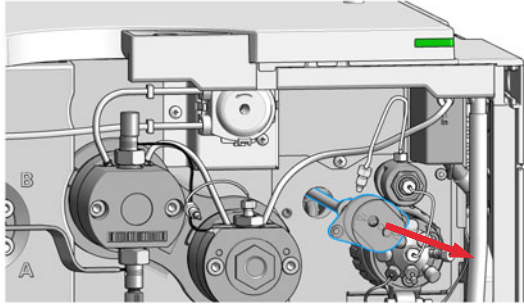
- 2** Remove the screws that fix the pressure sensor to the chassis.



## Maintenance

### Replace the Pressure Sensor

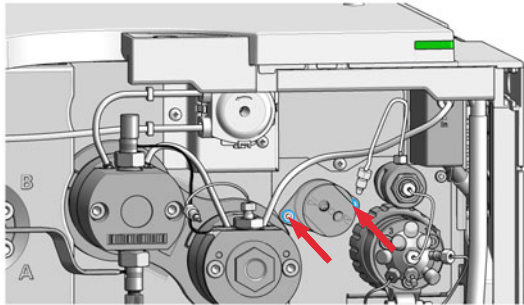
- 3** Carefully pull out the pressure sensor for about 2 cm. Then unscrew the cable from the pressure sensor.



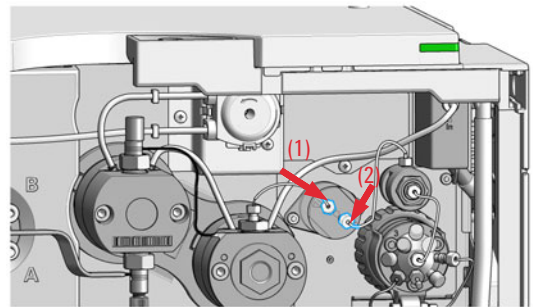
- 4** Connect the new pressure sensor to the pressure sensor connector.



- 5** Fix the pressure sensor to the instrument chassis.





- 6** Connect the capillary from the pump head outlet to the pressure sensor inlet (1). Connect the capillary from the high pressure filter to the pressure sensor outlet (2). Two arrow signs on the pressure sensor indicate the flow direction.



## Replace the Inlet Weaver

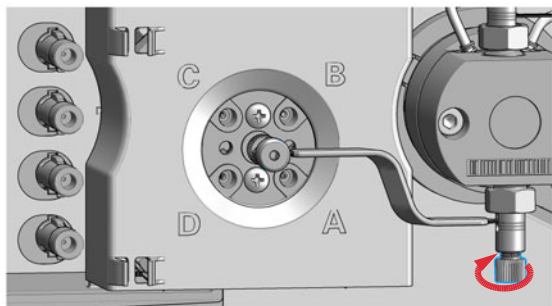
### Parts required

p/n	Description
G4204-81090 	Quaternary Pump/Flexible Pump Inlet Weaver Assembly
G7131-60090 	Inlet Weaver Assembly Biocompatible

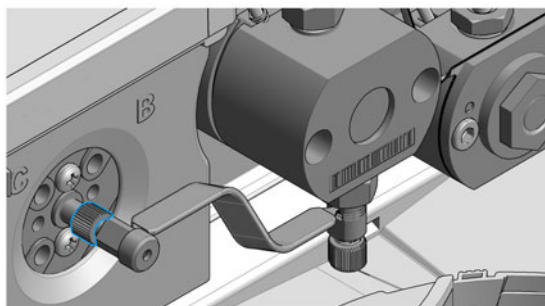
### Preparations

- Switch off pump at the main power switch
- Open the doors
- Use an optional solvent shutoff valve or lift up solvent filters inside solvent bottles for avoiding leakages
- For easy access to the inlet weaver assembly, remove tubing connections between MCGV and degasser

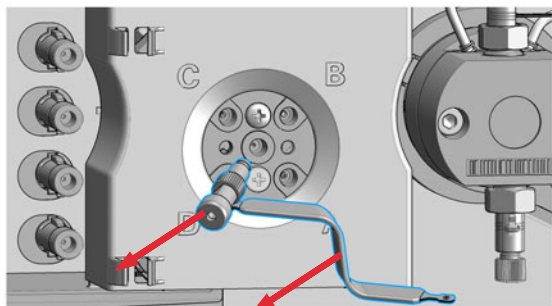
**1** Open the screw at the bottom of the inlet valve.



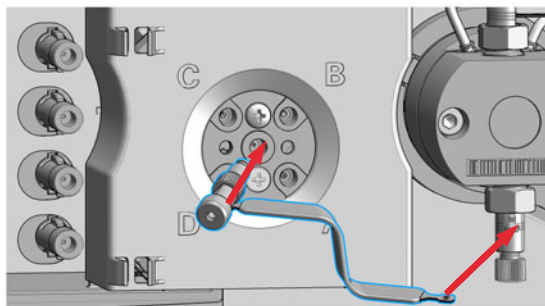
**2** Open the fitting at the center of the multi-channel gradient valve (MCGV). Remove the inlet weaver from the MCGV.



**3** Pull the Inlet Weaver out of the Inlet Valve.



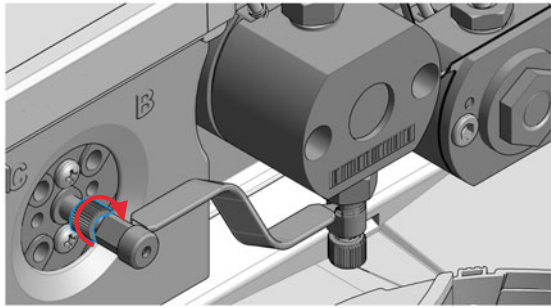
**4** Insert the new inlet weaver to the inlet valve. Fix the weaver with the plastic screw.



## Maintenance

### Replace the Inlet Weaver


5 Fix the fitting of the new inlet weaver to the MCGV.




6 Reconnect tubings between MCGV and degasser.

## Replace the Inlet Valve (G7104A)

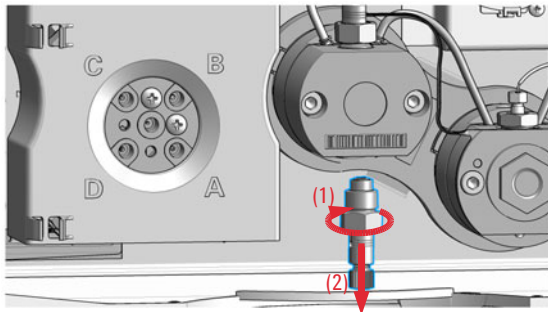
**When** If Inlet valve is defective.

<b>Tools required</b>	<b>p/n</b>	<b>Description</b>
		Wrench, 14 mm
	5067-5688 	Torque wrench 1 – 25 Nm with 14 mm wrench

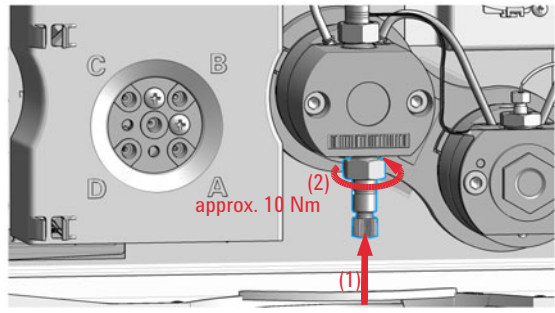
<b>Parts required</b>	<b>p/n</b>	<b>Description</b>
	G4204-60022 	Inlet Valve Quaternary Pump/Flexible Pump

- Preparations**
- Switch off pump at the main power switch
  - Open the doors
  - Use an optional solvent shutoff valve or lift up solvent filters inside solvent bottles for avoiding leakages
  - Remove the inlet weaver, see “Replace the Inlet Weaver” on page 164

- 1** With a 14 mm wrench, unscrew the inlet valve and remove it.



- 2** Install the new inlet valve and tighten it using a torque wrench with a 14 mm bit set to approximately 10 Nm.




**Next Steps:**

- 3** Insert the inlet weaver, see “Replace the Inlet Weaver” on page 164.
- 4** Purge and condition the system to remove air.

## Replace the Inlet Valve (G7131A)

**When** If Inlet valve is defective.

**Tools required**

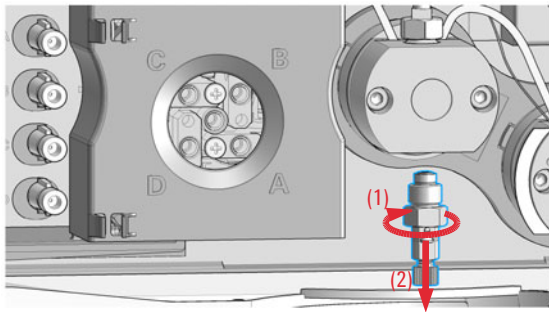
p/n	Description
	Wrench, 14 mm
5067-5688 	Torque wrench 1 – 25 Nm with 14 mm wrench

**Parts required**

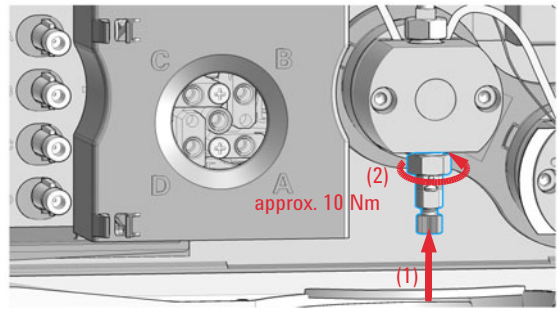
p/n	Description
G7131-60022 	Inlet Valve Bio-Compatible Flexible Pump

- Preparations**
- Switch off pump at the main power switch
  - Open the doors
  - Use an optional solvent shutoff valve or lift up solvent filters inside solvent bottles for avoiding leakages
  - Remove the inlet weaver, see “Replace the Inlet Weaver” on page 164

- 1** With a 14 mm wrench, unscrew the inlet valve and remove it.



- 2** Install the new inlet valve and tighten it using a torque wrench with a 14 mm bit set to approximately 10 Nm.



**Next Steps:**

- 3** Insert the inlet weaver, see “Replace the Inlet Weaver” on page 164.
- 4** Purge and condition the system to remove air.

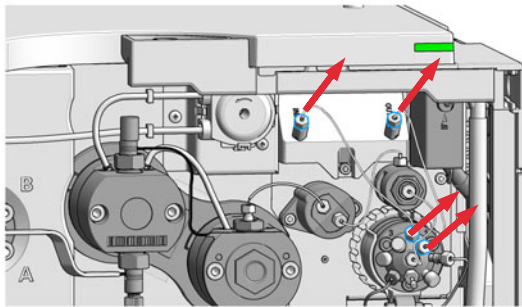
# Remove the Jet Weaver

Tools required	p/n	Description
	8710-0510 <a href="#">📄</a>	Open-end wrench 1/4 – 5/16 inch
	8710-0899 <a href="#">📄</a>	Screwdriver Pozidrive Shaft
	5023-2502 <a href="#">📄</a>	Hex driver SW-6.35, slitted

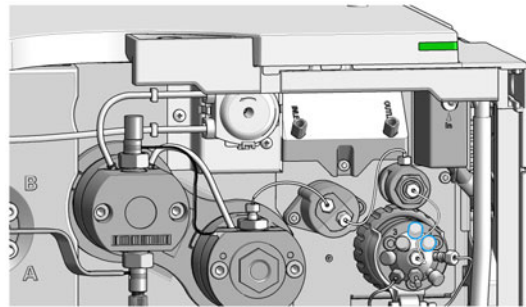
Parts required	p/n	Description
	0100-1259 <a href="#">📄</a>	Plastic fittings
	G4204-04002 <a href="#">📄</a>	Cover RFID Tag Metal lid for Jet Weaver

- Preparations**
- Select **Do not use mixer** in ChemStation.
  - Switch off the pump at the main power switch.

**1** Remove capillary connections from the Jet Weaver to the Multipurpose Valve.



**2** Plug the valve ports 1 and 2 with two plastic fittings.

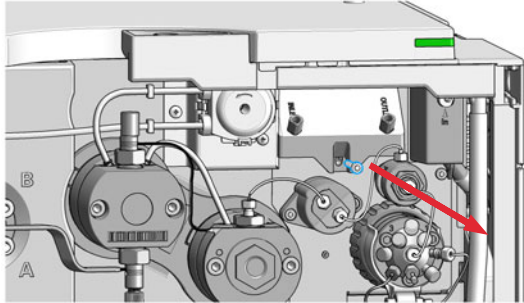




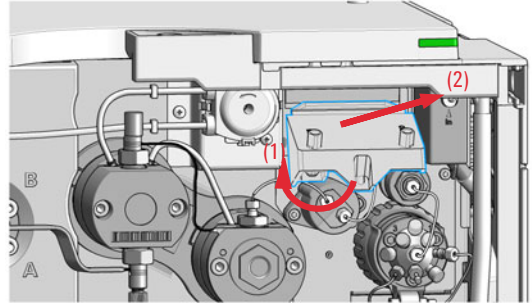
## Maintenance

### Remove the Jet Weaver

- 3** Open the screw which fixes the Jet Weaver to the front panel.



- 4** Lift up the Jet Weaver (1) and pull it out of the front panel (2).

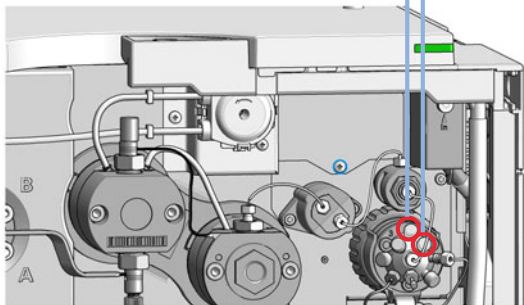


- 5** If no other Jet Weaver shall be installed, use plastic fittings for closing unused ports of the valve and install the metal lid.

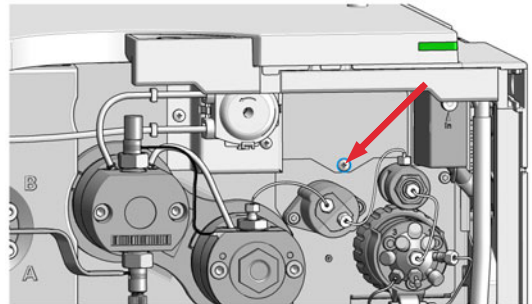
OR

Otherwise continue at "Install the Jet Weaver" on page 170.

Plastic fittings














- 6** Fix the metal lid to the instrument chassis with a screw.



## Install the Jet Weaver

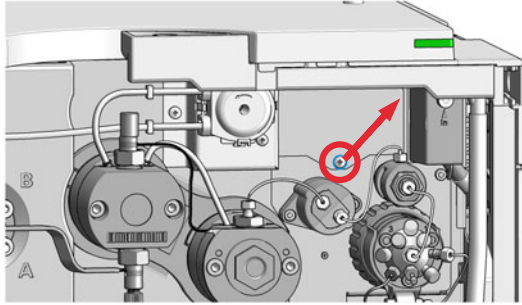
**When** Optional Jet Weavers are available for applications which require highest mixing performance, see chapter *Optimizing Performance*.

Tools required	p/n	Description
	8710-0510 	Open-end wrench 1/4 – 5/16 inch
	8710-0899 	Screwdriver Pozidrive Shaft
	5023-2502 	Hex driver SW-6.35, slitted

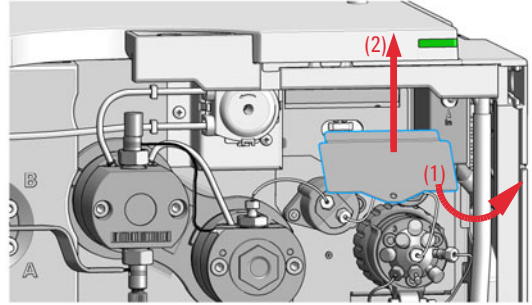
Parts required	#	p/n	Description
	1	G4204-68035 	Jet Weaver Mixer Kit V35 Quat/Flex
	1	G7131-68035 	Jet Weaver Mixer Kit V35 Flex Biocompatible
	1	G4204-68100 	Jet Weaver Mixer Kit V100 Quat/Flex
	1	G7131-68100 	Jet Weaver Mixer Kit V100 Flex Biocompatible
	1	G4204-68380 	Jet Weaver Mixer Kit V380 Quat/Flex each containing two 5500-1253
	1	G7131-68380 	Jet Weaver Mixer Kit V380 Flex Biocompatible each containing two 5004-0041
	2	5500-1253 	Capillary ST 0.17 mm x 130 mm SX/S Jet Weaver to Multipurpose Valve
	2	5004-0041 	Capillary MP35N 0.17 mm x 130 mm SI/SX

**Preparations** Switch off the pump at the main power switch

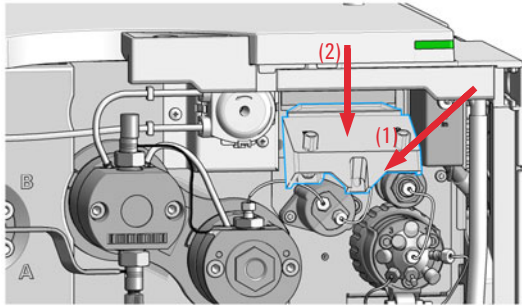
1 Open the screw of the Jet Weaver metal lid.



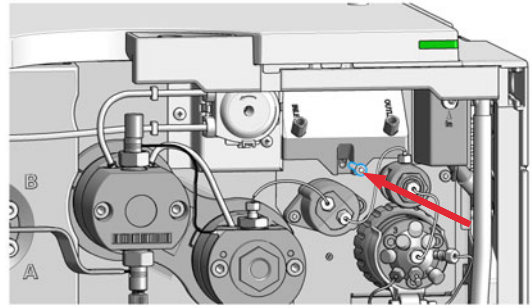
2 Remove the metal lid by lifting it up (1) and pulling it out of the front panel (2).



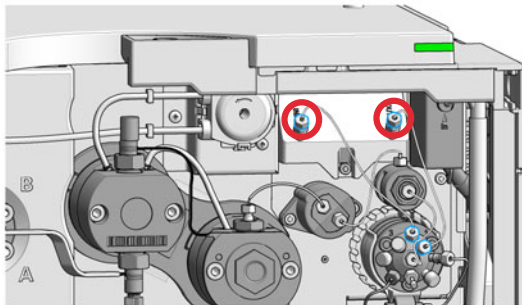
3 Insert the Jet Weaver to the opening in the front panel (1) and push it down (2).



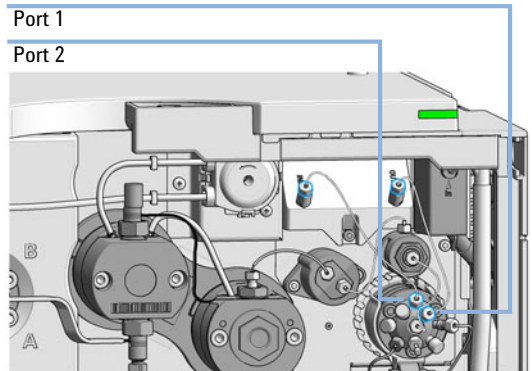
4 Fix the Jet Weaver with a screw.



5 Mount both capillary connections to the Jet Weaver observing the correct orientation (long fitting to Jet Weaver).





6 Connect the inlet capillary of the Jet Weaver to port 2 of the Multipurpose Valve. Connect the outlet capillary to port 1.



7 Configure the Jet Weaver as mixer in the user interface.

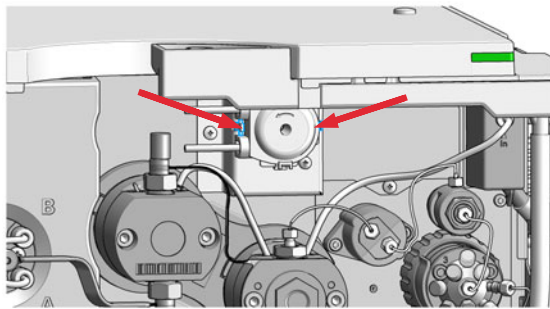
# Replace the Seal Wash Pump

**When** In case of seal wash pump wear

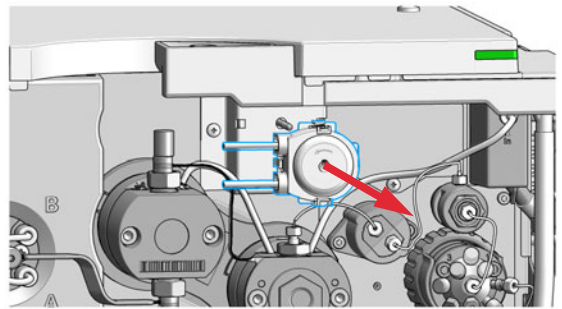
Parts required	p/n	Description
	5065-4445 	Peristaltic pump with PharMed tubing
	5065-9978 	Tubing, 1 mm i.d., 3 mm o.d., silicone, 5 m

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

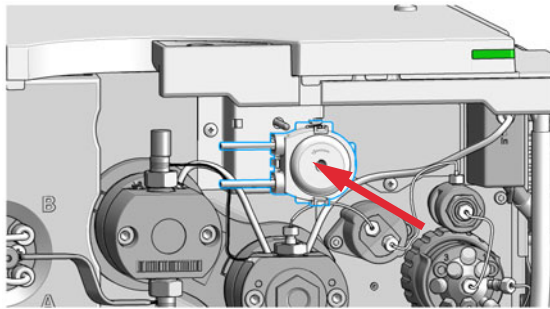
1 Press the clips.



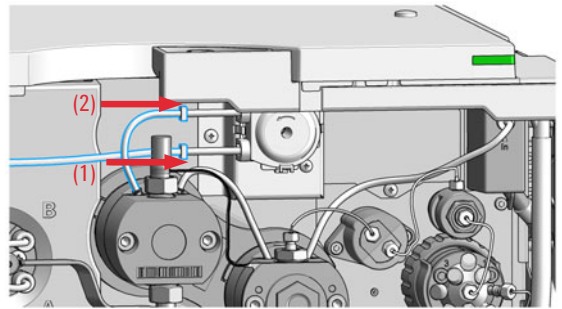
2 Pull the pump to the front.





3 Insert the pump clips to the holes in the module 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 Multi-Channel Gradient Valve (MCGV)

Tools required	p/n	Description
	0100-1710 	Mounting Tool for Tubing Connections
	8710-0899 	Screwdriver Pozidrive Shaft

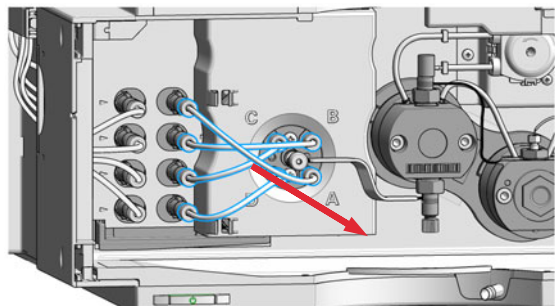
Parts required	p/n	Description
	G1311-67701 	Multi channel gradient valve (MCGV)

Preparations	
	<ul style="list-style-type: none"> <li>• Switch off pump at the main power switch</li> <li>• Open the doors</li> <li>• Use an optional solvent shutoff valve or lift up solvent filters inside solvent bottles for avoiding leakages</li> </ul>

### NOTE

For best performance and life time, use lower channels A and D for aqueous solvents in buffer applications.

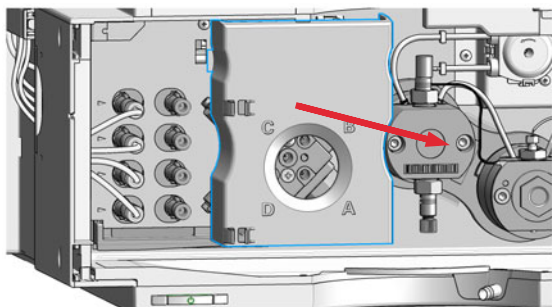
**1** Use the mounting tool for removing tubing connections between the degassing unit and the MCGV.



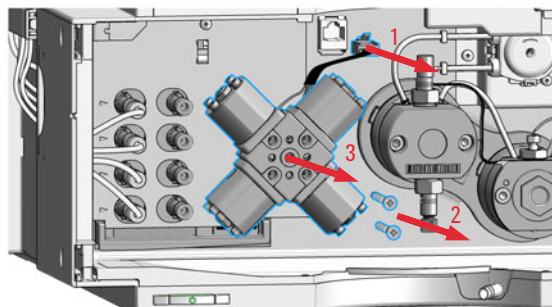
**2** Remove the inlet weaver, see "Replace the Inlet Weaver" on page 164.

## Replace the Multi-Channel Gradient Valve (MCGV)

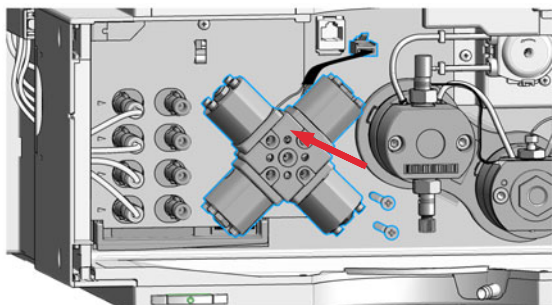
3 Remove the cover from the MCGV.



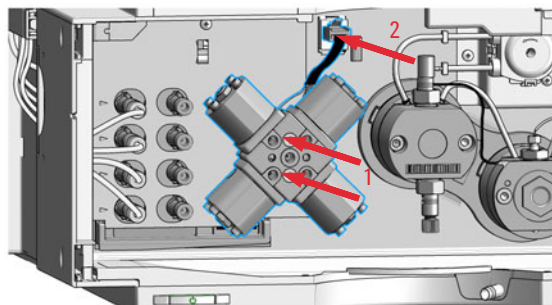
4 Disconnect the MCGV cable (1), unscrew the two screws (2) and remove the valve (3).



5 Place the new MCGV into position.

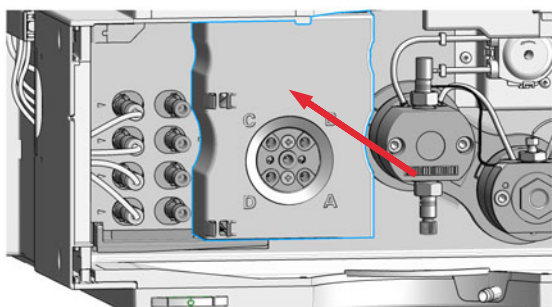


6 Tighten the two screws (1) and connect the cable to its connector (2).

**NOTE**

Make sure that channel A of the MCGV is put at the bottom-right position.



7 Install the MCGV cover.

**Next Steps:**

8 Install the inlet weaver, see [“Replace the Inlet Weaver”](#) on page 164.

9 Reconnect solvent tubes for channels A-D from the MCGV to the degasser outlets.

# Replace the Four-Channel Gradient Valve (4CGV)

Tools required	p/n	Description
	0100-1710 	Mounting Tool for Tubing Connections
	8710-0899 	Screwdriver Pozidrive Shaft

Parts required	p/n	Description
	G7111-67701 	Four-Channel Gradient Valve (4CGV)

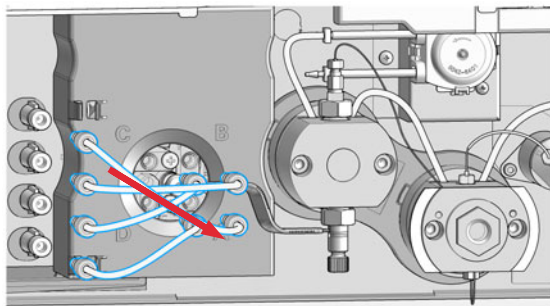
- Preparations**
- Switch off pump at the main power switch
  - Open the doors
  - Use an optional solvent shutoff valve or lift up solvent filters inside solvent bottles for avoiding leakages

## NOTE

The 4CGV is used in the following modules and requires firmware  $\geq$  B.07.33:

- **G7104A:** DEBAX04563 or greater
- **G7104A (MS-Ready):** DEBA301668 or greater
- **G7131A:** All

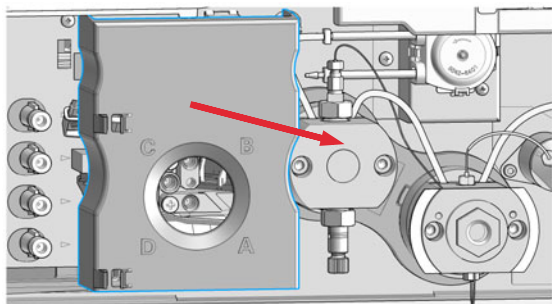
- 1** Use the mounting tool for removing tubing connections between the degassing unit and the 4CGV.



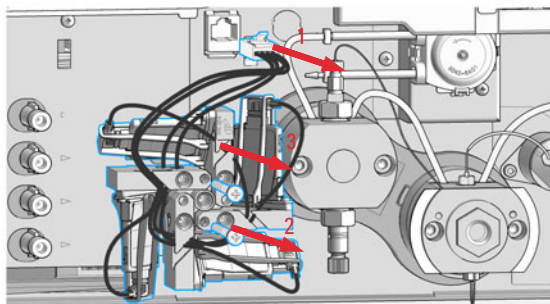
- 2** Remove the inlet weaver, see "Replace the Inlet Weaver" on page 164.

## Replace the Four-Channel Gradient Valve (4CGV)

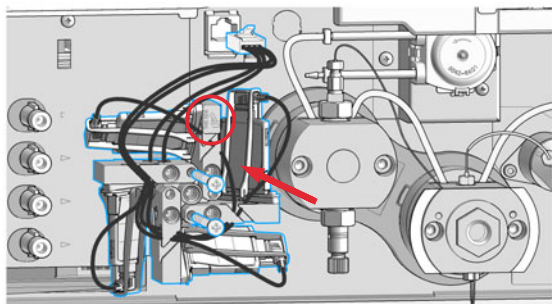
3 Remove the cover from the 4CGV.



4 Disconnect the 4CGV cable (1), unscrew the two screws (2) and remove the valve (3).

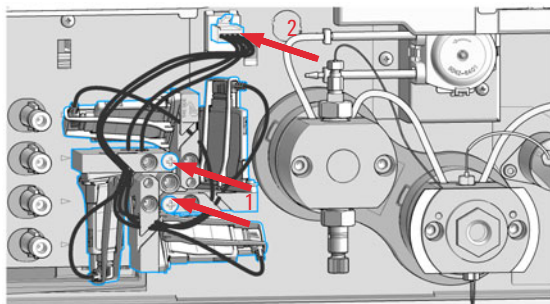


5 Place the new 4CGV into position.

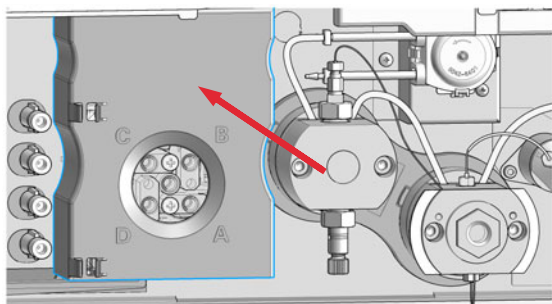
**NOTE**

Make sure that the THIS SIDE UP label arrow is pointing upward towards the top of the module.

6 Tighten the two screws (1) and connect the cable to its connector (2).






7 Install the 4CGV cover.

**Next Steps:**

- 8 Install the inlet weaver, see ["Replace the Inlet Weaver"](#) on page 164.
- 9 Reconnect solvent tubes for channels A-D from the 4CGV to the degasser outlets.



## Release a Stuck Inlet Valve

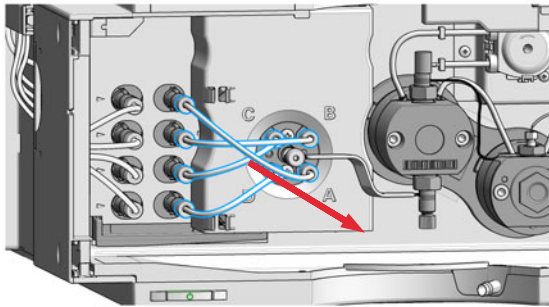
Tools required	p/n	Description
	9301-0411 	Syringe, Plastic
	9301-1337 	Syringe adapter
	0100-1710 	Mounting Tool for Tubing Connections
		Beaker

### CAUTION

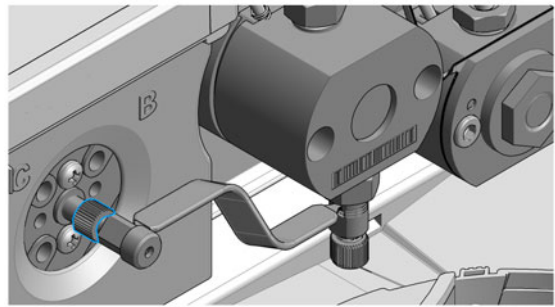
**Pressure damages the multi-channel gradient valve (MCGV) and/or degasser**

- ✓ **Never apply pressure to the MCGV or degasser.**
- ✓ **Directly connect the syringe to the inlet weaver.**

**1** Remove tubing connections channels A, B, C and D to the MCGV such that you can access the inlet weaver.



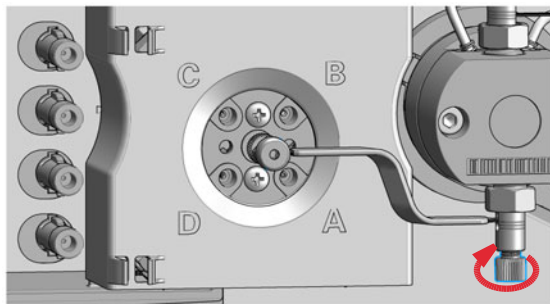
**2** Open the fitting at the center of the multi-channel gradient valve (MCGV). Remove the inlet weaver from the MCGV.



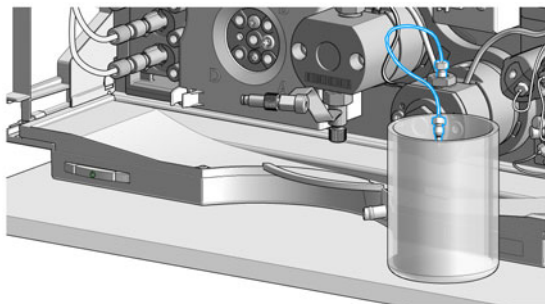
## Maintenance

### Release a Stuck Inlet Valve

- 3** Slightly open the black plastic screw at the bottom of the inlet valve, and rotate the inlet weaver to the front. Then retighten the screw.



- 4** Disconnect the capillary from the pressure sensor inlet and route the capillary to a small beaker.

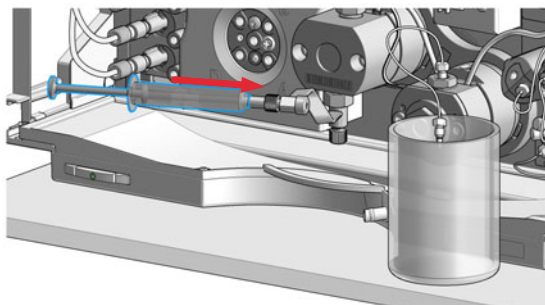


- 5** Fill the syringe with a suitable wash solvent.

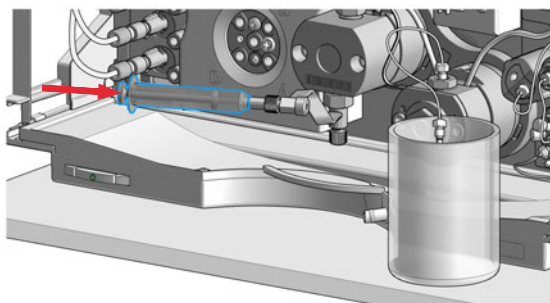
#### NOTE

For salt deposits, warm water is a good choice. For organic deposits, use ethanol or acetone.

- 6** Connect the syringe and adapter to the inlet weaver.



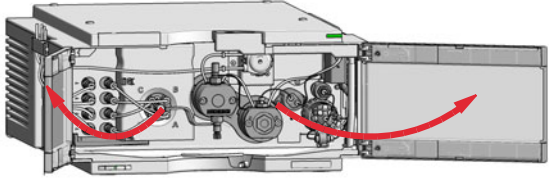
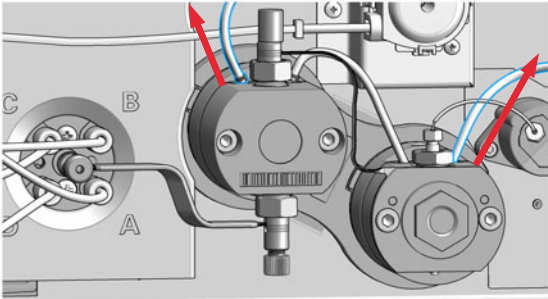
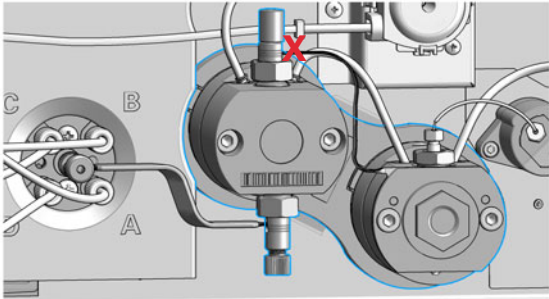
- 7** Push the syringe for flushing the inlet valve and pump head.



- 8** Restore original connections. Flush the system for several minutes.

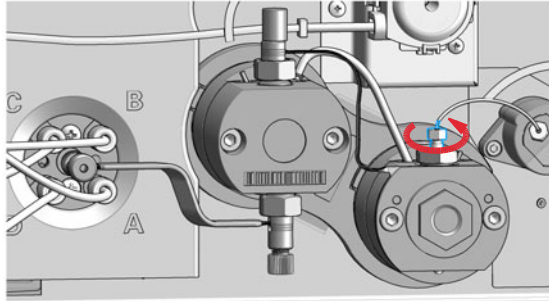
## Remove the Pump Head Assembly (G7104A)

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

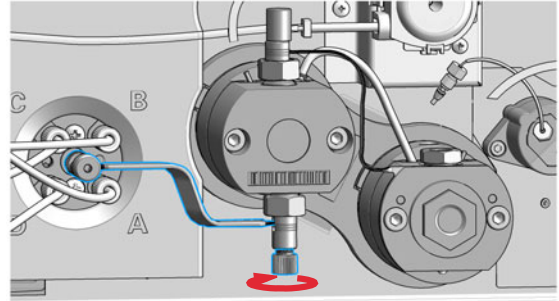
<p><b>1</b> In Lab Advisor go to <b>Service &amp; Diagnostics &gt;Remove/Install Pump Head</b> and follow instructions given on the screen.</p>	<p><b>2</b> Open the doors.</p> 
<p><b>3</b> Remove the seal wash tubes.</p> 	<p><b>4</b> DO NOT REMOVE the heat exchanger connection between the pump heads marked by the red X.</p> 

## Remove the Pump Head Assembly (G7104A)

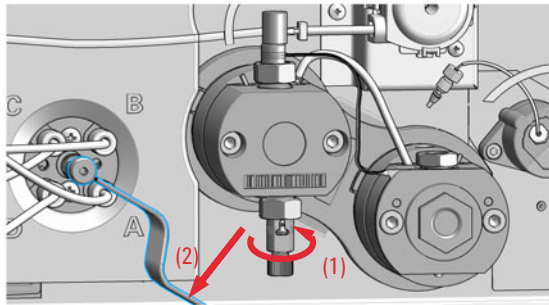
- 5 Remove the capillary connection from the outlet adapter on the secondary pump head to the pressure sensor.



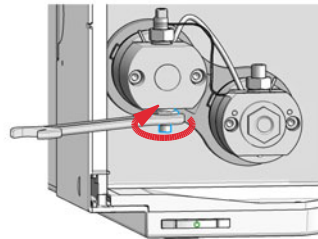
- 6 Open the black plastic screw of the inlet valve at the bottom of the primary pump head.



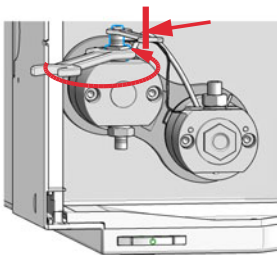
- 7 Turn the inlet valve 90 ° counterclockwise (1) and remove the inlet weaver from the inlet valve (2).



- 8 Loosen the inlet valve. Keep the inlet valve installed to the pump head assembly.



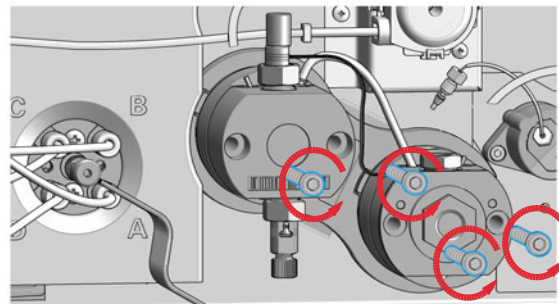
- 9 Counter the lock screw of the heat exchanger capillary while loosening the outlet valve. Keep the outlet valve installed to the pump head assembly.



- 10 Remove the four screws holding the pump heads.

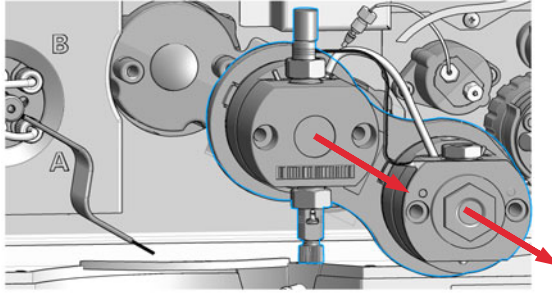
**NOTE**

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

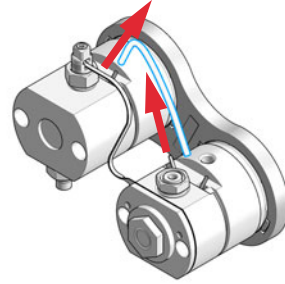


## Remove the Pump Head Assembly (G7104A)

**11** Remove the complete pump head assembly by holding both heads and pulling it to the front.

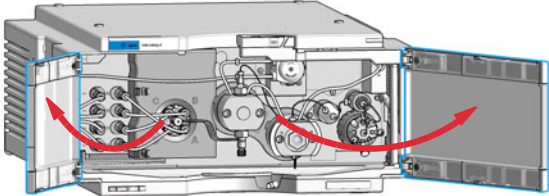
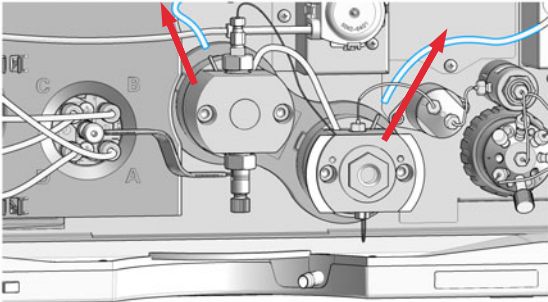
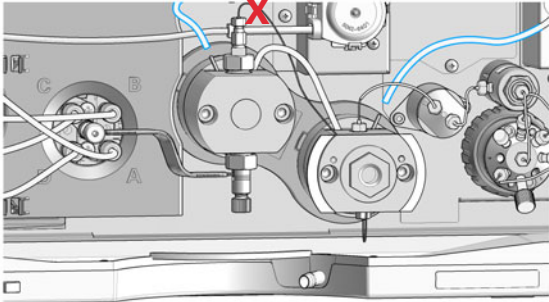


**12** Remove the seal wash tubing interconnecting the two pump heads.



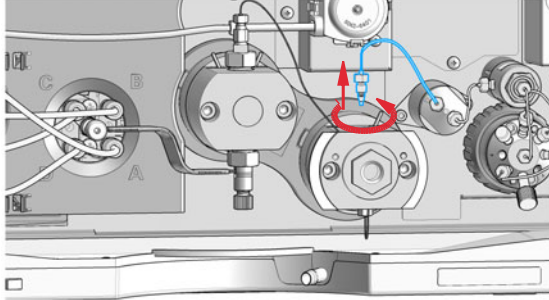
## Remove the Pump Head Assembly (G7131A)

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

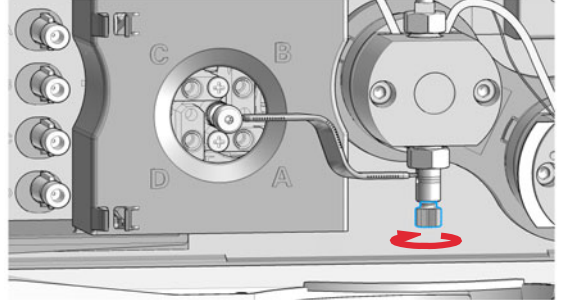
<p>1 In Lab Advisor go to <b>Service &amp; Diagnostics &gt;Remove/Install Pump Head</b> and follow instructions given on the screen.</p>	<p>2 Open the doors.</p> 
<p>3 Remove the seal wash tubes.</p> 	<p>4 DO NOT REMOVE the heat exchanger connection between the pump heads marked by the red X.</p> 

## Remove the Pump Head Assembly (G7131A)

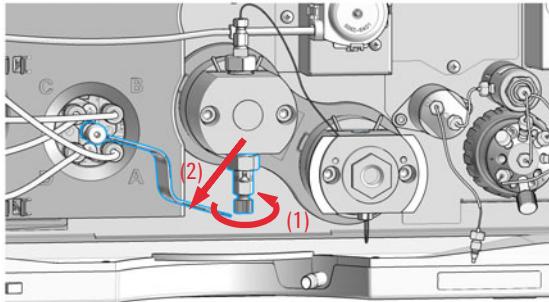
- 5 Remove the capillary connection from the outlet adapter on the secondary pump head to the pressure sensor.



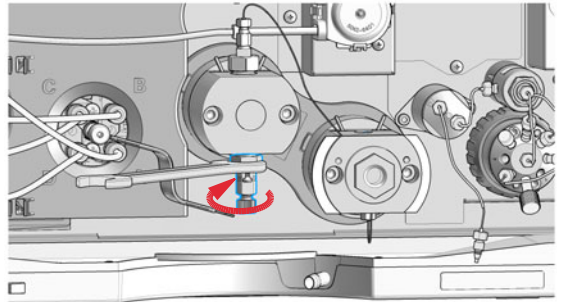
- 6 Open the black plastic screw of the inlet valve at the bottom of the primary pump head.



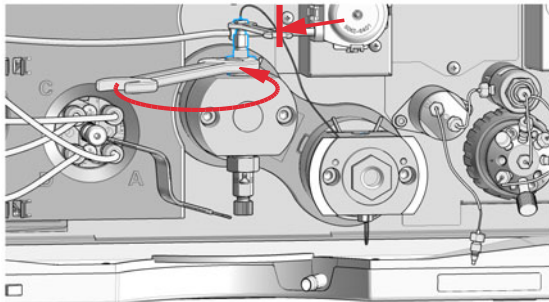
- 7 Turn the inlet valve 90 ° counterclockwise (1) and remove the inlet weaver from the inlet valve (2).



- 8 Loosen the inlet valve. Keep the inlet valve installed to the pump head assembly.



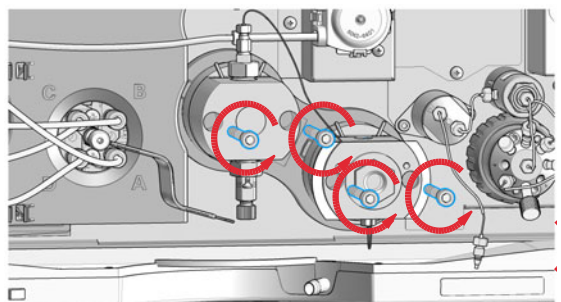
- 9 Counter the lock screw of the heat exchanger capillary while loosening the outlet valve. Keep the outlet valve installed to the pump head assembly.



- 10 Remove the four screws holding the pump heads.

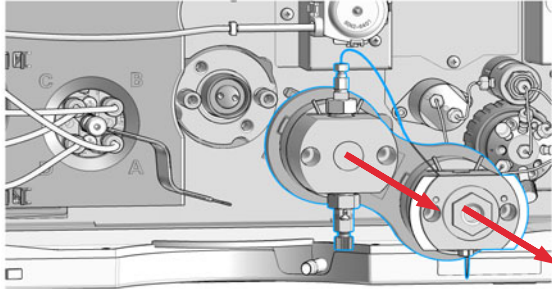
**NOTE**

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

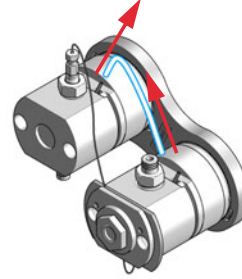


## Remove the Pump Head Assembly (G7131A)

**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 G7131A/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 Pump Heads (G7104)

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

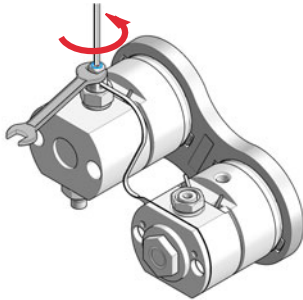
Exchanging seals and cleaning pistons is exemplarily shown for the primary pump head, but works in the same way for the secondary pump head.

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

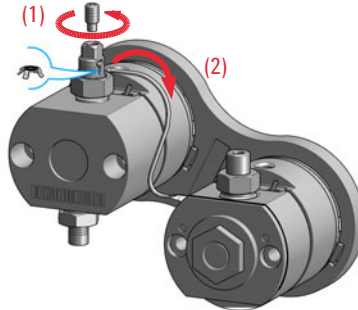
### NOTE

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.



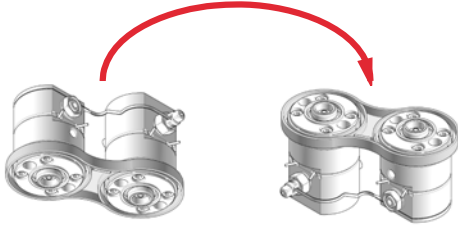
### NOTE

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

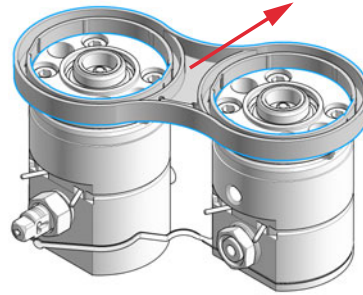
## Maintenance

### Pump Head Maintenance (Tool Free)

- 3 Turn the pump head assembly upside down.

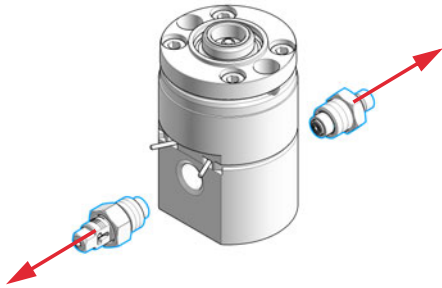


- 4 Remove the link plate by gently pulling it off the pump head assembly.



The two pump chambers are now isolated.

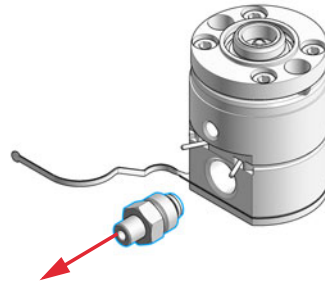
- 5 Remove the inlet valve and the outlet valve from the primary pump head.



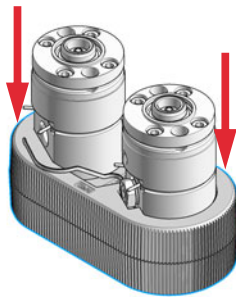
#### NOTE

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

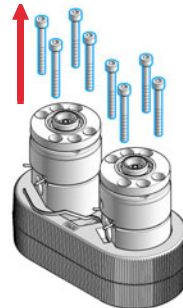
- 6 Binary/High-Speed Pumps only: Remove the high pressure filter from the secondary pump head.



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



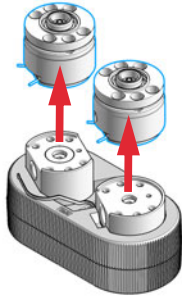
- 8 Remove the pump head screws from the back of the pump heads.



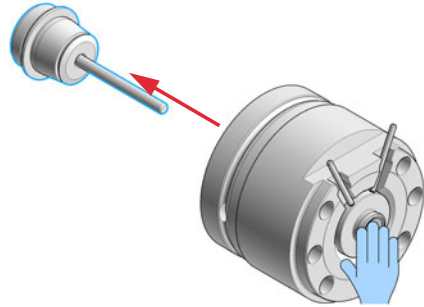
## Maintenance

### Pump Head Maintenance (Tool Free)

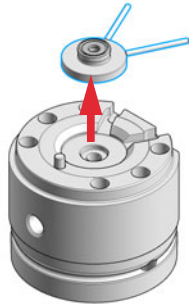
- 9** Open the pump heads and remove the piston housings from the pump chambers.



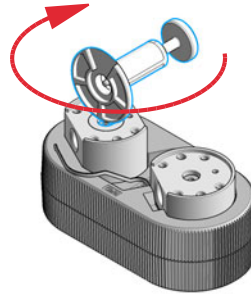
- 10** Remove the piston by pressing it out of the seal holder with a finger.



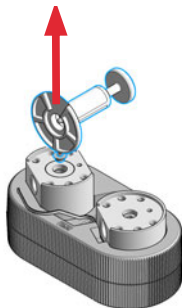
- 11** Remove the seal holder from the spring housing.



- 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.

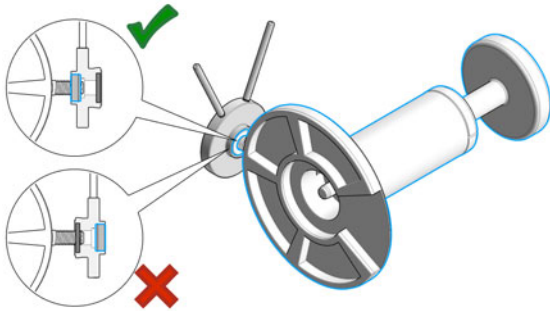


- 14** Repeat for the other pump chamber.

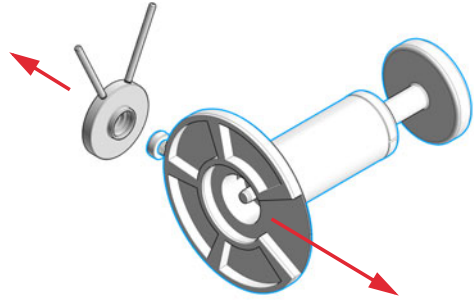
**15** Screw the pin of the Seal Handling Device into the wash seal.

#### 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.

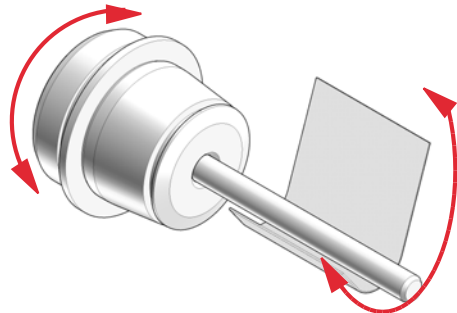


**16** Pull out the Seal Handling Device with the wash seal in a straight movement with only gentle force.



**17** Repeat for the other seal holder.

**18** Clean the piston with abrasive paper.







**19** Rinse pump heads and pistons with isopropanol.

## Disassemble Pump Heads (G7131)

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.

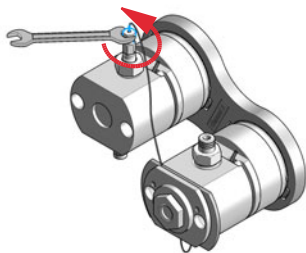
### Tools required

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

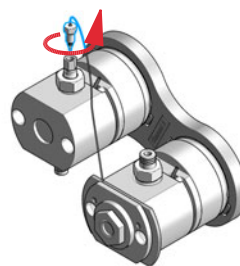
### NOTE

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.



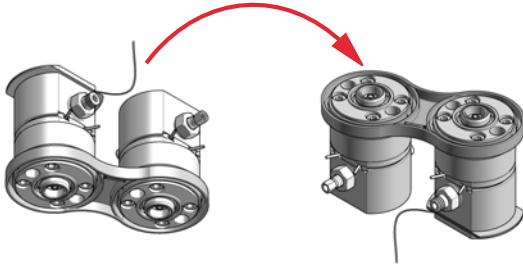
**2** Remove the heat exchanger capillary from the valve.



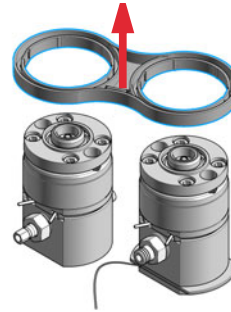
## Maintenance

### Pump Head Maintenance (Tool Free)

- 3 Turn the pump head assembly upside down.

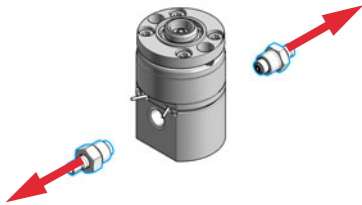


- 4 Remove the link plate by gently pulling it off the pump head assembly.



The two pump chambers are now isolated.

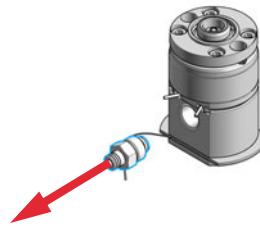
- 5 Remove the inlet valve and the outlet valve from the primary pump head.



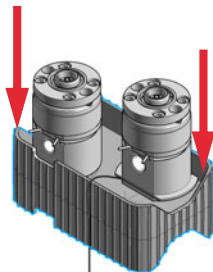
#### NOTE

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

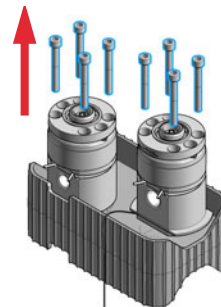
- 6 Binary/High-Speed Pumps only: Remove the high-pressure filter from the secondary pump head.



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



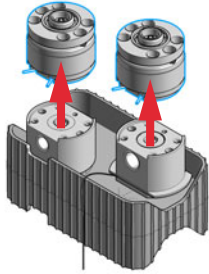
- 8 Remove the pump head screws from the back of the pump heads.



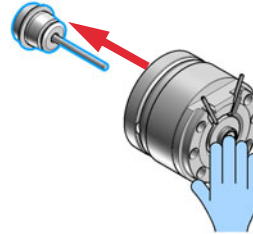
## Maintenance

### Pump Head Maintenance (Tool Free)

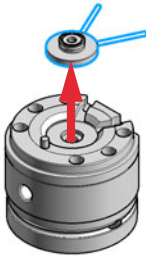
- 9** Open the pump heads and remove the piston housings from the pump chambers.



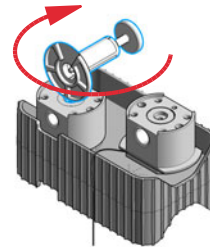
- 10** Remove the piston by pressing it out of the seal holder with a finger.



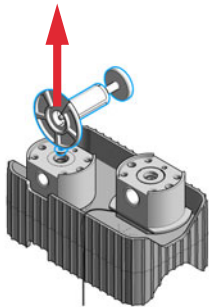
- 11** Remove the seal holder from the spring housing.



- 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.



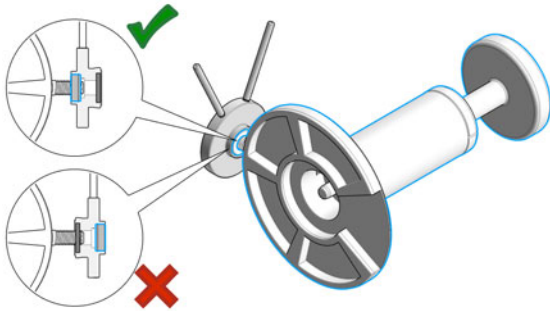
- 14** Repeat for the other pump chamber.



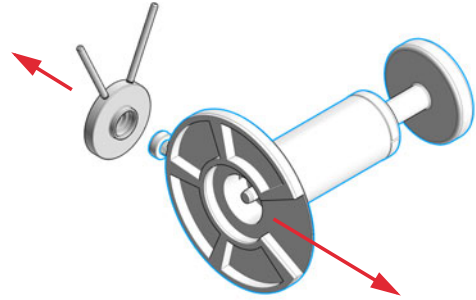
**15** Screw the pin of the Seal Handling Device into the wash seal.

#### 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.

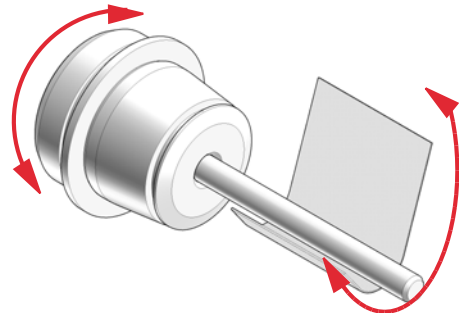


**16** Pull out the Seal Handling Device with the wash seal in a straight movement with only gentle force.








**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 (G7104A)

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
	G4220-81013 	Heat Exchanger Channel A

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

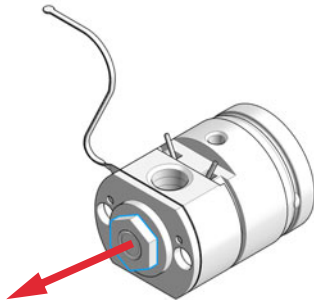
### CAUTION

#### Loss of small spacer fitting

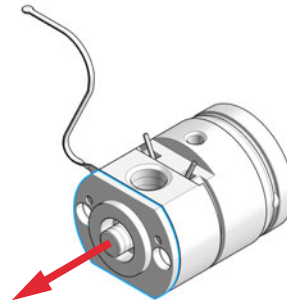
Inside the secondary pump head is a small spacer fitting, which can be dropped easily when removing the heat exchanger.

- ✓ 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.



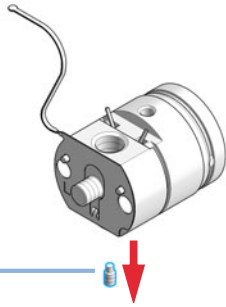
2 Remove the front plate.



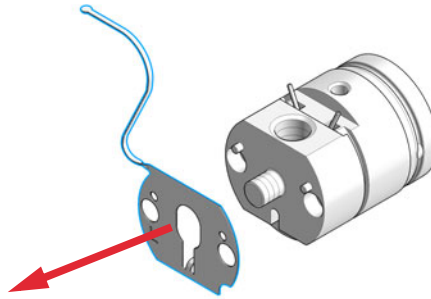
## Maintenance

### Pump Head Maintenance (Tool Free)

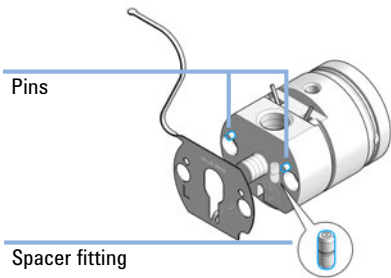
- 3** Remove the screw at the bottom of the pump head. Do not drop the golden spacer fitting.



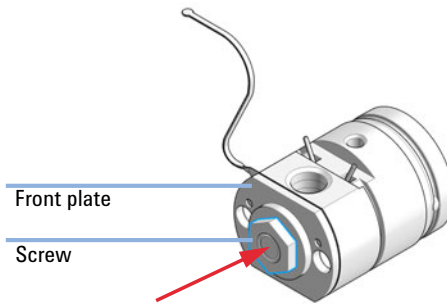
- 4** Lift out the heat exchanger.



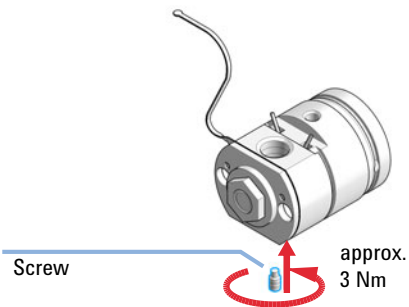
- 5** If removed, first insert the spacer fitting. Then insert the new heat exchanger to the opening in the pump head and lift it over the pins.



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



- 7** Insert and fix the screw.



## Replace the Heat Exchanger (G7131A)

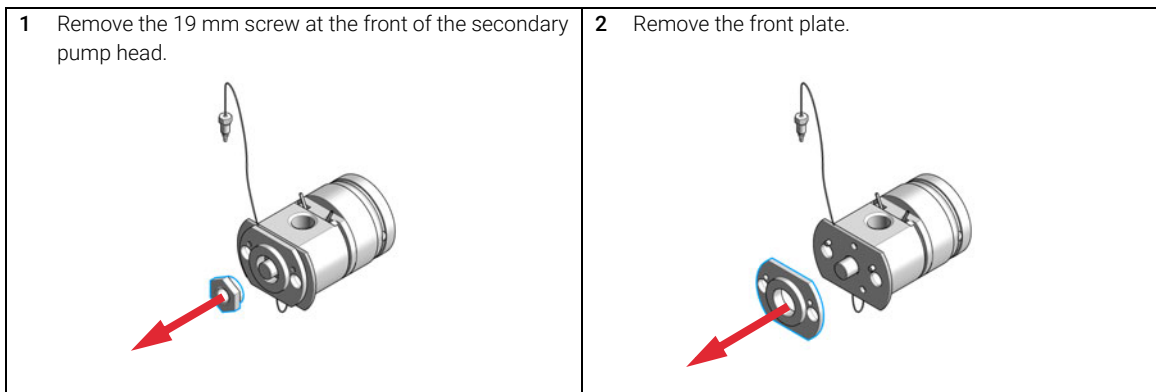


For 1290 Infinity II Bio LC modules, use bio / biocompatible parts only.  
 Do not mix parts between 1260 Infinity II Bio-Inert LC modules and 1290 Infinity II Bio LC modules.

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

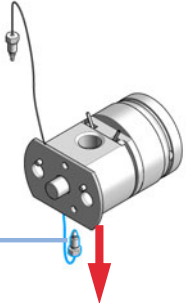
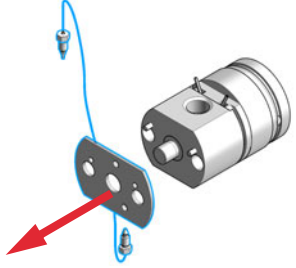
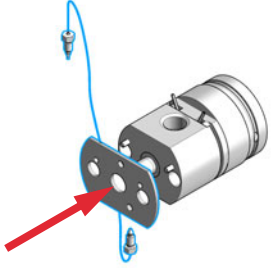
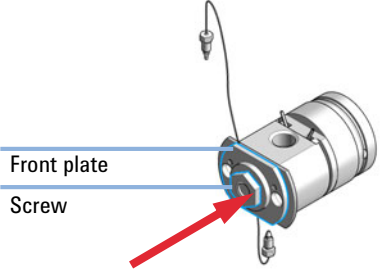
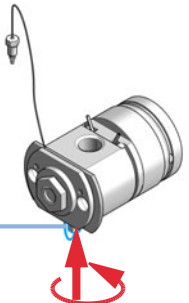
Parts required	p/n	Description
	G7131-60005 <a href="#">📄</a>	Heat Exchanger for biocompatible Pump

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



## Maintenance

### Pump Head Maintenance (Tool Free)

<p><b>3</b> Remove the screw at the bottom of the pump head.</p>  <p>Screw</p>	<p><b>4</b> Lift out the heat exchanger.</p> 
<p><b>5</b> Insert the new heat exchanger into the opening of the pump head and lift it over the pins.</p> 	<p><b>6</b> Use the 19 mm screw for fixing the front plate.</p>  <p>Front plate</p> <p>Screw</p>
<p><b>7</b> Insert and fix the screw.</p>  <p>Screw</p>	

## Assemble Pump Heads (G7104A)

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 <a href="#">📄</a>	HPLC System Tool Kit-Infinity-II
5067-5688 <a href="#">📄</a>	Torque wrench 1 – 25 Nm with 14 mm wrench
G4220-20013 <a href="#">📄</a>	4 mm hex bit
G4220-20015 <a href="#">📄</a>	Adapter ¼ in square to hex
G4220-20041 <a href="#">📄</a>	Bit Torx 10x25 mm
5043-1400 <a href="#">📄</a>	Pump Head Holder
5067-6197 <a href="#">📄</a>	Seal Handling Device
	Isopropanol

### Parts required

#	p/n	Description
2	0905-1719 <a href="#">📄</a>	PE Seal
2	0905-1175 <a href="#">📄</a>	Wash seal (PTFE)

### NOTE

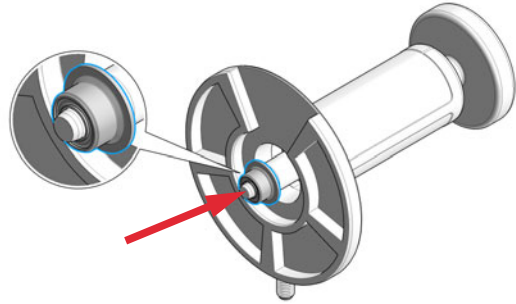
Seals must be exchanged in both primary and secondary pump heads.

## Maintenance

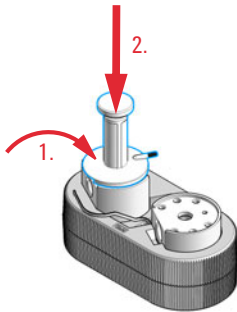
### Pump Head Maintenance (Tool Free)

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.

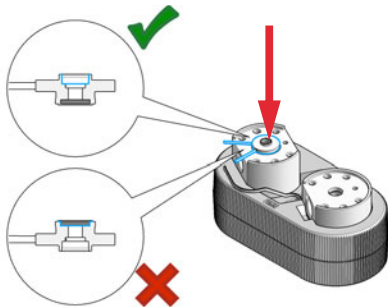


3 Take care that the Seal Handling Device is seating flush and press the seal into the pump chamber.



4 Repeat for the other pump chamber.

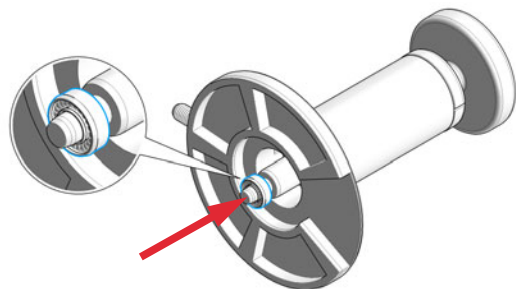
5 Place the seal holder onto the pump chamber.



#### NOTE

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

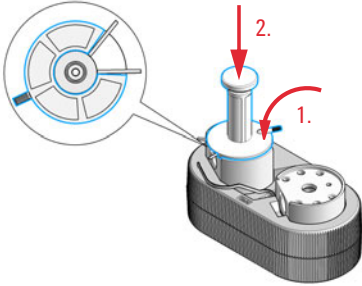
6 Place the wash seal onto the designated nose of the Seal Handling Device. The metal spring of the wash seal must be visible.



## Maintenance

### Pump Head Maintenance (Tool Free)

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

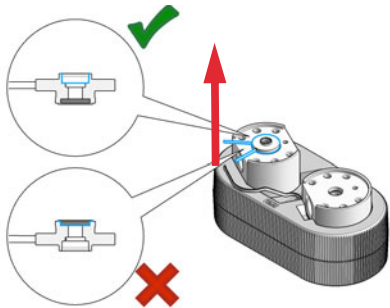


#### NOTE

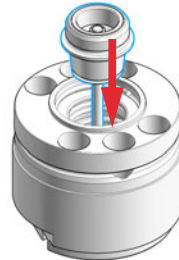
The Seal Handling Device has a cavity to fit over the pins of the seal wash tubings.

- 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.

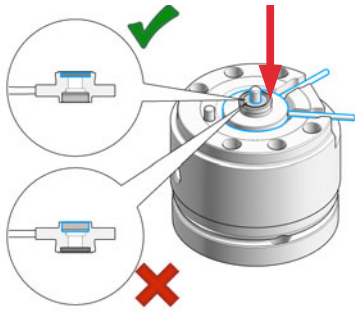




## Maintenance

### Pump Head Maintenance (Tool Free)

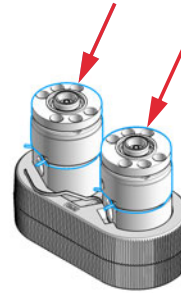
**11** Place the seal holder onto the spring housing.



#### NOTE

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

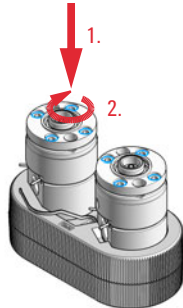
**12** Place the assembled spring housings on top of the pump chambers.



#### NOTE

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

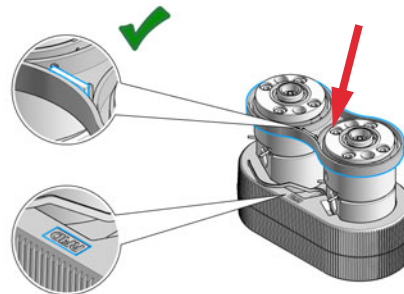
**13** Place the screws into the pump heads and loosely tighten them in a crosswise manner.



#### 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.



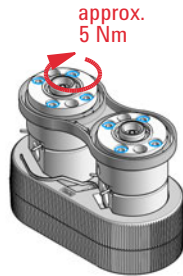
#### NOTE

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.

## Maintenance

### Pump Head Maintenance (Tool Free)

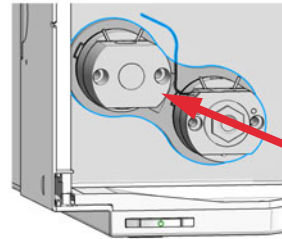
- 15** Tighten the pump head screws with a torque wrench set to approx. 5 Nm in a crosswise manner.



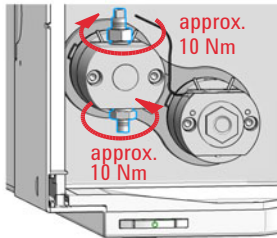
#### NOTE

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

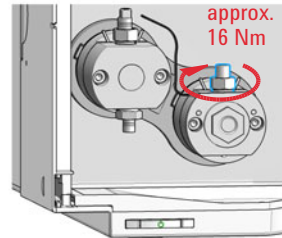
- 16** Mount the pump head to the module. Do not fix the screws at this stage!



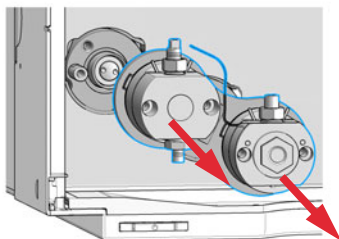
- 17** Screw in the inlet valve and the outlet valve and fix them with a torque wrench set to approx. 10 Nm.



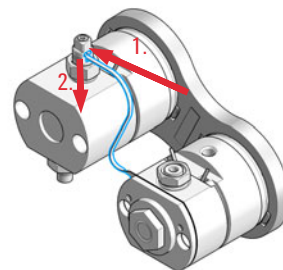
- 18** Binary/High-Speed Pumps only: Screw in the high pressure filter and fix it with a torque wrench set to approx. 16 Nm.



- 19** Remove the pump head from the module again.



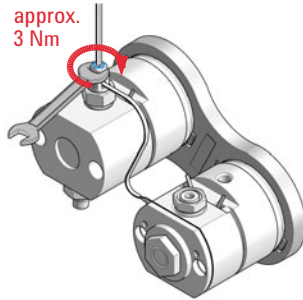
- 20** Position the entrance slit for the heat exchanger capillary to face exactly to it, and then seat the heat exchanger capillary back into the outlet valve by moving it into the valve and pressing it down.



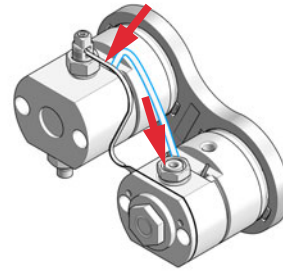
## Maintenance

### Pump Head Maintenance (Tool Free)

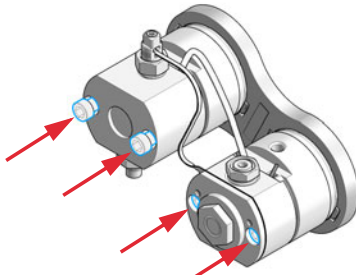
**21** Counter the outlet valve and tighten the lock screw of the heat exchanger capillary with a torque wrench set to approx. 3 Nm.



**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 Pump Heads (G7131A)



For 1290 Infinity II Bio LC modules, use bio / biocompatible 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 <a href="#">📄</a>	HPLC System Tool Kit-Infinity-II
G4220-20013 <a href="#">📄</a>	4 mm hex bit
G4220-20015 <a href="#">📄</a>	Adapter ¼ in square to hex
G4220-20041 <a href="#">📄</a>	Bit Torx 10x25 mm
G7132-42000 <a href="#">📄</a>	Bio Pump Head Holder
5067-6197 <a href="#">📄</a>	Seal Handling Device
	Isopropanol

### Parts required

#	p/n	Description
2	G7131-20009 <a href="#">📄</a>	Seal biocompatible
2	0905-1731 <a href="#">📄</a>	Bio-Inert Wash Seal

### NOTE

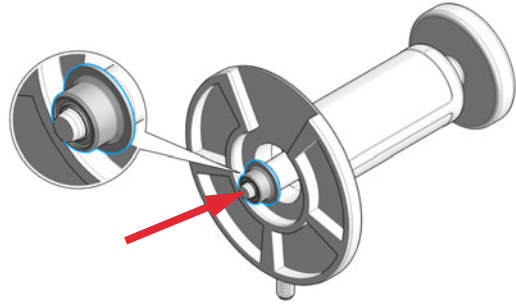
Seals must be exchanged in both primary and secondary pump heads.

## Maintenance

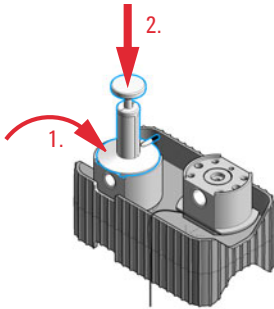
### Pump Head Maintenance (Tool Free)

- 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.

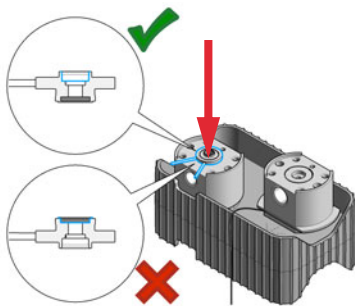


- 3 Take care that the Seal Handling Device is seating flush and press the seal into the pump chamber.



- 4 Repeat for the other pump chamber.

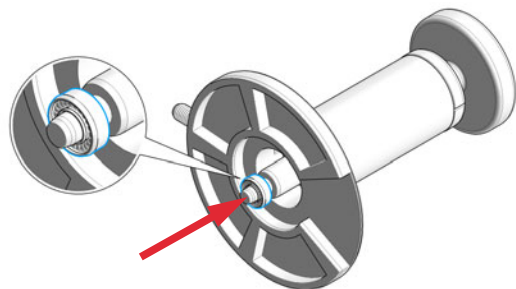
- 5 Place the seal holder onto the pump chamber.



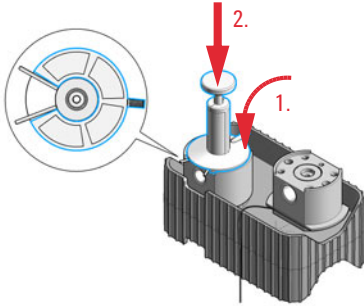
#### NOTE

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.



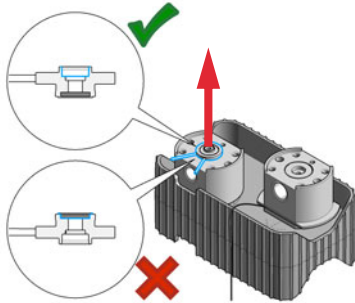
- 7** Take care that the Seal Handling Device is seating flush and press the wash seal into the seal holder.

**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.



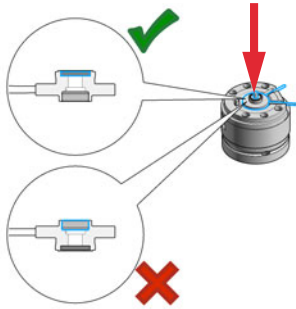
- 10** Lubricate the piston with isopropanol and place it into the spring housing.



## Maintenance

### Pump Head Maintenance (Tool Free)

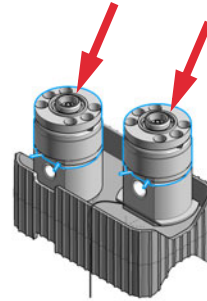
**11** Place the seal holder onto the spring housing.



#### NOTE

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

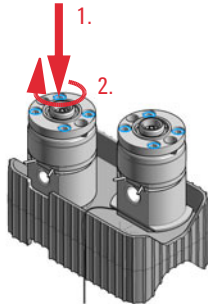
**12** Place the assembled spring housings on top of the pump chambers.



#### NOTE

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

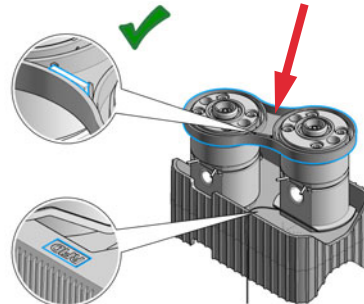
**13** Place the screws into the pump heads and loosely tighten them in a crosswise manner.



#### 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.



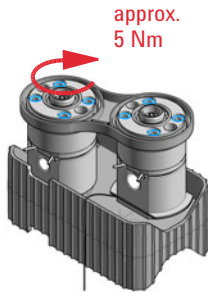
#### NOTE

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.

## Maintenance

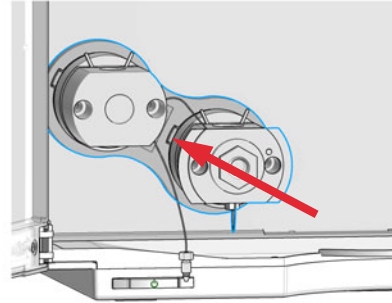
### Pump Head Maintenance (Tool Free)

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

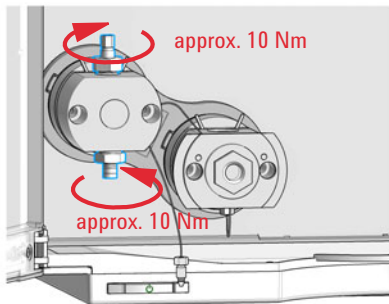


When the wrench clicks, the set torque is reached. Do not overtighten the screws.

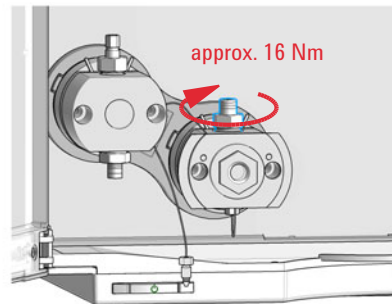
- 16** Mount the pump head to the module. Do not fix the screws at this stage!



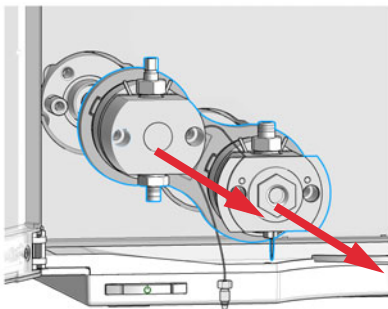
- 17** Screw in the inlet valve and the outlet valve and fix them with a torque wrench set to approximately 10 Nm.



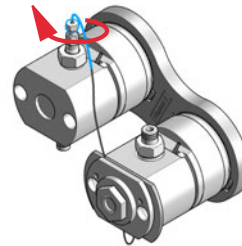
- 18** Binary/High-Speed Pumps only: Screw in the high-pressure filter and fix it with a torque wrench set to approximately 16 Nm.



- 19** Remove the pump head from the module again.



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

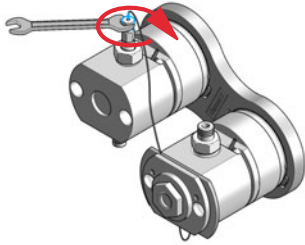




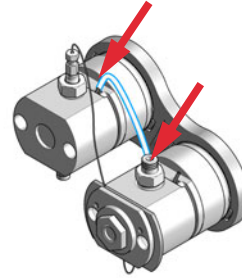
## Maintenance

### Pump Head Maintenance (Tool Free)

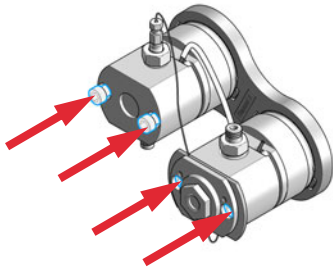
**21** Counter the outlet valve and tighten the lock screw of the heat exchanger capillary with a torque wrench set to approximately 3 Nm.







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



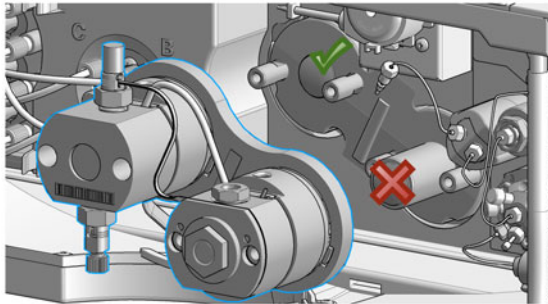
**23** Insert the screws that later fix the pump head assembly to the module housing.



## Install the Pump Head Assembly (G7104A)

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

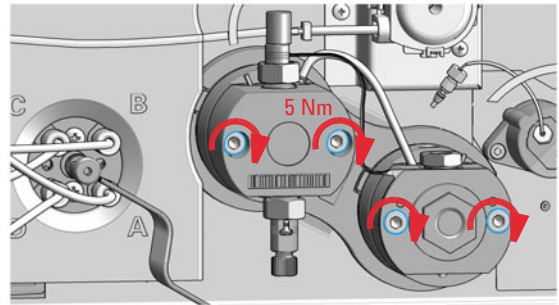
- 1 Bring the pump drive to the maintenance position using the Lab Advisor user interface: Go to **Service & Diagnostics >Remove/Install Pump Head** and follow instructions given on the screen. Both pump drives must be retracted.

**CAUTION****Damage to the pump head**

Using a wrong torque will damage the pump head.

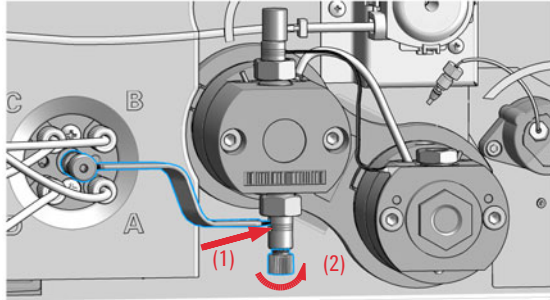
- ✓ For handling the torque wrench, setting and applying the right torque, consult the manual of your torque wrench.

- 2 Install the new pump head assembly by tightening the screws step by step. Apply 5 Nm using a torque hex key, which is included to the 1290 Infinity Service Kit p/n 5067-4699.

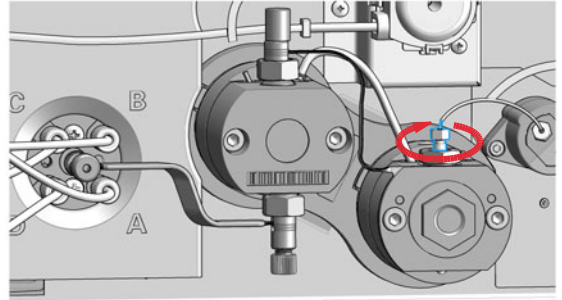


## Install the Pump Head Assembly (G7104A)

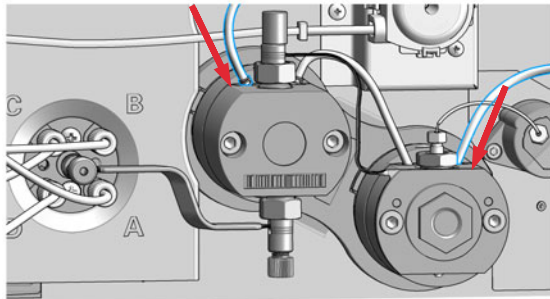
- 3** Insert the inlet weaver to the inlet valve (1). Fix the weaver with the plastic screw to the inlet valve (2).



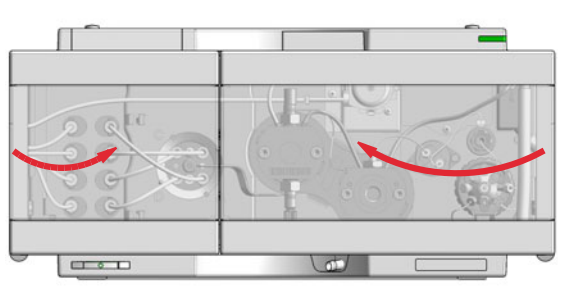
- 4** Connect the capillary from the outlet adapter on the secondary pump head to the pressure sensor.



- 5** Connect the seal wash tubes.







- 6** Close the doors.



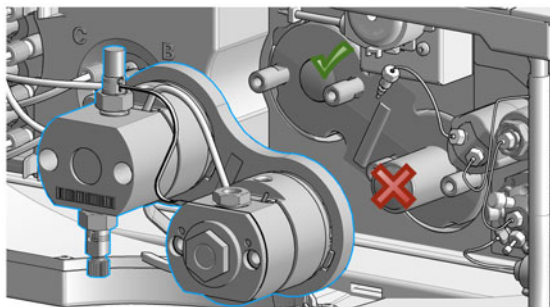
- 7** Perform a Pump Leak Rate Test.

## Install the Pump Head Assembly (G7131A)

## Tools required

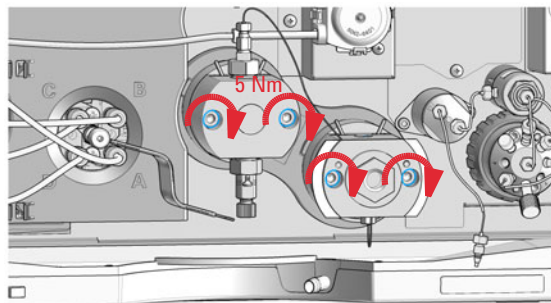
p/n	Description
G7120-68708 	HPLC System Tool Kit-Infinity-II
5067-5688 	Torque wrench 1 – 25 Nm with 14 mm wrench
G4220-20013 	4 mm hex bit
G4220-20015 	Adapter ¼ in square to hex

- 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**

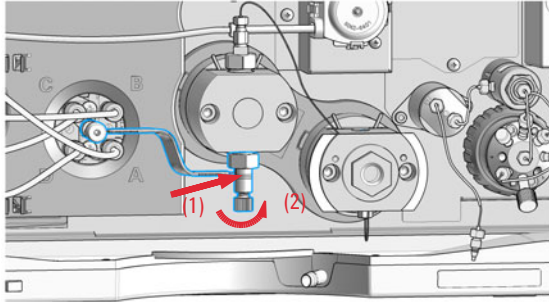
Using a wrong torque will damage the pump head.

- ✓ For handling the torque wrench, setting and applying the right torque, consult the manual of your torque wrench.
- 2 Install the new pump head assembly by tightening the screws step by step. Apply 5 Nm using a torque hex key, which is included to the 1290 Infinity Service Kit p/n 5067-4699.

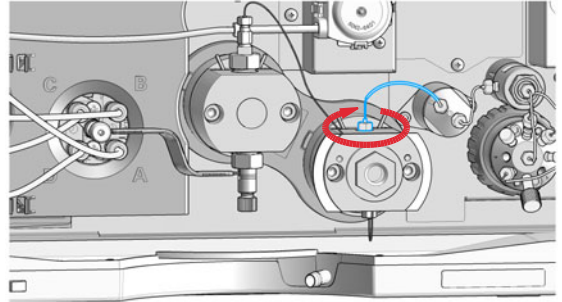


## Install the Pump Head Assembly (G7131A)

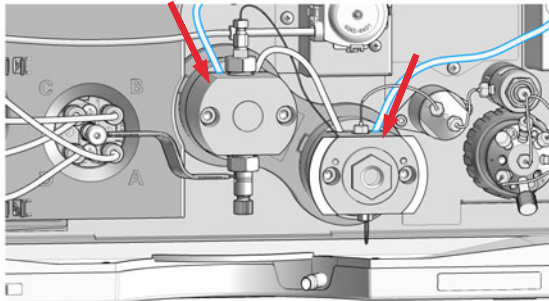
- 3 Insert the inlet weaver to the inlet valve (1). Fix the weaver with the plastic screw to the inlet valve (2).



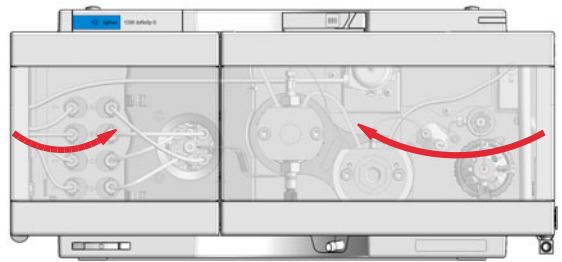
- 4 Connect the capillary from the outlet adapter on the secondary pump head to the pressure sensor.



- 5 Connect the seal wash tubes.






- 6 Close the doors.





- 7 Perform a Pump Leak Rate Test.

## Replace the Outlet Valve (G7104A)

**When** If Outlet valve is defective.

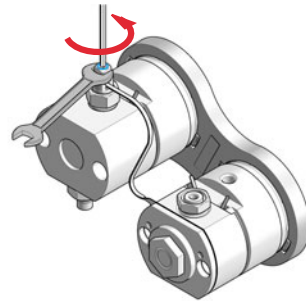
Tools required	p/n	Description
		Wrench, 14 mm
	5067-5688 	Torque wrench 1 – 25 Nm with 14 mm wrench
	G4220-20015 	Adapter ¼ in square to hex
	G4220-20041 	Bit Torx 10x25 mm

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

- Preparations**
- Switch off pump at the main power switch
  - Open the doors
  - Use an optional solvent shutoff valve or lift up solvent filters inside solvent bottles for avoiding leakages
  - Remove the pump head from the module

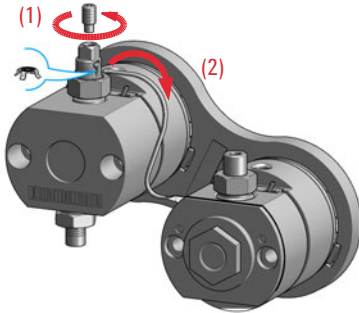
**1** Remove the cap from the outlet valve.

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



## Replace the Outlet Valve (G7104A)

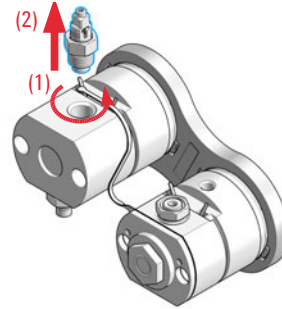
- 3 Remove the heat exchanger capillary by pushing the connector up and pulling it out of the valve.



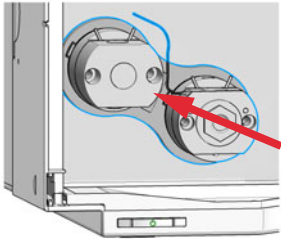
## NOTE

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

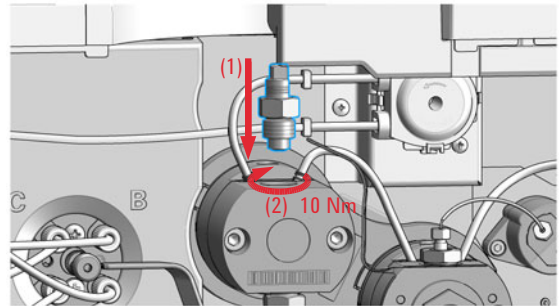
- 4 Unscrew the outlet valve with a 14 mm wrench (1) and remove it (2).



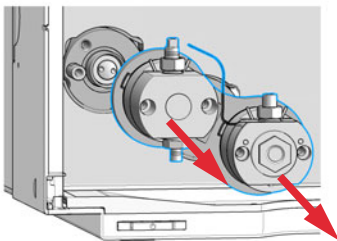
- 5 Mount the pump head to the module. Do not fix the screws at this stage!



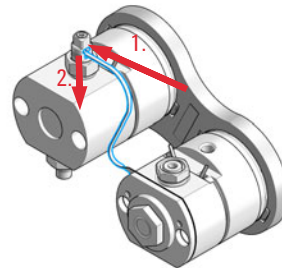
- 6 Insert the new outlet valve and tighten it using a torque wrench with a 14 mm bit set to 10 Nm.



- 7 Remove the pump head from the module again.

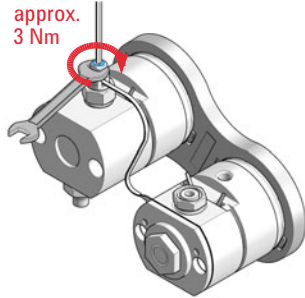


- 8 Position the entrance slit for the heat exchanger capillary to face exactly to it, and then seat the heat exchanger capillary back into the outlet valve by moving it into the valve and pressing it down.



## Replace the Outlet Valve (G7104A)

- 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 Purge the system to remove air.



## Replace the Outlet Valve (G7131A)

**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**

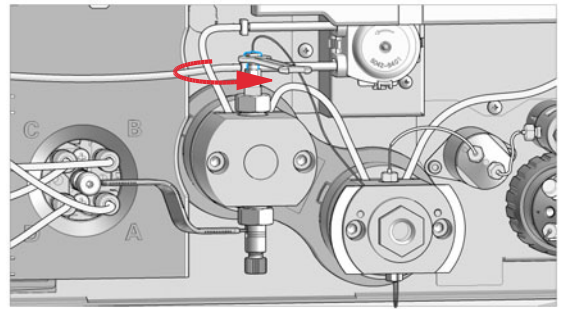
p/n	Description
G7131-60028 	Outlet Valve biocompatible

**Preparations**

- Switch off pump at the main power switch
- Open the doors
- Use an optional solvent shutoff valve or lift up solvent filters inside solvent bottles for avoiding leakages
- Remove the pump head from the module

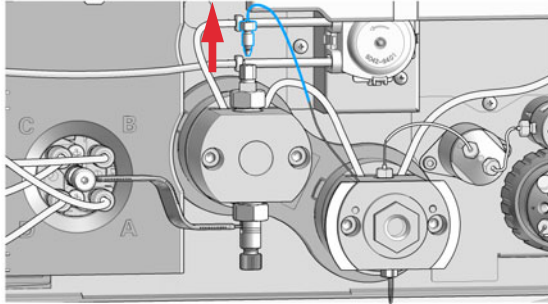
**1** Close the shut off valves to avoid solvent leaks.

**2** Open the lock screw of the heat exchanger capillary.



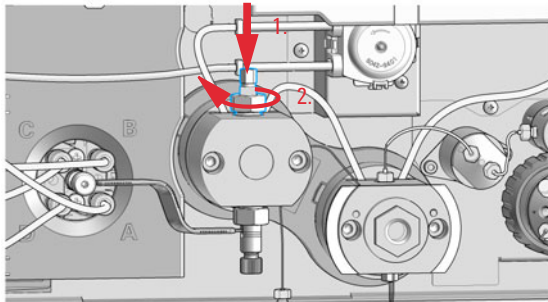
## Replace the Outlet Valve (G7131A)

- 3 Remove the heat exchanger capillary from the outlet valve.

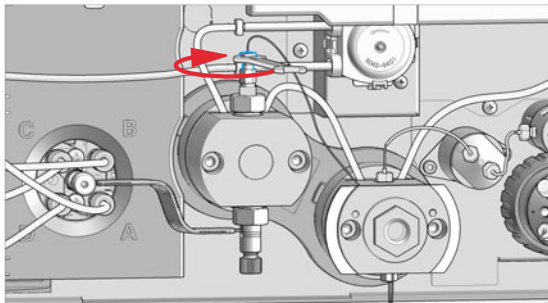
**NOTE**

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

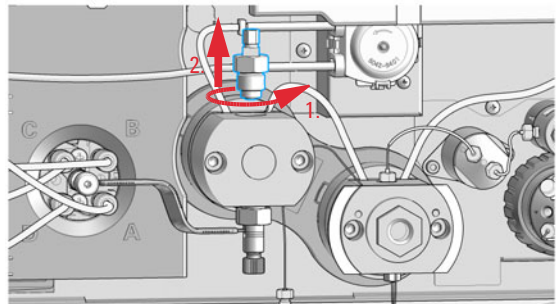
- 5 Insert the outlet valve into the pump head (1). Using a torque wrench, set approx. 10 Nm and close the outlet valve (2).



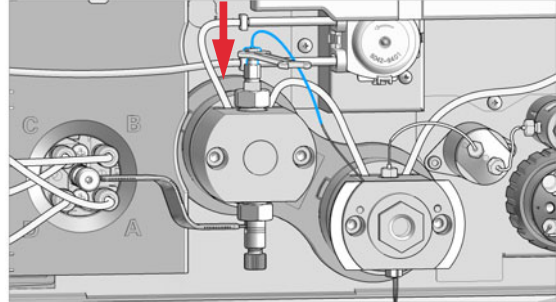
- 7 Tighten the screw of the heat exchanger capillary with a torque wrench set to approx. 3 Nm.



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











- 6 Connect the heat exchanger capillary to the outlet valve.

**Next Steps:**

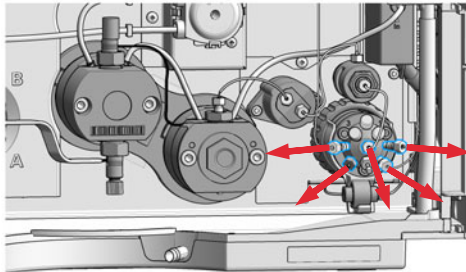
- 8 Reconnect all hydraulic connections, and power up the pump.  
9 Open the shutoff valves and purge the system to remove air.

# Replace the Multipurpose Valve

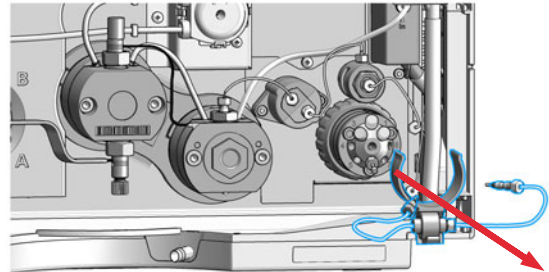
Tools required	p/n	Description
	5023-2502 	Hex driver SW-6.35, slitted

Parts required	#	p/n	Description
	1	0100-1259 	Blank nut (plastic)
	1	01080-83202 	Blank nut (stainless steel)
	1	5067-4237 	Multipurpose Valve Head
	2	5500-1253 	Capillary ST 0.17 mm x 130 mm SX/S (OPTIONAL)
	1	5067-6704 	Multipurpose Valve Biocompatible
	1	5043-0277 	Blank nut long 10-32, PEEK
	1	5500-1284 	Capillary MP35N 0.17 mm x 120 mm SI/SX
	1	5004-0041 	Capillary MP35N 0.17 mm x 130 mm SI/SX

**1** Remove all capillary connections from the Multipurpose Valve.



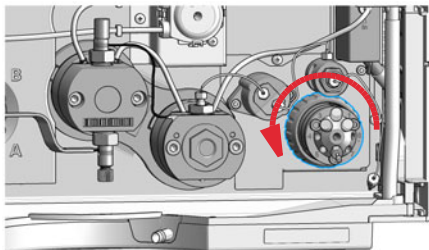
**2** Remove the clamp with the inline filter (if installed).



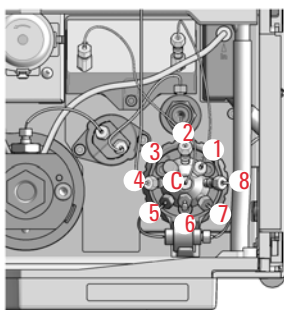
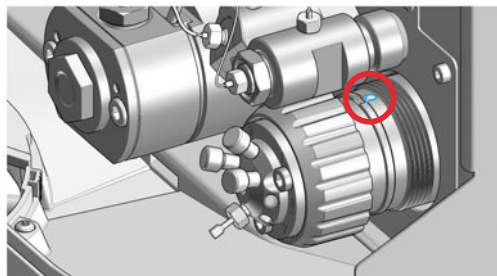
## Maintenance

### Replace the Multipurpose Valve

- 3** Unscrew the black union nut and 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.



The central (C) port is connected to the outlet of the filter outlet.







- Port 1 is connected to the outlet of the optional Jet Weaver
- Port 2 is connected to the inlet of the optional Jet Weaver
- Port 3 is blocked by a blank nut (plastic)
- Port 4 is connected to the system (typically multisampler)
- Port 5 is connected to the outlet of the optional inline filter
- Port 6 is blocked by a blank nut (SST/Biocompatible)
- Port 7 is connected to the waste capillary
- Port 8 is connected to the inlet of the optional inline filter

Block unused ports with blank nuts.

If the optional inline filter is not installed, connect ports 5 and 8 with a capillary (Capillary ST 0.17 x 120 mm, SLV/SV (5067-5416) or Capillary MP35N 0.17 mm x 120 mm SI/SX (5500-1284)).

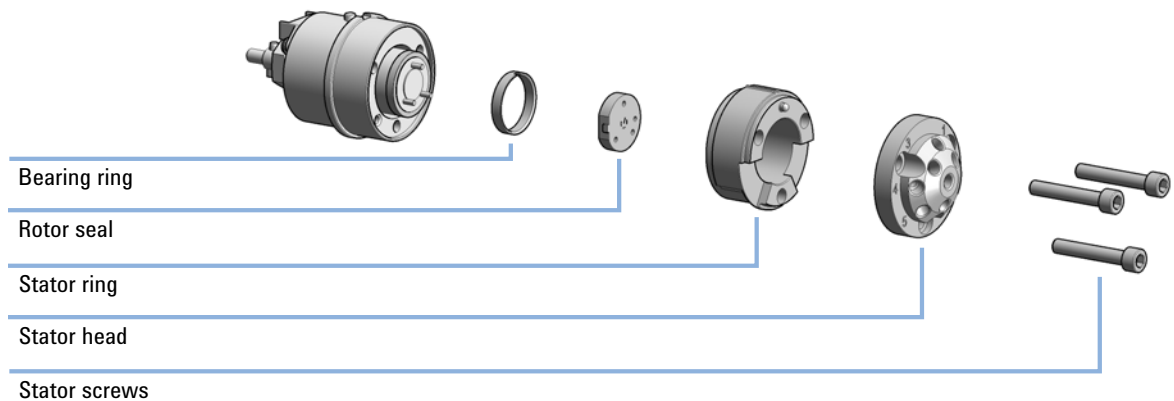
If the optional Jet Weaver is not installed, connect ports 1 and 2 with a capillary (Capillary ST 0.17 mm x 130 mm SX/S (5500-1253) or Capillary MP35N 0.17 x 130 mm SI/SX (5004-0041)).

## Replace Parts of the Multipurpose Valve (G7104A)





Tools required	p/n	Description
	8710-2394 	9/64 inch hex key
Parts required	p/n	Description
	1535-4045 	Bearing ring
	5068-0202 	Rotor seal, Multipurpose Valve, PEEK, 1300 bar
	5068-0120 	Stator ring
	5068-0001 	Stator head
	1535-4857 	Stator screws, 10/pk

**Preparations** Remove all capillary connections from the Multipurpose Valve.

- 1 Use the 9/64 inch hex key for opening the valve head.
- 2 Replace parts as required.
- 3 Reassemble the valve head mounted to the valve drive.

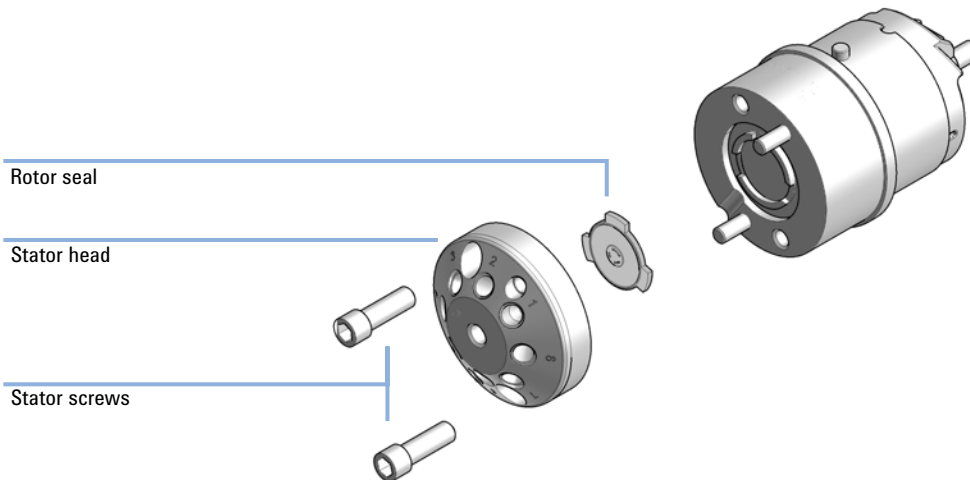


## Replace Parts of the Multipurpose Valve (G7131A)

Tools required	p/n	Description
	8710-2394 	9/64 inch hex key
Parts required	p/n	Description
	5068-0379 	Rotor Seal Biocompatible, Multipurpose Valve Biocompatible, PEEK, 1300 bar
	5068-0378 	Stator head biocompatible
	5428-0006 	Stator screws biocompatible






**Preparations** Remove all capillary connections from the Multipurpose Valve.





- 1 Use the 9/64 inch hex key for opening the valve head.
- 2 Replace parts as required.
- 3 Reassemble the valve head mounted to the valve drive.



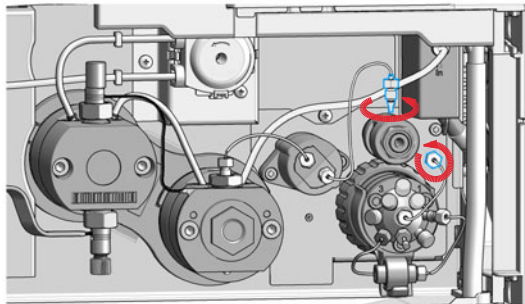
# Replace the High Pressure Outlet Filter or Filter Frit

**When** For removing blockages and leaks in the high pressure filter assembly. The outlet filter should be replaced as required depending on the system usage.

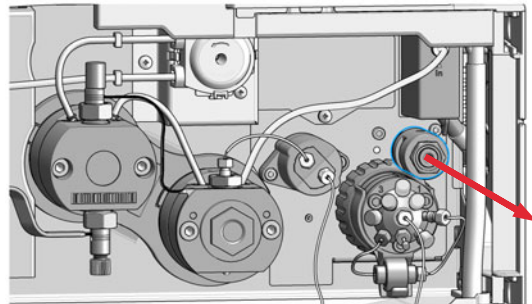
Tools required	p/n	Description
	5023-2502 	Hex driver SW-6.35, slitted
	8710-0510 	Open-end wrench 1/4 – 5/16 inch
	8710-1924 	Open-end wrench 14 mm
	5067-5688 	Torque wrench 1 – 25 Nm with 14 mm wrench
	5067-5690 	Torque wrench head, 14 mm, for torque wrench

Parts required	#	p/n	Description
	1	G4204-60004 	Outlet filter Quaternary Pump/Flexible Pump
	1	5067-5716 	Frit for pump outlet filter 2/pk
OR	1	G7131-60004 	Outlet Filter Flex Biocompatible
OR	1	5320-0048 	Frit for pump outlet filter biocompatible 2/pk

**1** Remove the capillary from the high pressure outlet filter to the pressure sensor (1) and from the high pressure outlet filter to the Multipurpose valve (2).

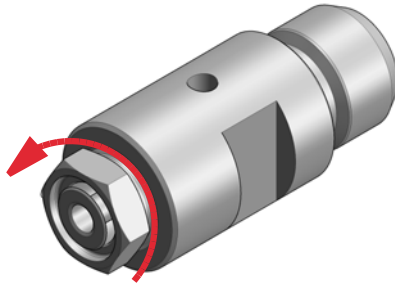


**2** Remove the high pressure outlet filter from the filter holder.



## Replace the High Pressure Outlet Filter or Filter Frit

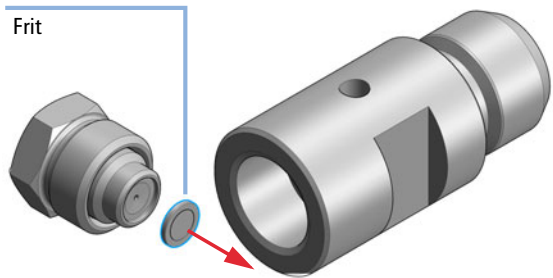
3 Unscrew the high pressure outlet filter.

**WARNING**

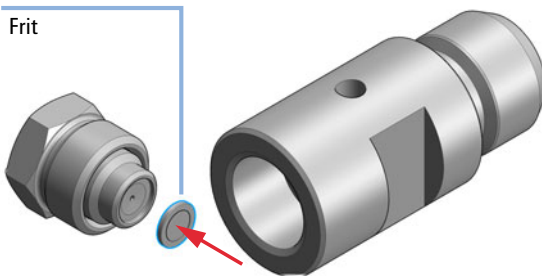
**Sharp blade**  
Risk of cutting with the knife.

✓ Be careful when handling the knife.

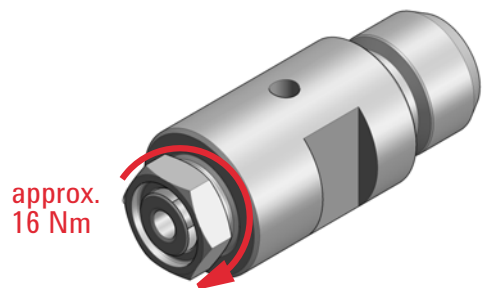
4 Remove the filter frit with the sharp side of the blade of a knife.



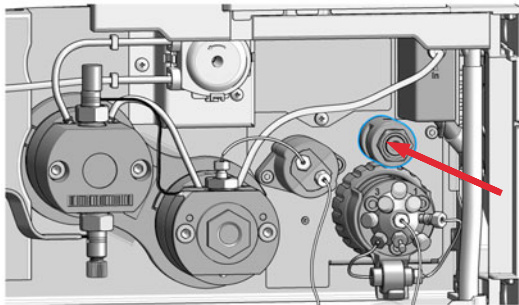
5 Insert new filter frit.



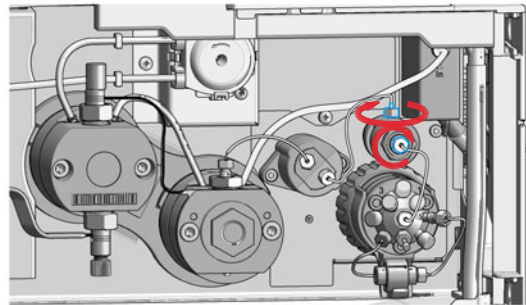
6 Reassemble the high pressure outlet filter (approx. 16 Nm).



7 Reinstall the high pressure outlet filter to the filter holder.






8 Mount the capillary connection to the pressure sensor (1) and to the Multipurpose valve (2).

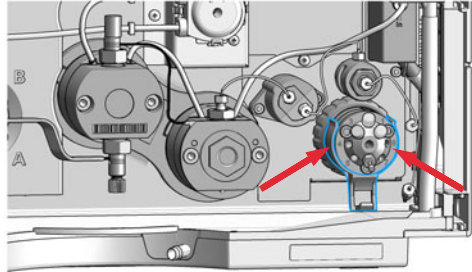
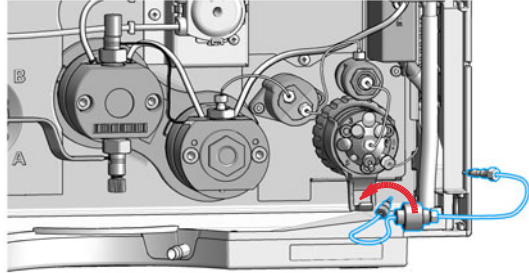




## Install the Inline Filter

<b>Tools required</b>	<b>p/n</b>	<b>Description</b>	
	8710-0510 	Open-end wrench 1/4 – 5/16 inch	
<b>Parts required</b>	<b>#</b>	<b>p/n</b>	<b>Description</b>
	1	G7104-68000 	Inline Filter Upgrade Kit
OR	1	G7131-68000 	Inline Filter Upgrade Kit Biocompatible

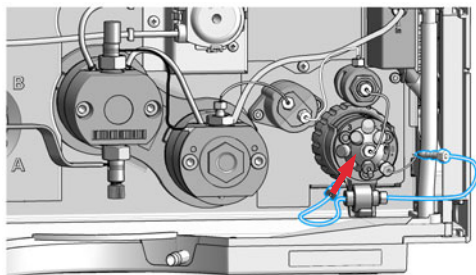
**Preparations** Turn the pump off.

<p><b>1</b> Remove the capillary between ports 5 and 8 from the Multipurpose Valve.</p>	<p><b>2</b> Clip the inline filter clamp to the Multipurpose Valve.</p> 
<p><b>3</b> Connect the 90 mm capillary (part of the upgrade kit) to the filter outlet.</p>	<p><b>4</b> Fix the inline filter to the clamp.</p> 

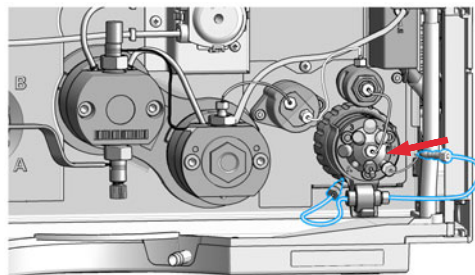
## Maintenance

### Install the Inline Filter




- 5 Install the integrated capillary of the inline filter to port 5 of the Multipurpose Valve.



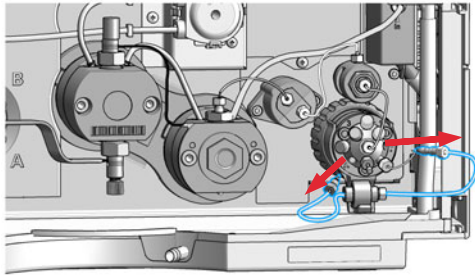
- 6 Install the removable capillary of the inline filter to port 8 of the Multipurpose Valve.



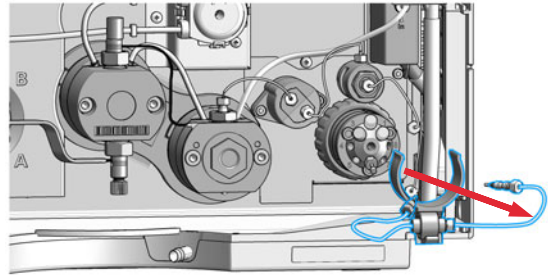
## Remove the Inline Filter

<b>Tools required</b>	<b>p/n</b>	<b>Description</b>
	8710-0510 	Open-end wrench 1/4 – 5/16 inch
<b>Parts required</b>	<b>p/n</b>	<b>Description</b>
	5067-5416 	Capillary ST 0.17 x 120 mm, SLV/SV
	5500-1284 	Capillary MP35N 0.17 mm x 120 mm SI/SX

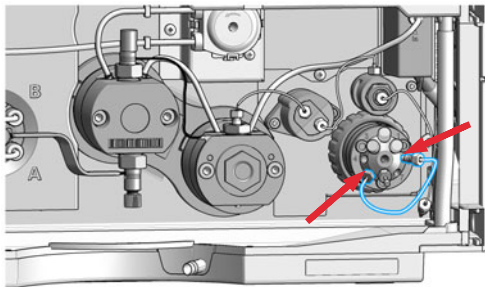
- 1** Remove the capillaries from the Multipurpose Valve to the inline filter.






- 2** Remove the clamp with the inline filter.



- 3** Install the capillary between ports 5 and 8 of the Multipurpose Valve.



## Replace Parts of the Inline Filter

Tools required	p/n	Description
	8710-0510 	Open-end wrench 1/4 – 5/16 inch
Parts required	p/n	Description
	5023-0271 	Frit 0.3 µm for inline filter, 5/pk
	5230-0022 	Frit 0.3 µm for Inline Filter Biocompatible

### CAUTION

#### Stuck Capillary in Multi Purpose Valve

Shortcutting the inline filter by directly connecting its right capillary to valve port 5 can damage the Multi Purpose Valve.

The size/position of this capillary in its fitting is incompatible, so it may get stuck irreversibly to the valve.

- ✓ Do not shortcut the filter by directly connecting its right capillary to valve port 5 in case the inline filter cannot or shall not be used.
- ✓ Use Capillary ST 0.17 x 120 mm, SLV/SV (5067-5416) or Capillary MP35N 0.17 mm x 120 mm SI/SX (5500-1284) instead.

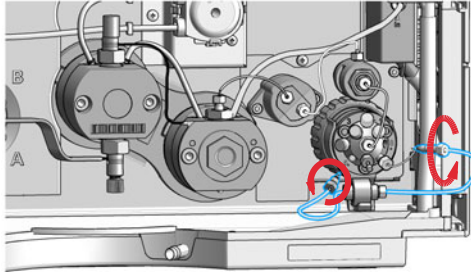
### NOTE

The inline filter can be cleaned using the back-flush function in the user interface of your Agilent instrument control software.

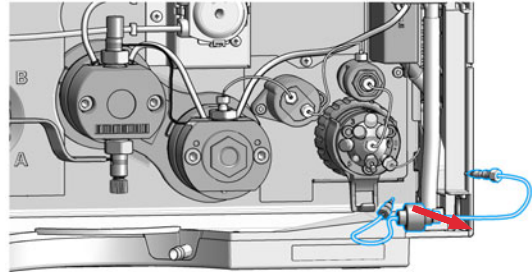
Only use the back-flush option, if an inline filter is installed.

## Replace Parts of the Inline Filter

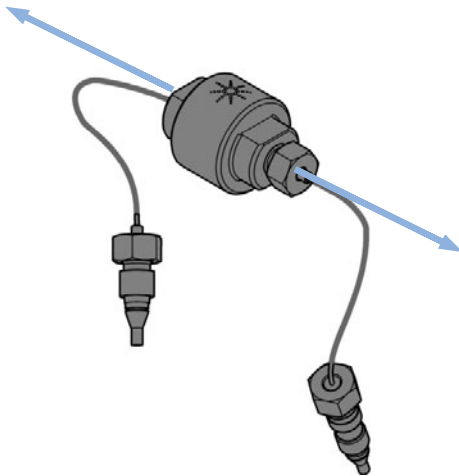
- 1 Remove the capillaries from the Multi Purpose Valve to the inline filter.



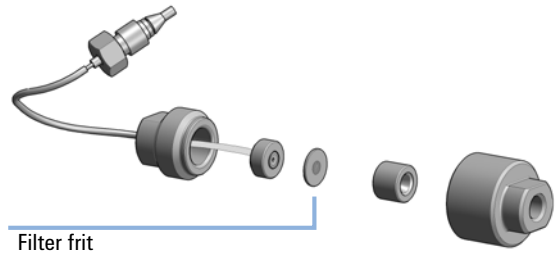
- 2 Remove the inline filter from the clamp attached to the Multi Purpose Valve.



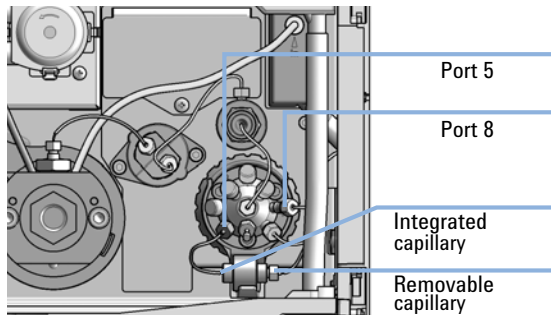
- 3 Use two 5/16 wrenches for opening the inline filter.



- 4 Replace the filter frit and reassemble the inline filter.



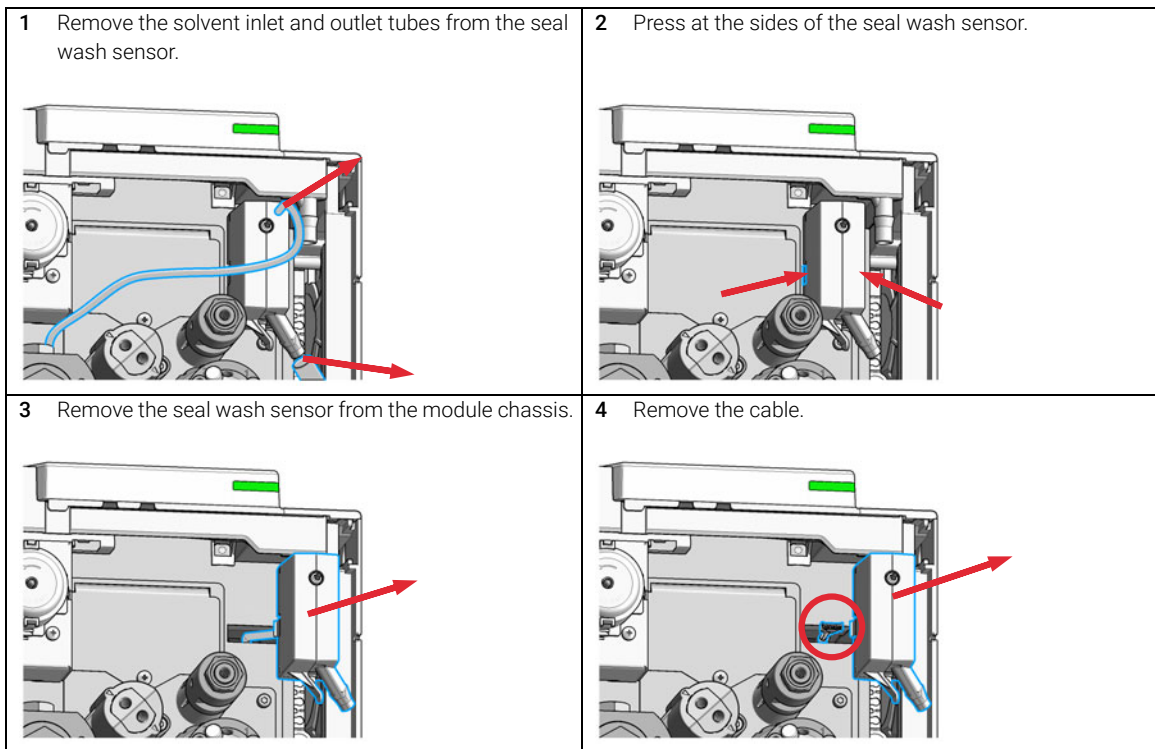
- 5 Put the inline filter to the clamp and install its capillaries. The integrated capillary is connected to port 5 of the Multi Purpose Valve. The removable capillary is connected to port 8.



## Replace the Seal Wash Sensor

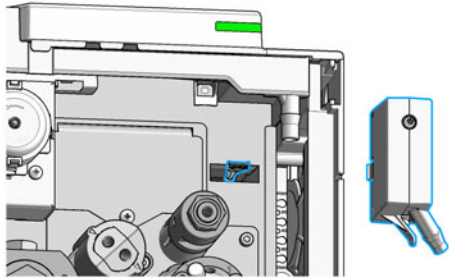
Parts required	p/n	Description
	5067-6172 	Seal Wash Sensor Pre Assembly

- Preparations**
- Shut-down the pump.
  - Remove the seal wash tubing from the seal wash solvent bottle.

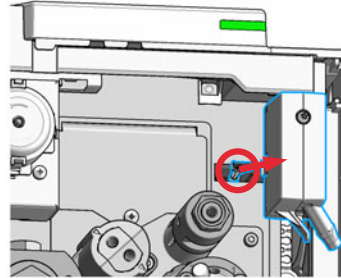


## Replace the Seal Wash Sensor

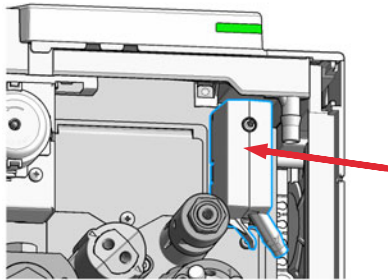
5 Remove the seal wash sensor completely.



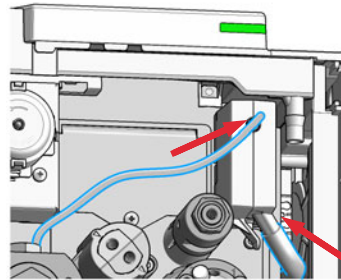
6 Connect the cable to the new seal wash sensor.



7 Install the new sensor to the module chassis.



8 Install the solvent inlet and outlet tubes to the seal wash sensor.



## 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

- | # | 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.  
<https://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
	G7104-44000 	Transport protection foam (G7104A/C)
	G7131-98000 	Transport protection foam (G7131A/C)

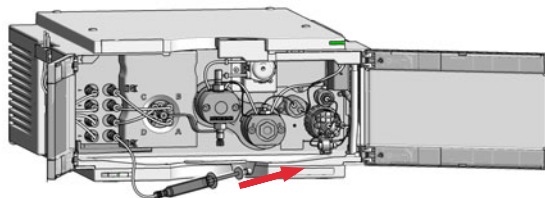
### CAUTION

#### 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.

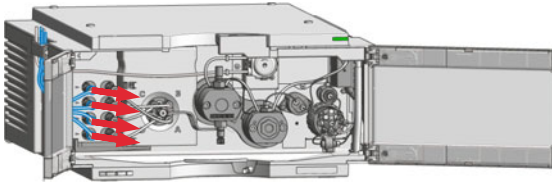
- 1 Flush all solvent channels with isopropanol.
- 2 Remove solvent inlet tubes from solvent reservoirs and tubing clips at other modules.
- 3 Remove tubings between the seal wash function and solvent bottle/waste.
- 4 Turn off the pump.
- 5 Remove cable and capillary connections to other modules.
- 6 Remove the waste tube.
- 7 Remove the module from the stack.

- 8 Disconnect the degasser outlet tubings at the MCGV one after another. Use a syringe for removing liquid from the degasser and the solvent tubings.

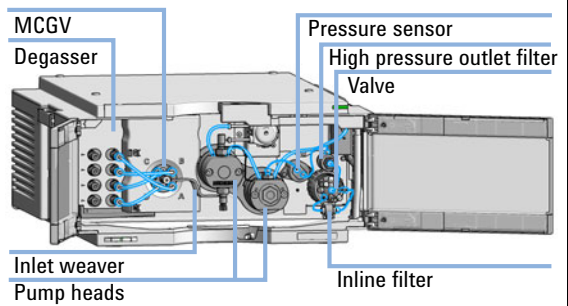


## Prepare the Pump Module for Transport

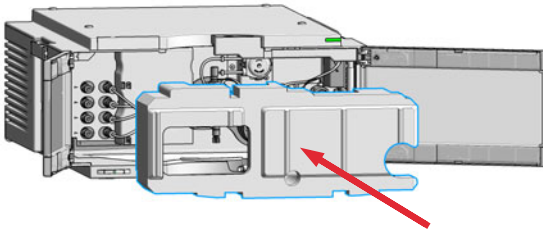
- 9** Reconnect the degasser outlet tubings to the MCGV. Remove the degasser inlet tubings.



- 10** You may keep internal tubing and capillary connections.



- 11** Carefully insert the protective foam to the front part of the instrument. Do not damage any tubing or capillary connections.

**Next Steps:**

- 12** Close the doors.
- 13** For transport or shipment, put the module and accessory kit to the original shipment box.

## 9

# Parts and Materials

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This chapter provides information on parts for maintenance.

# Overview of Main Assemblies (G7104A)

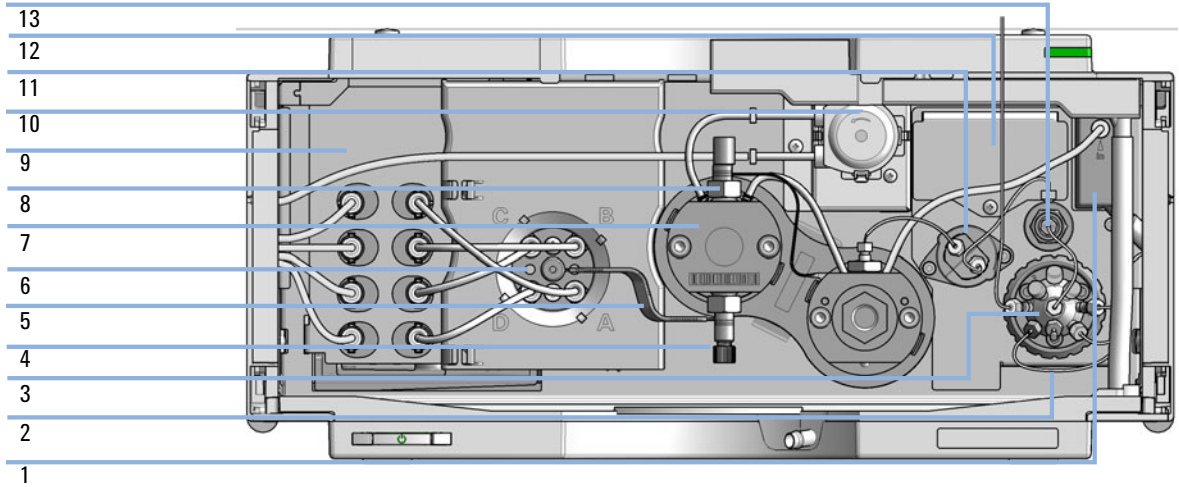




















Figure 21 Overview of main assemblies

## Parts and Materials

### Overview of Main Assemblies (G7104A)

Item	p/n	Description
1	5067-6172 	Seal Wash Sensor Pre Assembly
2	5067-5416 	Capillary ST 0.17 x 120 mm, SLV/SV
2	5067-5407 	Inline filter assembly, material: <i>stainless steel</i> (OPTIONAL)
	5023-0271 	Frit 0.3 µm for inline filter, 5/pk (OPTIONAL)
	G4204-40000 	Clamp for Inline Filter (OPTIONAL)
3	5067-4237 	Multipurpose Valve Head
4	G4204-60022 	Inlet Valve Quaternary Pump/Flexible Pump
5	G4204-81090 	Quaternary Pump/Flexible Pump Inlet Weaver Assembly
6	G7111-67701 	4GCV- 4 Channel Gradient Valve
	5041-8365 	Blank plug for MCGV
7	G4204-60350 	Long Life Pump Head Quat
8	G4220-60028 	Outlet valve (primary pump head)
9	G1311-60070 	Degasser 4 Channels for Quaternary Pump
10	5065-4445 	Peristaltic pump with PharMed tubing
11	5067-6791 	Pressure sensor 1300 bar
12	G4204-68380 	Jet Weaver Mixer Kit V380 Quat/Flex (OPTIONAL)
13	G4204-60004 	Outlet filter Quaternary Pump/Flexible Pump
	5067-5716 	Frit for pump outlet filter 2/pk

# Overview of Main Assemblies (G7131A)

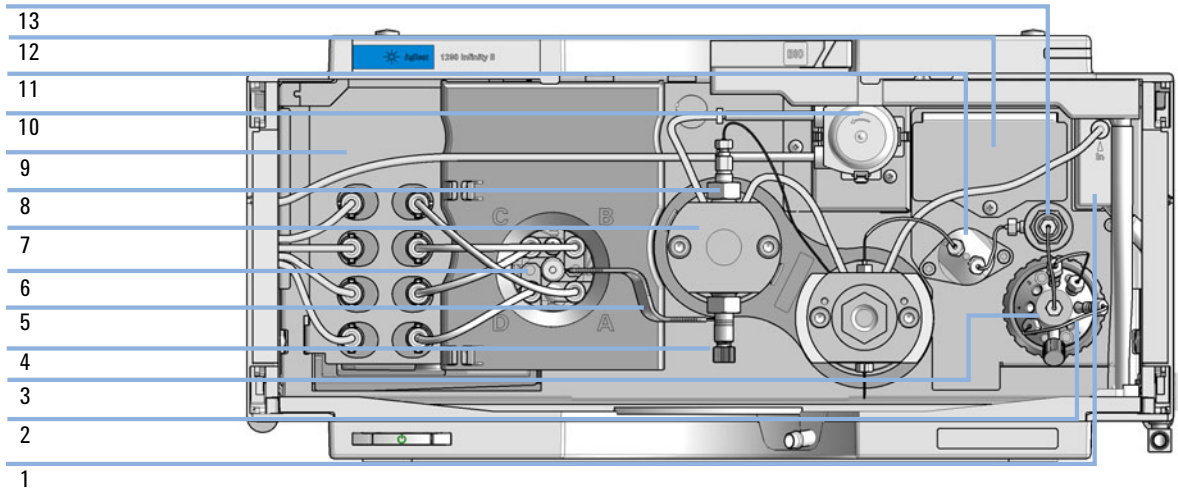


Figure 22 Overview of main assemblies

## Parts and Materials

### Overview of Main Assemblies (G7131A)

Item	p/n	Description
1	5067-6172 	Seal Wash Sensor Pre Assembly
2	5500-1284 	Capillary MP35N 0.17 mm x 120 mm SI/SX
2	5720-0003 	Inline Filter Assembly, Biocompatible
	5230-0022 	Frit 0.3 µm for Inline Filter Biocompatible
	G4204-40000 	Clamp for Inline Filter (OPTIONAL)
3	5067-6704 	Multipurpose Valve Biocompatible
4	G7131-60022 	Inlet Valve Bio-Compatible Flexible Pump
5	G7131-60090 	Inlet Weaver Assembly Biocompatible
6	G7111-67701 	4GCV- 4 Channel Gradient Valve
	5041-8365 	Blank plug for MCGV
7	G7131-60300 	Biocompatible Pump Head Flexible
8	G7131-60028 	Outlet Valve biocompatible
9	G1311-60070 	Degasser 4 Channels for Quaternary Pump
10	5065-4445 	Peristaltic pump with PharMed tubing
11	5067-7010 	Pressure sensor biocompatible 1300 bar
12	G7131-68380 	Jet Weaver Mixer Kit V380 Flex Biocompatible
13	G7131-60004 	Outlet Filter Flex Biocompatible
	5320-0048 	Frit for pump outlet filter biocompatible 2/pk

# Flow Connections (G7104A)

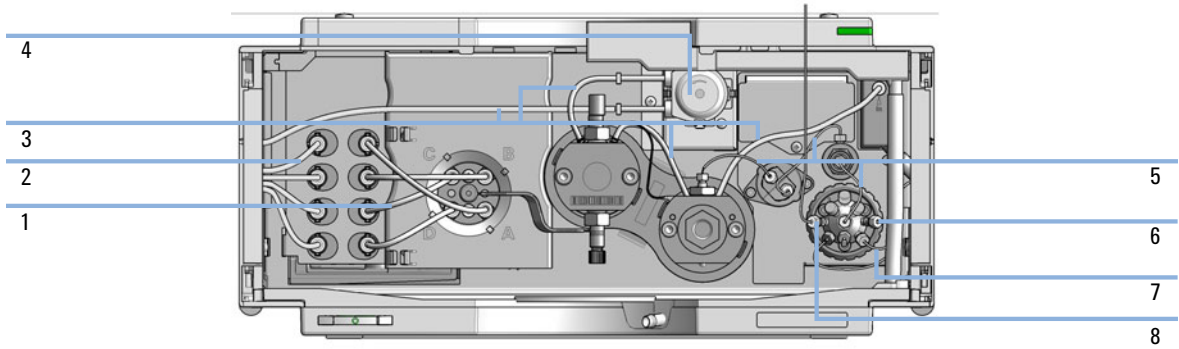



Figure 23 Flow connections of the pump



## Parts and Materials

### Flow Connections (G7104A)

Item	p/n	Description
1	G4220-60035 	Tubing kit 140 mm, 2/pk Degasser to MCGV
2	G7120-60007 	Bottle Head Assembly
	5067-6871 	Solvent Cabinet Kit (not shown)
3	5065-9978 	Tubing, 1 mm i.d., 3 mm o.d., silicone, 5 m
4	5065-4445 	Peristaltic pump with PharMed tubing
5	5067-4656 	Capillary ST, 0.25 mm x 80 mm Pressure Sensor to Outlet Filter, to Pump Head, and to Multipurpose Valve
6	5067-4748 	Capillary ST, 0.17 mm x 90 mm Multipurpose Valve to Inline Filter
7	G4220-67000 	Waste Tubing with Fitting
8	5500-1217 	Capillary, ST, 0.17 mm x 900 mm SI/SX Pump to Multisampler
	5500-1246 	Capillary ST 0.17 mm x 500 mm SI/SI
	5500-1253 	Capillary ST 0.17 mm x 130 mm SX/S for Jet Weaver (not shown)
	G7120-68070 	Ultra Clean Tubing Kit (includes bottle head assemblies and tubing connections within the pump)
	G4220-60070 	Tubing Kit 140 mm - Ultra Clean Tubing (tubes from SSV to shutoff valve or degassing unit to MCGV)
	G7120-60017 	Bottle Head Assembly Ultra Clean Tubing (bottle heads and tubing to shutoff panel / degasser)

# Flow Connections (G7131A)

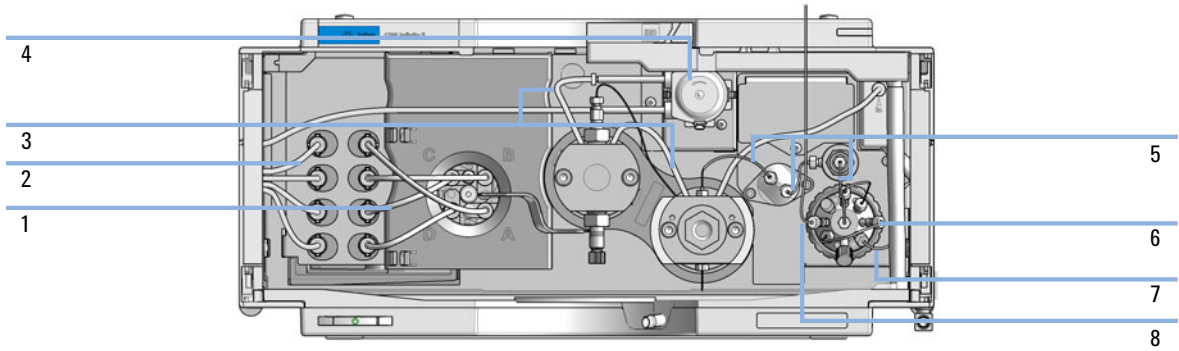












Figure 24 Flow connections of the pump

## Parts and Materials

### Flow Connections (G7131A)

Item	p/n	Description
1	G4220-60035 	Tubing kit 140 mm, 2/pk Degasser to 4CGV
2	G7120-60007 	Bottle Head Assembly
	5067-6871 	Solvent Cabinet Kit (not shown)
3	5065-9978 	Tubing, 1 mm i.d., 3 mm o.d., silicone, 5 m
4	5065-4445 	Peristaltic pump with PharMed tubing
5	5500-1283 	Capillary MP35N 0.25 mm x 80 mm Pressure Sensor to Outlet Filter, to pump head, and to Multipurpose valve
6	5500-1284 	Capillary MP35N 0.17 mm x 120 mm SI/SX
7	G4220-67000 	Waste Tubing with Fitting
8	5500-1419 	Capillary MP35N 0.17 mm x 500 mm, SI/SI
	G7120-68070 	Ultra Clean Tubing Kit (includes bottle head assemblies and tubing connections within the pump)
	G4220-60070 	Tubing Kit 140 mm - Ultra Clean Tubing (tubes from SSV to shutoff valve or degassing unit to MCGV)
	G7120-60017 	Bottle Head Assembly Ultra Clean Tubing (bottle heads and tubing to shutoff panel / degasser)
	5004-0041 	Capillary MP35N 0.17 mm x 130 mm SI/SX (for Jet Weaver not shown)

## Pump Heads (G7104A)

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

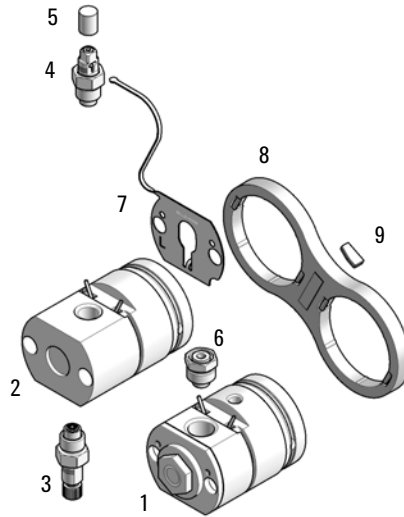
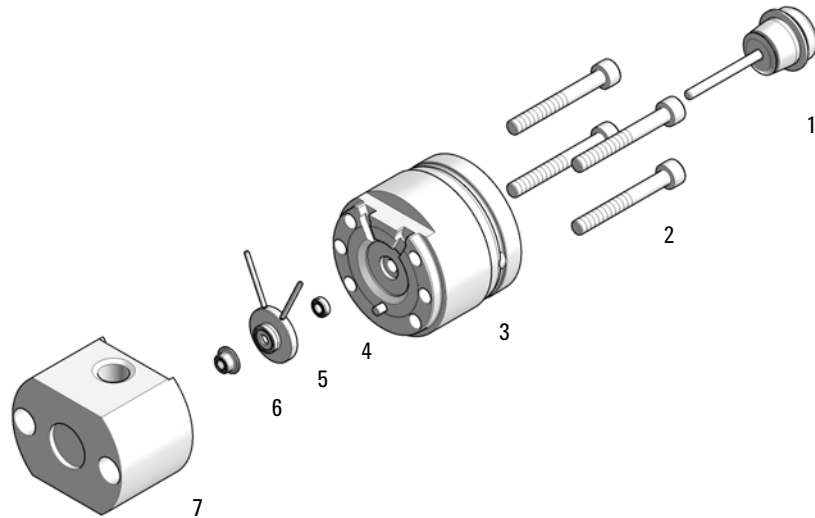


Figure 25 Pump head assembly parts

Long Life Pump Head Quat (G4204-60350)

Item	p/n	Description
1	G4220-60660 <a href="#">[E]</a>	Secondary Pump Head Assembly Pendulum
2	G4220-60661 <a href="#">[E]</a>	Primary Pump Head Assembly Pendulum
3	G4204-60022 <a href="#">[E]</a>	Inlet Valve Quaternary Pump/Flexible Pump
4	G4220-60028 <a href="#">[E]</a>	Outlet valve (primary pump head)
	G4220-20020 <a href="#">[E]</a>	Internal gold seal for Outlet Valve (not shown)
5	5042-9966 <a href="#">[E]</a>	Cap Outlet Valve
6	G1312-60001 <a href="#">[E]</a>	Pump head adapter assembly, material: <i>stainless steel</i>
7	G4220-81013 <a href="#">[E]</a>	Heat Exchanger
8	G4220-40001 <a href="#">[E]</a>	Link Plate
9	0960-2971 <a href="#">[E]</a>	RF Transponder

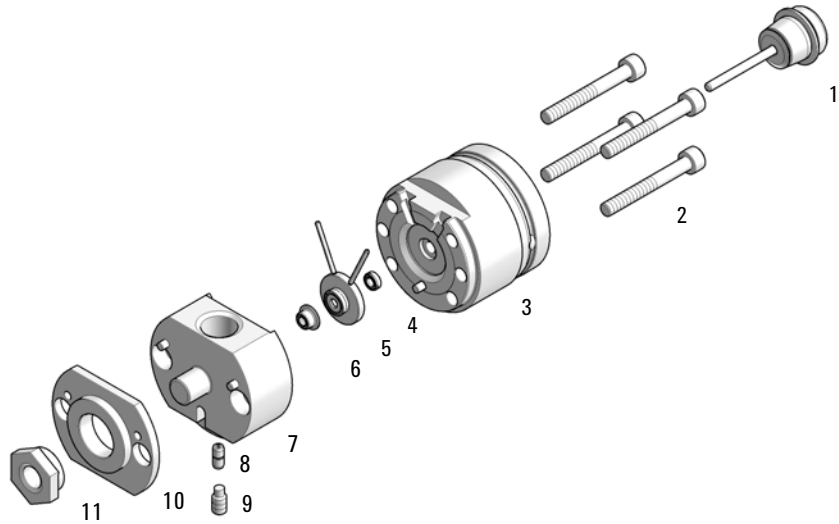
## Primary Pump Head Parts



Primary Pump Head Assembly Pendulum (G4220-60661)

Item	p/n	Description
1	5067-5975 <a href="#">[i]</a>	Plunger Assy ZrO <sub>2</sub> LL
2	5810-0009 <a href="#">[i]</a>	Screw M5x40 A4-80 Lubric Silver
3	G4220-60046 <a href="#">[i]</a>	Preload-Support Assembly LL
4	0905-1175 <a href="#">[i]</a>	Wash seal (PTFE)
5	G4220-60616 <a href="#">[i]</a>	Seal Holder Integrated Assembly EM/LL
6	0905-1719 <a href="#">[i]</a>	PE Seal
7	G4220-60533 <a href="#">[i]</a>	Body Head Primary EM/LL

## Secondary Pump Head Parts



Secondary Pump Head Assembly Pendulum (G4220-60660)

Item	p/n	Description
1	5067-5975 <a href="#">[E]</a>	Plunger Assy ZrO <sub>2</sub> LL
2	5810-0009 <a href="#">[E]</a>	Screw M5x40 A4-80 Lubric Silver
3	G4220-60046 <a href="#">[E]</a>	Preload-Support Assembly LL
4	0905-1175 <a href="#">[E]</a>	Wash seal (PTFE)
5	G4220-60616 <a href="#">[E]</a>	Seal Holder Integrated Assembly EM/LL
6	0905-1719 <a href="#">[E]</a>	PE Seal
7	G4220-25513 <a href="#">[E]</a>	Body Head Secondary EM/LL
8	G4220-20001 <a href="#">[E]</a>	Spacer Fitting
9	5023-3119 <a href="#">[E]</a>	Screw M5x10 Planar Front
10	G4220-20000 <a href="#">[E]</a>	LID
11	G4220-20003 <a href="#">[E]</a>	Pump Head Screw

## Pump Heads (G7131A)

### Pump Head Assembly Parts

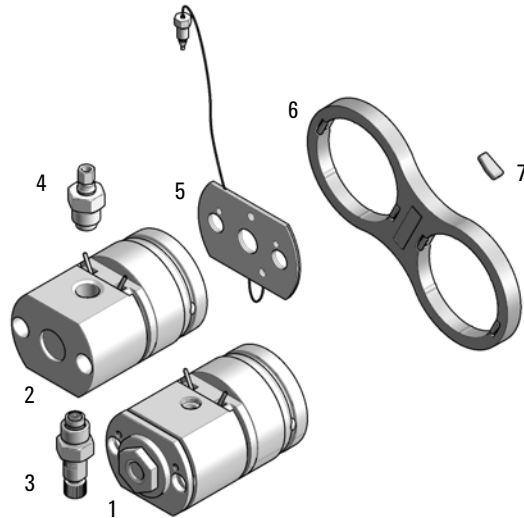


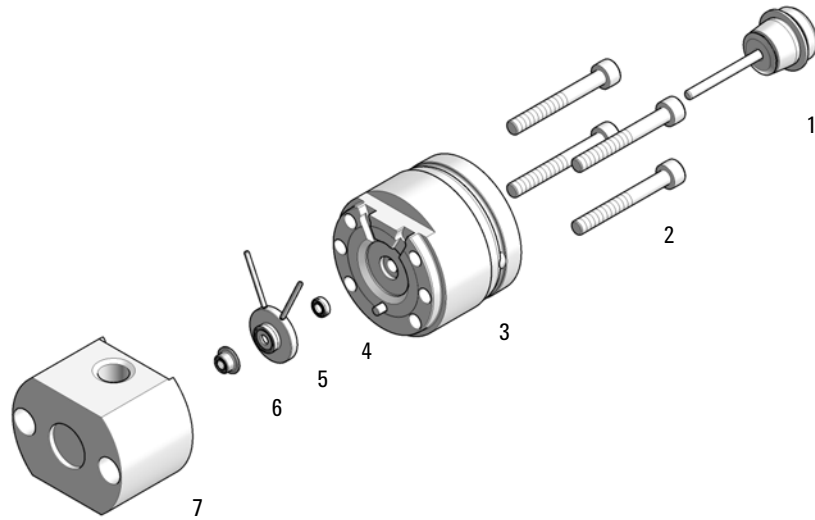
Figure 26 Pump head assembly parts

#### Biocompatible Pump Head Flexible (G7131-60300)

Item	p/n	Description
1	G7131-60640 <a href="#">[E]</a>	Secondary Pump Head Assembly biocompatible
2	G7131-60641 <a href="#">[E]</a>	Primary Pump Head Assembly biocompatible
3	G7131-60022 <a href="#">[E]</a>	Inlet Valve Bio-Compatible Flexible Pump
4	G7131-60028 <a href="#">[E]</a>	Outlet Valve biocompatible
5	G7131-60005 <a href="#">[E]</a>	Heat Exchanger for biocompatible Pump
6	G4220-40001 <a href="#">[E]</a>	Link Plate
7	0960-2971 <a href="#">[E]</a>	RF Transponder



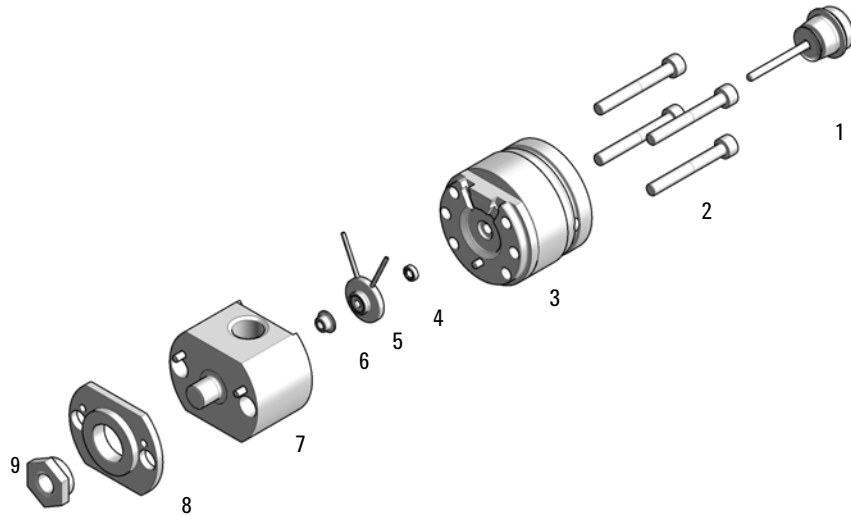
## Primary Pump Head Parts



Primary Pump Head Assembly biocompatible (G7131-60641)

Item	p/n	Description
1	5067-5975 <a href="#">[E]</a>	Plunger Assy ZrO <sub>2</sub> LL
2	5810-0009 <a href="#">[E]</a>	Screw M5x40 A4-80 Lubric Silver
3	G4220-60046 <a href="#">[E]</a>	Preload-Support Assembly LL
4	0905-1731 <a href="#">[E]</a>	Bio-Inert Wash Seal
5	G7131-60616 <a href="#">[E]</a>	Seal Holder Integrated Assembly biocompatible
6	G7131-20009 <a href="#">[E]</a>	Seal biocompatible
7	G7131-60533 <a href="#">[E]</a>	Body Head Primary biocompatible

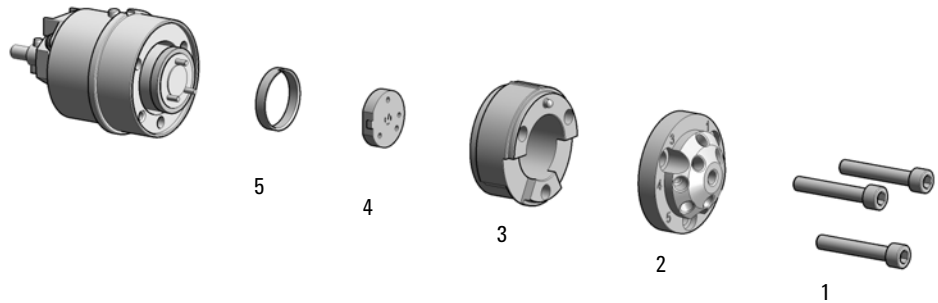
## Secondary Pump Head Parts



Secondary Pump Head Assembly biocompatible (G7131-60640)

Item	p/n	Description
1	5067-5975 <a href="#">[E]</a>	Plunger Assy ZrO <sub>2</sub> LL
2	5810-0009 <a href="#">[E]</a>	Screw M5x40 A4-80 Lubric Silver
3	G4220-60046 <a href="#">[E]</a>	Preload-Support Assembly LL
4	0905-1731 <a href="#">[E]</a>	Bio-Inert Wash Seal
5	G7131-60616 <a href="#">[E]</a>	Seal Holder Integrated Assembly biocompatible
6	G7131-20009 <a href="#">[E]</a>	Seal biocompatible
7	G7132-60000 <a href="#">[E]</a>	Body Head Secondary biocompatible
8	G4220-20000 <a href="#">[E]</a>	LID
9	G4220-20003 <a href="#">[E]</a>	Pump Head Screw

## Multipurpose Valve (G7104A)



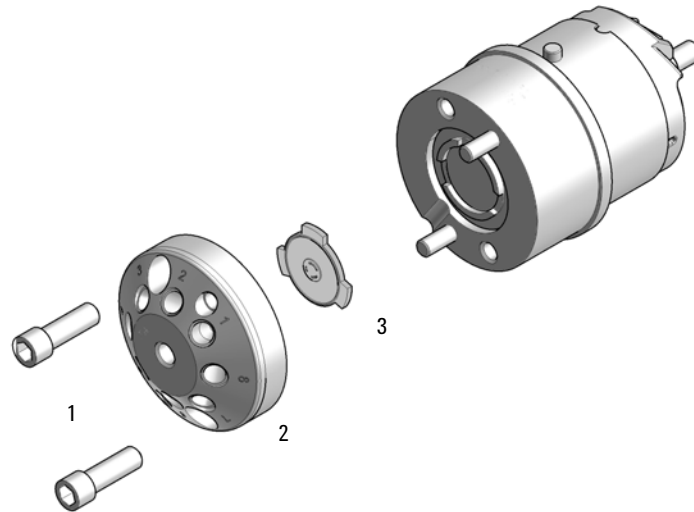
**Figure 27** Multipurpose Valve parts

Item	p/n	Description
	5067-4237 <a href="#">📄</a>	Multipurpose Valve Head
1	1535-4857 <a href="#">📄</a>	Stator screws, 10/pk
2	5068-0001 <a href="#">📄</a>	Stator head
3	5068-0120 <a href="#">📄</a>	Stator ring
4	5068-0202 <a href="#">📄</a>	Rotor seal, Multipurpose Valve, PEEK, 1300 bar
5	1535-4045 <a href="#">📄</a>	Bearing ring

## Parts and Materials

### Multipurpose Valve (G7131A)

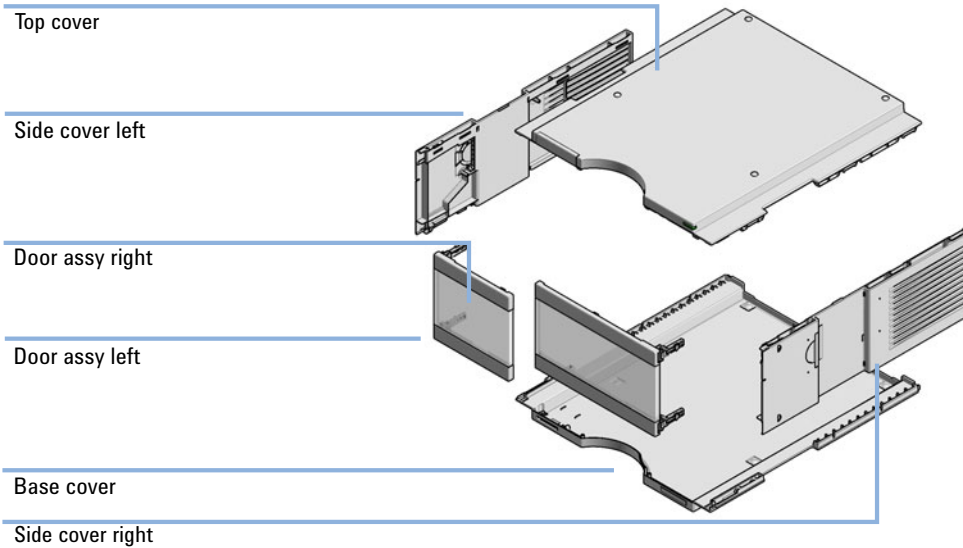
## Multipurpose Valve (G7131A)



**Figure 28 Biocompatible Multipurpose Valve parts**

Item	#	p/n	Description
	1	5067-6704 <a href="#">📄</a>	Multipurpose Valve Biocompatible
1	2	5428-0006 <a href="#">📄</a>	Stator screws biocompatible
2	1	5068-0378 <a href="#">📄</a>	Stator head biocompatible
3	1	5068-0379 <a href="#">📄</a>	Rotor Seal Biocompatible, Multipurpose Valve Biocompatible, PEEK, 1300 bar

## Cover Parts



p/n	Description
G7104-68713 <a href="#">[i]</a>	Cabinet Kit 180 Infinity II
5043-0286 <a href="#">[i]</a>	Base Cover Infinity II
G7104-60200 <a href="#">[i]</a>	Cover Side Right 180
G7104-60201 <a href="#">[i]</a>	Cover Side Left 180
	Top Cover Kit Infinity II
5043-0856 <a href="#">[i]</a>	Leak Adapter (not shown)
5067-5745 <a href="#">[i]</a>	Door Assembly Infinity 180 Left
5067-5746 <a href="#">[i]</a>	Door Assembly Infinity 180 Right
















## Accessory Kit (G7104A)

### G7104-68705

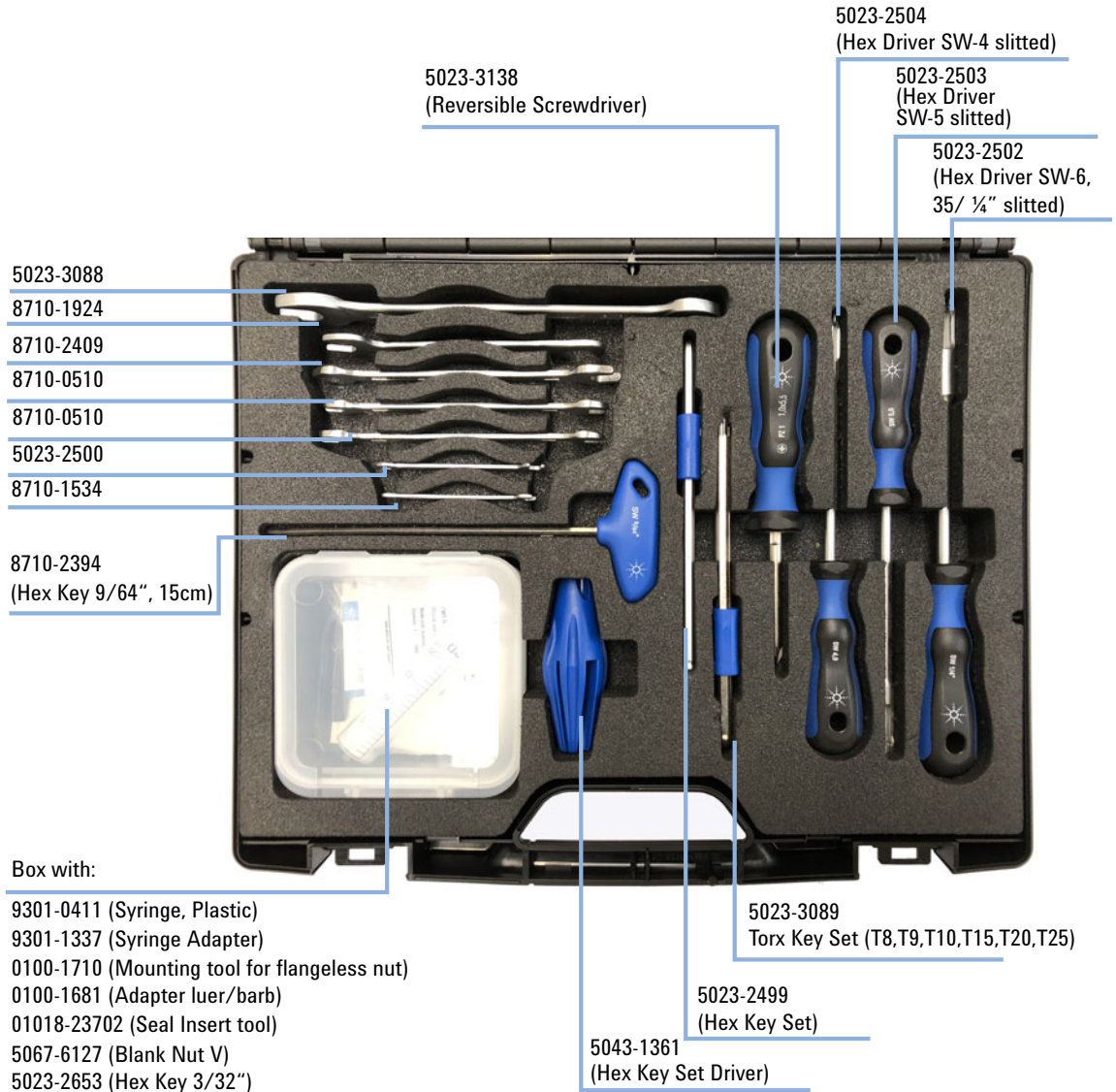
#	p/n	Description
1	G4220-67000 <a href="#">📄</a>	Waste Tubing with Fitting
2	5043-1013 <a href="#">📄</a>	Tubing Clip IF-II
3	5063-6527 <a href="#">📄</a>	Tubing, Silicon Rubber, 1.2 m, ID/OD 6/9 mm
1	5067-5443 <a href="#">📄</a>	Inlet tubing
1	5181-1519 <a href="#">📄</a>	CAN cable, Agilent module to module, 1 m
6	5500-1155 <a href="#">📄</a>	Tube Connector, 90 degree, ID 6.4
1	5500-1246 <a href="#">📄</a>	Capillary ST 0.17 mm x 500 mm SI/SI
1	9301-6476 <a href="#">📄</a>	Syringe with luerlock 5 mL Polypropylene
1	G1311-90107 <a href="#">📄</a>	Algae note
1	9301-1337 <a href="#">📄</a>	Syringe adapter
1	5500-1156 <a href="#">📄</a>	T-Tube Connector ID6.4
3	5500-1169 <a href="#">📄</a>	Y Tube Connector ID 6.4
1	5500-1217 <a href="#">📄</a>	Capillary, ST, 0.17 mm x 900 mm SI/SX
1	01200-90091 <a href="#">📄</a>	1290 Infinity Pump Quick Reference Sheet
1	5067-6197 <a href="#">📄</a>	Seal Handling Device
1	5043-1400 <a href="#">📄</a>	Pump Head Holder
1	5067-5716 <a href="#">📄</a>	Frit for pump outlet filter 2/pk

## Accessory Kit (G7131A)

### G7131-68755

p/n	Description
5043-1013 	Tubing Clip IF-II
5063-6527 	Tubing, Silicon Rubber, 1.2 m, ID/OD 6/9 mm
5067-5443 	Inlet tubing
5181-1519 	CAN cable, Agilent module to module, 1 m
5500-1155 	Tube Connector, 90 degree, ID 6.4
5500-1419 	Capillary MP35N 0.17 mm x 500 mm, SI/SI
9301-6476 	Syringe with luerlock 5 mL Polypropylene
G1311-90107 	Algae note
9301-1337 	Syringe adapter
5500-1156 	T-Tube Connector ID6.4
5500-1169 	Y Tube Connector ID 6.4
G7132-90110 	1290 Infinity II Bio Best Practice Sheet
5067-6197 	Seal Handling Device
G7132-42000 	Bio Pump Head Holder
5067-6658 	Biocompatible Frit Assembly

Tool Kit







# 10

## Identifying Cables

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CAN/LAN Cables	266
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USB Cables	268

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 <a href="#">📄</a>	Agilent 35900A A/D converter
01046-60105 <a href="#">📄</a>	Analog cable (BNC to general purpose, spade lugs)



#### Remote cables

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



#### CAN cables

p/n	Description
5181-1516 <a href="#">📄</a>	CAN cable, Agilent module to module, 0.5 m
5181-1519 <a href="#">📄</a>	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

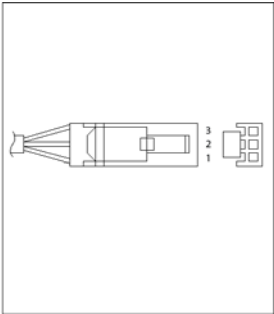
p/n	Description
5188-8050 	USB A M-USB Mini B 3 m (PC-Module)
5188-8049 	USB A F-USB Mini B M OTG (Module to Flash Drive)

## Analog Cables

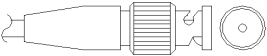
### 35900

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

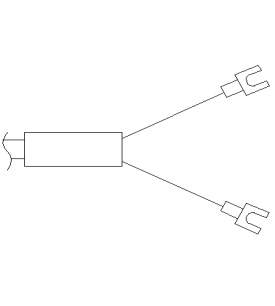
p/n 35900-60750	35900	Pin Agilent module	Signal Name
	1		Not connected
	2	Shield	Analog -
	3	Center	Analog +

Agilent Module to BNC Connector

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

**Identifying Cables**  
Analog Cables

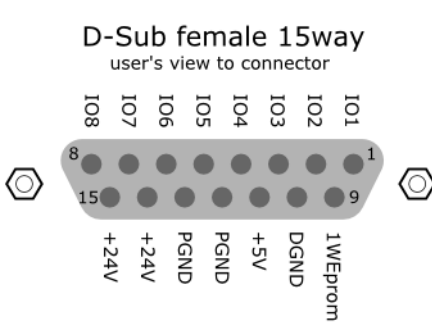
Agilent Module to General Purpose

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)
 <p>D-Sub female 15way user's view to connector</p>	1	white	IO1	START REQUEST	Low
	2	brown	IO2	STOP	Low
	3	green	IO3	READY	High
	4	yellow	IO4	PEAK DETECT	Low
	5	grey	IO5	POWER ON	High
	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			

### NOTE


Configuration is different with old firmware revisions.

The configuration for IO4 and IO5 is swapped for modules with firmware lower than D.07.10.

### NOTE


Peak Detection is used for LCMS systems connected with the Fraction Collection Remote Y-Cable (5188-8057).

- 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 17** 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 Trigger	5	High	4
	5	Power on	6	High	
	6	Shut Down	4	High	
	7	Start	3	High	
	8	Prepare	2	High	
	Ground	Cable Shielding	NC		



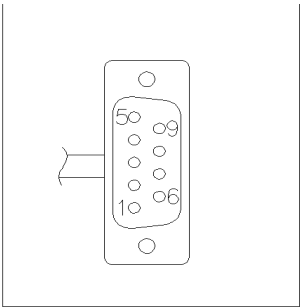
One end of these cables provides an Agilent Technologies APG (Analytical Products Group) remote connector to be connected to Agilent modules. The other end depends on the instrument to be connected to.



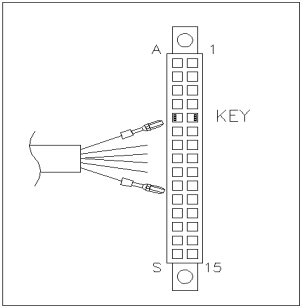
## Identifying Cables

### Remote Cables

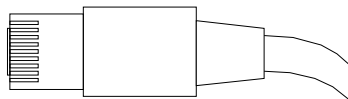
#### Agilent Module to Agilent 35900 A/D Converters

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 <a href="#">📄</a>	CAN cable, Agilent module to module, 0.5 m
5181-1519 <a href="#">📄</a>	CAN cable, Agilent module to module, 1 m

### LAN Cables



p/n	Description
5023-0203 <a href="#">📄</a>	Cross-over network cable, shielded, 3 m (for point to point connection)
5023-0202 <a href="#">📄</a>	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 Cables

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

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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: <https://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.

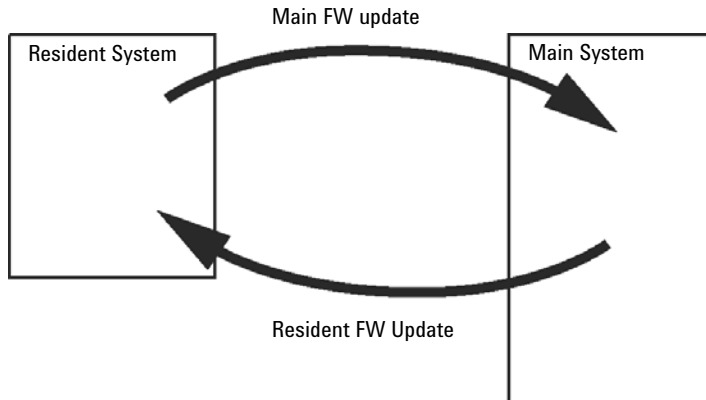


Figure 29 Firmware Update Mechanism

**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.

- <https://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  $\pm$  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 <ul style="list-style-type: none"> <li>• DE = Germany</li> <li>• JP = Japan</li> <li>• CN = China</li> </ul>
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

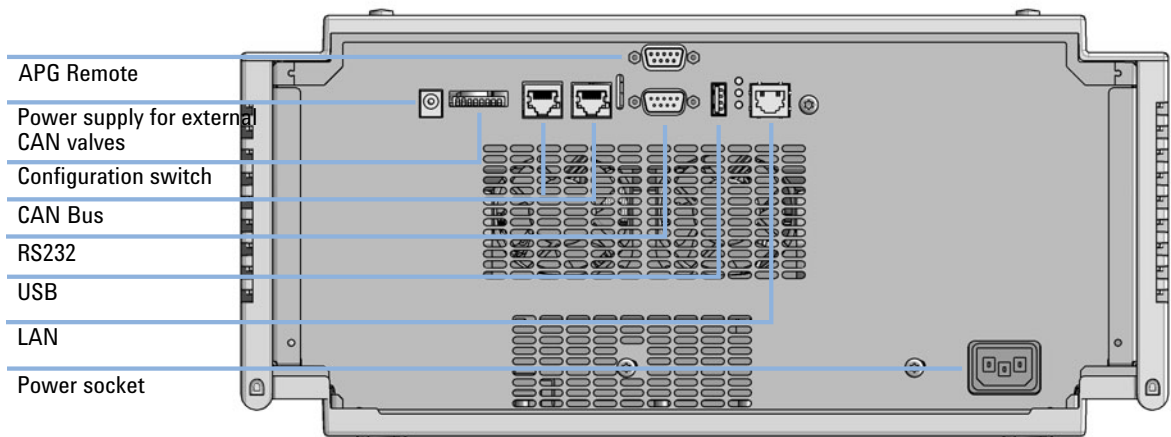


Figure 30 Rear view of the Flexible Pump

## Interfaces

The Agilent InfinityLab LC Series modules provide the following interfaces:

**Table 18** Agilent InfinityLab LC Series Interfaces

Module	CAN	USB	LAN (on-board)	RS-232	Analog	APG (A) / ERI (E)	Special
<b>Pumps</b>							
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	
<b>Samplers</b>							
G7129A/B/C	2	Yes	Yes	No	No	E	
G7167A/B/C, G7137A, G5668A, G3167A	2	Yes	Yes	No	No	E	
G7157A	2	Yes	Yes	No	No	E	
<b>Detectors</b>							
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 18 Agilent InfinityLab LC Series Interfaces

Module	CAN	USB	LAN (on-board)	RS-232	Analog	APG (A) / ERI (E)	Special
<b>Fraction Collectors</b>							
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
<b>Others</b>							
G1170A	2	No	No	No	No	No	
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 Serial 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 279.

### 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 19 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 1.7 A 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.

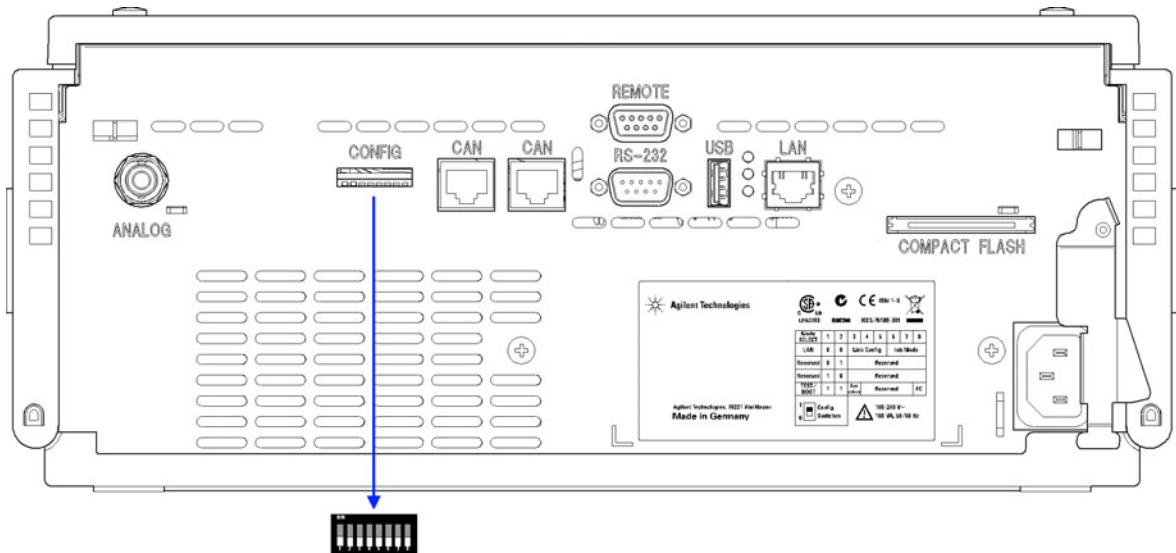


Figure 31 Location of Configuration Switch (example shows a G4212A DAD)



**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 20 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 282.

## 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 21 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 22 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

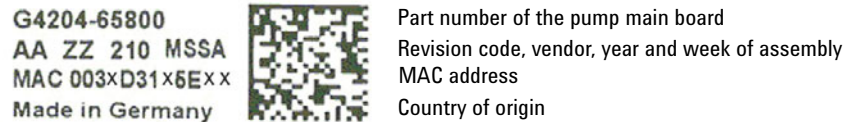
What You Have To Do First	286
TCP/IP Parameter Configuration	287
Configuration Switch	288
Initialization Mode Selection	289
Dynamic Host Configuration Protocol (DHCP)	291
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Setup (DHCP)	292
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With Telnet	296
PC and User Interface Software Setup	300
PC Setup for Local Configuration	300
User Interface Software Setup	301

This chapter provides information on connecting the module to the control software.

## What You Have To Do First

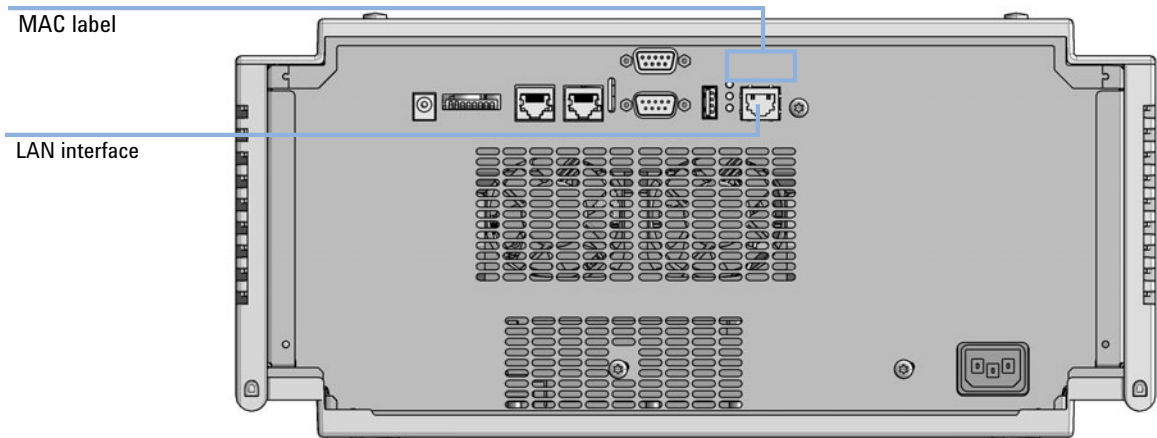
The module has an on-board LAN communication interface.

- 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 underneath the configuration switch (see [Figure 33](#) on page 286).



**Figure 32** MAC label

- 2 Connect the instrument's LAN interface (see [Figure 33](#) on page 286) to
  - the PC network card using a crossover network cable (point-to-point) or
  - a hub or switch using a standard LAN cable.



**Figure 33** Location of LAN interfaces 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

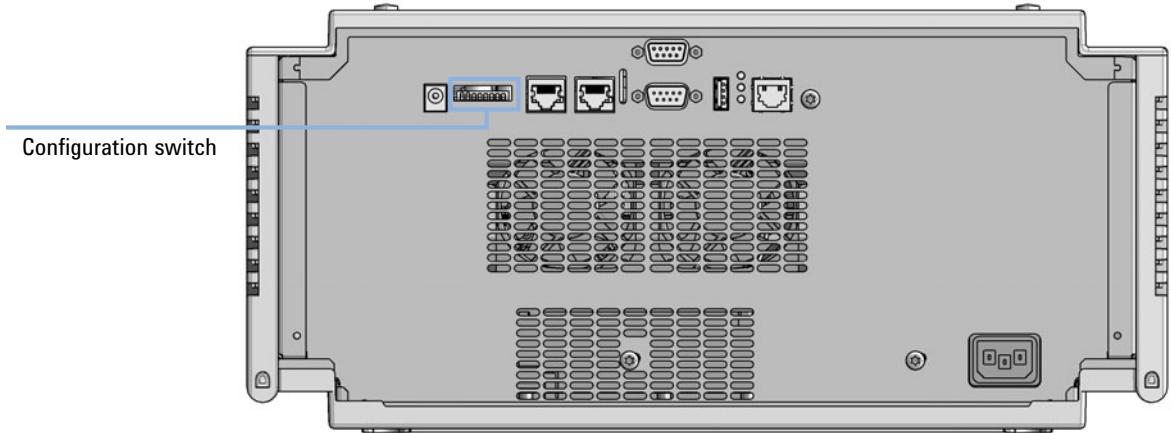
The TCP/IP parameters can be configured by the following methods:

- 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 292
- 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 24](#) on page 289.

## Configuration Switch

The configuration switch can be accessed at the rear of the module.



**Figure 34** 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 23** Factory Default Settings


Link Configuration	speed and duplex mode determined by auto-negotiation, for details see "Link Configuration Selection" on page 294
--------------------	--



## Initialization Mode Selection

The following initialization (init) modes are selectable:

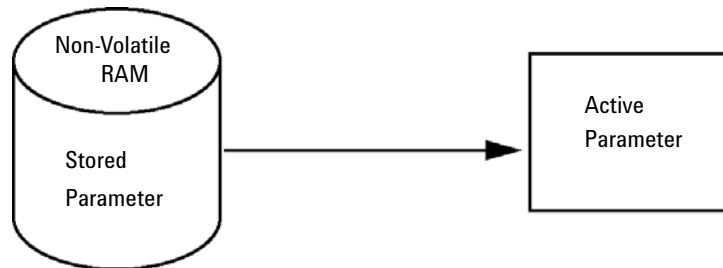
**Table 24** Initialization Mode Switches

	SW 6	SW 7	SW 8	Init Mode
	OFF	ON	OFF	Using Stored
	OFF	ON	ON	Using Default
	ON	OFF	OFF	DHCP <sup>1</sup>

<sup>1</sup> Requires firmware B.06.40 or above. Modules without LAN on board, see G1369C LAN Interface Card

### Using Stored

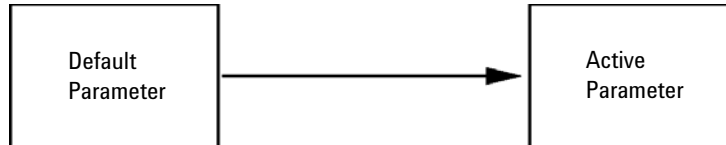
When initialization mode **Using Stored** is selected, the parameters are taken from the non-volatile memory of the module. The TCP/IP connection will be established using these parameters. The parameters were configured previously by one of the described methods.



**Figure 35** 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 25](#) on page 290.



**Figure 36** 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 25** 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).

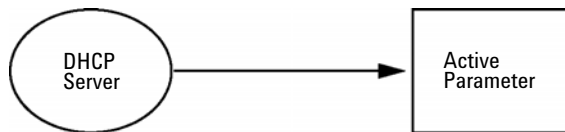


Figure 37 DHCP (Principle)

#### 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.

- 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.

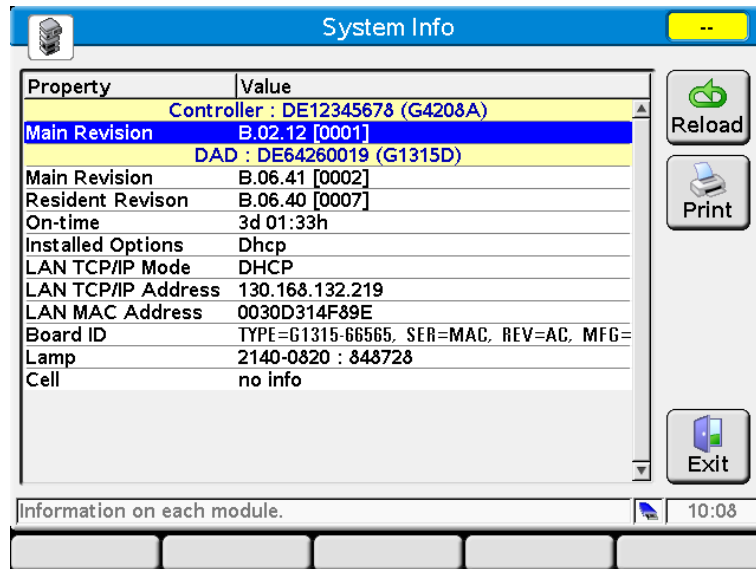


Figure 38 LAN Setting on Instant Pilot

## LAN Configuration

### Dynamic Host Configuration Protocol (DHCP)

- 2 Set the configuration switch to DHCP either on the G1369C LAN Interface Card or the mainboard of above mentioned modules.

**Table 26 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 27 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 291).

## 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 28** 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.

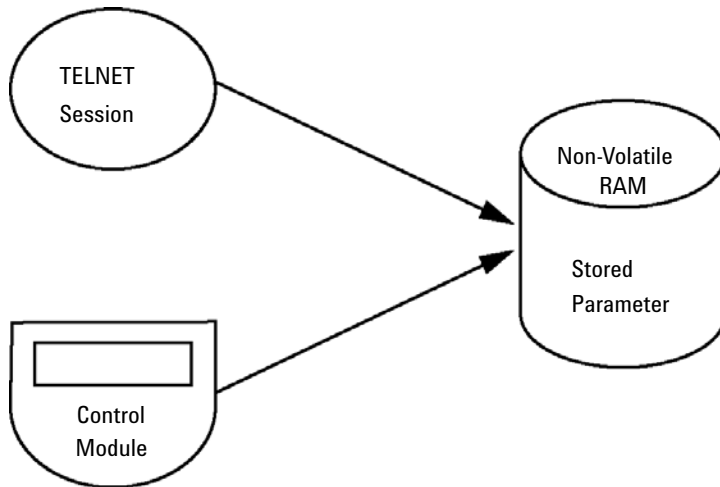
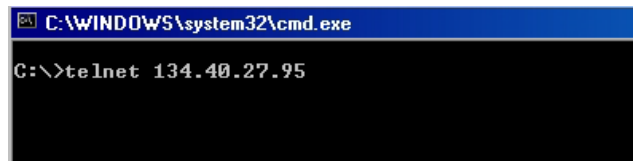


Figure 39 Manual Configuration (Principle)

## 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>

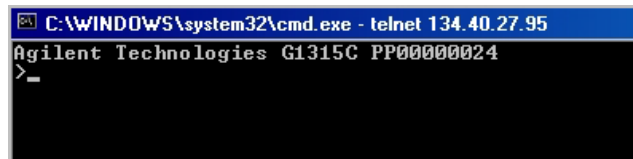


```
C:\WINDOWS\system32\cmd.exe
C:\>telnet 134.40.27.95
```

Figure 40 Telnet - Starting a session

where <IP address> may be the assigned address from a configuration session with the Handheld Controller, or the default IP address (see "Configuration Switch" on page 288).

When the connection was established successfully, the module responds with the following:

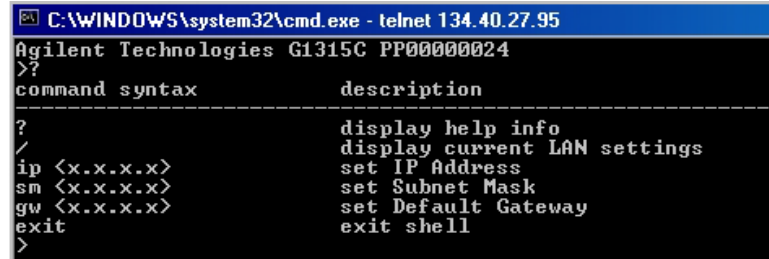


```
C:\WINDOWS\system32\cmd.exe - telnet 134.40.27.95
Agilent Technologies G1315C PP00000024
>_
```

Figure 41 A connection to the module is made



- 3 Type `?` and press enter to see the available commands.



```

C:\WINDOWS\system32\cmd.exe - telnet 134.40.27.95
Agilent Technologies G1315C PP00000024
>?
command syntax          description
-----
?                        display help info
/                        display current LAN settings
ip <x.x.x.x>             set IP Address
sm <x.x.x.x>             set Subnet Mask
gw <x.x.x.x>             set Default Gateway
exit                    exit shell
>

```

Figure 42 Telnet Commands

Table 29 Telnet Commands

Value	Description
<code>?</code>	displays syntax and descriptions of commands
<code>/</code>	displays current LAN settings
<code>ip &lt;x.x.x.x&gt;</code>	sets new ip address
<code>sm &lt;x.x.x.x&gt;</code>	sets new subnet mask
<code>gw &lt;x.x.x.x&gt;</code>	sets new default gateway
<code>exit</code>	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.

```

C:\WINDOWS\system32\cmd.exe - telnet 134.40.27.95
>/
LAN Status Page
-----
MAC Address      : 0030D30A0838
-----
Init Mode       : Using Stored
-----
TCP/IP Properties
- active -
IP Address      : 134.40.27.95
Subnet Mask     : 255.255.248.0
Def. Gateway    : 134.40.24.1
-----
TCP/IP Status   : Ready
-----
Controllers    : no connections
>_

```

Figure 43 Telnet - Current settings in "Using Stored" mode

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

- 6 Change the IP address (in this example 134.40.27.99) and type "/" to list current settings.

```

C:\WINDOWS\system32\cmd.exe - telnet 134.40.27.95
>ip 134.40.27.99
>/
LAN Status Page
-----
MAC Address      : 0030D30A0838
-----
Init Mode       : Using Stored
-----
TCP/IP Properties
- active -
IP Address      : 134.40.27.95
Subnet Mask     : 255.255.248.0
Def. Gateway    : 134.40.24.1
- stored -
IP Address      : 134.40.27.99
Subnet Mask     : 255.255.248.0
Def. Gateway    : 134.40.24.1
-----
TCP/IP Status   : Ready
-----
Controllers    : no connections
>_

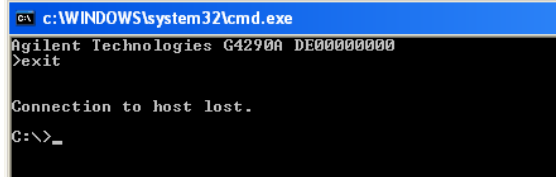
```

Figure 44 Telnet - Change IP 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

- 7 When you have finished typing the configuration parameters, type `exit` and press **Enter** to exit with storing parameters.



```
CA c:\WINDOWS\system32\cmd.exe
Agilent Technologies G4290A DE00000000
>exit

Connection to host lost.
C:\>_
```

Figure 45 Closing the Telnet Session

#### NOTE

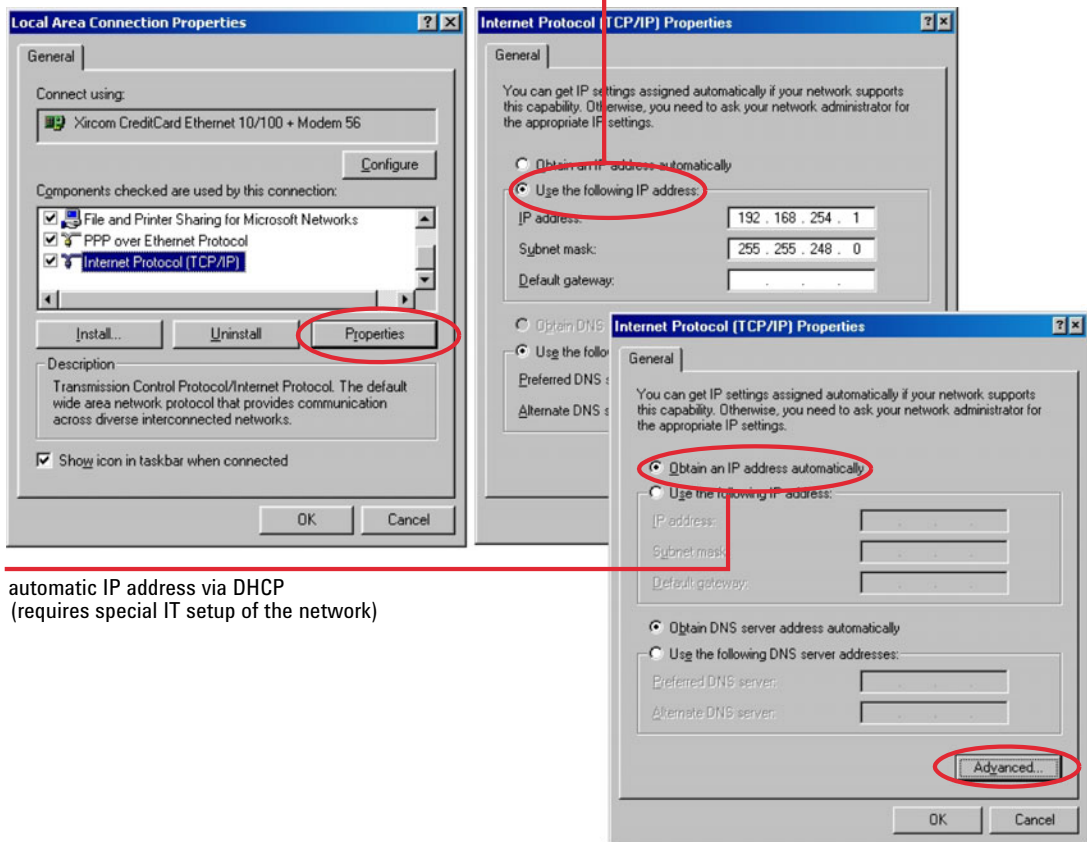
If the Initialization Mode Switch is changed now to “Using Stored” mode, the instrument will take the stored settings when the module is re-booted. In the example above it would be 134.40.27.99.

## PC and User Interface Software Setup

### 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 289).

FIXED IP address



automatic IP address via DHCP  
(requires special IT setup of the network)

Figure 46 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

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This chapter provides additional 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 307.

## 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 30 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: <a href="http://regulations.corporate.agilent.com/DoC/search.htm">http://regulations.corporate.agilent.com/DoC/search.htm</a>
	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 30 Symbols

	<p>Magnetic field</p> <p>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.</p>
	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 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 <https://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

Sound pressure

Sound pressure  $L_p < 70 \text{ db(A)}$  according to DIN EN ISO 7779

Schalldruckpegel

Schalldruckpegel  $L_p < 70 \text{ db(A)}$  nach DIN EN ISO 7779

## Agilent Technologies on Internet

For the latest information on products and services visit our worldwide web site on the Internet at:

<https://www.agilent.com>



## In This Book

This manual contains technical reference information about the Agilent 1290 Infinity II Flexible Pump (G7104A) and Agilent 1290 Infinity II Bio Flexible Pump (G7131A).

The manual describes the following:

- Introduction,
- Site requirements and specifications,
- using and optimizing,
- troubleshooting and diagnostic,
- error information,
- test functions,
- maintenance and repair,
- parts identification,
- hardware information,
- safety and related information.

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