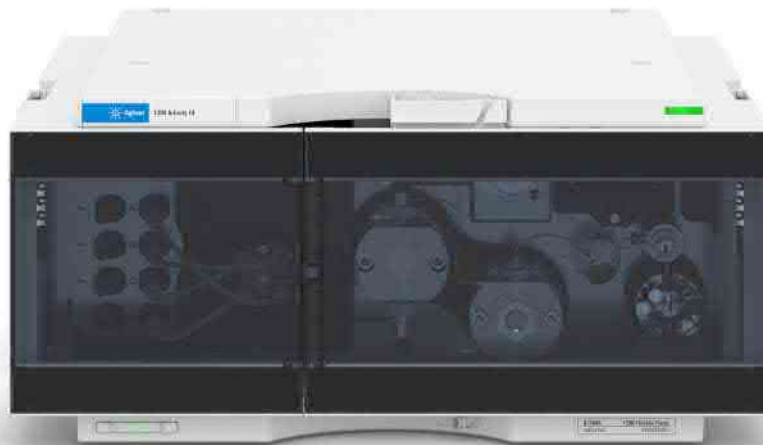




Agilent InfinityLab LC Series

1290 Infinity III Flexible Pumps

User Manual



Notices

Document Information

The information in this document also applies to 1260 Infinity II and 1290 Infinity II modules.

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Safety Notices

CAUTION

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

WARNING

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

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In This Book

This manual covers the following modules:

- Agilent 1290 Infinity III Flexible Pump (G7104A)
- Agilent 1290 Infinity III Bio Flexible Pump (G7131A)



1 Introduction

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

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Product Description of the 1290 Infinity III Flexible Pump (G7104A)

The Agilent 1290 Infinity III 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 III 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.

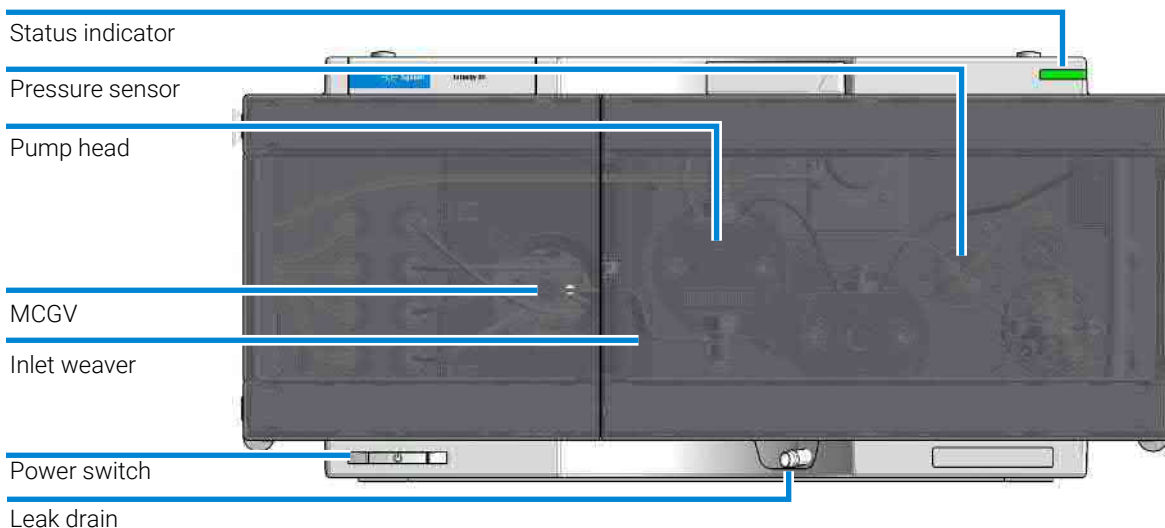


Figure 1: Overview of the Flexible Pump

Features of the 1290 Infinity III Flexible Pump (G7104A)

- 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 μ L, 100 μ L, 380 μ 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.
- InfinityLab Level Sensing adds weight controlled level sensing and solvent prediction of the equipped HPLC solvents to avoid downtime by running out solvent.

Product Description of the 1290 Infinity III Bio Flexible Pump (G7131A)

The 1290 Infinity III 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 III 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.

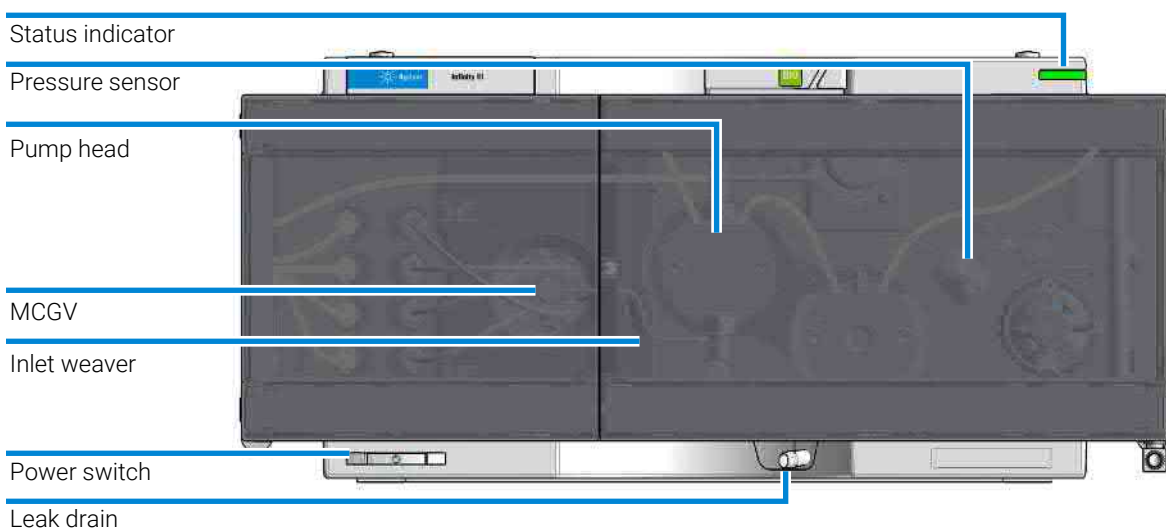


Figure 2: Overview of the Bio Flexible Pump

Features of the 1290 Infinity III Bio Flexible Pump (G7131A)

- 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
- InfinityLab Level Sensing adds weight controlled level sensing and solvent prediction of the equipped HPLC solvents to avoid downtime by running out solvent.

Operating Principle

Overview of the Hydraulic Path

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.

Hydraulic Path

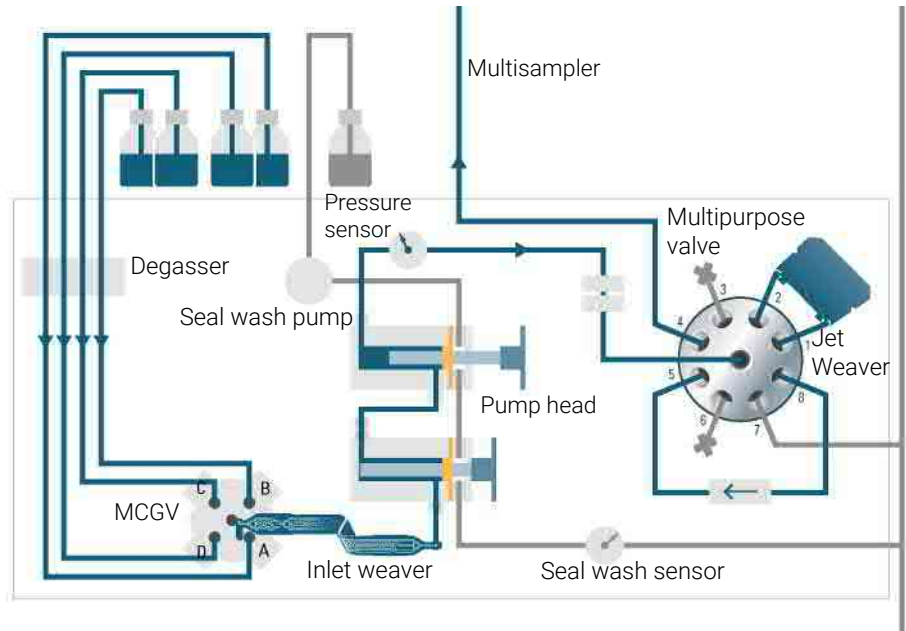


Figure 3: The hydraulic path (example of G7104A Flexible Pump installed with a G7167B Multisampler)

Introduction

Positions of the Multipurpose Valve

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.).

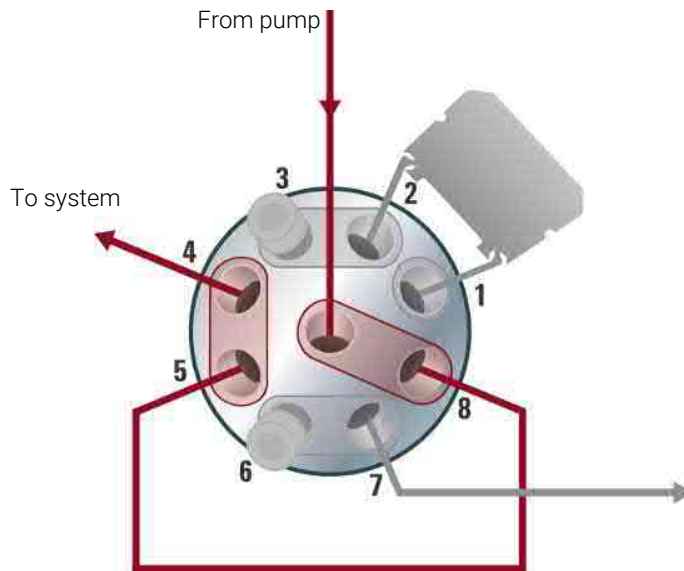


Figure 4: Valve position in normal operating mode without mixer

Introduction

Positions of the Multipurpose Valve

Purge Mode

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

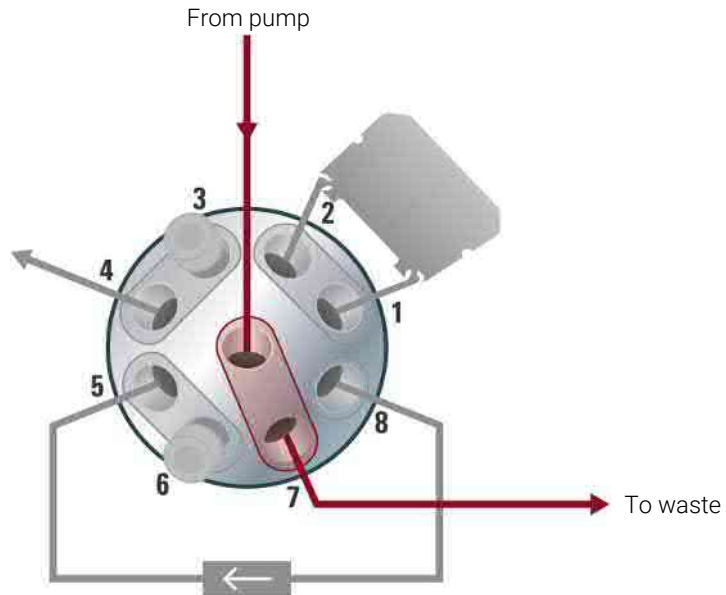


Figure 5: Valve position in purge mode

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.

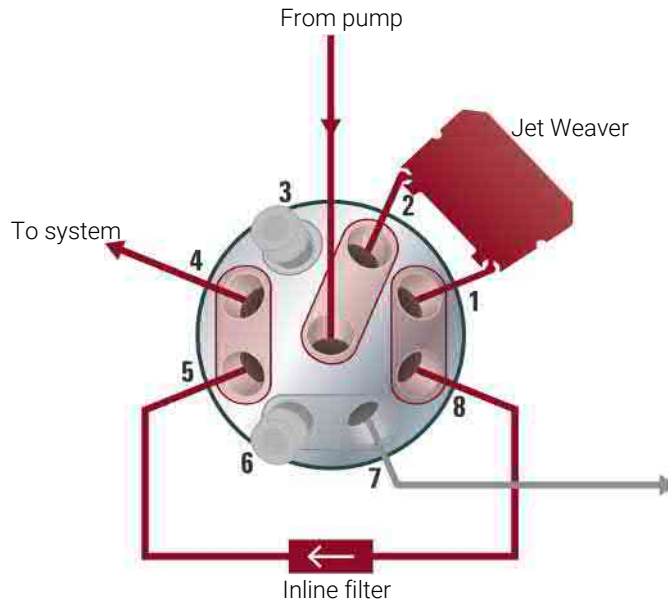


Figure 6: Valve position in normal operating mode with Jet Weaver

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.

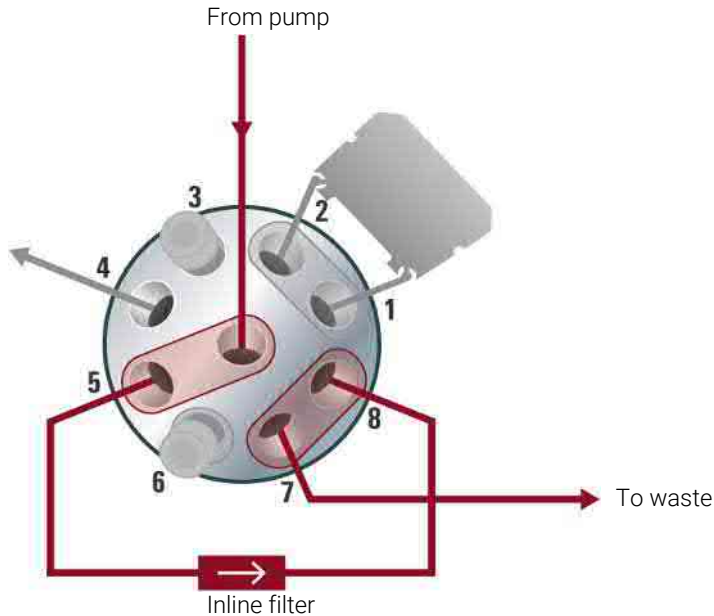


Figure 7: Valve position in filter flush mode

CAUTION

Damage to the valve

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



2

Site Requirements and Specifications

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

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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 section *Physical Specifications*. 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**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.

WARNING**Incorrect line voltage at the module**

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

- Connect your module to the specified line voltage.

WARNING

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

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

- Make sure that it is always possible to access the power plug.
 - Remove the power cable from the instrument before opening the cover.
 - Do not connect the power cable to the Instrument while the covers are removed.
-

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 Physical Specifications) allow you to place the module on almost any desk or laboratory bench. It needs an additional 2.5 cm (1.0 inches) of space on either side and approximately 8 cm (3.1 inches) in the rear for air circulation and electric connections.

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

The module should be operated in a horizontal position.

NOTE

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

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.
-

Specifications of the 1290 Infinity III Flexible Pump (G7104A)

Table 1: Physical specifications of the 1290 Infinity III Flexible Pump (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

Table 2: Performance specifications of the 1290 Infinity III Flexible Pump (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.	
Designed for use with Agilent InfinityLab Assist	Intuitive User Interface, Automated Workflows, Predictive Maintenance & Assisted Troubleshooting	
Pump resolution step size	300 pL	
Flow range	Settable: 0.001 – 5 mL/min	In 0.001 mL/min increments

Site Requirements and Specifications

Specifications of the 1290 Infinity III Flexible Pump (G7104A)

Type	Specification	Comments
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 ₂ 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	
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	

Site Requirements and Specifications

Specifications of the 1290 Infinity III Flexible Pump (G7104A)

Type	Specification	Comments
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	
Instrument control	LC & CE Drivers A.02.11 or above Instrument Control Framework (ICF) A.02.03 or above Lab Advisor software B.02.06 or above InfinityLab Assist (G7180A) with firmware D.07.40 or above Instant Pilot (G4208A) with firmware B.02.17 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.	

Site Requirements and Specifications

Specifications of the 1290 Infinity III Flexible Pump (G7104A)

Type	Specification	Comments
GLP features	Early maintenance feedback (EMF) for continuous tracking of instrument usage in terms of seal wear and volume of pumped mobile phase with pre-defined and user settable limits and feedback messages. Electronic records of maintenance and errors.	
Housing	All materials are recyclable.	
		Performance specifications determined with standard configuration (4CGV).

Specifications of the 1290 Infinity III Bio Flexible Pump (G7131A)

Table 3: Physical specifications of the 1290 Infinity III Flexible Pump (G7131A)

Type	Specification	Comments
Weight	16.8 kg (37.0 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

Table 4: Performance specifications of the 1290 Infinity III Flexible Pump (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.	
Designed for use with Agilent InfinityLab Assist	Intuitive User Interface, Automated Workflows, Predictive Maintenance & Assisted Troubleshooting	
Pump resolution step size	300 pL	
Flow range	Settable: 0.001 – 5 mL/min	In 0.001 mL/min increments

Site Requirements and Specifications

Specifications of the 1290 Infinity III Bio Flexible Pump (G7131A)

Type	Specification	Comments
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 ₂ 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	
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	

Site Requirements and Specifications

Specifications of the 1290 Infinity III Bio Flexible Pump (G7131A)

Type	Specification	Comments
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 Lab Advisor software B.02.17 or above InfinityLab Assist (G7180A) with firmware D.07.40 or above Instant Pilot (G4208A) with firmware B.02.24 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.	

Site Requirements and Specifications

Specifications of the 1290 Infinity III Bio Flexible Pump (G7131A)

Type	Specification	Comments
GLP features	Early maintenance feedback (EMF) for continuous tracking of instrument usage in terms of seal wear and volume of pumped mobile phase with pre-defined and user settable limits and feedback messages. Electronic records of maintenance and errors.	
Housing	All materials are recyclable.	Performance specifications determined with standard configuration (4CGV).



3 Installation

The installation of the module will be done by an Agilent service representative. In this chapter, only installation of user-installable options and accessories are described.

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Installing Capillaries

This section provides information on how to install capillaries and fittings.

Install Capillaries

Capillaries and connections depend on which system is installed.

NOTE

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

NOTE

Agilent capillaries are color-coded for quick identification, see [At-a-Glance Details About Agilent Capillaries](#) on page 388.

Table 5: Capillary connections for 1290 Infinity III systems

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

Table 6: Capillary connections for 1290 Infinity III Bio LC

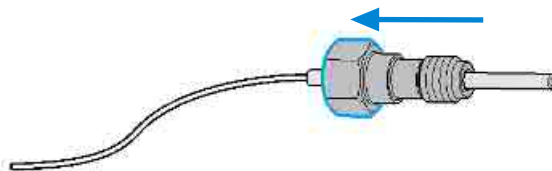
p/n	From	To
G7120-60007 (Bottle Head Assembly)	Solvent Bottle	Infinity III Pump
5500-1419 (Capillary MP35N 0.17 mm x 500 mm, SI/SI)	Pump	Multisampler
5500-1279 (Capillary MP35N 0.12 mm x 500 mm SI/SI)	Multisampler	MCT
5500-1578 (Quick Connect Capillary MP35N 0.12 mm x 105 mm)	MCT Heat Exchanger	Column
5500-1596 (Quick Turn Capillary MP35N 0.12 mm x 280 mm)	Column/MCT Valve	Detector (DAD)
5500-1598 (Quick Turn Capillary MP35N 0.12 mm x 500 mm)	Column/MCT Valve	Detector (VWD)
5062-8535 (Waste accessory kit (Flow Cell to waste))	VWD	Waste
5062-2462 (Tube PTFE 0.7 mm x 5 m, 1.6 mm od)	DAD/FLD	Waste
G5664-68712 (Analytical tubing kit 0.25 mm i.d. PTFE-ESD)	Detector	Fraction Collector

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

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



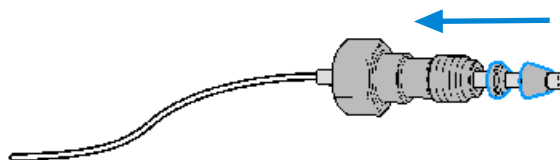
- 2 Slide the nut over the end of the tubing or capillary.



Installation

Installing Capillaries

- 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.

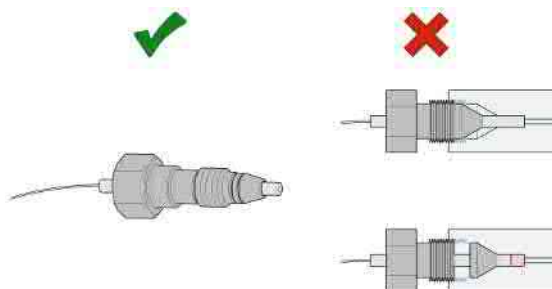


- Use a stable port installed to the module to gently tighten the fitting facing to the module. Or use the column to tighten the fitting facing to the column. This measure forces the ferrule to seat onto the tubing or capillary.

NOTE

Do not overtighten. Over-tightening will shorten the lifetime of the fitting.

- 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.

For Bio and Bio-Inert Systems, the Swagelok instructions do not apply.

Install the Bio-Inert Zero Dead Volume (ZDV) Union

The 5067-4741 (ZDV union (Bio-inert)) has two different connectors where capillaries need to be installed in the correct sequence. Otherwise, an inset of the union may be damaged and the connection may not be tight.

CAUTION

Potential leak or damage of the Bio-inert ZDV Union.

— To avoid leaks or a damage to the Bio-inert ZDV union, follow the procedure below in the prescribed sequence.

- 1 Install the capillary at the end marked with a ring/indentation.



- 2 Install the second capillary at the other end.



Install Stainless Steel Clad PEEK Capillaries

NOTE

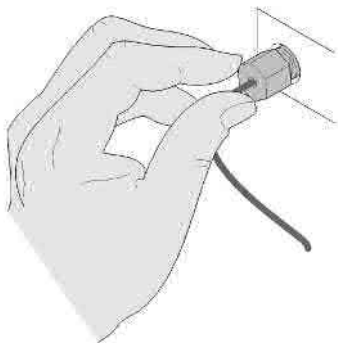
This installation procedure applies for capillaries and corresponding fittings used in modules delivered before January 2013.

The 1260 Infinity Bio-inert LC system uses PEEK capillaries that are clad with stainless steel. These capillaries combine the high-pressure stability of steel with the inertness of PEEK. They are used in the high-pressure flow path after sample introduction (loop/needle seat capillary) through the thermostatted column compartment/heat exchangers to the column. Such capillaries need to be installed carefully in order to keep them tight without damaging them by over-tightening.

The installation consists of two steps. In the first step, the fitting is installed finger-tight without using tools. Finger-tight means that the fitting will grip and hold the capillary. This brings the fitting to the appropriate start position (marked as 0 ° below) for the second step.

First Step: Finger-tight Fitting

- 1 Tighten the fitting using your fingers.

**Second Step: Installation to Connector**

In the second step ([Second Step: Installation to Hard Connectors](#) on page 38 or [Second Step: Installation to Soft Connectors](#) on page 39), a wrench is used to rotate the fitting relative to the finger-tight position by a defined angle. For each of the cases mentioned above, there is a recommended range in which the fitting is tight.

Staying below this range could create a leak, either a visible one or a micro-leak, potentially biasing measurement results. Exceeding the recommended range could damage the capillary.

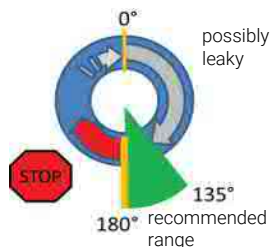
Alternatively, a torque wrench may be used. The target torque for all connections is about 0.7 Nm. When using a torque wrench, read instructions for that tool carefully, as wrong handling may easily miss the correct torque.

Second Step: Installation to Hard Connectors

Use this procedure for hard connectors made from metal (titanium) or ceramics. In the system, these are connections to and from the analytical head of the autosampler (connections to injection valve and needle), and to a metal column.

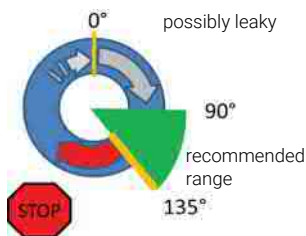
First installation of a capillary to a hard connector

- 1 When tightening a fitting for the first time, start from the finger-tight position (which is not necessarily a vertical wrench position) and rotate the wrench by $135 - 180^\circ$. Staying below 135° (grey arrow) will be insufficiently tight, more than 180° (red arrow) could damage the capillary.



Second and subsequent installations of a capillary to a hard connector

- 1 When tightening the fitting for the second and subsequent times, again start from the finger-tight position (which is not necessarily a vertical wrench position) and rotate the wrench by $90 - 135^\circ$. Staying below 90° (grey arrow) could be insufficiently tight, more than 135° (red arrow) could damage the capillary.



Second Step: Installation to Soft Connectors

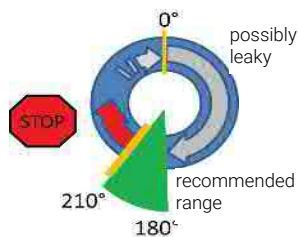
Use this procedure for soft connectors, which are typically made from PEEK. These are the following connections:

- to and from all bio-inert valves (injection valve in the autosampler and valves in the thermostatted column compartment and 1290 Infinity Valve Drive),
- bio-inert ZDV unions (detector flow cells, multidraw upgrade kit, capillary to capillary connections, for example, for heat exchangers),
- to the autosampler needle and
- to PEEK columns (like many bio-inert columns).

For the installation of bio-inert ZDV unions, see *Installation of stainless steel clad PEEK capillaries Technical Note (G5611-90120)*.

First installation of a capillary to a soft connector

- 1 When tightening a fitting for the first time, start from the finger-tight position (which does not necessarily need to be a vertical wrench position) and rotate the wrench by 180 – 210°. Staying below 180° (grey arrow) will not be sufficiently tight, more than 210° (red arrow) could damage the capillary.

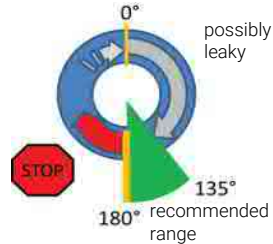


Second and subsequent installations of a capillary to a soft connector

Installation

Installing Capillaries

- 1 When tightening the fitting for the second and subsequent times, again start from the finger-tight position (which is not necessarily a vertical wrench position) and rotate the wrench by 135 – 180°. Staying below 135° (grey arrow) could be insufficiently tight enough, more than 180° (red arrow) could damage the capillary.



Summary Second Step: Installation to Connector

Table 7: Summary for second step

2 nd Step	First installation	Subsequent installations
Hard connectors		
Soft connectors		

Removing Capillaries

CAUTION

Potential damage of capillaries

- Do not remove fittings from used capillaries.

To keep the flow path free of stainless steel, the front end of the capillary is made of PEEK. Under high pressure, or when in contact with some solvents, PEEK can expand to the shape of the connector where the capillary is installed. If the capillary is removed, this may become visible as a small step. In such cases, do not try to pull the fitting from the capillary, as this can destroy the front part of the capillary. Instead, carefully pull it to the rear. During installation of the capillary, the fitting will end up in the correct position.

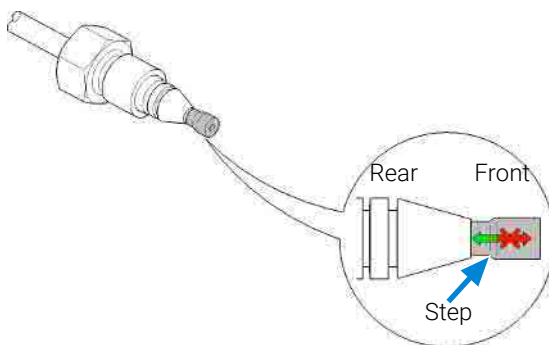


Figure 8: Capillary fitting

Handling Leak and Waste

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 III 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/III 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 Thermostat (condensate)
- from the pump's Seal Wash Sensor (if applicable)
- from the pump's Purge Valve or Multipurpose Valve

Installation

Handling Leak and Waste

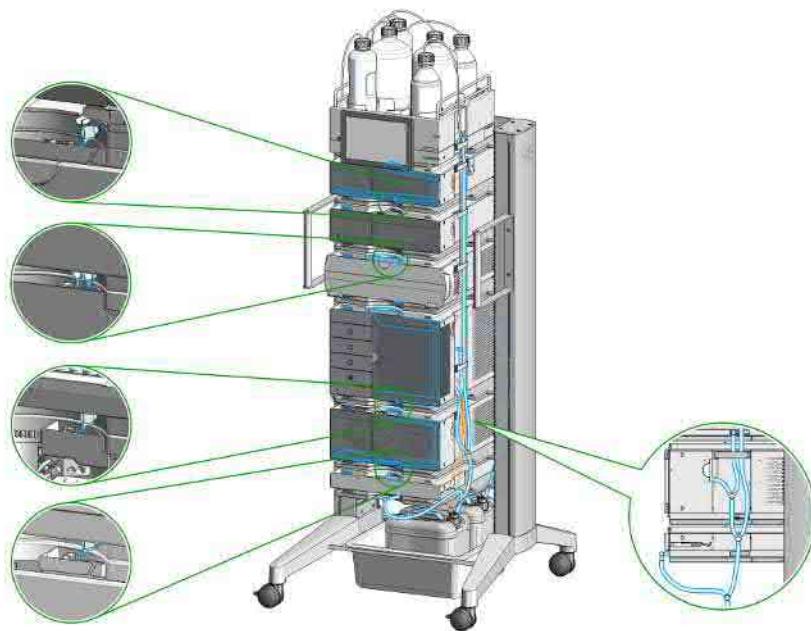


Figure 9: Infinity III Leak Waste Concept (Flex Bench installation)

Installation

Handling Leak and Waste

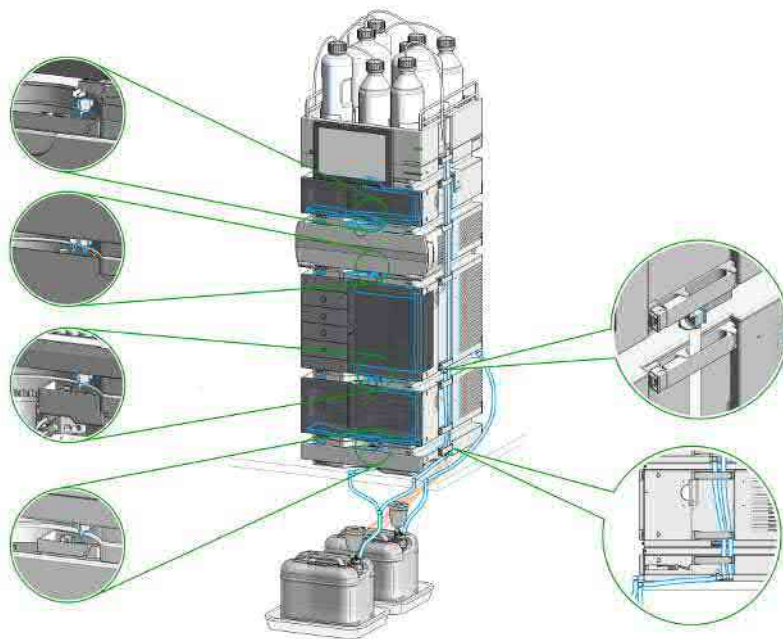


Figure 10: Infinity III Single Stack Leak Waste Concept (bench installation)

Installation

Handling Leak and Waste

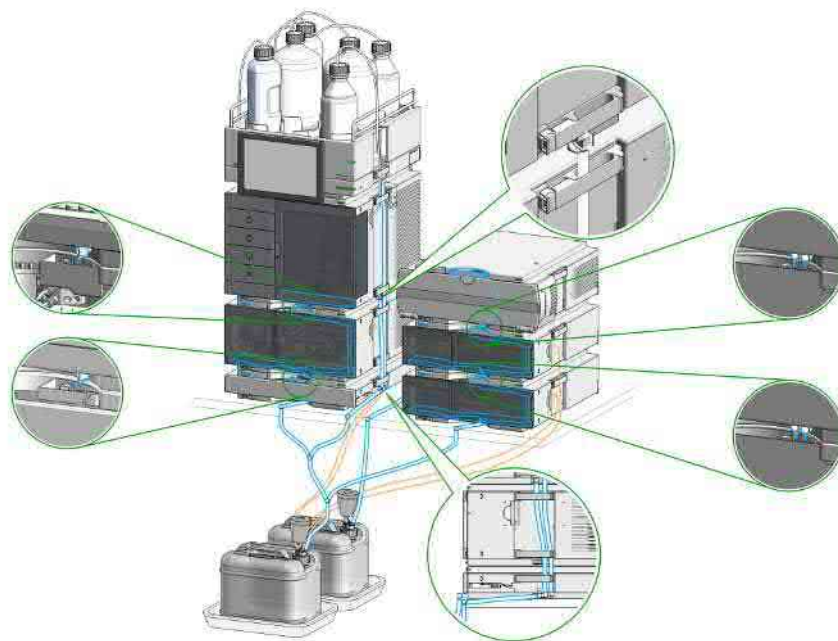


Figure 11: Infinity III Two Stack Leak Waste Concept (bench installation)

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

Drain Connectors Installation

Drain Connectors have been developed to improve leak drainage for low flow leaks of high viscosity solvents (for example, isopropanol) in Agilent InfinityLab LC Series Systems. Install these parts to modules where they are missing (usually preinstalled).

- Make sure that dripping adapters are correctly installed on each module in the LC stack, excluding lowest module.
- Remove the dripping adapter if it is appeared to be installed on the lowest module in the LC stack and connect waste tube instead.
- Consider 5004-0000 (Drain Connectors Kit) if drain adaptor is missing on some module(s).

For illustration, see [Handling Leak and Waste](#) on page 43.

Parts required

Qty.	p/n	Description
	 5004-0000	Drain Connectors Kit

Content of Drain Connectors Kit (p/n 5004-0000)

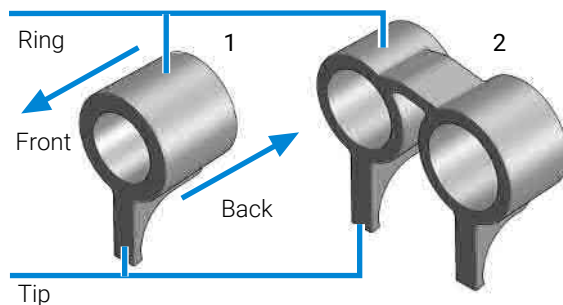


Figure 12: Overview of Drain Connectors: Single (left) and Double (right)



Qty.	p/n	Description
Parts can be ordered only as a complete kit.		
3	 5043-1834	Single Drain Connector ID3.0-Long
1	 5043-1836	Double Drain Connector-Long

Table 8: Compatibility of drain connectors and modules

Drain Connector Type	Compatible Module	Compatible Module Type	
Double	G7116A/B	Column Compartment	
Single	G7114A/B	Detector	
	G7115A		
	G7117A/B/C		
	G7121A/B		
	G7162A/B		
	G7165A		
	G7129A/B/C		Sampler
	G7167A/B/C		
	G5668A		
	G7137A		
	G7157A	Degasser	
	G4767A		
	G7122A		
	G7104A/C		Pump
	G7110B		
	G7111A/B		
	G7112B		
	G7120A		
	G7131A/C		
	G7132A		
G5654A			
G4782A			

Preparations

- Leak drains of LC modules are clean and free of salt or solvent residuals.

NOTE

Do not install drain connectors on the bottom modules of the stack. Drain outlet of the bottom module has to be connected via waste tubing to a suitable waste container (see Leak and Waste Handling in the manual for a respective module).

Installation

Handling Leak and Waste

NOTE

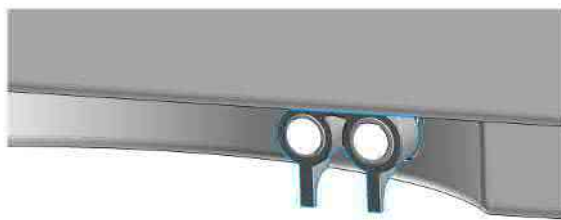
In case of incorrect installation, drain connectors cannot fully perform the intended function.

NOTE

It is not required to power off the HPLC stack to install Single and Double Drain Connectors. The installation of the connectors does not affect the analysis performed during the installation.

Install the Double Drain Connector on the leak drain of the 1260 Infinity III Multicolumn Thermostat (G7116A)/ 1290 Infinity III Multicolumn Thermostat (G7116B)

- 1 Align the rings with the leak drain outlets of the module, press slightly with the fingers, and slide the connector along the leak drain outlets until it is aligned with the front of the leak drain.

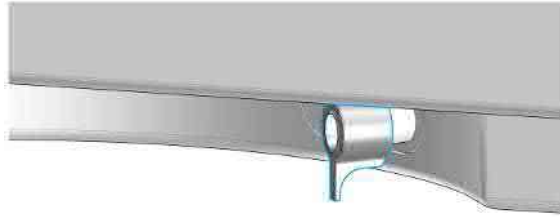


Install Single Drain Connectors on other modules in the LC stack

Installation

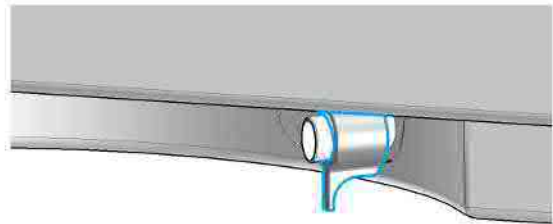
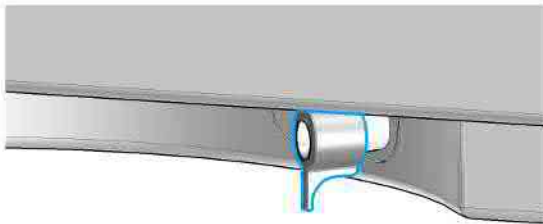
Handling Leak and Waste

- 1 Align the ring with the leak drain outlet of the module, press slightly with the fingers, and slide the connector along the leak drain outlet until it is aligned with the front of the leak drain.



Make sure that the following requirements are covered:

- The tip of the drain connector points straight down.
- The leak drain outlets and the drain connectors are aligned properly.

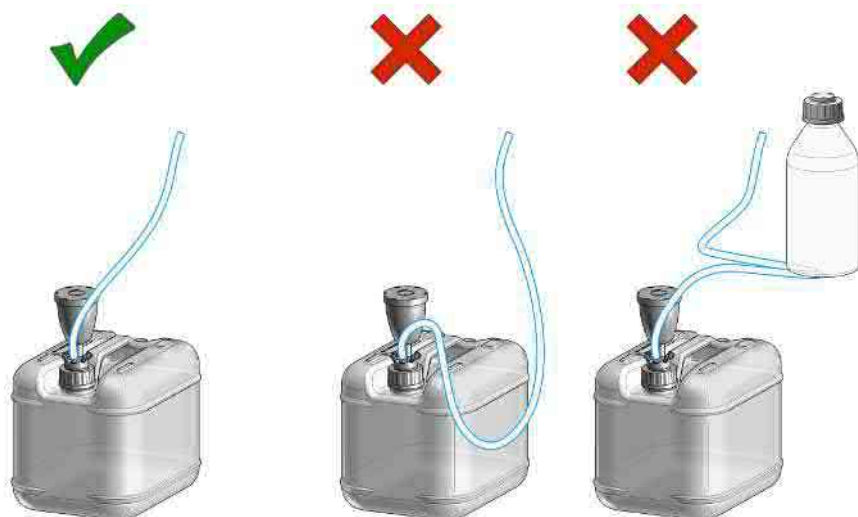


Waste Concept

Agilent recommends using the 5043-1221 (6 L waste can with 1 Stay Safe cap GL45 with 4 ports) 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.



Waste Guidance



NOTE

The waste drainage must go straight into the waste containers. The waste flow must not be restricted at bends or joints.

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.

Connecting Modules and Control Software

WARNING**Use of unsupplied cables**

Using cables not supplied by Agilent Technologies can lead to damage of the electronic components or personal injury.

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

4 Using the Module

This chapter provides information on how to use the module.

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Turn On/Off 55

Status Indicators 57

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Daily / Weekly Tasks 59

Power Up / Shut Down the Pump 59

Solvent Recommendation for Agilent 1290 Infinity, 1290 Infinity II/III, and 1260 Infinity II/III Flexible Pumps 60

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Seal Wash 68

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Select Channels for Multi-Channel Gradient Valve (MCGV) 69

Optional Inline Filter 69

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Prepare a Run 71

Prime and Purge the System 78

Preparing the Module 80

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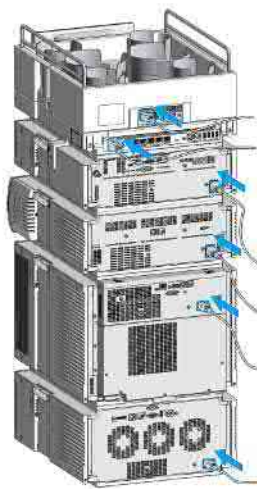
Setting up the Pump with the Instrument Control Interface 84

General Information

Turn On/Off

This procedure exemplarily shows an arbitrary LC stack configuration.

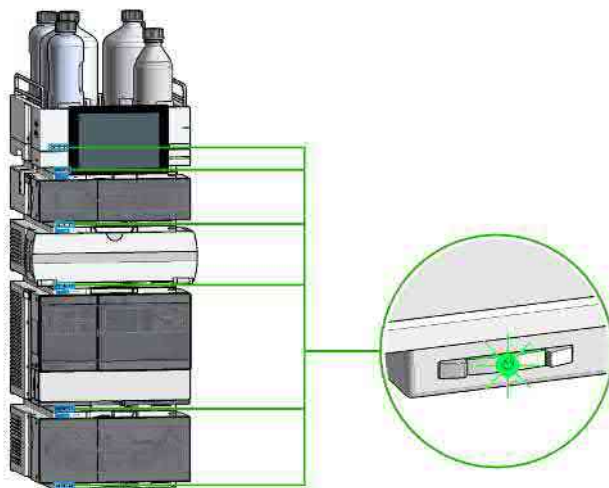
1



Using the Module

General Information

2 On/Off switch: On



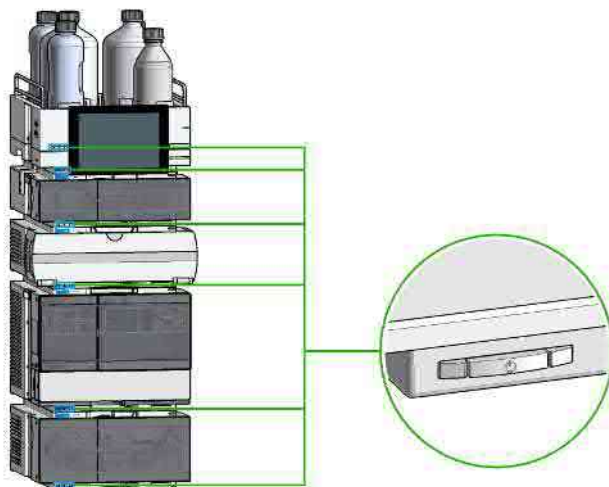
3 Turn instrument On/Off with the control software.



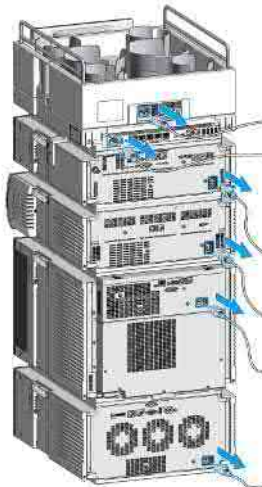
Using the Module

General Information

4 On/Off switch: Off



5



Status Indicators

The module status indicator indicates one of six possible module conditions.

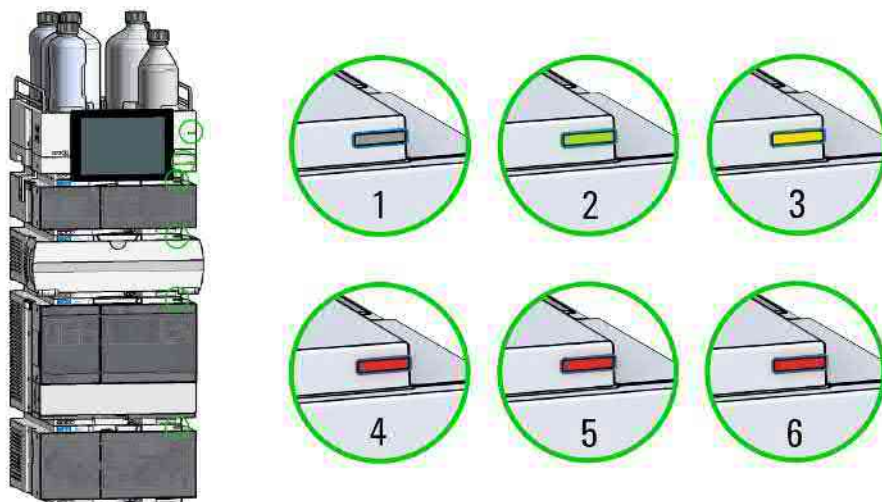


Figure 13: Arbitrary LC stack configuration (example)

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.

InfinityLab Assist Hub Status Indicator

The Assist Hub status indicator displays the status of the entire system. If a module in the system is not ready (yellow), the Assist Hub status indicator also shows not ready (yellow). The same applies for the module conditions Idle, Run mode, and Error mode.

Best Practices

Daily / Weekly Tasks

Daily Tasks

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

Weekly Tasks

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

Power Up / Shut Down the Pump

Prepare the Pump

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

Shut Down the System

- Flush the column with the appropriate solvents and store it according to column manual instructions (be sure that the flushing solvent is compatible with the solvent present in the system to avoid precipitation).
- 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 Out Aqueous Buffers Before Switching To Reversed-Phase Applications** on page 96.
- 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.

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

While the Agilent 1290 Infinity, 1290 Infinity II/III, and 1260 Infinity II/III 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 61.

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)

Using the Module

Best Practices

- 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 *Best Practices for Addressing Problems Associated With Unstable Solvents in an (U)HPLC Environment (BestPractices_UnstableSolvents_TN_EN.pdf, SD-29000193)*, 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/III 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/III pumps.

Seals for Normal Phase Applications

For running normal phase applications on Agilent Infinity III pumps, yellow PE seals are required as piston seals. By default, 1290 Infinity, 1290 Infinity III, and 1260 Infinity III Flexible Pumps use ceramic pistons and yellow PE seals as piston seals. 1260 Infinity I/II/III 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/III pumps, the piston seals have to be changed to yellow PE seals. For optimum performance, PE seals should be replaced during preventive maintenance.

Table 9: Recommended valves for normal phase applications

	Binary or High-Speed Pumps (G7120A)	Quaternary or Flexible Pumps (G7104A/C)
Inlet valves	G4220-60122 (1290 Infinity Inlet Valve Type N)	G4204-60122 (1290 Infinity Quat Inlet Valve Type N)
Outlet valves	G4220-60128 (1290 Infinity Outlet Valve Type N)	G4220-60128 (1290 Infinity Outlet Valve Type N)

CAUTION

Corrosion of valves

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

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

Solvent Handling

Handling of Normal Phase Solvents

Observe the following recommendations when using normal phase solvents:

- Always use fresh, filtered solvents. Exchange solvents every second day.
- Prevent reactions caused by heat, light, and oxygen. Use brown, firmly closed bottles.
- Whenever possible, use stabilizers, e.g. butylated hydroxytoluene (BHT) for ethyl ether.

- Use isopropanol (IPA) to flush out the previous solvent when converting a system from normal phase to reverse phase, or vice versa.
- Store all unused channels in IPA.
- Don't turn off the pump while it is filled with solvents with low boiling points. Generate a small flow throughout the used channels when the pump is not in use.

Handling of Buffers

The following recommendations should be observed when using buffer solutions:

- Buffers and aqueous solutions are possible sources of algae contamination, for avoiding related problems, please read [Algae Growth in HPLC Systems](#) on page 376.
- 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 5067-5407 (Inline filter assembly, material: stainless steel) .

- Never leave buffers in a system without flow. Before shutting down a system, flush it extensively with warm water to avoid clogging of valves, capillaries, or flow cells or reducing the life time of your column. If the system is not used for some time, for example more than a day depending on lab temperature, fill all solvent lines with organic solvent or water with at least 10 % isopropanol.
- Regularly maintain the LC system.

Handling of Acetonitrile

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

As Acetonitrile ages, some residue can get stuck on internal pump surfaces 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 217) 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 *Best Practices for Using an Agilent LC System Technical Note (InfinityLab-BestPractice-en-SD-29000194.pdf, SD-29000194)*, which can be downloaded from our website <https://www.agilent.com>.

Prepare the Pump

The Agilent 1290 Infinity I/II/III 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.

Prepare the Pump using the Driver Interface

The described functions can be triggered from the driver interface:

- 1290 Infinity

NOTE

For parameter settings, see *Best Practices for Using an Agilent LC System Technical Note (InfinityLab-BestPractice-en-SD-29000194.pdf, SD-29000194)*.

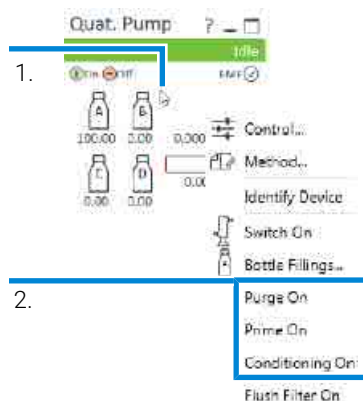


Figure 14: Prepare the pump (1290 Infinity pumps)

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

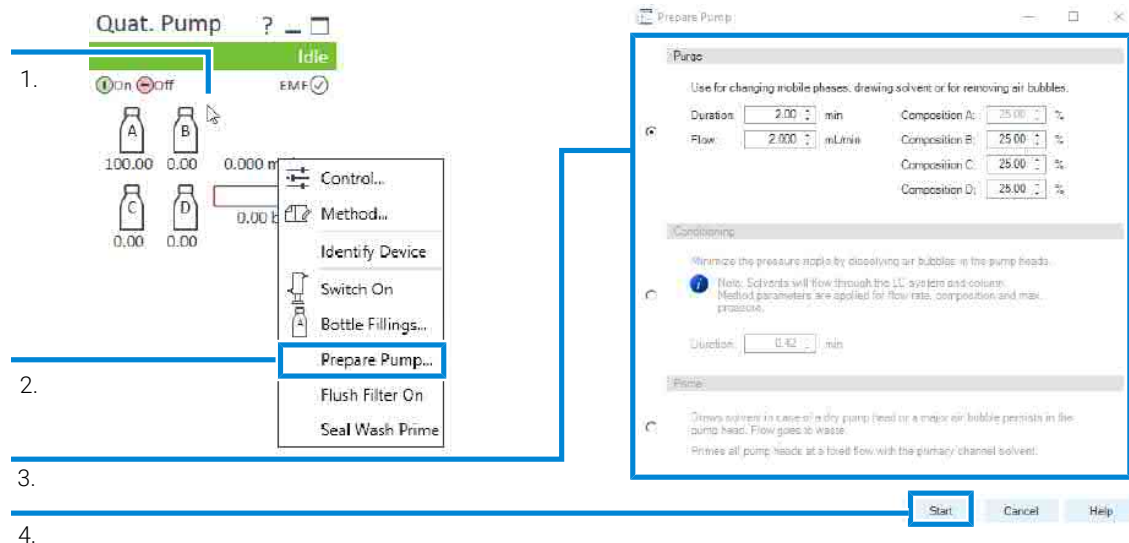


Figure 15: Prepare the pump (1290 Infinity III pumps)

- 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 (5067-5407 (Inline filter assembly, material: stainless steel) or 5720-0003 (Bio Inline Filter for Infinity II Bio Flexible Pumps)) with a nominal filter pore size of 0.3 µL.

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,

Using the Module

Best Practices

- 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 *1290 Infinity II Inline Filters Technical Note (G7167-Inline-Filters-TechPu-en-SD-29000397.pdf, SD-29000397)* for further reference.

Preparation of the System

Prepare a Run

This procedure exemplarily shows how to prepare a run. Parameters as shown in the screenshots may vary, depending on the system installed.

WARNING**Toxic, flammable and hazardous solvents, samples and reagents**

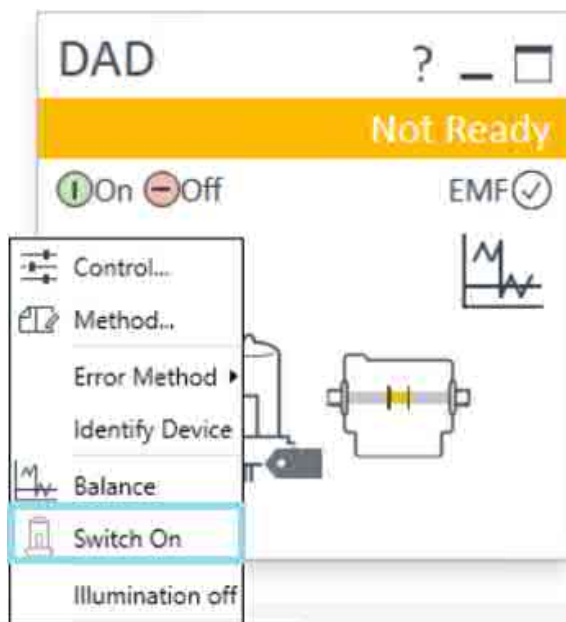
The handling of solvents, samples and reagents can hold health and safety risks.

- 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.

Using the Module

Preparation of the System

- 1 Switch on the detector.

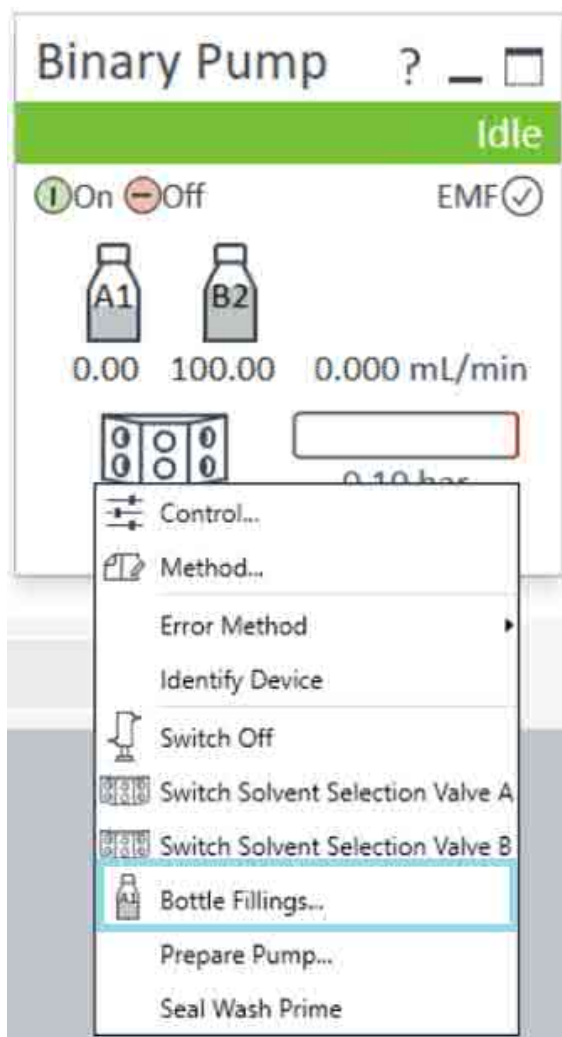


- 2 Fill the solvent bottles with adequate solvents for your application.
- 3 Place solvent tubings with bottle head assemblies into the solvent bottles.
- 4 Place solvent bottles into the solvent cabinet.

Using the Module

Preparation of the System

- 5 Solvent bottle filling dialog (in the software).



Using the Module

Preparation of the System

Bottle Fillings

Solvent Bottle

Filling

	Actual Volume	Unit	Total Volume	Unit
A1	0.22	liter	1.00	liter
A2	0.29	liter	1.00	liter
B1	0.16	liter	1.00	liter
B2	0.49	liter	1.00	liter

Actions

Prevent analysis if level falls below: 0.00 liter

Turn pump off if running out of solvent

Waste Bottle

Filling

	Actual Volume	Unit	Total Volume	Unit
Waste bottle:	0.00	liter	0.00	liter

Actions

Prevent analysis if level raises above: 0.00 liter

Turn pump off if waste volume has reached maximum limit

Ok Cancel Help

6 Purge the pump.

NOTE

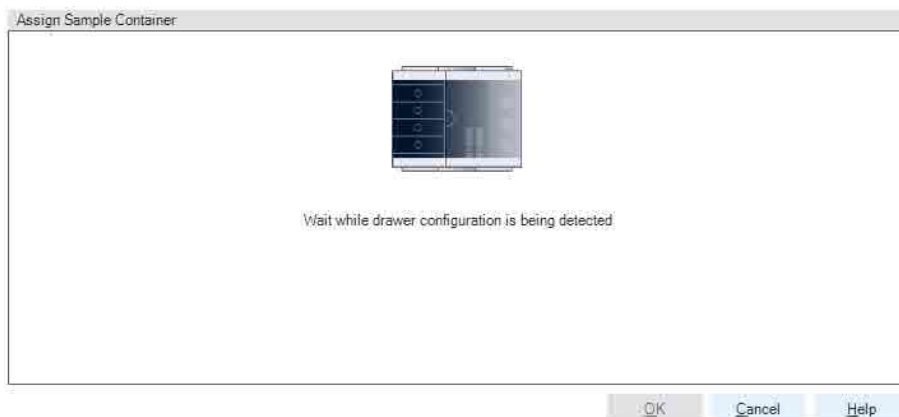
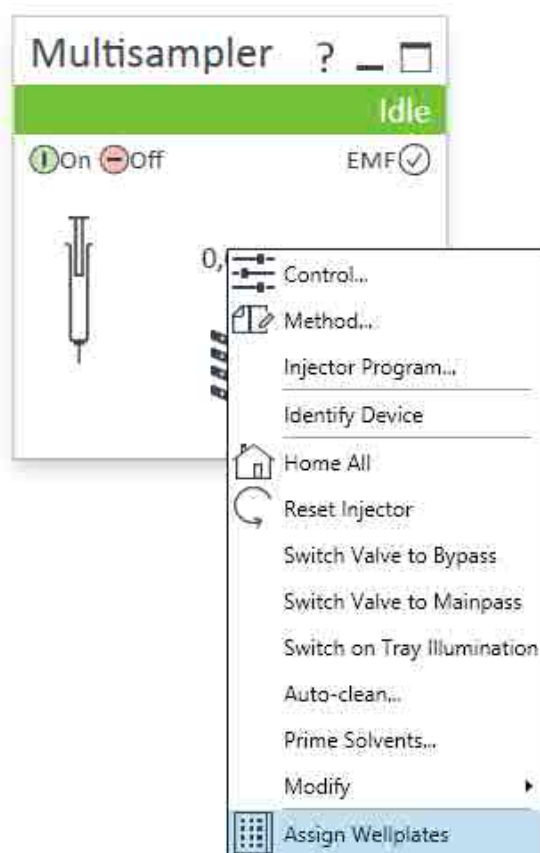
For details on priming and purging, refer to the technical note *Best Practices for Using an Agilent LC System Technical Note (InfinityLab-BestPractice-en-SD-29000194.pdf, SD-29000194)*.

7 Change solvent type if necessary.

Using the Module

Preparation of the System

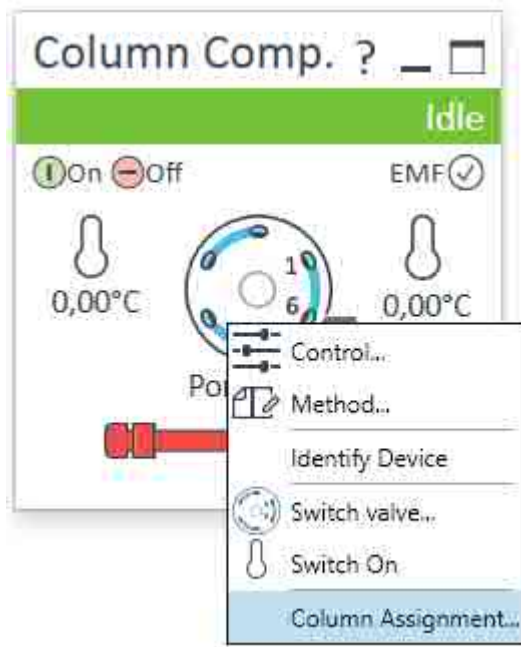
- 8 Choose the tray format of the sampler.



Using the Module

Preparation of the System

- 9 Add a new column.



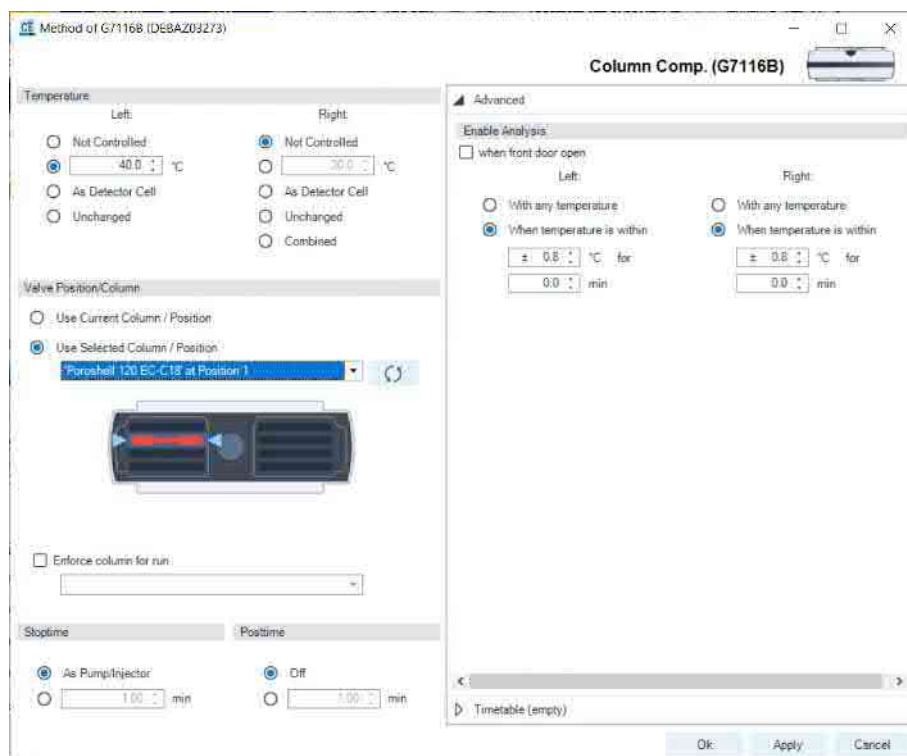
- 10 Enter the column information.



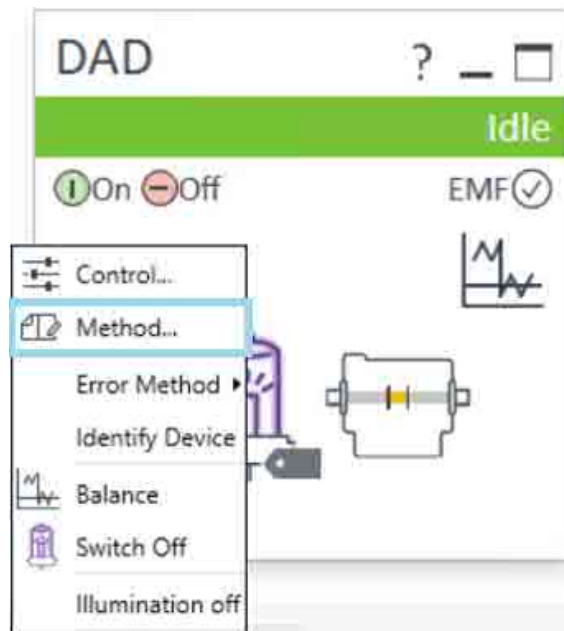
Using the Module

Preparation of the System

11 Select the column in the Method settings of the column compartment.



12 Set the detector parameters according to the needs of your method.



Prime and Purge the System

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

Table 10: 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	Best solvent to flush air out of the system
After an installation	Ethanol or Methanol	Alternative to Isopropanol (second choice) if no Isopropanol is available
To clean the system when using buffers	Bidistilled water	Best solvent to re-dissolve buffer crystals
After a solvent change	Bidistilled water	Best solvent to re-dissolve buffer crystals
After the installation of normal phase seals (P/N 0905-1420)	Hexane + 5% Isopropanol	Good wetting properties

NOTE

The pump should never be used for priming 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 prime with the pump.

- 1 Open the purge valve of your pump (by turning it counterclockwise) and set flow rate to 3 – 5 mL/min.
- 2 Flush all tubes with at least 30 mL of solvent.
- 3 Set flow to required value of your application and close the purge valve.

NOTE

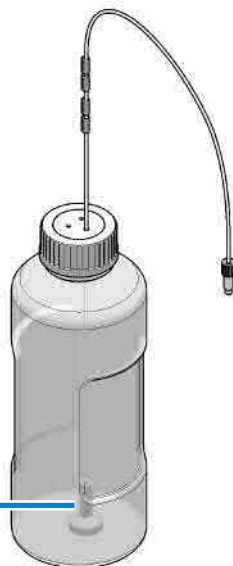
Pump for approximately 10 minutes before starting your application.

Preparing the Module

Flushing the Filter

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

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



Solvent inlet filter

2. An *Outlet Filter* (average pore size 5 μm ; G4204-60004 (Outlet filter Quaternary Pump/Flexible Pump) or G7131-60004 (Outlet Filter Flex Biocompatible)) between pressure sensor and Multipurpose valve filters out particles which may be created in the pump by wear of piston or wash seals.

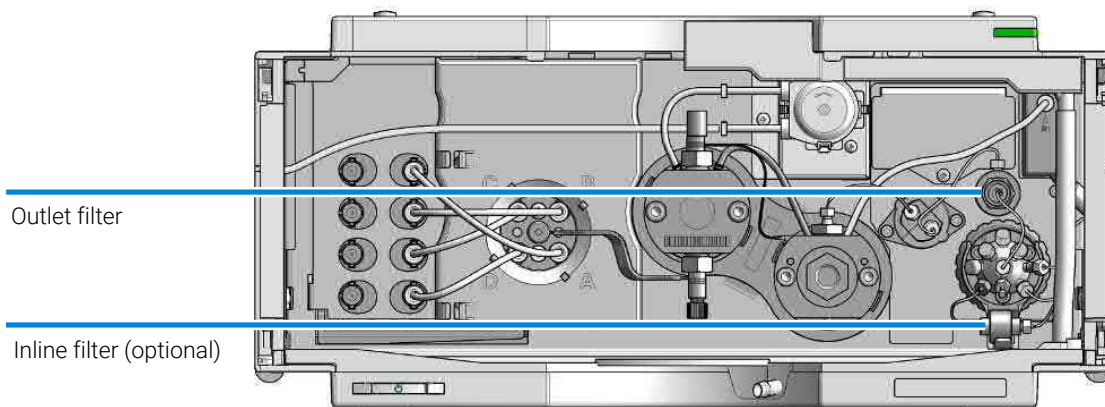
This filter or filter frits can be replaced as required (see [Replace the High Pressure Outlet Filter or Filter Frit](#) on page 284).

3. An optional *Inline Filter* connected to the Multipurpose Valve with a small pore size of about 0.3 μm (5067-5407 (Inline filter assembly, material: stainless steel) or 5720-0003 (Bio Inline Filter for Infinity II Bio Flexible Pumps)).

Using the Module

Preparing the Module

This filter can be flushed using the graphical user interface or replaced as required (see [Replace Parts of the Inline Filter](#) on page 292).



In the instrument control panel of Agilent user interfaces, use the context menu and select **Flush Filter On**, see also [Context Menu](#) on page 87.

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

The pump can be equipped with an additional inline filter (5067-5407 (Inline filter assembly, material: stainless steel) or 5720-0003 (Bio Inline Filter for Infinity II Bio Flexible Pumps)) with a nominal filter pore size of 0.3 μm .

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,

Using the Module

Preparing the Module

- Back flush the filter weekly (**Flush Filter** in context menu figure),
- Exchange the filter frit regularly (5023-0271 (Frit 0.3 μm for inline filter, 5/pk) , 5320-0022 (Frit 0.3 μm for inline filter, biocompatible, 5/pk)).

NOTE

See *1290 Infinity II Inline Filters Technical Note (G7167-Inline-Filters-TechPu-en-SD-29000397.pdf, SD-29000397)* 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.

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.

Table 11: 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	

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.

Using the Module

Preparing the Module

- 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.

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.

Using the Module

Preparing the Module

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**

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 104.

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:

Using the Module

Preparing the Module



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.



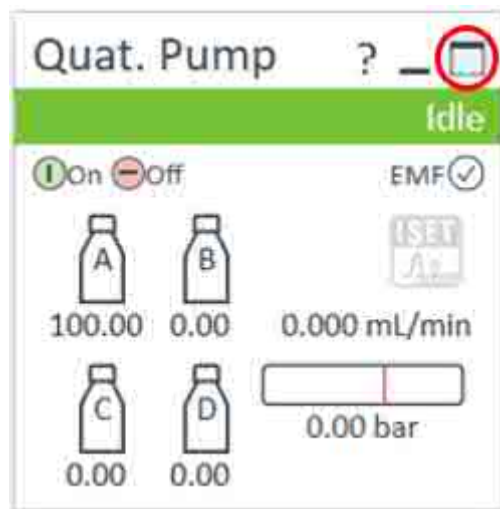
Indicates that the ISET option is installed but with no active method (light gray) or installed and active (dark gray).



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:




Using the Module

Preparing the Module

Flow	The current solvent flow rate (in mL/min).
Pressure	The current pump pressure (in bar, psi or MPa, see Instrument Configuration on page 84).
Tuning	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.
Pressure Limit	The current maximum pressure limit.
Composition A:B	The contributions of channels A and B to the current solvent composition.
Composition C:D	The contributions of channels C and D to the current solvent composition.
Valve position	The current valve position.
Prepare Pump	The status of a prepare pump task (purge, prime, or condition).

Context Menu

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

	Control	Displays the pump's Control dialog box.
	Method	Displays the pump's Method Setup dialog box.
	Set Error Method	Sets the method that is loaded if an error occurs to the method that is currently available in the hardware.
	Identify Device	Causes the LED on the front of the module to blink for a few seconds.
	Switch Pump On/Off	Toggles the status of the pump, on or off.
	Bottle Fillings	Displays the Bottle Fillings dialog box.

Prepare Pump...	Displays the Prepare Pump dialog box.
Flush Filter On/Off	Allows you to flush a clogged inline filter, which is connected to the Multipurpose Valve, see Filter Flush Mode on page 18. Use the pump self-test for checking the filter backpressure. Do not use this option if no filter is installed!

Prepare Pump Dialog

Table 12: Prepare Pump dialog box

Parameter	Limits	Description
Purge	<p>Time: 0 – 100.00 min in steps of 0.01</p> <p>Flow: 0.000 – 5.000 mL/min for each channel, in steps of 0.001</p>	<p>Setup and activation of Purge parameters. The automatic purge valve can be used for purging the system. The process has been automated for ease of use.</p> <ul style="list-style-type: none"> • Off: Turns off the purge. • On: The device is purged. • Purge Flow, Time and Composition during purge have to be defined. <p>As soon as the duration time of the purge ends, the module automatically switches to analytical conditions again.</p>
Prime		<p>Select On to start priming, Off to turn priming off.</p> <p>The Prime function is helpful if air has entered the pump heads. The module draws solvent at high speed with all four pump drives simultaneously, and dispenses it against the waste position of the automatic purge valve. This is done 20 times, before the process comes to an end. It should only be used when purging is not successful in removing stuck air bubbles from the pump head, and under no circumstances to fill the solvent lines when they are completely empty.</p>
Conditioning	<p>at least 200 bar (> 500 bar is better)</p>	<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 13: Pump control parameters

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

Method Parameter Settings

The Quaternary Pump method setup parameters are in nine sections:

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

Table 14: 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 Blend Assist section of the method setup is available.

Parameter	Limits	Description
Solvents		<p>Blend Assist Disabled: When Blend Assist is disabled, you can set the percentages of solvents B, C, and D to any value from 0 through 100 %. Solvent A 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>Blend Assist Enabled: When Blend Assist is enabled, the table shows the solvent blends that have been set up in the Blend Assist section of the method setup.</p> <ul style="list-style-type: none"> • Solvent: The solvent or blend of solvents as set up in the Blend Assist section. • Used: Mark this check box if you want to use this solvent or blend in the method. • %: Enter the percentage of the solvent or blend in this field. • Name: Type a name for the solvent or blend in this field.
Stoptime	0.01 – 99999 min or As Injector/No Limit (an infinite run time).	The stoptime sets a time limit for your analysis. After the stoptime, all gradients are stopped and the pump parameters return to their initial values. The pump can be used as a stoptime master for the complete analytical system. If they have a No Limit 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 Off (0.0 min).	Your instrument remains in a not ready state during the posttime to delay the start of the next analysis. You can use the Posttime to allow your column to equilibrate after changes in solvent composition (for example after gradient elution).
Pressure Limits	<p>Max: 1300 bar (18850 psi) for flow rates up to 2 mL/min. For flow rates between 2 mL/min and 5 mL/min, the maximum pressure ramps down to 800 bar (11600 psi).</p> <p>Min: 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"> • Max is the maximum pressure limit at which the pump will switch itself off, protecting the analytical system against overpressure. • Min 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.
Timetable		See Timetable Settings on page 92
Advanced		See Advanced Settings on page 91
ISET		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-ISET-SysMa-en-SD-29002093.pdf, SD-29002093)</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 15: Advanced method parameters

Parameter	Limits	Description
Minimum Stroke	20 – 100 µL	The Stroke Volume is used for optimizing between performance of the module and seal life time. For performance, a low stroke volume is beneficial, as it divides disturbances into smaller packages, but a larger volume is extending the life time of the pump seals. If Automatic is activated, the pump tries to achieve an optimized stroke volume for the Inline Weaver geometry.
Compressibility		The compressibility of the mobile phase affects the performance of the pump. For best flow accuracy and mixing performance, you can set the parameter according to the mobile phase being used. Use solvent types: <ul style="list-style-type: none"> • 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 Solvents section. Using this check box hides compressibility fields for manual settings. • 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.
Maximum Flow Gradient	1.000 - 1000.000 mL/min/min in steps of 0.001 mL/min/min Default value: 100.000 mL/min/min	You can set a limit on the rate of change of the solvent flow to protect your analytical column. You can set individual values for Flow ramp up and Flow ramp down .

Parameter	Limits	Description
Primary Channel		Using Automatic is recommended. 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 Automatic chooses the channel with the highest percentage at start conditions before a gradient.
Mixer Selection		Click the down-arrow and select the mixer to use from the list: <ul style="list-style-type: none"> • Use any mixer: The currently installed mixer is used, irrespective of its type. • Do not use mixer: The valve is set to bypass the mixer so that it is not in the flow path. • <Mixer Name>: Only the specified mixer may be used; if the mixer is not found, the pump goes into a Not Ready state.

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 [Table 2](#) on page 23 or [Table 4](#) on page 27).
- **Conc. unit:** The concentration can be defined as mM (mmol/L) or as %.



5 Optimizing the Performance of the Module

This chapter provides information on how to optimize the module.

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Recommendations for Degassers 97

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Delay Volume 98

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Recommendations for Biocompatible and Bio-Inert Systems

- 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 5005-0046 (Capillary MP35N 0.12 mm x 2 m) 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 (InfinityLab-BestPractice-en-SD-29000194.pdf, SD-29000194)*)

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**When**

- 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 60.
- 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.

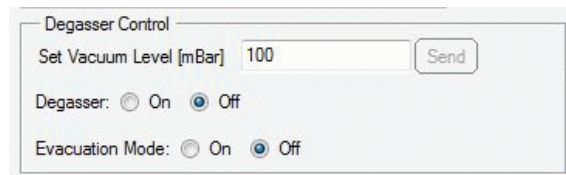


Figure 16: Degasser Control for internal degassers in Agilent Lab Advisor

NOTE

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

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 μL mixer only contributes with 150 μL to the pump delay volume (< 350 μL without Jet Weaver), which is the partial mixer volume that creates a composition change corresponding to the delay volume.

Optimizing the Performance of the Module

How to Configure the Optimum Delay Volume

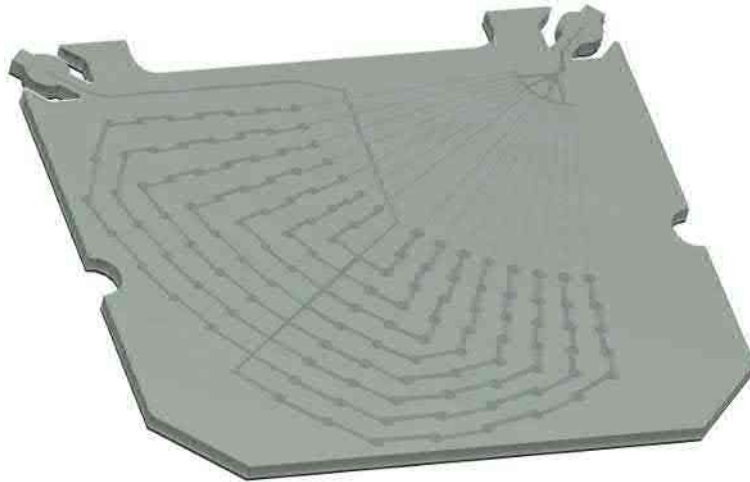


Figure 17: The Jet Weaver mixer

The installation procedure is illustrated in [Install the Jet Weaver](#) on page 206.

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
- Minimal extra-column volume
- Optimize injection solvent and volume
- Fast enough data collection

Resolution between two peaks is described by the resolution equation:

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

where

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

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

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

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

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

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

where:

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

Optimizing the Performance of the 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*).

Any reduction in extra-column volume will reduce dispersion and give better resolution. This is already optimized in the 1290 Infinity LC system with narrow bore (0.12 mm i.d.) capillaries (check that the shortest length is used between column and detector) and the Max-light cartridge flow cell.

Finally, any gains in resolution must be preserved by having data collection which is fast enough to accurately profile the narrow peaks.

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.

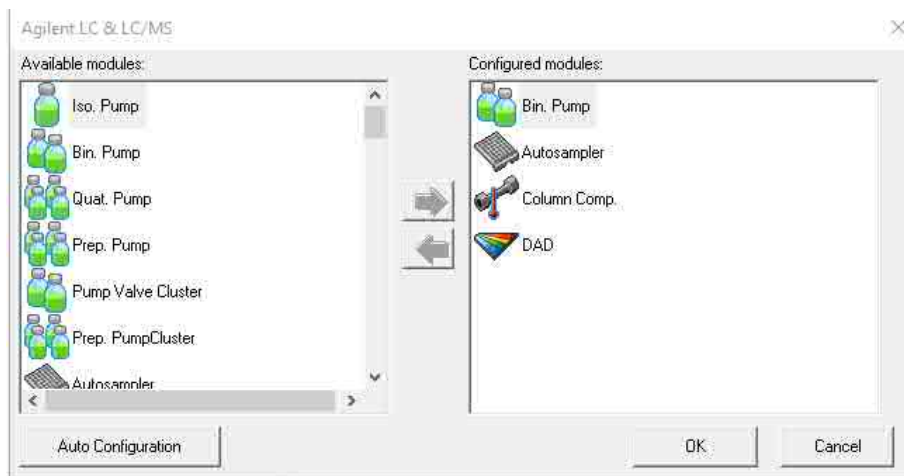
If your solvent is neither available in the user interface nor in the library, please use generic solvents. "Generic aqueous" gives good results for most solvent mixtures with at least 50 % water, which have similar properties as pure water. For other solvents with high organic percentage, "Generic organic"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

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

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



Optimizing the Performance of the 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.

Binary Pump Configuration

Communication

Device name: Binary Pump

Type ID: G7120A

Serial number: DEBAY01809

Firmware revision: B.07.28 [0006]

Connection settings...

Options

Pressure Unit: bar

Installed mixer: Jet Weaver V35 Mixer

Custom mixer:

ISET installed

ISET Configuration ...

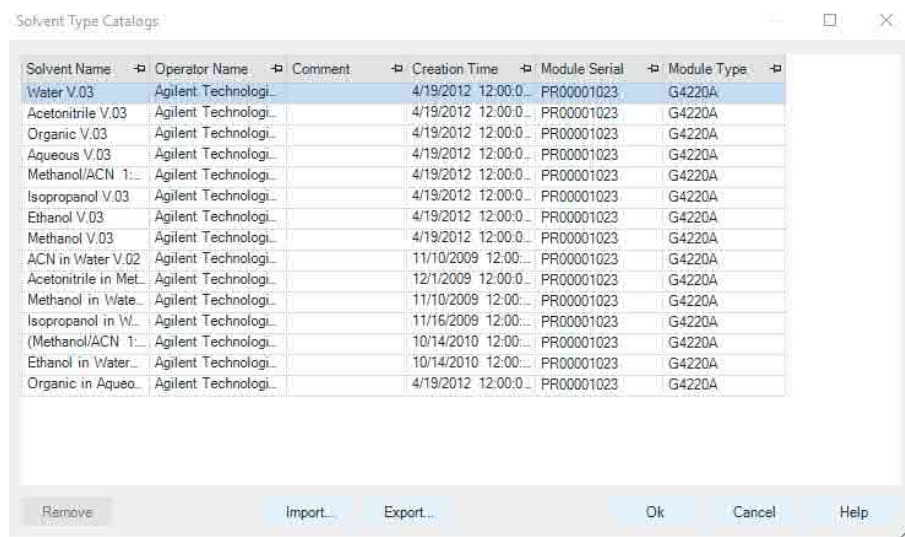
Configure Solvent Type Catalogs...

OK Cancel Help

Optimizing the Performance of the Module

Using Solvent Calibration Tables

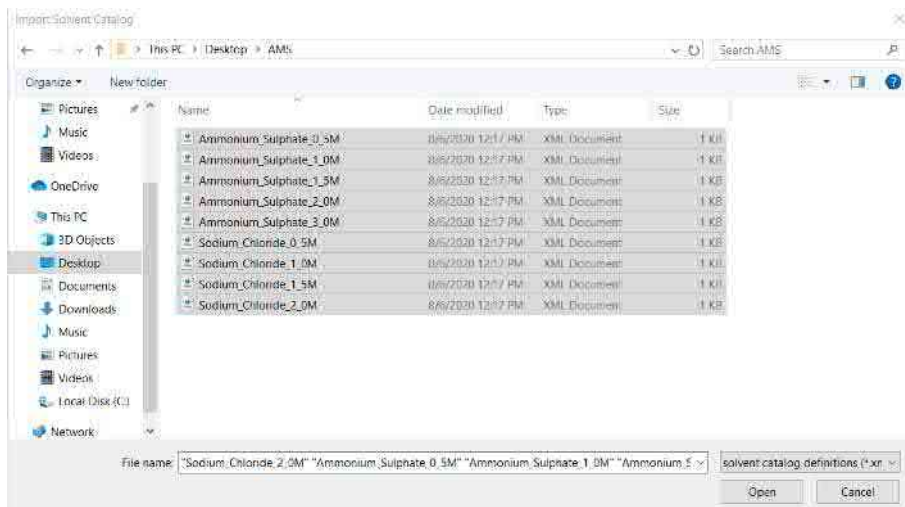
- 3 In the additional configuration of the pump module, choose **Configure Solvent Type Catalogs...**



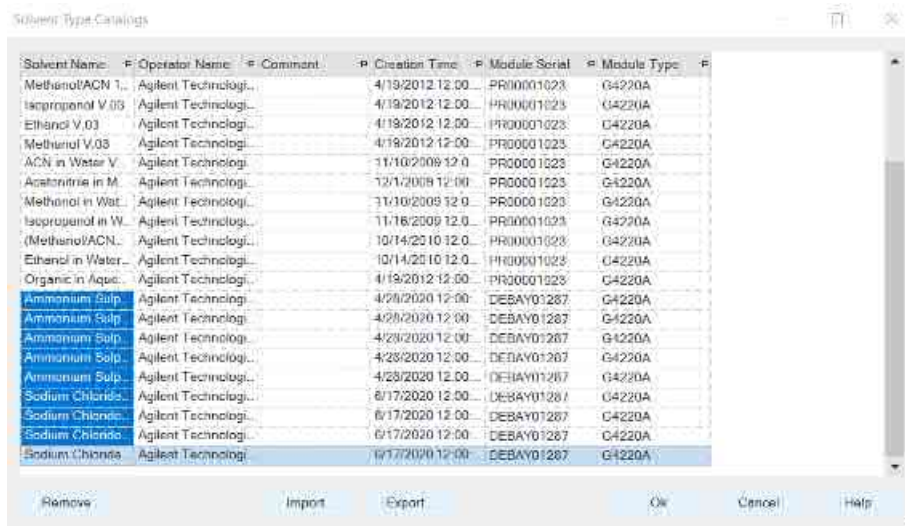
- 4 In the **Solvent Type Catalogs**, press the **Import** button.

Optimizing the Performance of the Module Using Solvent Calibration Tables

- 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.



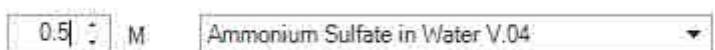
- The imported solvent table will now appear in the Solvent Type Catalogs.



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

Recommendations for Setting up Methods Using Salt-Containing Eluents

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 (0.5 M - 3.0 M or 0.5 M - 2.0 M respectively) as shown in the example below.



With the 1290 Infinity III 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.

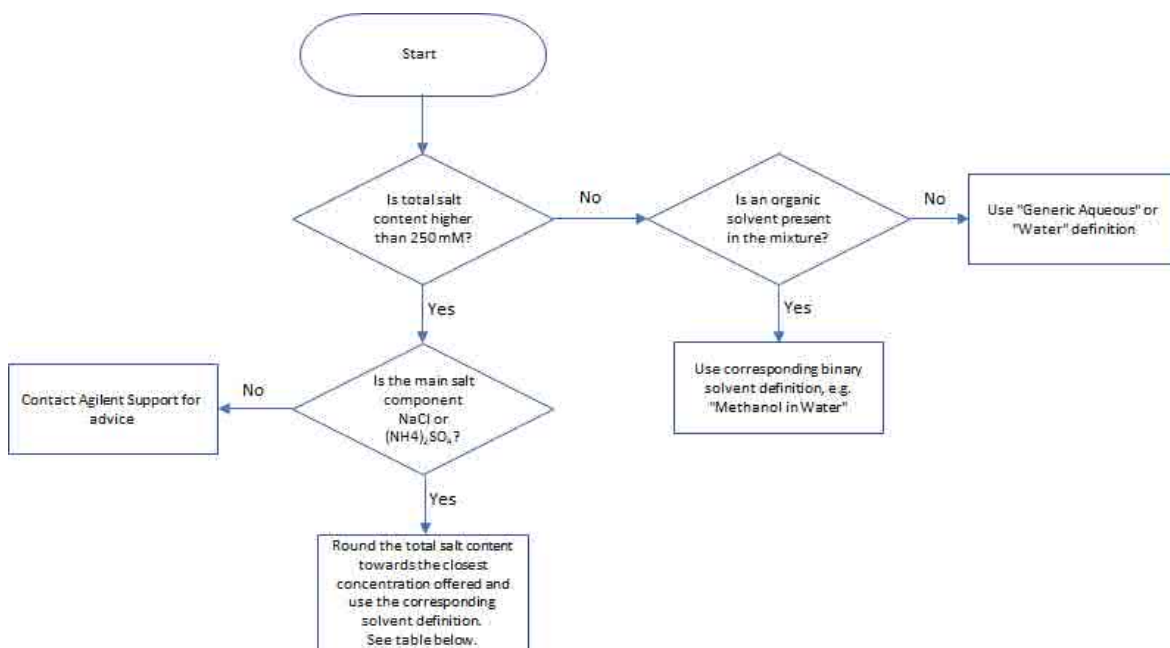
For LC Drivers 3.3 or older, please choose the solvent definition most suitable for the application according to the chart below.

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.

Optimizing the Performance of the Module

Using Solvent Calibration Tables



Main salt component	Total salt content (c, mol/L)	Select solvent definition
NaCl	0.25 < c ≤ 0.75	Sodium Chloride 0.5 M V.03
	0.75 < c ≤ 1.25	Sodium Chloride 1.0 M V.03
	1.25 < c ≤ 1.75	Sodium Chloride 1.5 M V.03
	c > 1.75	Sodium Chloride 2.0 M V.03
(NH ₄) ₂ SO ₄	0.25 < c ≤ 0.75	Ammonium Sulphate 0.5 M V.03
	0.75 < c ≤ 1.25	Ammonium Sulphate 1.0 M V.03
	1.25 < c ≤ 1.75	Ammonium Sulphate 1.5 M V.03
	1.75 < c ≤ 2.5	Ammonium Sulphate 2.0 M V.03
	c > 2.5	Ammonium Sulphate 3.0 M V.03



6 Diagnostics and Troubleshooting

This chapter gives an overview of the maintenance, troubleshooting, and diagnostic features available.

Diagnostic Features 112

User Interfaces 112

Troubleshooting With HPLC Advisor 112

Maintenance and Troubleshooting Tools of the Module 113

Pump Leak Rate Test 113

System Pressure Test 118

Pump Self Test 120

Diagnostic Signals 124

Agilent Lab Advisor Software 127

Diagnostic Features

This section gives an overview of the diagnostic features available.

User Interfaces



InfinityLab Assist

InfinityLab Assist provides you with assisted troubleshooting and maintenance at your instrument.

If the system in use supports the InfinityLab Assist, follow the instructions provided. Else, the preferred solution is to use Agilent Lab Advisor Software.

- 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 127.
- 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.

Troubleshooting With HPLC Advisor

Baseline, Peak Shape, Pressure, Retention related issues, can be solved using the HPLC Advisor App. For more information, see [Troubleshooting Reversed-Phase Chromatographic Techniques With HPLC Advisor](#).

If using an InfinityLab Assist, navigate to **Health > Troubleshooting** to help solve baseline, peak shape, pressure, and retention related issues.

Maintenance and Troubleshooting Tools of the Module

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.

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 18 on page 115 and **Figure 19** on page 116 show a typical test run.

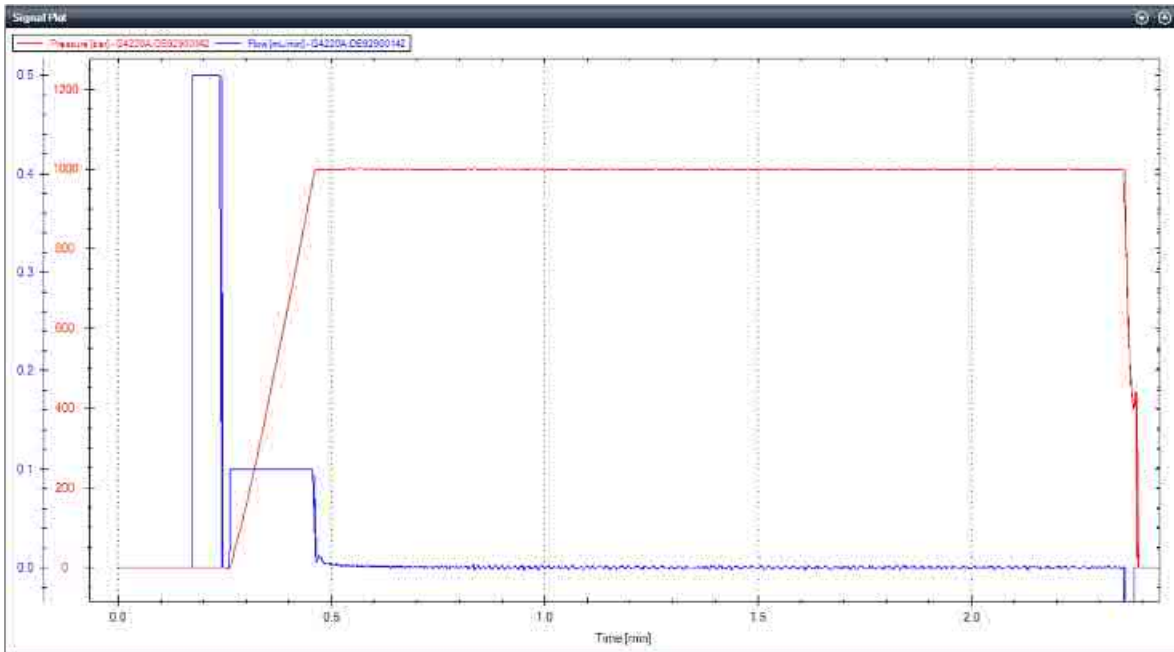


Figure 18: Static (secondary) Leak Test

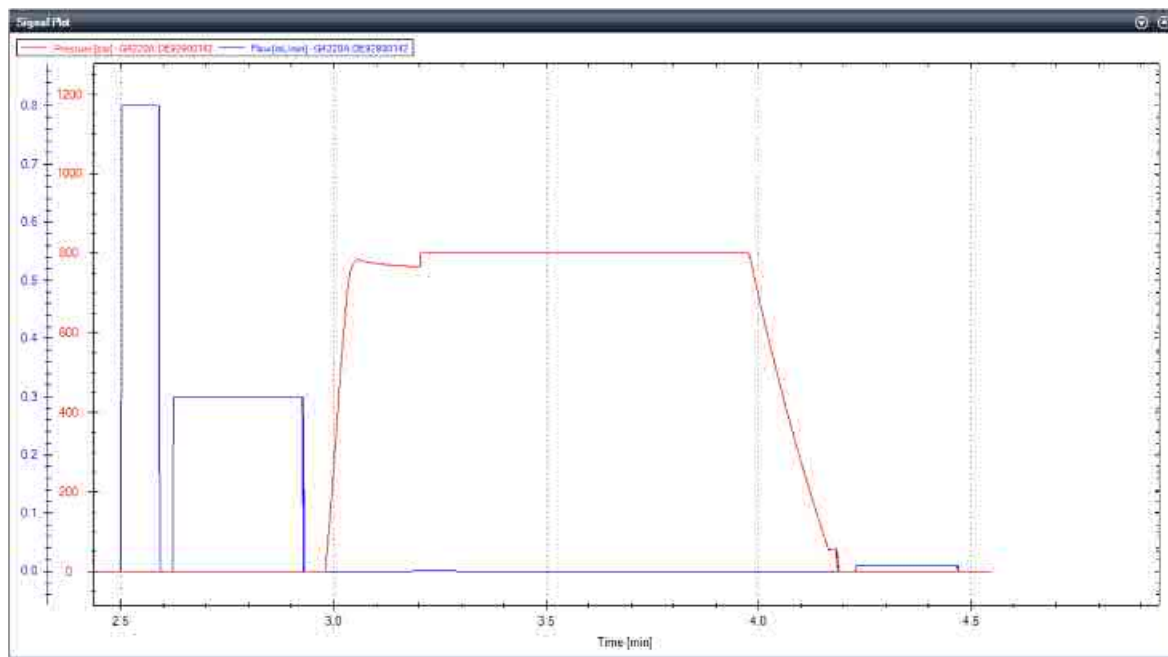


Figure 19: Dynamic (primary) Leak Test

Troubleshooting the Pump Leak Rate Test

Secondary Leak > 3 µL/min

If a secondary leak is found, the following reasons are possible:

Diagnostics and Troubleshooting

Maintenance and Troubleshooting Tools of the Module

Probable cause	Suggested actions
1 Leak between the OBV and automatic purge valve	<ul style="list-style-type: none"> • Leaks on fittings/connectors • Check for visible leaks on fittings and connectors: • Connector not fixed/tight enough • Connector damaged • Leaky filter frit assembly • Remove the seal wash tubes • 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 • Remove waste lines from the automatic purge valve: • Damage to rotor seal and/or stator head
2 Outlet valve not properly assembled	<ul style="list-style-type: none"> • Check if Outlet valve is properly assembled • Check if outlet valve is 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

Probable cause		Suggested actions
1	Air in the primary pump chamber	<ul style="list-style-type: none"> • Check for air • Check for air in the solvent inlet lines and the Tuning signal: • Purge the lines, condition and if necessary prime the pump head
2	Abort due to over pressure	<ul style="list-style-type: none"> • Check solvent and solvent settings • Purge and condition the pump head with water
3	Leak in inlet valve	<ul style="list-style-type: none"> • 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
4	Outlet valve not properly assembled	<ul style="list-style-type: none"> • Retighten the outlet valve • Check the position of the gold seal
5	Leaky piston seals and/or position-dependent leaks on the piston	<ul style="list-style-type: none"> • Remove the SW tubes • Remove the SW tubes from the support ring and check for leaks • Replace the piston seals and clean the pistons: • Ensure that seals are lubricated when pushed in • Use abrasive mesh > 5000 grit

System Pressure Test

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

Preparations:

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

The test runs automatically without any further user interaction.

Evaluation:

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

- For a pressure setting ≤ 1000 bar, the allowed leak limit is ≤ 5 $\mu\text{L}/\text{min}$
- For a pressure setting > 1000 bar, the allowed leak limit is ≤ 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 20 on page 120 shows a typical test run.

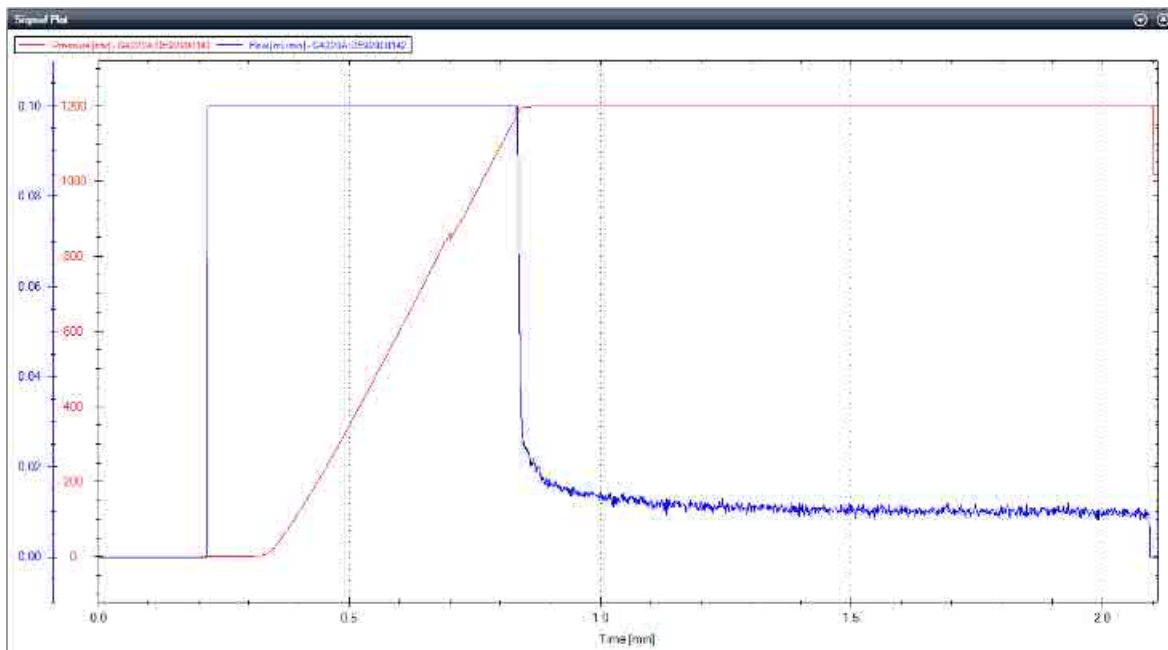


Figure 20: System Pressure Test

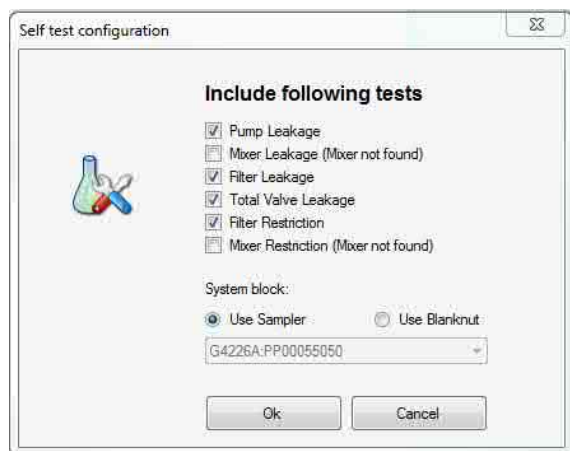
Pump Self Test

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 21** on page 123 shows a typical test run.

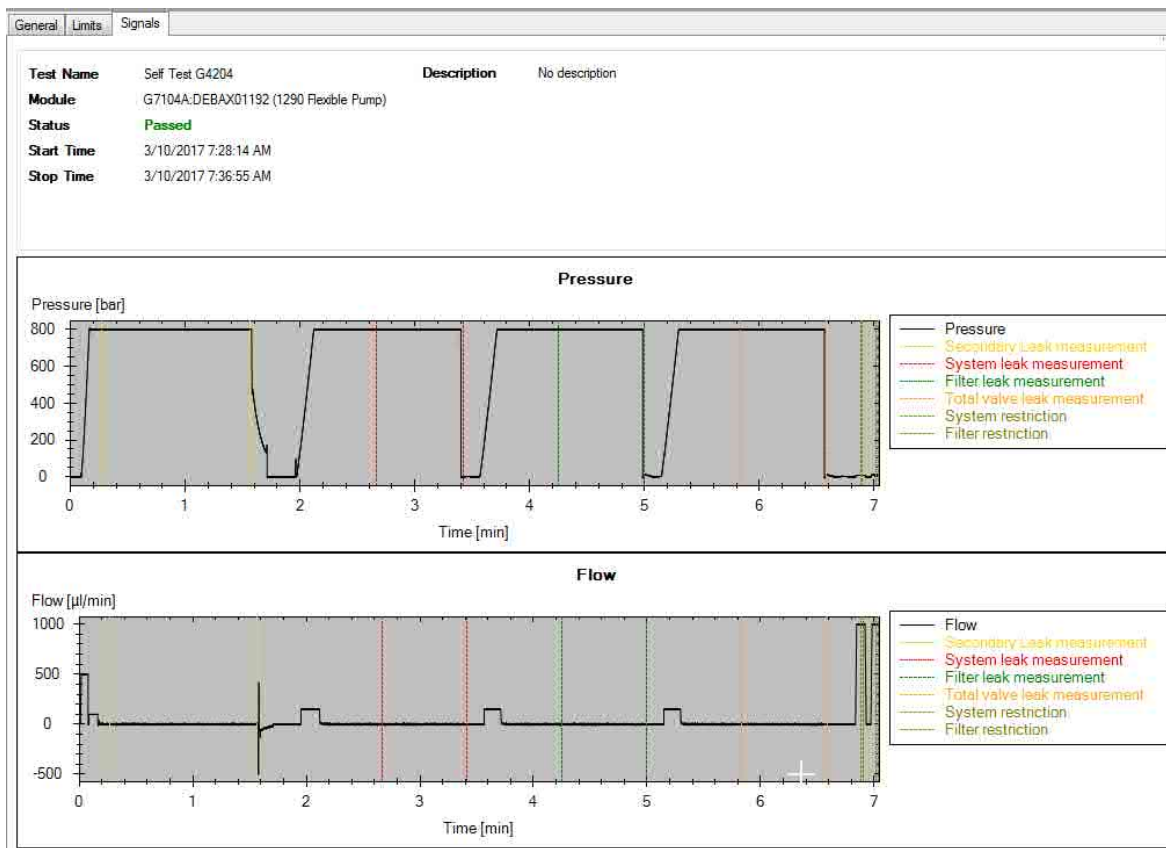


Figure 21: Pump Self Test

Diagnostic Signals

Tuning

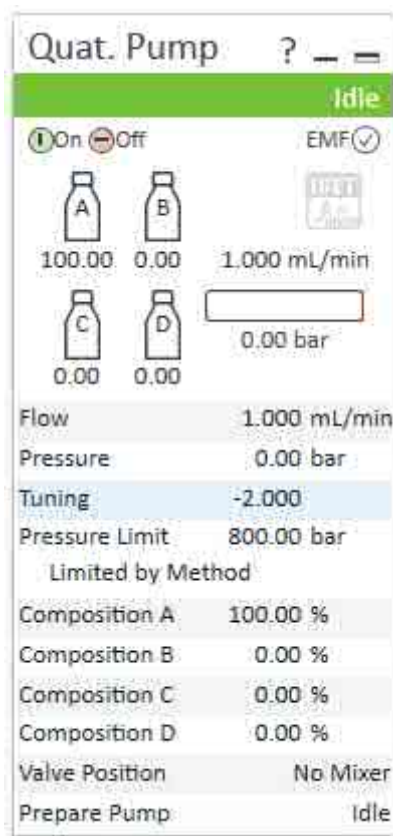
For pumps operating as expected, the signal should stay in a range of -1 to $+1$ within the full scale of -2 to $+2$. Ideal performance is at 0 .

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**.



Symptom	Possible Source	Possible Fix
Tuning 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.
Tuning 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.
Tuning 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.

Symptom	Possible Source	Possible Fix
	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.
Tuning 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.
Tuning 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.

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 makes it possible 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.

7 Error Information

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

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What Are Error Messages

Error messages are displayed in the user interface when an electronic, mechanical, or hydraulic (flow path) failure occurs that 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).

If using the InfinityLab Assist, instrument errors will generate a notification. To view the probable causes and recommended actions for this error, click on **Help** button displayed on the notification.

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: 62

The timeout threshold was exceeded.

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

Shutdown

Error ID: 63

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

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

Probable cause		Suggested actions
1	Leak detected in another module with a CAN connection to the system.	<ul style="list-style-type: none"> Fix the leak in the external instrument before restarting the module.
2	Leak detected in an external instrument with a remote connection to the system.	<ul style="list-style-type: none"> Fix the leak in the external instrument before restarting the module.
3	Shut-down in an external instrument with a remote connection to the system.	<ul style="list-style-type: none"> Check external instruments for a shut-down condition.
4	The degasser failed to generate sufficient vacuum for solvent degassing.	<ul style="list-style-type: none"> Check the vacuum degasser for an error condition. Refer to the Service Manual for the degasser or the pump that has the degasser built-in. Check the external vacuum degasser module (if installed) 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: 70

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: 71

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">• Ensure all the CAN cables are connected correctly.• Ensure all CAN cables are installed correctly.
2	Defective CAN cable.	<ul style="list-style-type: none">• Exchange the CAN cable.
3	Defective mainboard in another module.	<ul style="list-style-type: none">• Switch off the system. Restart the system, and determine which module or modules are not recognized by the system.

Leak

Error ID: 64

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
1	Loose fittings.	<ul style="list-style-type: none">• Ensure all fittings are tight.
2	Broken capillary.	<ul style="list-style-type: none">• Exchange defective capillaries.
3	Loose or leaking purge valve, inlet valve, or outlet valve.	<ul style="list-style-type: none">• Ensure pump components are seated correctly. If there are still signs of a leak, exchange the appropriate seal (purge valve, inlet valve, outlet valve).
4	Defective pump seals.	<ul style="list-style-type: none">• Exchange the pump seals.

Leak Sensor Open

Error ID: 83

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 on/off 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	On/Off switch assembly defective.	• Please contact your Agilent service representative.

Leak Sensor Short

Error ID: 82

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

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

Probable cause		Suggested actions
1	Defective leak sensor.	<ul style="list-style-type: none">• Please contact your Agilent service representative.
2	Leak sensor incorrectly routed, being pinched by a metal component.	<ul style="list-style-type: none">• Please contact your Agilent service representative.
3	On/Off switch assembly defective.	<ul style="list-style-type: none">• Please contact your Agilent service representative.
4	Cable or contact problem.	<ul style="list-style-type: none">• Please contact your Agilent service representative.

Compensation Sensor Open

Error ID: 81

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 on/off switch board and the mainboard.	• Please contact your Agilent service representative.
2 Defective on/off switch assembly.	• Please contact your Agilent service representative.

Compensation Sensor Short

Error ID: 80

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	Defective on/off switch assembly.	<ul style="list-style-type: none">• Please contact your Agilent service representative.
2	Loose connection between the on/off switch board and the mainboard.	<ul style="list-style-type: none">• Please contact your Agilent service representative.

Fan Failed

Error ID: 68

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.

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

Pressure Below Lower Limit

Error ID: 29176

The pressure has dropped below the lower limit.

- Parameter: None

Probable cause		Suggested actions
1	Leak	<ul style="list-style-type: none">• Check for leaks.
2	Bottle empty	<ul style="list-style-type: none">• Check bottle filling.• Fill solvent bottle.
3	Wrong solvent (viscosity)	<ul style="list-style-type: none">• Check solvent.
4	Inappropriate setting	<ul style="list-style-type: none">• Check flow rate and lower pressure limit.
5	Column degradation	<ul style="list-style-type: none">• 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.	<ul style="list-style-type: none">• Refill solvent bottle.
2	Inappropriate setting.	<ul style="list-style-type: none">• 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.	<ul style="list-style-type: none">• Empty waste container.
2	Inappropriate setting for waste counter.	<ul style="list-style-type: none">• Reset waste counter.• Adjust waste counter limit.

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	<ul style="list-style-type: none">• Check for leaks in the pump and flow path.
2	Bottle empty	<ul style="list-style-type: none">• Check bottle filling.• Fill solvent bottle.
3	Shutoff valve closed (if applicable).	<ul style="list-style-type: none">• Open shutoff valve.
4	Drift of pressure sensor (unlikely for short tests taking only minutes).	<ul style="list-style-type: none">• 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, 29210

Drive encoder failed during pump drive calibration.

Probable cause		Suggested actions
1	Internal error.	<ul style="list-style-type: none">• Please contact your Agilent service representative.

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	<ul style="list-style-type: none">• Remove capillary connection to system, check outlet filter, check valves, check pump head.
2	Blockage of pump drive Drive motor defect.	<ul style="list-style-type: none">• 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.	<ul style="list-style-type: none">• Check for blockage of e.g. outlet valve filter frit, Multipurpose Valve, heat exchanger.
2	Drive motor defect.	<ul style="list-style-type: none">• Please contact your Agilent service representative.

Deliver Underrun

Error ID: 29233

Internal error.

- Parameter: None

Probable cause		Suggested actions
1	Internal error.	<ul style="list-style-type: none">• Please contact your Agilent service representative.
2	Firmware issue	<ul style="list-style-type: none">• 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.	<ul style="list-style-type: none">• 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">• Check installation of multipurpose valve head.• Replace multipurpose valve head.

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.	<ul style="list-style-type: none">• Check cable connection.
2	Multipurpose valve head tag defect or empty.	<ul style="list-style-type: none">• Replace multipurpose valve head.
3	Multipurpose valve tag reader is defect.	<ul style="list-style-type: none">• 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.	<ul style="list-style-type: none">• 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.	<ul style="list-style-type: none">• 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.	<ul style="list-style-type: none">• Please contact your Agilent service representative.

Drive Encoder Error

Error ID: 29215, 29237, 29238, 29239

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.	<ul style="list-style-type: none">• 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.	<ul style="list-style-type: none">• 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.	<ul style="list-style-type: none">• 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.	<ul style="list-style-type: none">• 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 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.	<ul style="list-style-type: none">• Check cable connection.
2	Defect seal wash pump motor.	<ul style="list-style-type: none">• Please contact your Agilent service representative.
3	Defective mainboard.	<ul style="list-style-type: none">• 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.	<ul style="list-style-type: none">• Replace MCGV/4CGV.
2	Valve defect.	<ul style="list-style-type: none">• Please contact your Agilent service representative.• Replace MCGV/4CGV.
3	Defective mainboard.	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• Please contact your Agilent service representative.
2	Pressure sensor might be defective	<ul style="list-style-type: none">• 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.	<ul style="list-style-type: none">• Check MCGV/4CGV cable connection.
2	Valve defect.	<ul style="list-style-type: none">• Please contact your Agilent service representative.• Replace MCGV/4CGV.

8 Maintenance

It is necessary to perform periodic inspection of the instrument to ensure its safe use. It is possible to have these periodic inspections performed by Agilent service representatives on a contractual basis. For information regarding the maintenance inspection contract, contact your Agilent representative.

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Safety Information Related to Maintenance

WARNING

Fire and damage to the module

Wrong fuses

- Make sure that only fuses with the required rated current and of the specified type (super-fast, fast, time delay etc) are used for replacement.
 - The use of repaired fuses and the short-circuiting of fuse-holders must be avoided.
-

WARNING

Personal injury or damage to the product

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

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

WARNING

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

Sharp metal edges

Sharp-edged parts of the equipment may cause injuries.

- To prevent personal injury, be careful when getting in contact with sharp metal areas.
-

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.

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.

Introduction to Maintenance

Figure 22 on page 186 shows the main user-accessible assemblies of the Agilent 1290 Infinity III Flexible Pump. These parts can be accessed from the front (simple repairs) and don't require to remove the pump from the system stack.

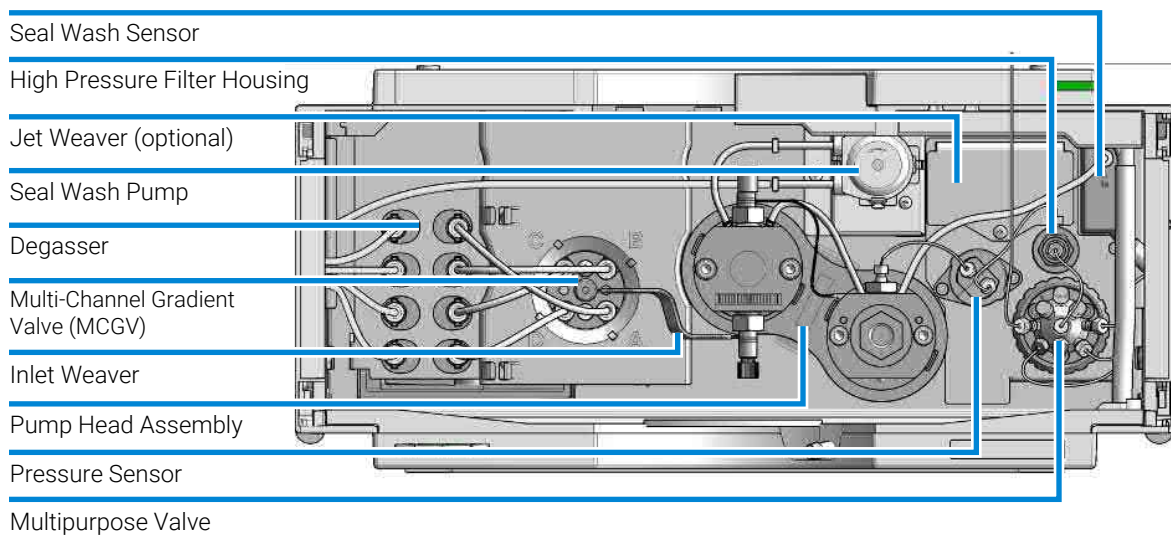


Figure 22: Overview of maintenance parts for the Flexible Pump

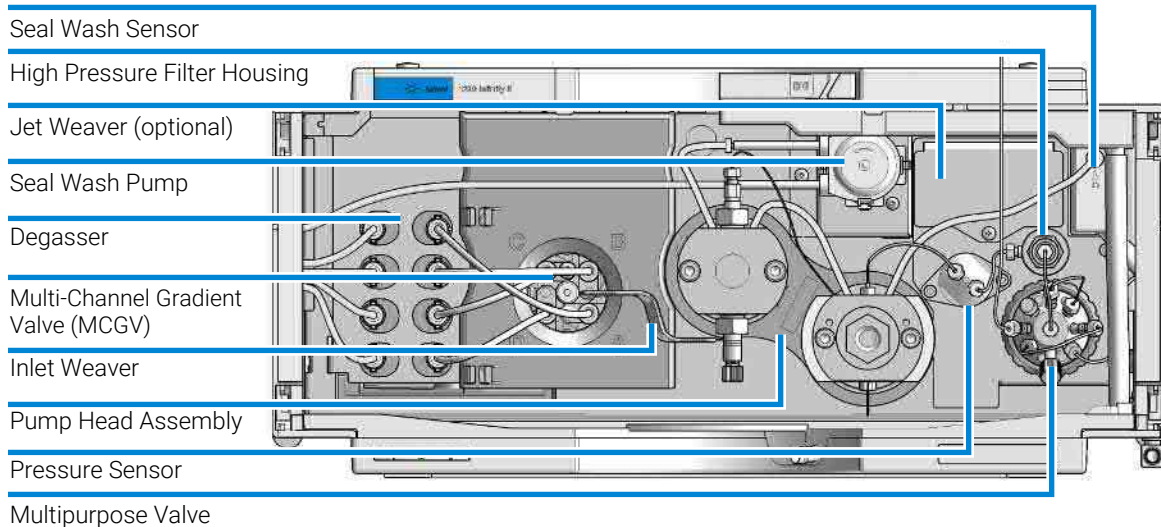


Figure 23: Overview of maintenance parts for the Bio Flexible Pump

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.

Overview of Maintenance and Simple Repair

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.

Installing 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

When

- The instrument doors or the hinges are broken.

Tools required

Qty.	p/n	Description
1	 5023-3138	Reversible Screwdriver + Blade 1,0 x 5,5

Parts required (Infinity III)

Qty.	p/n	Description
	5004-3180	Door Kit Infinity III 180mm Latched

Parts required (Infinity II)

Qty.	p/n	Description
	5004-0180	Door Kit Infinity II 180mm Latched

Preparations

- Finish any pending acquisition job.

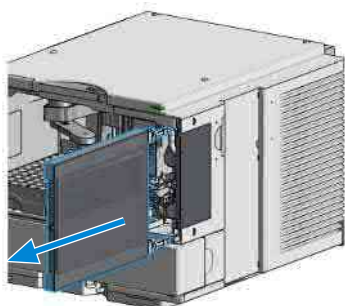
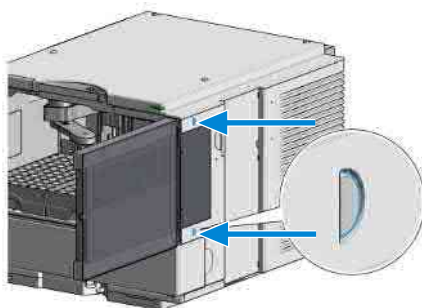
NOTE

The figures shown in this procedure exemplarily show the Infinity III Vialsampler module. The principle of how to remove and/or install doors works in the same way for all Infinity III modules.

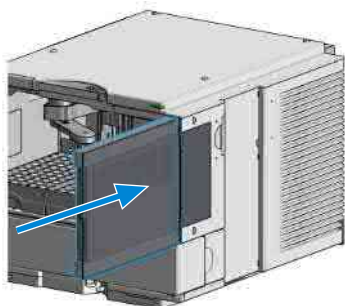
Maintenance

Remove and Install Doors

- 1 Press the release buttons and pull the front door out.

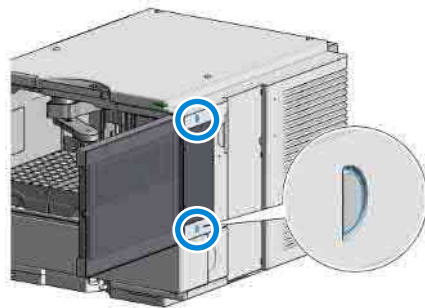


- 2 For the Installation of the front door, insert the hinges into their guides and push the door in until the release buttons click into their final position.



Maintenance

Remove and Install Doors





Replace the Pressure Sensor



When

- No or invalid pressure signal

Tools required

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

Parts required

Qty.	p/n	Description
1	 5067-6791	Pressure sensor 1300 bar
1	 5067-7010	Pressure sensor biocompatible 1300 bar

Preparations

- Turn off pump flow, switch off pump

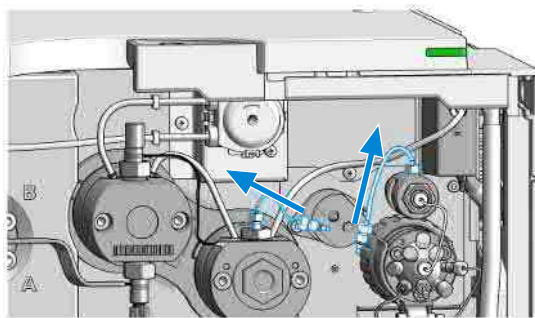
NOTE

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

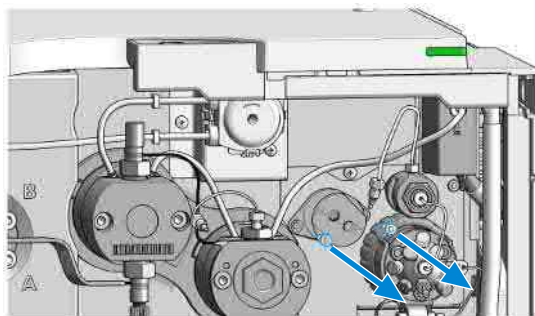
Working on connections to the pressure sensor may slightly change the displayed pressure. In case of a pressure offset at ambient pressure, a pressure offset calibration may be run.

- 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.

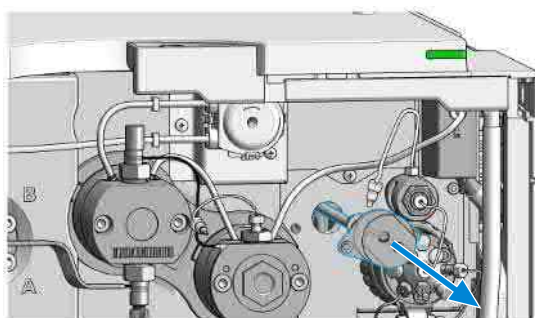


Maintenance**Replace the Pressure Sensor**

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



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



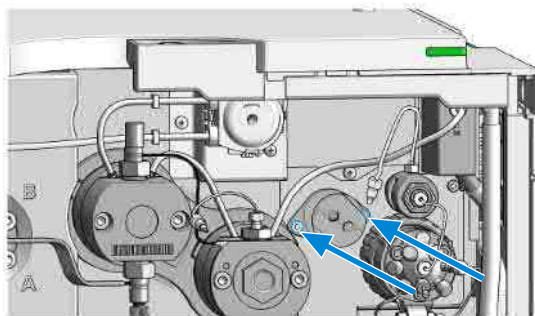
- 4 Connect the new pressure sensor to the pressure sensor connector.



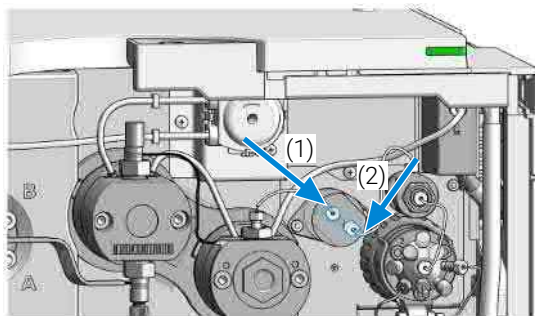
Maintenance

Replace the Pressure Sensor



- 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.



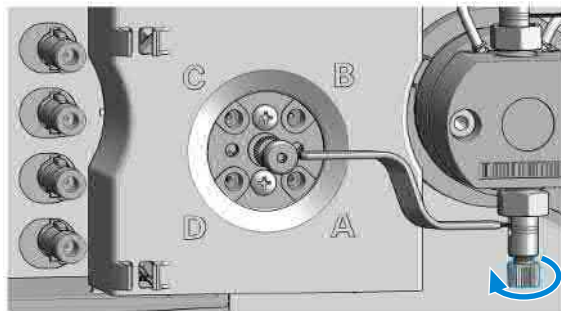
Replace the Inlet Weaver

Parts required	Qty.	p/n	Description
	1	 G4204-81090	Quaternary Pump/Flexible Pump Inlet Weaver Assembly
	1	 G7131-60090	Inlet Weaver Assembly Biocompatible

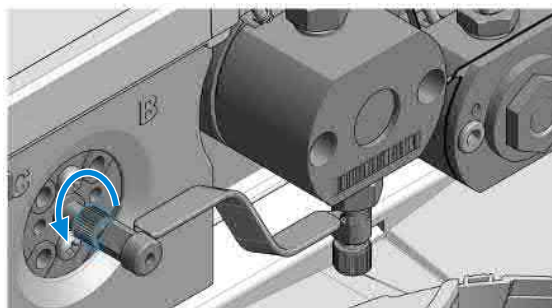
Preparations

- 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.

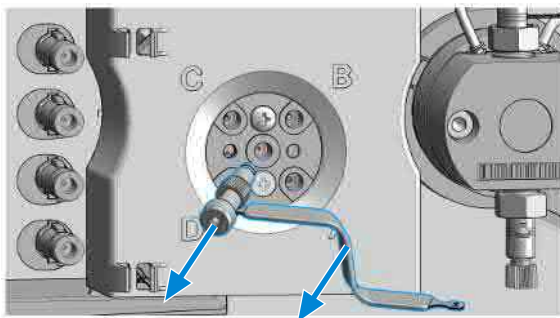


- 2 Open the fitting at the center of the multi-channel gradient valve (MCGV). Remove the inlet weaver from the MCGV.

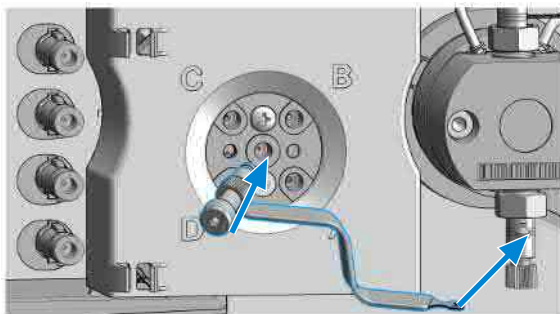


Maintenance**Replace the Inlet Weaver**

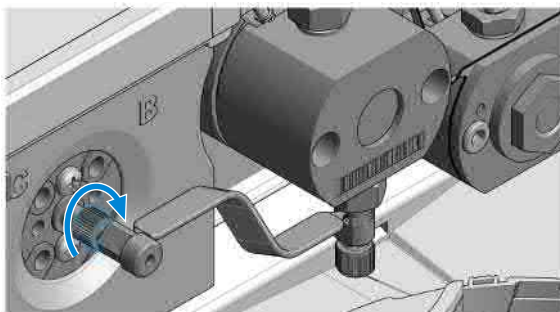
- 3 Pull the Inlet Weaver out of the Inlet Valve.



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



- 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.

Tools required

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

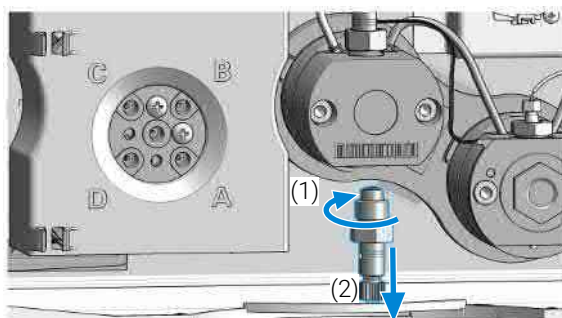
Parts required

Qty.	p/n	Description
1	 G4204-60022	Inlet Valve Quaternary Pump/Flexible Pump

Preparations

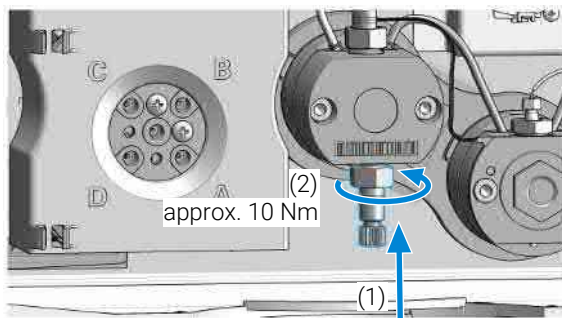
- Switch off pump at the main power switch
- Open the doors
- Use an optional solvent shutoff valve or lift up solvent filters inside solvent bottles for avoiding leakages
- Remove the inlet weaver, see [Replace the Inlet Weaver](#) on page 197

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



Maintenance**Replace the Inlet Valve (G7104A)**

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



- 3 Insert the inlet weaver, see [Replace the Inlet Weaver](#) on page 197.
- 4 Purge and condition the system to remove air.

Replace the Inlet Valve (G7131A)

When • If Inlet valve is defective.

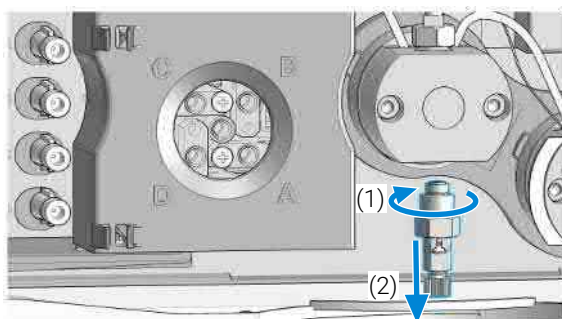
Tools required	Qty.	p/n	Description
	1		Wrench, 14 mm
	1	 5067-5688	Torque wrench 1 - 25 Nm with 14 mm wrench

Parts required	Qty.	p/n	Description
	1	 G7131-60022	Inlet Valve Bio-Compatible Flexible Pump

Preparations

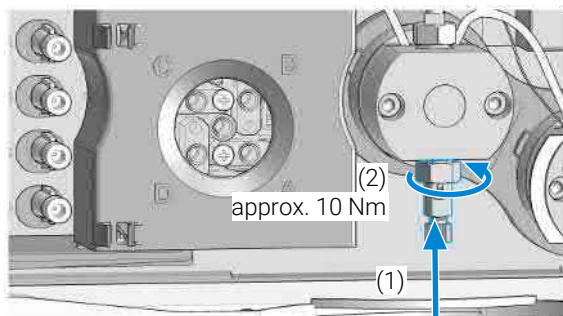
- Switch off pump at the main power switch
- Open the doors
- Use an optional solvent shutoff valve or lift up solvent filters inside solvent bottles for avoiding leakages
- Remove the inlet weaver, see [Replace the Inlet Weaver](#) on page 197

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



Maintenance**Replace the Inlet Valve (G7131A)**

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



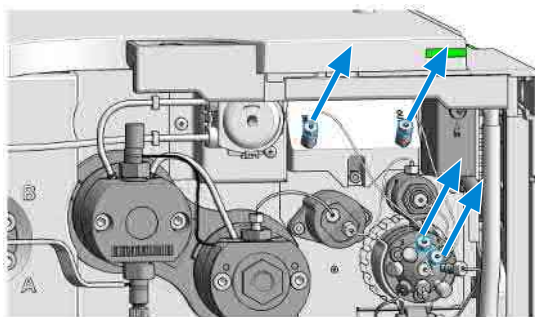
- 3 Insert the inlet weaver, see [Replace the Inlet Weaver](#) on page 197.
- 4 Purge and condition the system to remove air.

Remove the Jet Weaver

Tools required	Qty.	p/n	Description
	1	 8710-0510	Open-end wrench 1/4-5/16 inch
	1	 8710-0899	Screwdriver Pozidrive Shaft
	1	 5023-2502	Hex driver SW-6.35, slitted
Parts required	Qty.	p/n	Description
	1	 0100-1259	Plug-Screw 1032- Fitting
	1	 G4204-04002	Cover RFID Tag Metal lid for Jet Weaver

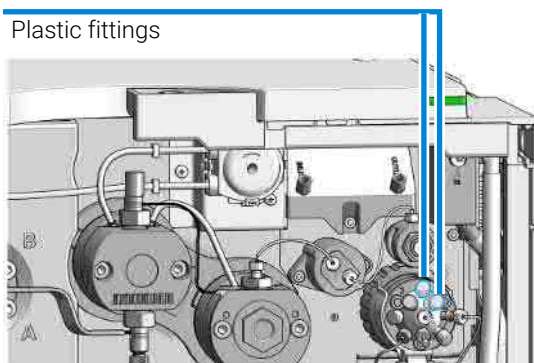
Preparations

- 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.

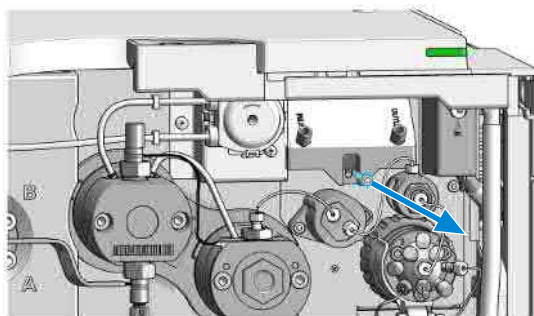


Maintenance**Remove the Jet Weaver**

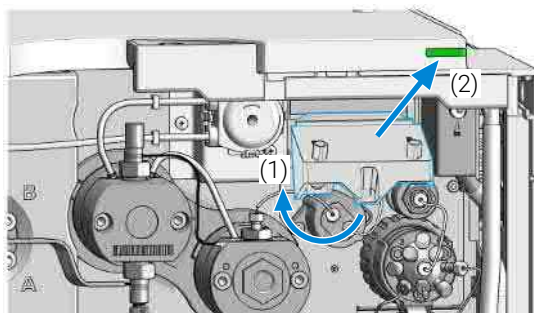
- 2 Plug the valve ports 1 and 2 with two plastic fittings.



- 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).

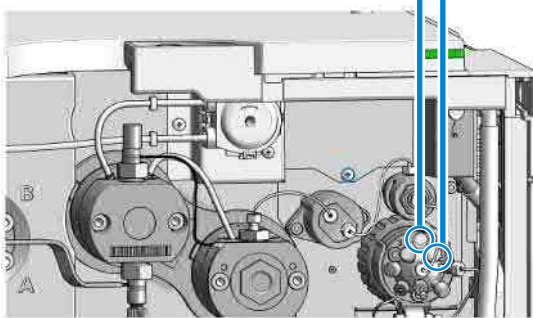


Maintenance

Remove the Jet Weaver

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

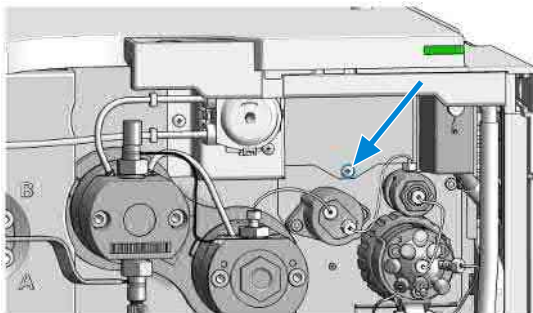
Plastic fittings



OR

Otherwise continue at [Install the Jet Weaver](#) on page 206.

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

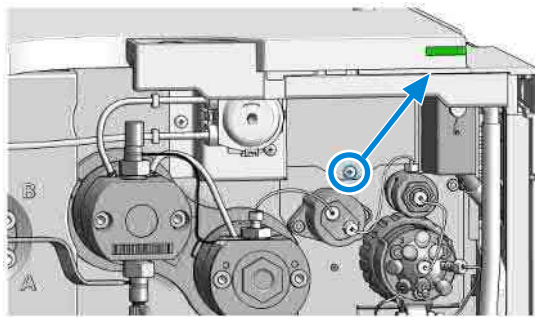


Install the Jet Weaver

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

Tools required	Qty.	p/n	Description
	1	 8710-0510	Open-end wrench 1/4-5/16 inch
	1	 8710-0899	Screwdriver Pozidrive Shaft
	1	 5023-2502	Hex driver SW-6.35, slitted
Parts required	Qty.	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
	2	 5004-0041	Jet Weaver to Multipurpose Valve Capillary MP35N 0.17 mm x 130 mm SI/SX

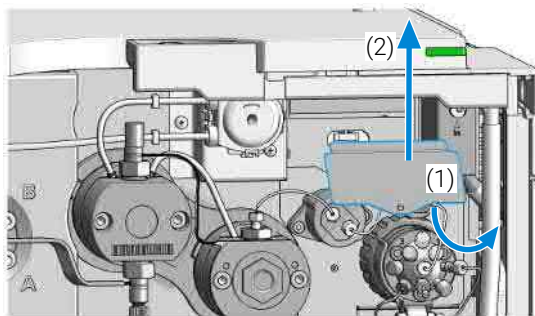
- Preparations**
- Switch off the pump at the main power switch
- 1 Open the screw of the Jet Weaver metal lid.



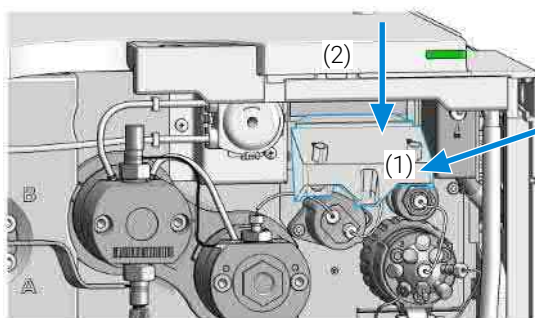
Maintenance

Install the Jet Weaver

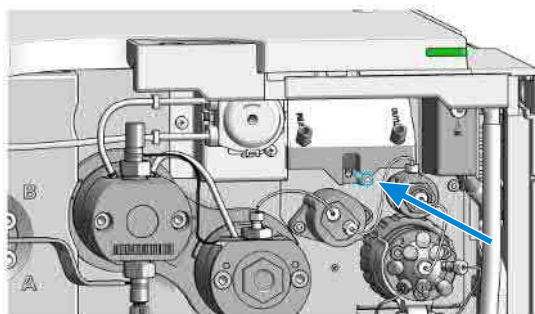
- 2 Remove the metal lid by lifting it up (1) and pulling it out of the front panel (2).



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



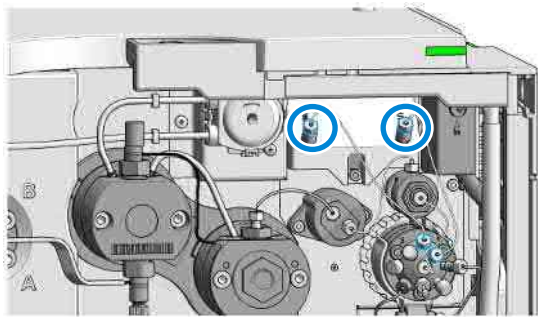
- 4 Fix the Jet Weaver with a screw.



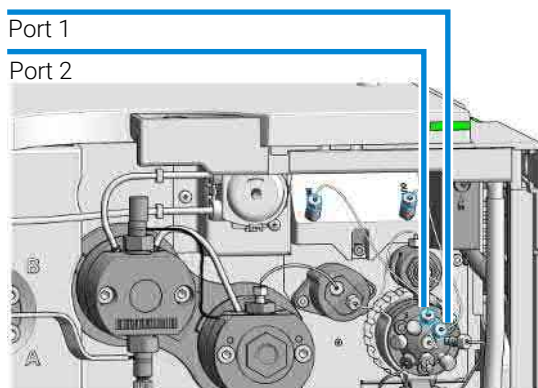
Maintenance

Install the Jet Weaver

- 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

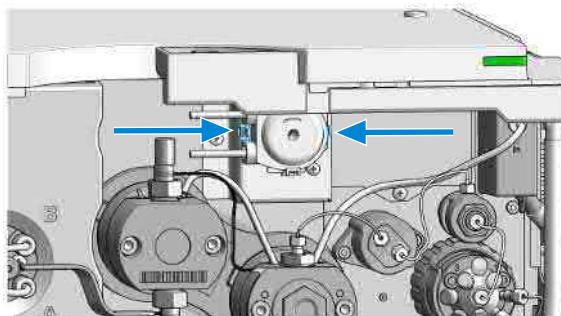
Parts required

Qty.	p/n	Description
1	 5065-4445	Peristaltic pump cartridge
1	 5065-9978	Silicone tubing, 1 mm i.d., 3 mm o.d., 5 m, re-order number

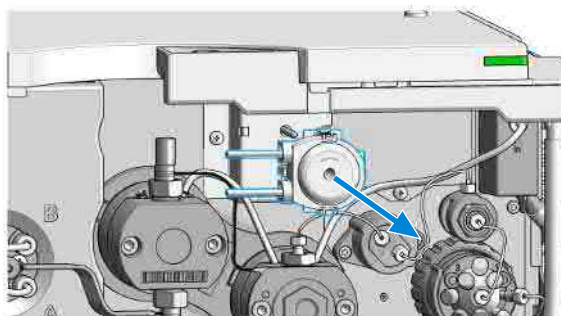
Preparations

- Remove the flow connections from and to the seal wash pump.

- 1 Press the clips.



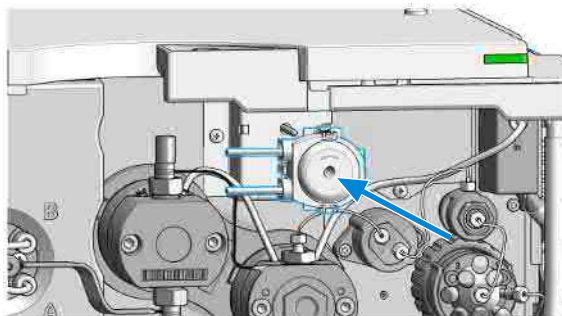
- 2 Pull the pump to the front.



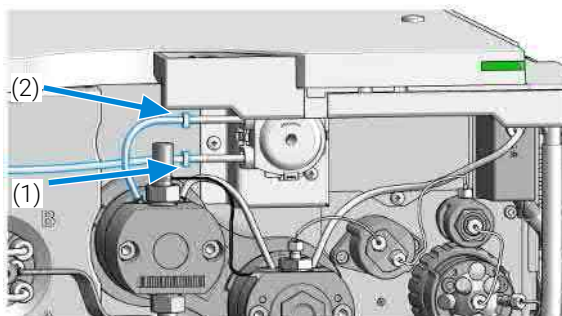
Maintenance

Replace the Seal Wash Pump




- 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)

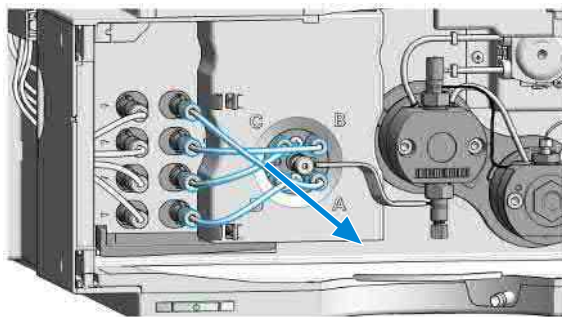
Tools required	Qty.	p/n	Description
	1	 0100-1710	Mounting Tool for Tubing Connections
	1	 8710-0899	Screwdriver Pozidrive Shaft
Parts required	Qty.	p/n	Description
	1	 G1311-67701	Multi channel gradient valve (MCGV)

- 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

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

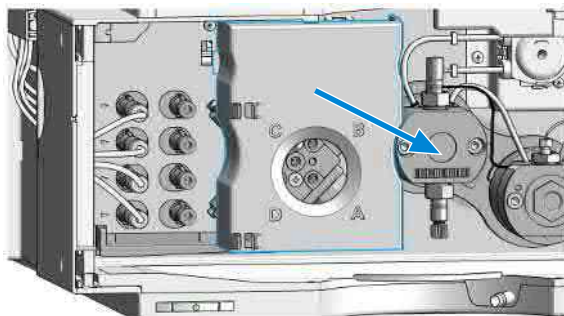
- 1 Use the mounting tool for removing tubing connections between the degassing unit and the MCGV.



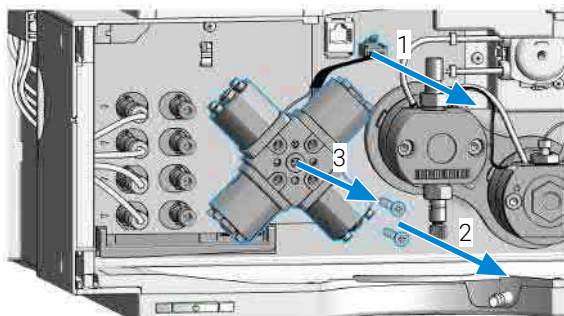
- 2 Remove the inlet weaver, see [Replace the Inlet Weaver](#) on page 197.

Maintenance**Replace the Multi-Channel Gradient Valve (MCGV)**

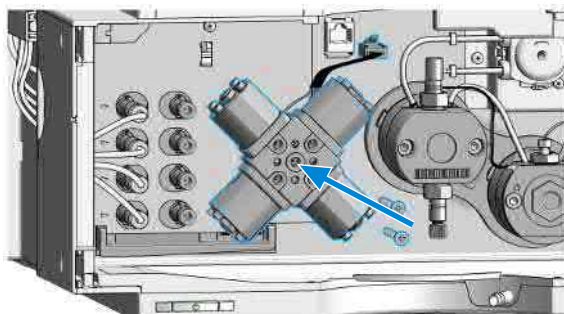
- 3 Remove the cover from the MCGV.



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



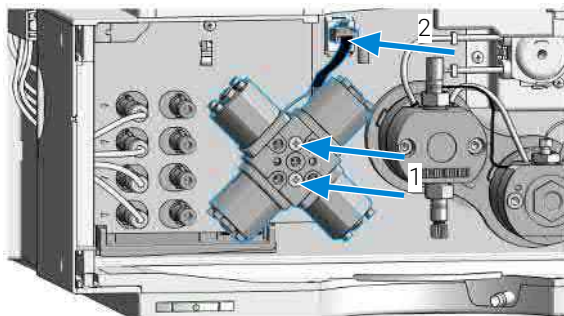
- 5 Place the new MCGV into position.

**NOTE**

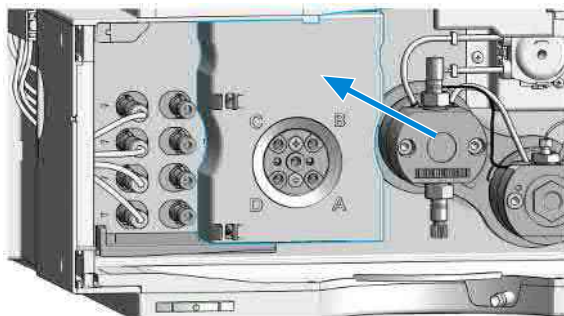
Make sure that channel A of the MCGV is put at the bottom-right position.

Maintenance**Replace the Multi-Channel Gradient Valve (MCGV)**

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



- 7 Install the MCGV cover.



- 8 Install the inlet weaver, see [Replace the Inlet Weaver](#) on page 197.
- 9 Reconnect solvent tubes for channels A-D from the MCGV to the degasser outlets.

Replace the Four-Channel Gradient Valve (4CGV)

Tools required	Qty.	p/n	Description
	1	 0100-1710	Mounting Tool for Tubing Connections
	1	 8710-0899	Screwdriver Pozidrive Shaft

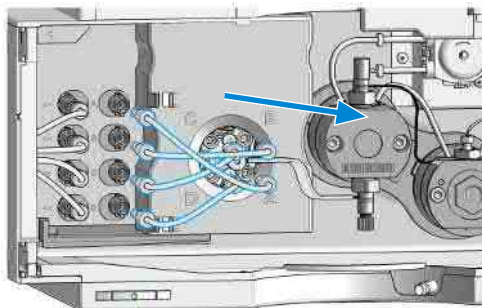
Parts required	Qty.	p/n	Description
	1	 G7111-67701	Four-Channel Gradient Valve (4CGV)

- 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

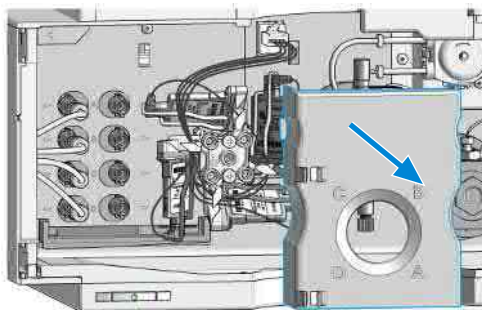
- 1 Use the mounting tool for removing tubing connections between the degassing unit and the 4CGV.



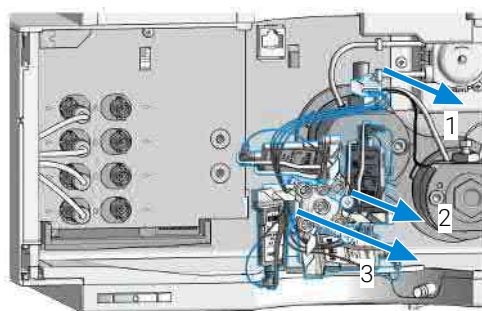
- 2 Remove the inlet weaver, see [Replace the Inlet Weaver](#) on page 197.

Maintenance**Replace the Four-Channel Gradient Valve (4CGV)**

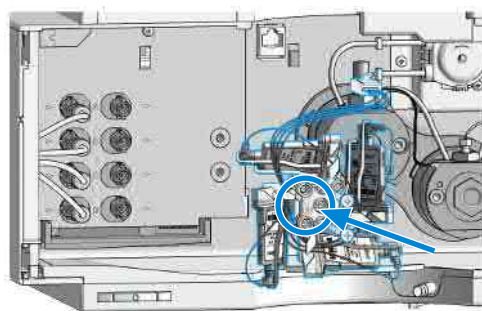
- 3 Remove the cover from the 4CGV.



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



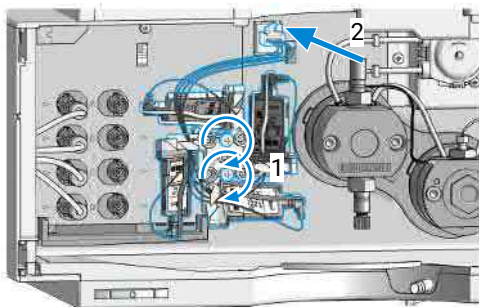
- 5 Place the new 4CGV into position.

**NOTE**

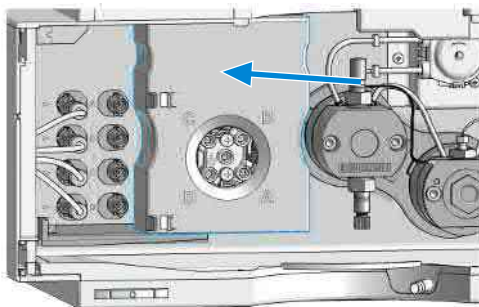
Make sure that the THIS SIDE UP label arrow is pointing upward towards the top of the module.

Maintenance**Replace the Four-Channel Gradient Valve (4CGV)**

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






- 7 Install the 4CGV cover.



- 8 Install the inlet weaver, see [Replace the Inlet Weaver](#) on page 197.
- 9 Reconnect solvent tubes for channels A-D from the 4CGV to the degasser outlets.

Release a Stuck Inlet Valve

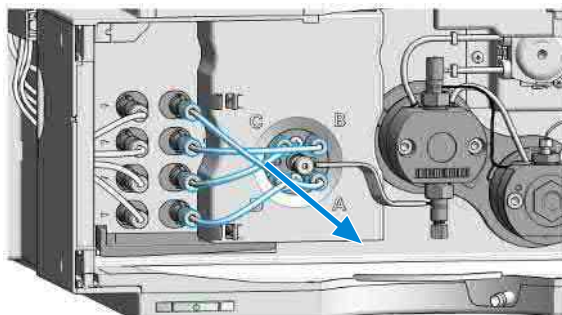
Tools required	Qty.	p/n	Description
	1	 9301-0411	Syringe, Plastic
	1	 9301-1337	Syringe adapter
	1	 0100-1710	Mounting Tool for Tubing Connections
	1		Beaker

CAUTION

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

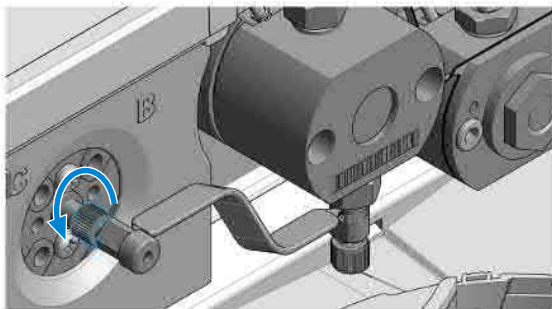
- Never apply pressure to the MCGV or degasser.
- Directly connect the syringe to the inlet weaver.

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

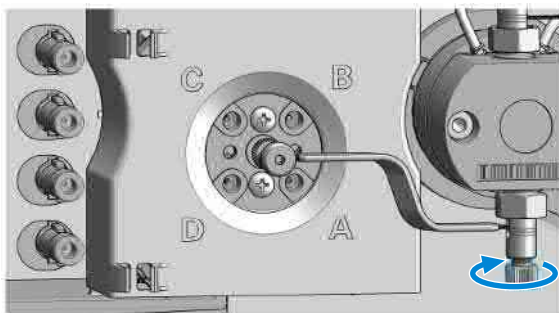


Maintenance**Release a Stuck Inlet Valve**

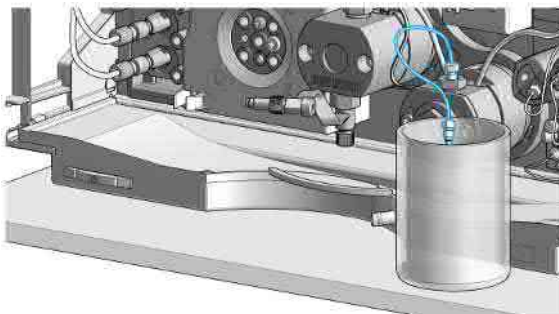
- 2 Open the fitting at the center of the multi-channel gradient valve (MCGV). Remove the inlet weaver from the MCGV.



- 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.



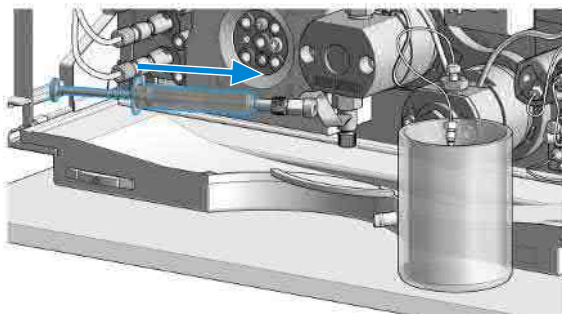
Maintenance**Release a Stuck Inlet Valve**

- 5 Fill the syringe with a suitable wash solvent.

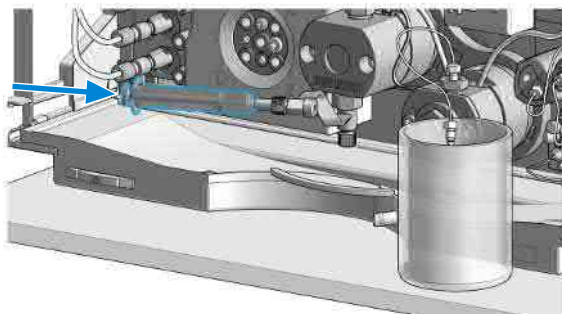
NOTE

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.



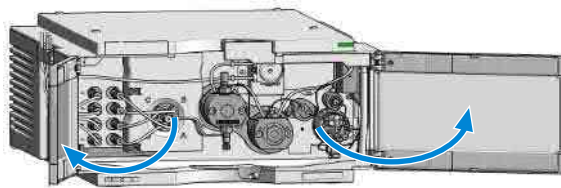
- 8 Restore original connections. Flush the system for several minutes.

Remove the Pump Head Assembly (G7104A)

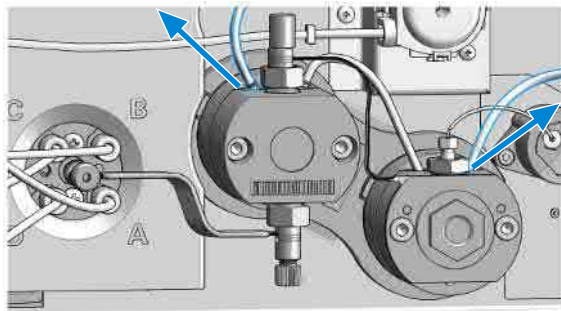
Tools required

Qty.	p/n	Description
1	 G7120-68708	HPLC System Tool Kit-Infinity-II

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

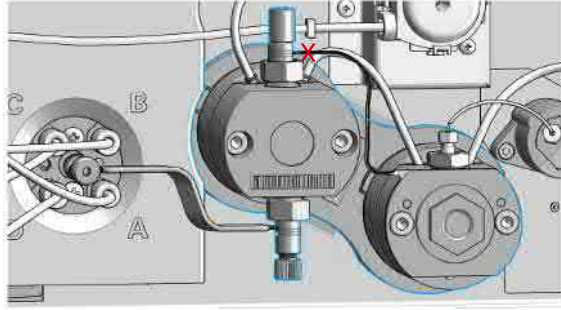


- 3 Remove the seal wash tubes.

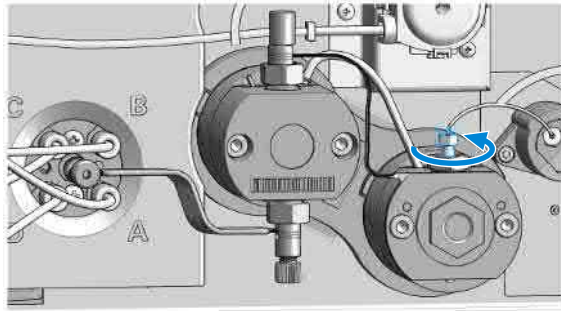


Maintenance**Remove the Pump Head Assembly (G7104A)**

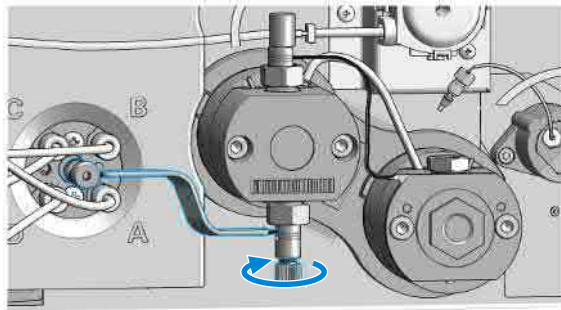
- 4 DO NOT REMOVE the heat exchanger connection between the pump heads marked by the red X.



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

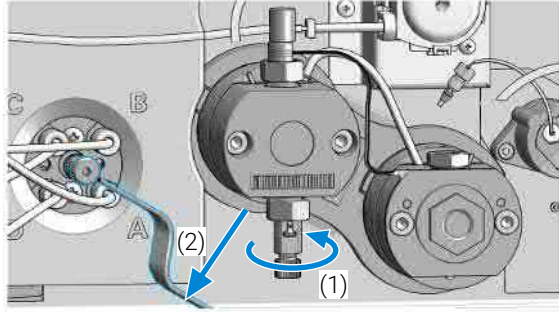


- 6 Open the black plastic screw of the inlet valve at the bottom of the primary pump head.

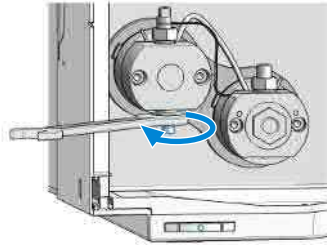


Maintenance**Remove the Pump Head Assembly (G7104A)**

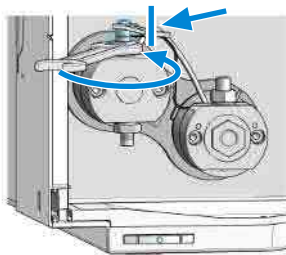
- 7 Turn the inlet valve 90 ° counterclockwise (1) and remove the inlet weaver from the inlet valve (2).



- 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.

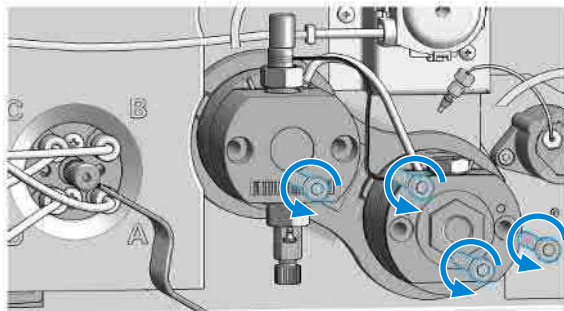


Maintenance**Remove the Pump Head Assembly (G7104A)**

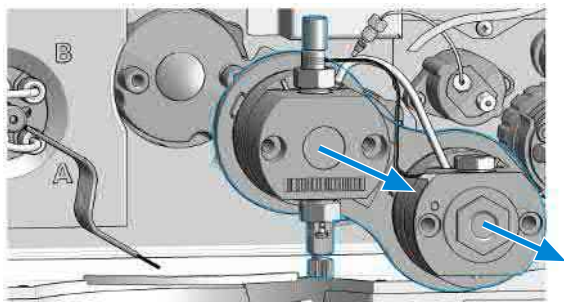
10 Remove the four screws holding the pump heads.

NOTE

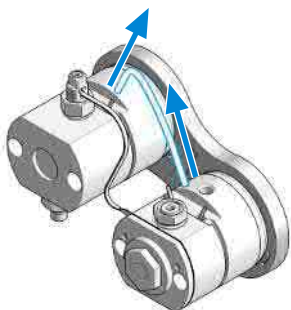
Open the screws step by step, not screw by screw.



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




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

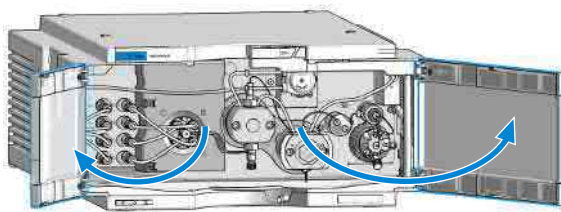


Maintenance

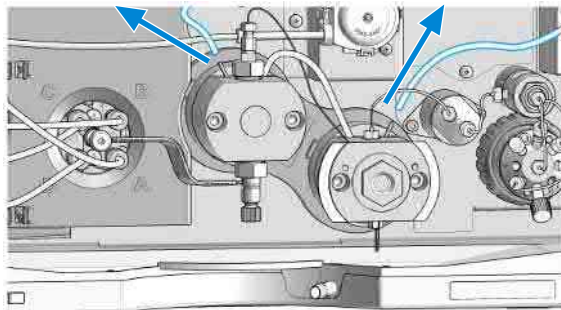
Remove the Pump Head Assembly (G7131A)

Remove the Pump Head Assembly (G7131A)**Tools required**

- | Qty. | p/n | Description |
|------|---|----------------------------------|
| 1 |  G7120-68708 | HPLC System Tool Kit-Infinity-II |
- 1 In Lab Advisor go to **Service & Diagnostics > Remove/Install Pump Head** and follow instructions given on the screen.
 - 2 Open the doors.

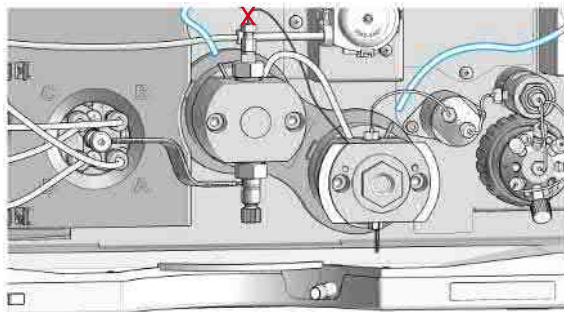


- 3 Remove the seal wash tubes.

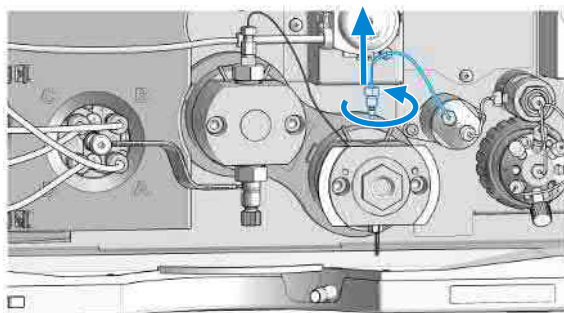


Maintenance**Remove the Pump Head Assembly (G7131A)**

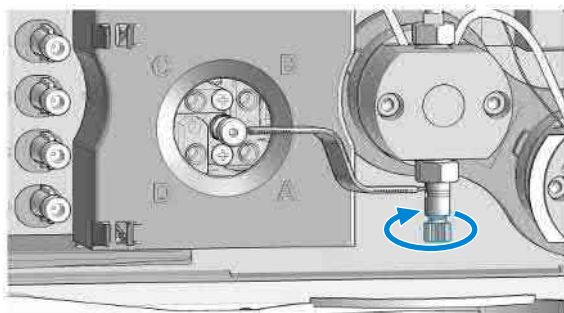
- 4 DO NOT REMOVE the heat exchanger connection between the pump heads marked by the red X.



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

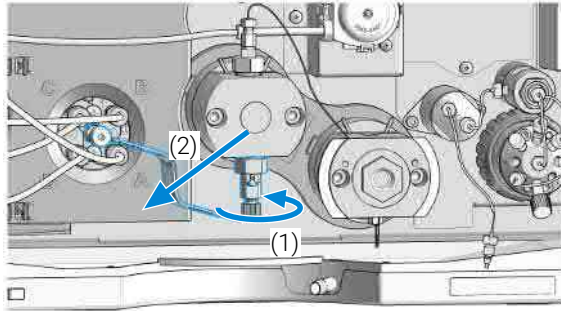


- 6 Open the black plastic screw of the inlet valve at the bottom of the primary pump head.

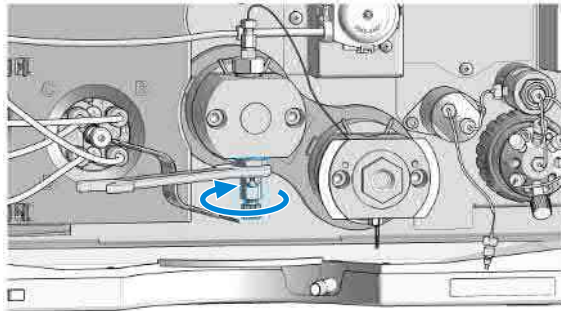


Maintenance**Remove the Pump Head Assembly (G7131A)**

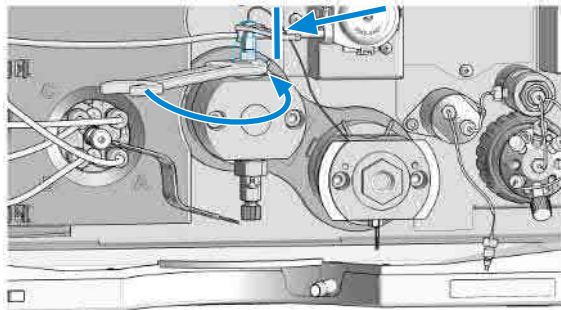
- 7 Turn the inlet valve 90 ° counterclockwise (1) and remove the inlet weaver from the inlet valve (2).



- 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.

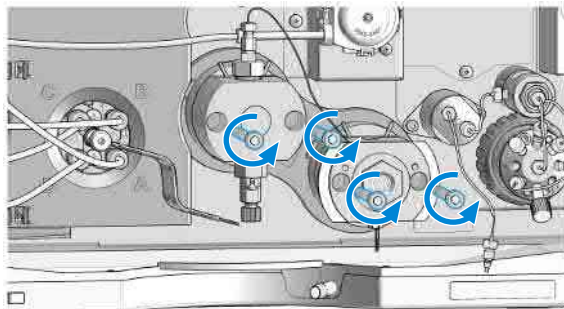


Maintenance**Remove the Pump Head Assembly (G7131A)**

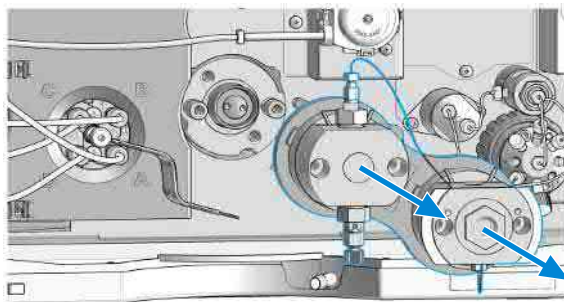
10 Remove the four screws holding the pump heads.

NOTE

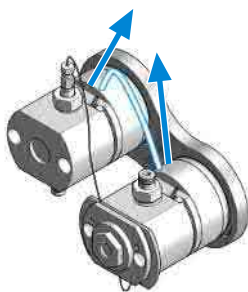
Open the screws step by step, not screw by screw.



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



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



Pump Head Maintenance (Tool Free)

Infinity III Flexible Pumps (G7104A/C and G7131A/C) and 1290 Infinity III 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 01200-90120 (Agilent 1290 Infinity II Easy Maintenance Pump Head Technical Note) for instructions on maintenance of Easy Maintenance Pump Heads, or to G4220-90122 (Agilent 1290 Infinity Pump Head Maintenance Technical Note) for instructions on maintenance of classical pump heads.

Disassemble Pump Heads (G7104A)

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

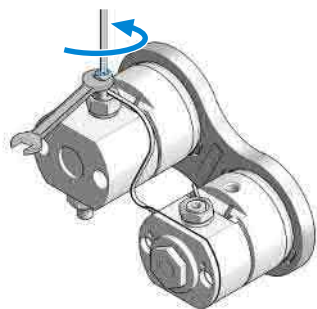
Exchanging seals and cleaning pistons is exemplarily shown for the primary pump head, but works in the same way for the secondary pump head.

Tools required	Qty.	p/n	Description
	1	 G7120-68708	HPLC System Tool Kit-Infinity-II
	1	 5043-1400	Pump Head Holder
	1	 5067-6197	Seal Handling Device
	1	 8660-0852	Abrasive Mesh (Micro-Grit Paper)
	1		Isopropanol

NOTE

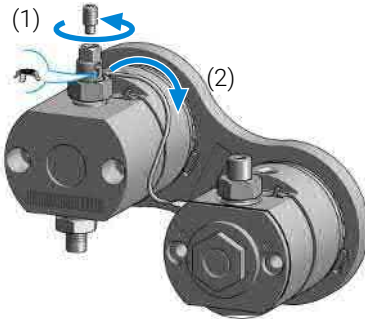
Seals must be exchanged and pistons must be cleaned in both primary and secondary pump heads.

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



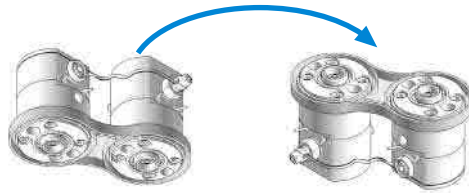
Maintenance**Pump Head Maintenance (Tool Free)**

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

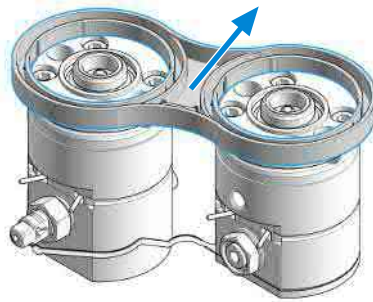
**NOTE**

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

- 3 Turn the pump head assembly upside down.



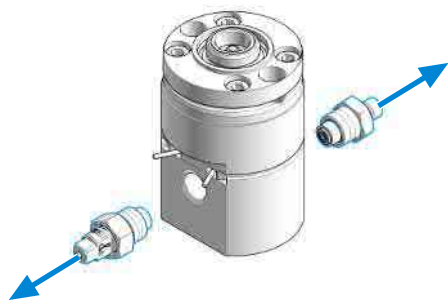
- 4 Remove the link plate by gently pulling it off the pump head assembly.



The two pump chambers are now isolated.

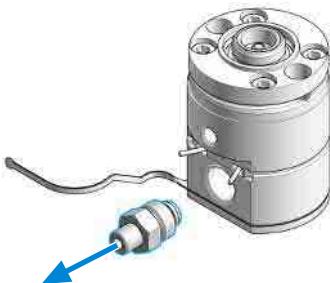
Maintenance**Pump Head Maintenance (Tool Free)**

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

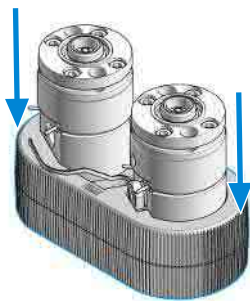
**NOTE**

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.

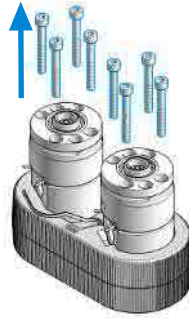


- 7 Place the two pump heads in the Pump Head Holder.

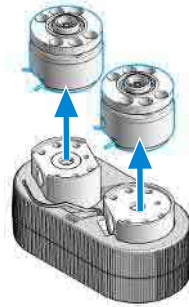


Maintenance**Pump Head Maintenance (Tool Free)**

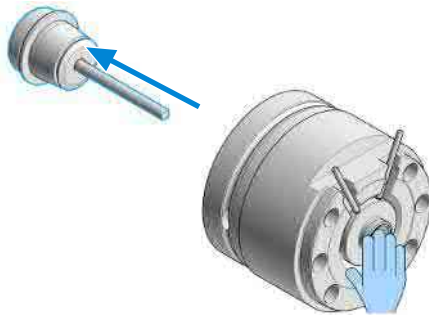
- 8 Remove the pump head screws from the back of the pump heads.



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

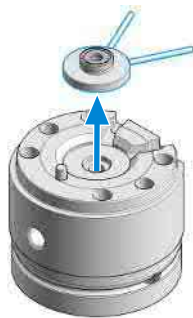


- 10 Remove the piston by pressing it out of the seal holder with a finger.

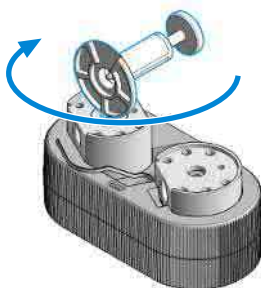


Maintenance**Pump Head Maintenance (Tool Free)**

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.



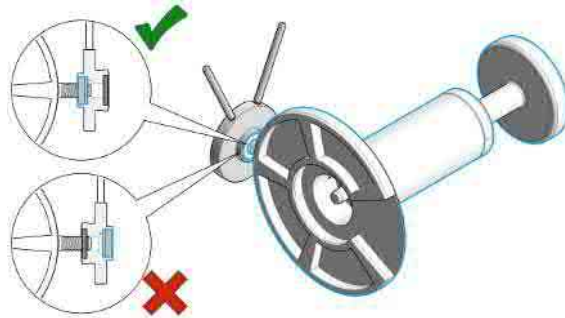
14 Repeat for the other pump chamber.

Maintenance**Pump Head Maintenance (Tool Free)**

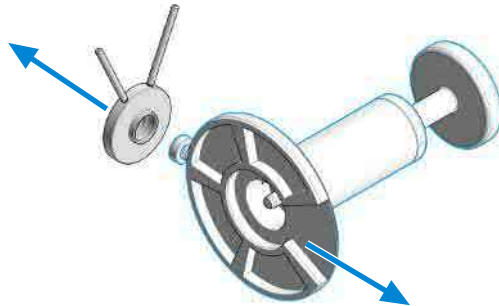
15 Screw the pin of the Seal Handling Device into the wash seal.

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.



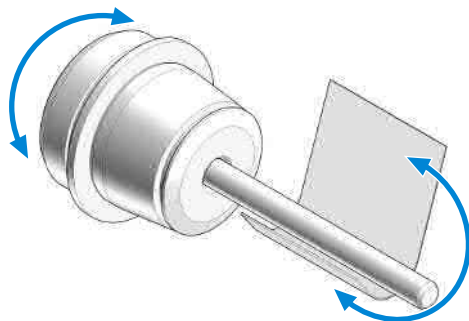
16 Pull out the Seal Handling Device with the wash seal in a straight movement with only gentle force.



17 Repeat for the other seal holder.

Maintenance**Pump Head Maintenance (Tool Free)**

18 Clean the piston with abrasive paper.



19 Rinse pump heads and pistons with isopropanol.

Disassemble Pump Heads (G7131A)

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

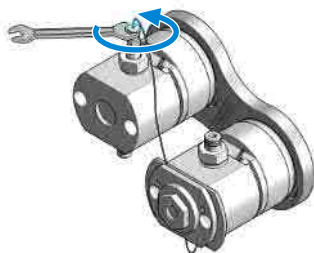
Exchanging seals and cleaning pistons is exemplarily shown for the primary pump head, but works in the same way for the secondary pump head.

Tools required	Qty.	p/n	Description
	1	 G7120-68708	HPLC System Tool Kit-Infinity-II
	1	 G7132-42000	Bio Pump Head Holder
	1	 5067-6197	Seal Handling Device
	1	 8660-0852	Abrasive Mesh (Micro-Grit Paper)
	1		Isopropanol

NOTE

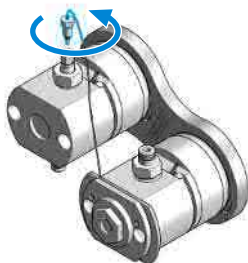
Seals must be exchanged and pistons must be cleaned in both primary and secondary pump heads.

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

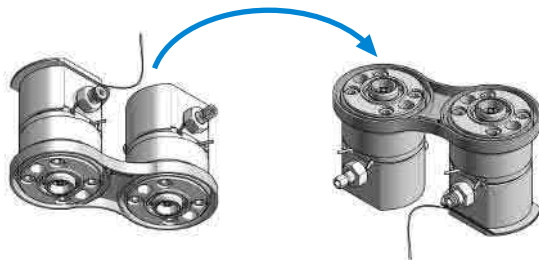


Maintenance**Pump Head Maintenance (Tool Free)**

- 2 Remove the heat exchanger capillary from the valve.



- 3 Turn the pump head assembly upside down.



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



The two pump chambers are now isolated.

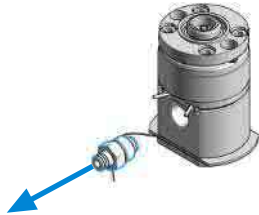
Maintenance**Pump Head Maintenance (Tool Free)**

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

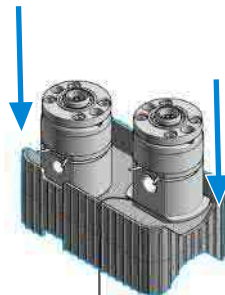
**NOTE**

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.

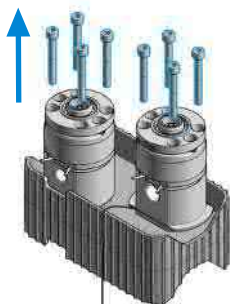


- 7 Place the two pump heads in the pump head holder.

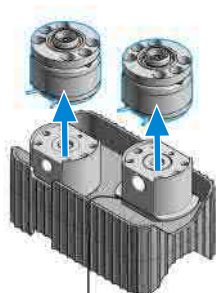


Maintenance**Pump Head Maintenance (Tool Free)**

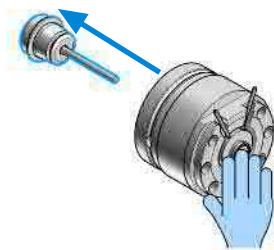
- 8 Remove the pump head screws from the back of the pump heads.



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



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

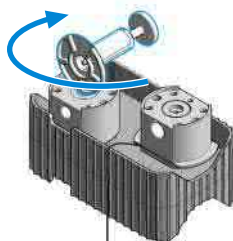


Maintenance**Pump Head Maintenance (Tool Free)**

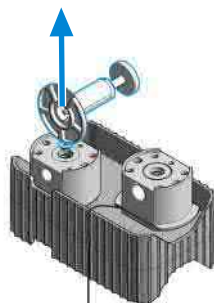
11 Remove the seal holder from the spring housing.



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.



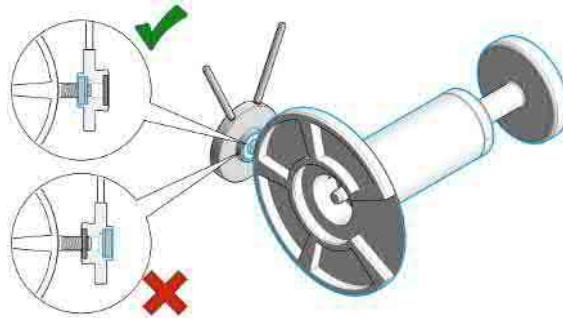
14 Repeat for the other pump chamber.

Maintenance**Pump Head Maintenance (Tool Free)**

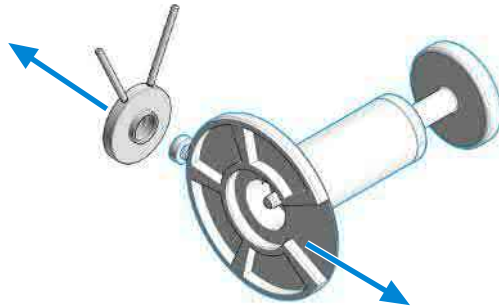
15 Screw the pin of the Seal Handling Device into the wash seal.

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.



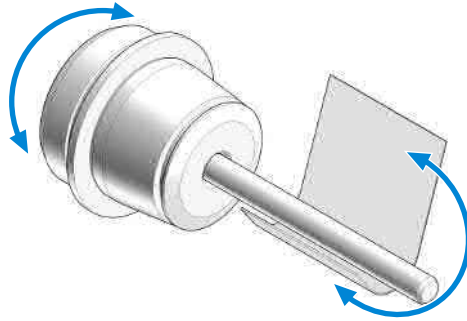
16 Pull out the Seal Handling Device with the wash seal in a straight movement with only gentle force.



17 Repeat for the other seal holder.

Maintenance**Pump Head Maintenance (Tool Free)**

18 Clean the piston with abrasive paper.



19 Rinse pump heads and pistons with isopropanol.

Replace the Heat Exchanger (G7104A)

Tools required	Qty.	p/n	Description
	1		Wrench, 19 mm
	1	 5023-2501	Screwdriver Torx-T10
	1	 5067-5688	Torque wrench 1 - 25 Nm with 14 mm wrench
	1	 G4220-20013	4 mm hex bit
	1	 G4220-20015	Adapter ¼ in square to hex
	1	 G4220-20041	Bit Torx 10x25 mm
Parts required	Qty.	p/n	Description
	1	 G4220-81013	Heat Exchanger Channel A

Preparations

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

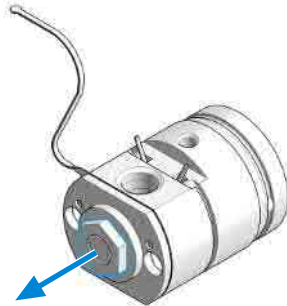
CAUTION

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.

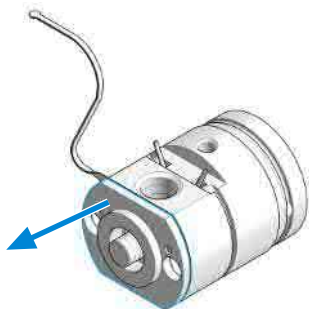
- The heat exchanger does not need to be removed for pump head maintenance.

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

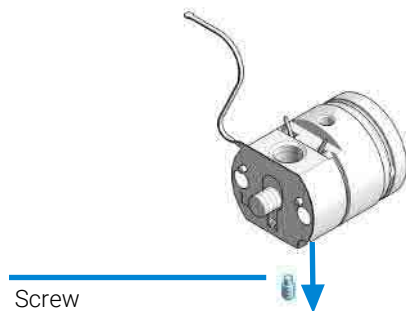


Maintenance**Pump Head Maintenance (Tool Free)**

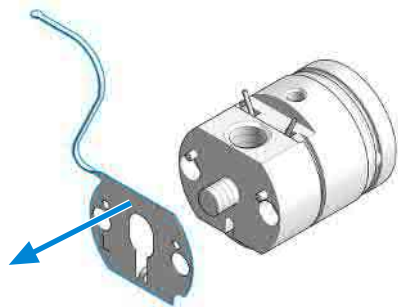
- 2 Remove the front plate.



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

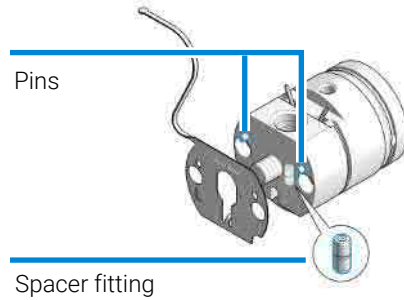


- 4 Lift out the heat exchanger.

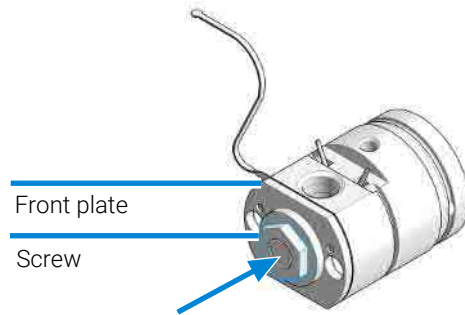


Maintenance**Pump Head Maintenance (Tool Free)**

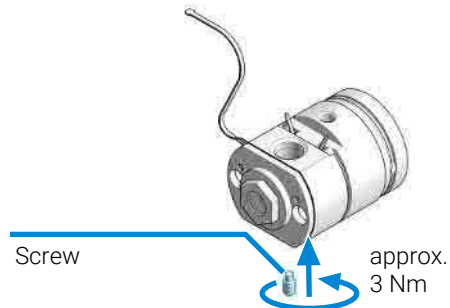
- 5 If removed, first insert the spacer fitting. Then insert the new heat exchanger to the opening in the pump head and lift it over the pins.



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



- 7 Insert and fix the screw.



Replace the Heat Exchanger (G7131A)




For biocompatible modules use bio / biocompatible parts only!

Do not mix with bio-inert parts.

Tools required

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

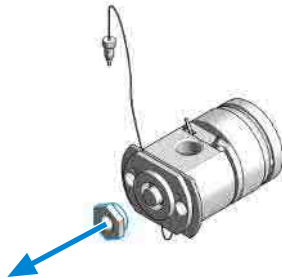
Parts required

Qty.	p/n	Description
1	 G7131-60005	Heat Exchanger for biocompatible Pump

Preparations

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

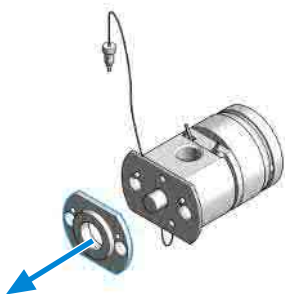
- 1 Remove the 19 mm screw at the front of the secondary pump head.



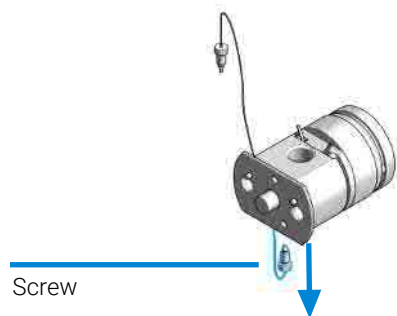
Maintenance

Pump Head Maintenance (Tool Free)

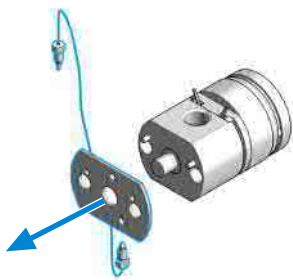
- 2 Remove the front plate.



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

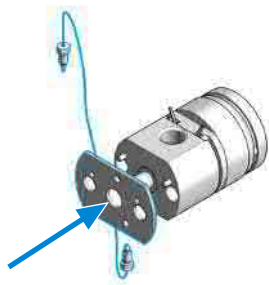


- 4 Lift out the heat exchanger.

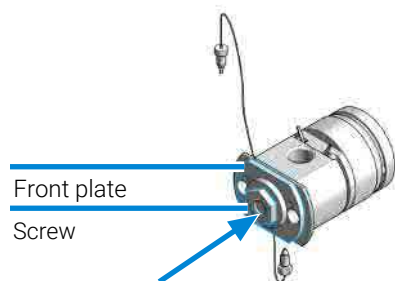


Maintenance**Pump Head Maintenance (Tool Free)**

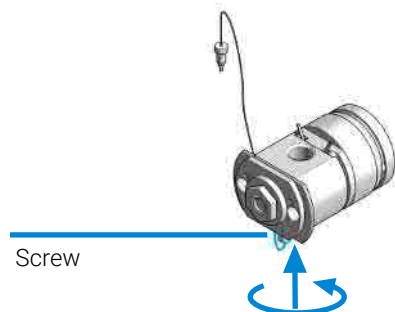
- 5 Insert the new heat exchanger into the opening of the pump head and lift it over the pins.



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












- 7 Insert and fix the screw.



Assemble Pump Heads (G7104A)

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

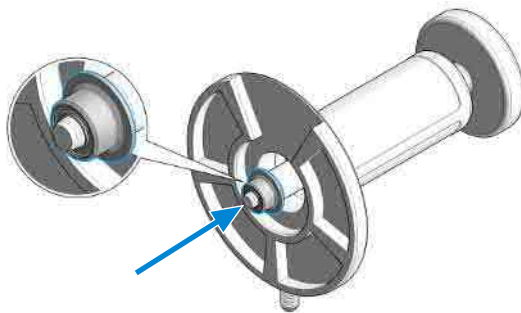
Exchanging seals is exemplarily shown for the primary pump head, but works in the same way for the secondary pump head.

Tools required	Qty.	p/n	Description
	1	 G7120-68708	HPLC System Tool Kit-Infinity-II
	1	 5067-5688	Torque wrench 1 - 25 Nm with 14 mm wrench
	1	 G4220-20013	4 mm hex bit
	1	 G4220-20015	Adapter ¼ in square to hex
	1	 G4220-20041	Bit Torx 10x25 mm
	1	 5043-1400	Pump Head Holder
	1	 5067-6197	Seal Handling Device
	1		Isopropanol
Parts required	Qty.	p/n	Description
	2	 0905-1719	Metering Seal, 100 µL
	2	 0905-1175	Wash seal (PTFE)

NOTE

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

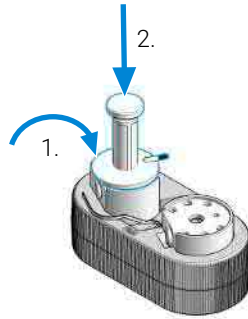
- 1 Lubricate the seals, the seal holder, and the pump chambers with isopropanol.
- 2 Place the piston seal onto the designated nose of the Seal Handling Device. The metal spring of the piston seal must be visible.



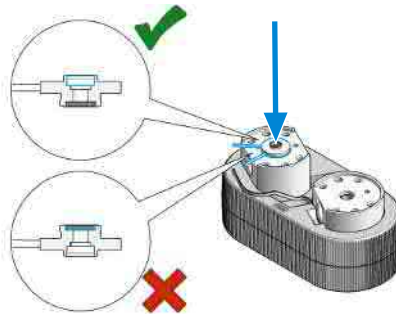
Maintenance

Pump Head Maintenance (Tool Free)

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



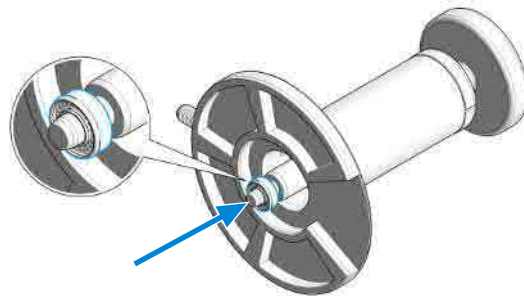
- 4 Repeat for the other pump chamber.
- 5 Place the seal holder onto the pump chamber.



NOTE

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

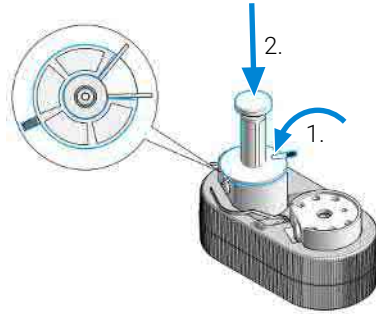
- 6 Place the wash seal onto the designated nose of the Seal Handling Device. The metal spring of the wash seal must be visible.



Maintenance

Pump Head Maintenance (Tool Free)

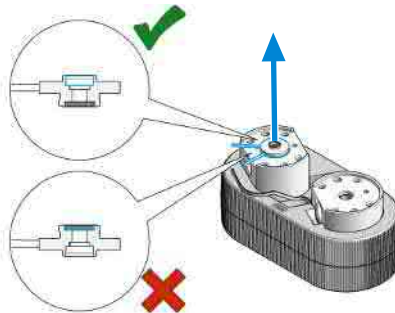
- 7 Take care that the Seal Handling Device is seating flush and press the wash seal into the seal holder.



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.

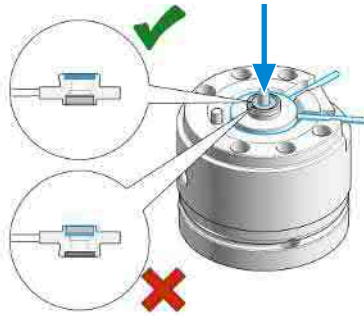


- 10 Lubricate the piston with isopropanol and place it into the spring housing.



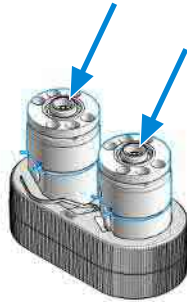
Maintenance**Pump Head Maintenance (Tool Free)**

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.

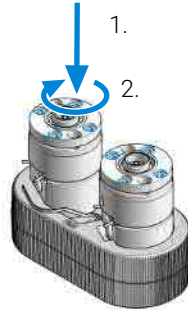
12 Place the assembled spring housings on top of the pump chambers.

**NOTE**

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

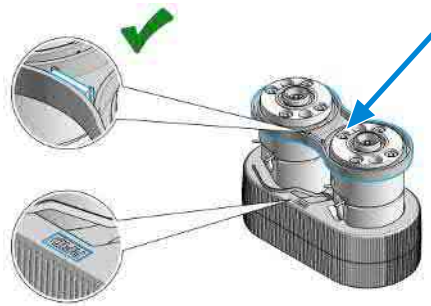
Maintenance**Pump Head Maintenance (Tool Free)**

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.

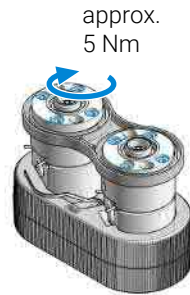
14 Mind the correct orientation of the link plate and click it into place.

**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.

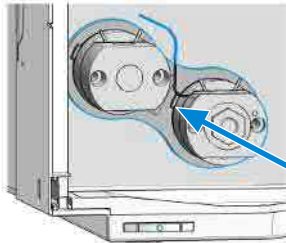
Maintenance**Pump Head Maintenance (Tool Free)**

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

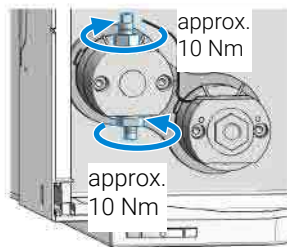
**NOTE**

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!

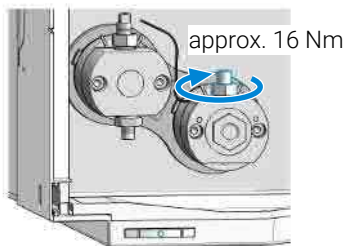


- 17** Screw in the inlet valve and the outlet valve and fix them with a torque wrench set to approx. 10 Nm.

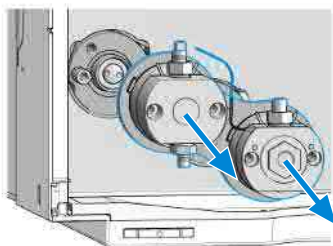


Maintenance**Pump Head Maintenance (Tool Free)**

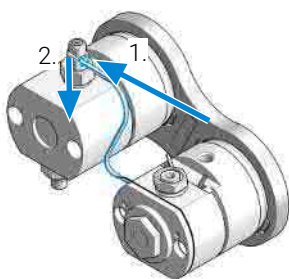
- 18** Binary/High-Speed Pumps only: Screw in the high pressure filter and fix it with a torque wrench set to approx. 16 Nm.



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

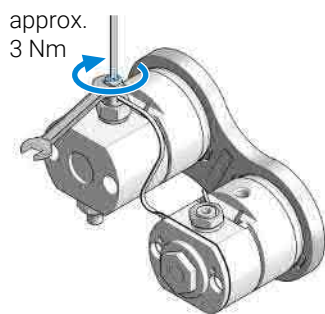


- 20** Position the entrance slit for the heat exchanger capillary to face exactly to it, and then seat the heat exchanger capillary back into the outlet valve by moving it into the valve and pressing it down.

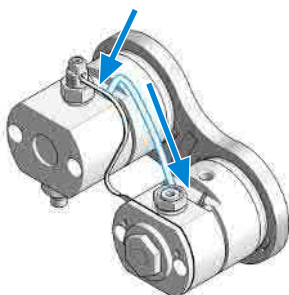


Maintenance**Pump Head Maintenance (Tool Free)**

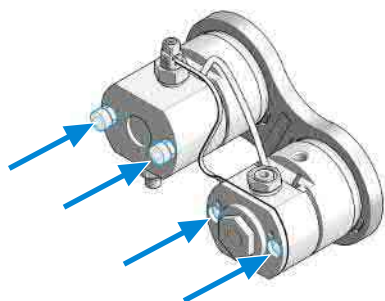
- 21 Counter the outlet valve and tighten the lock screw of the heat exchanger capillary with a torque wrench set to approx. 3 Nm.



- 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 biocompatible modules use bio / biocompatible parts only!
 Do not mix with bio-inert parts.

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	Qty.	p/n	Description
	1	 G7120-68708	HPLC System Tool Kit-Infinity-II
	1	 G4220-20013	4 mm hex bit
	1	 G4220-20015	Adapter ¼ in square to hex
	1	 G4220-20041	Bit Torx 10x25 mm
	1	 G7132-42000	Bio Pump Head Holder
	1	 5067-6197	Seal Handling Device
	1		Isopropanol
Parts required	Qty.	p/n	Description
	2	 G7131-20009	Metering Seal PTFE (Bio), 100 µL
	2	 0905-1731	Bio-Inert Wash Seal

NOTE

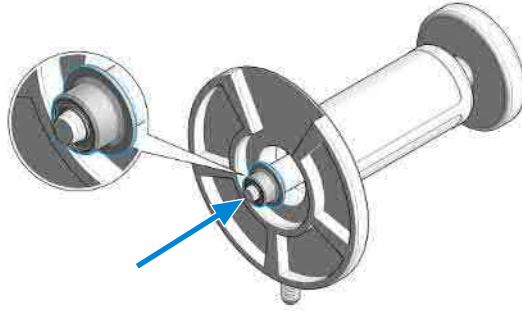
Seals must be exchanged in both primary and secondary pump heads.

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

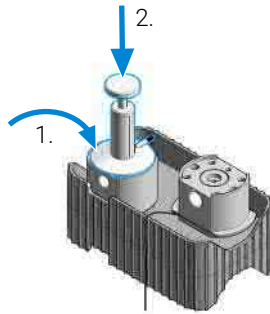
Maintenance

Pump Head Maintenance (Tool Free)

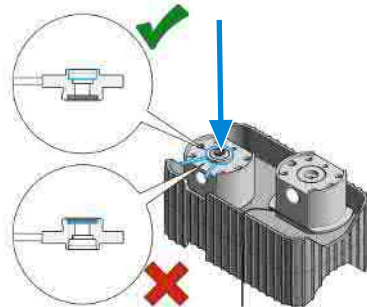
- Place the piston seal onto the designated nose of the Seal Handling Device. The metal spring of the piston seal must be visible.



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



- Repeat for the other pump chamber.
- Place the seal holder onto the pump chamber.

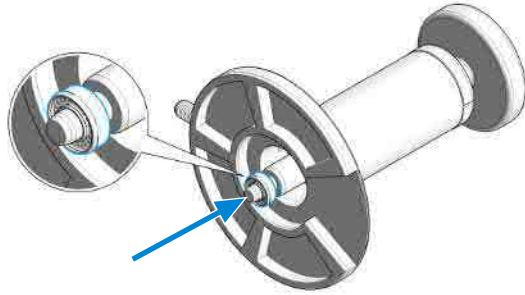


NOTE

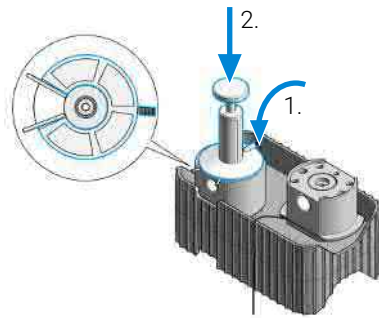
Mind the correct orientation of the seal holder. The backup ring must face down.

Maintenance**Pump Head Maintenance (Tool Free)**

- 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.

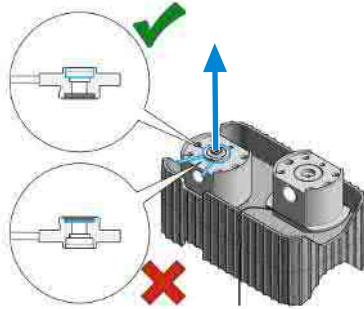
**NOTE**

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

- 8 Repeat for the other seal holder.

Maintenance**Pump Head Maintenance (Tool Free)**

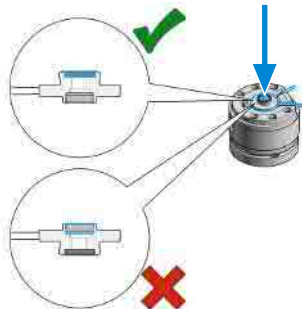
- 9 Remove the seal holders from the pump chambers.



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



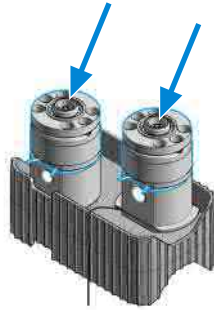
- 11 Place the seal holder onto the spring housing.

**NOTE**

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

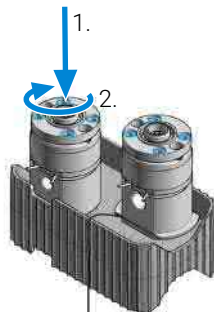
Maintenance**Pump Head Maintenance (Tool Free)**

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.

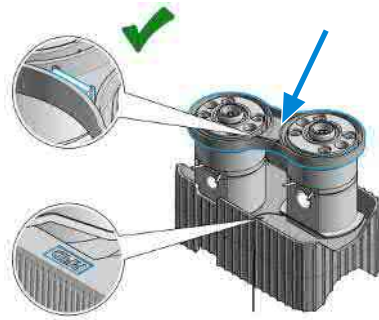
**NOTE**

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.

Maintenance

Pump Head Maintenance (Tool Free)

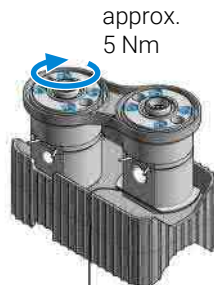
14 Mind the correct orientation of the link plate and click it into place.



NOTE

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

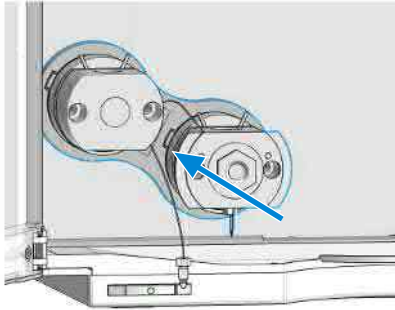
15 Tighten the pump head screws with a torque wrench set to approx. 5 Nm in a crosswise manner.



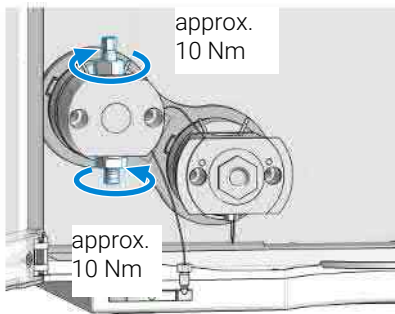
When the wrench clicks, the set torque is reached. Do not overtighten the screws.

Maintenance**Pump Head Maintenance (Tool Free)**

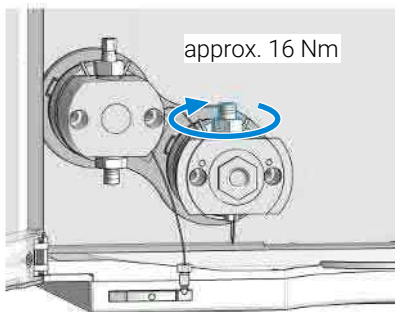
16 Mount the pump head to the module. Do not fix the screws at this stage!



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

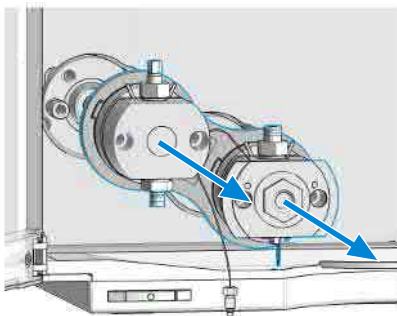


18 Binary/High-Speed Pumps only: Screw in the high-pressure filter and fix it with a torque wrench set to approximately 16 Nm.

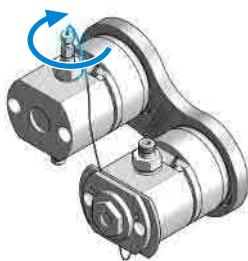


Maintenance**Pump Head Maintenance (Tool Free)**

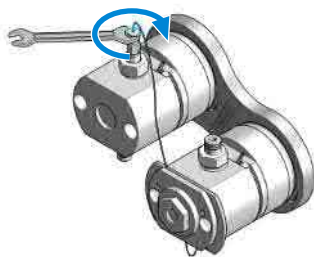
19 Remove the pump head from the module again.



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

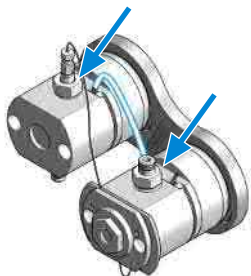


21 Counter the outlet valve and tighten the lock screw of the heat exchanger capillary with a torque wrench set to approximately 3 Nm.

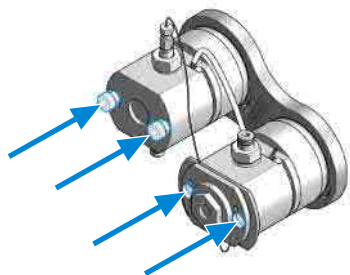


Maintenance**Pump Head Maintenance (Tool Free)**

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.

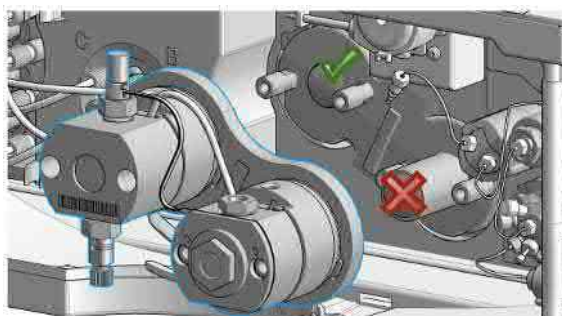


Install the Pump Head Assembly (G7104A)

Tools required

Qty.	p/n	Description
1	 G7120-68708	HPLC System Tool Kit-Infinity-II
1	 5067-5688	Torque wrench 1 - 25 Nm with 14 mm wrench
1	 G4220-20013	4 mm hex bit
1	 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.

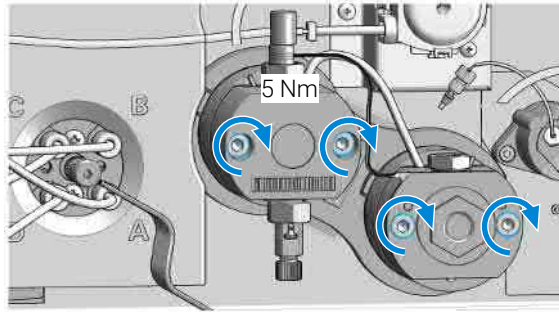


Install the Pump Head Assembly (G7104A)**CAUTION**

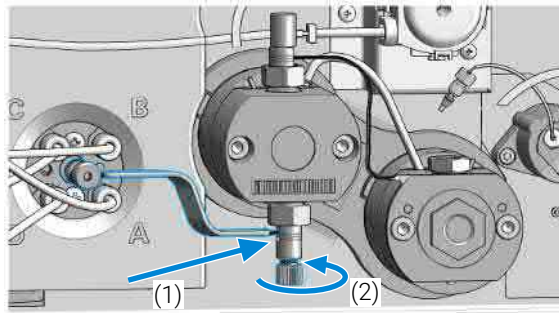
Damage to the pump head

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.

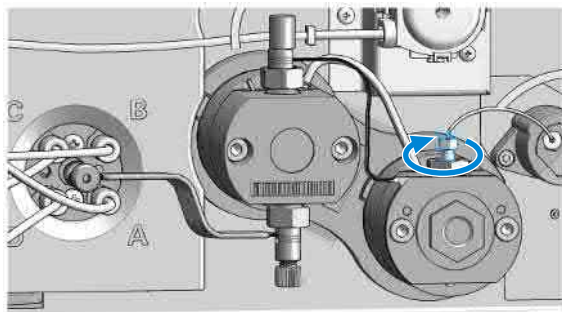


- 3 Insert the inlet weaver to the inlet valve (1). Fix the weaver with the plastic screw to the inlet valve (2).

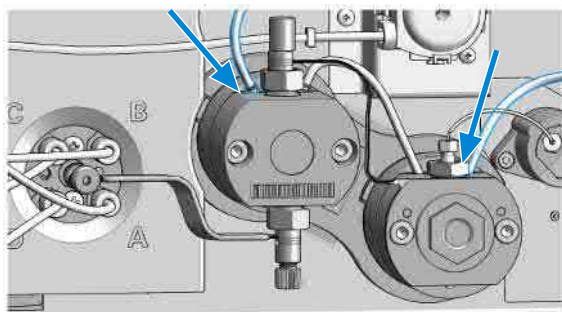


Maintenance**Install the Pump Head Assembly (G7104A)**

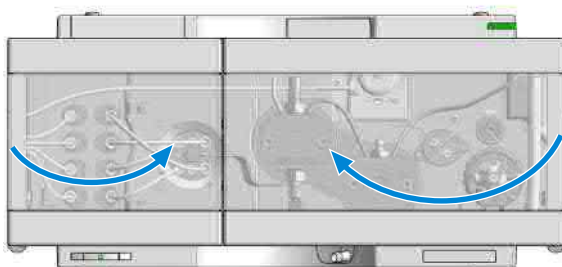
- 4 Connect the capillary from the outlet adapter on the secondary pump head to the pressure sensor.



- 5 Connect the seal wash tubes.







- 6 Close the doors.



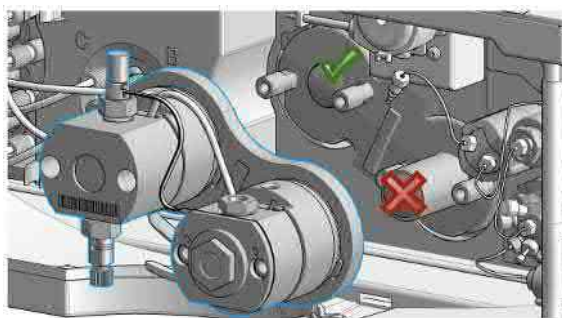
- 7 Perform a Pump Leak Rate Test.

Install the Pump Head Assembly (G7131A)

Tools required

Qty.	p/n	Description
1	 G7120-68708	HPLC System Tool Kit-Infinity-II
1	 5067-5688	Torque wrench 1 - 25 Nm with 14 mm wrench
1	 G4220-20013	4 mm hex bit
1	 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.

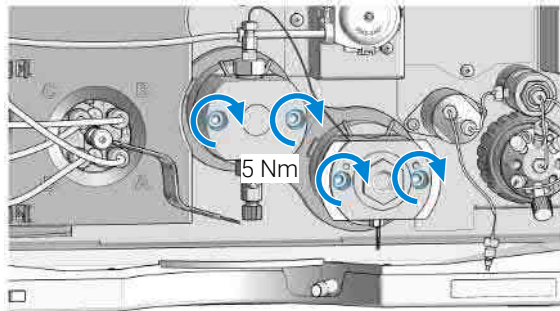


Install the Pump Head Assembly (G7131A)**CAUTION**

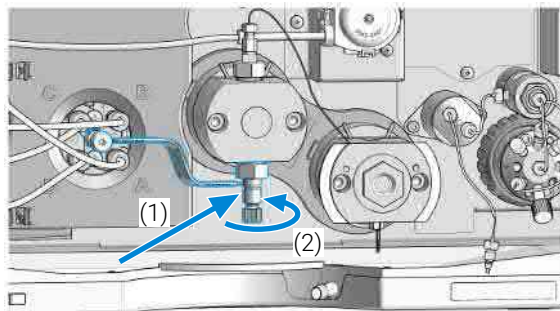
Damage to the pump head

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.

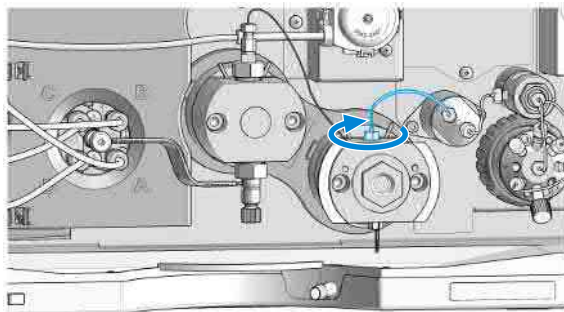


- 3 Insert the inlet weaver to the inlet valve (1). Fix the weaver with the plastic screw to the inlet valve (2).

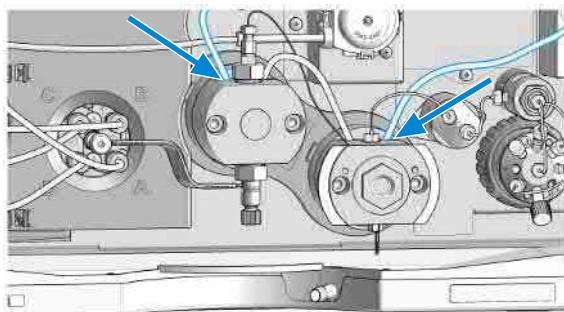


Maintenance**Install the Pump Head Assembly (G7131A)**

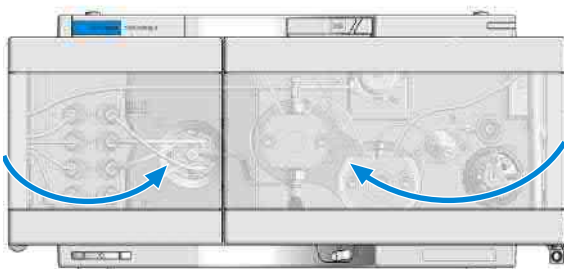
- 4 Connect the capillary from the outlet adapter on the secondary pump head to the pressure sensor.



- 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

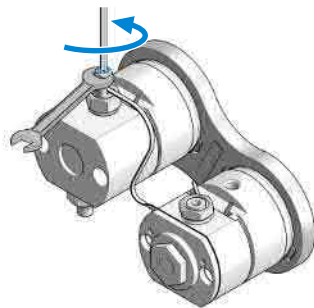
Qty.	p/n	Description
1		Wrench, 14 mm
1	 5067-5688	Torque wrench 1 - 25 Nm with 14 mm wrench
1	 G4220-20015	Adapter ¼ in square to hex
1	 G4220-20041	Bit Torx 10x25 mm

Parts required

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

Preparations

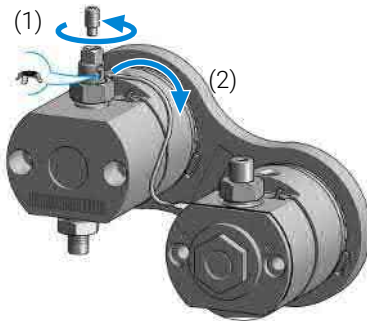
- Switch off pump at the main power switch
 - Open the doors
 - Use an optional solvent shutoff valve or lift up solvent filters inside solvent bottles for avoiding leakages
 - Remove the pump head from the module
- 1 Remove the cap from the outlet valve.
 - 2 Counter the outlet valve while opening the lock screw of the heat exchanger capillary.



Maintenance

Replace the Outlet Valve (G7104A)

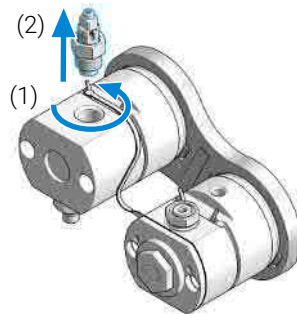
- 3 Remove the heat exchanger capillary by pushing the connector up and pulling it out of the valve.



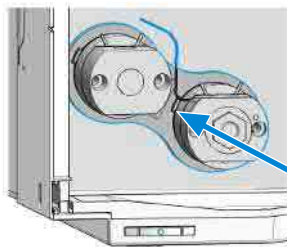
NOTE

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).

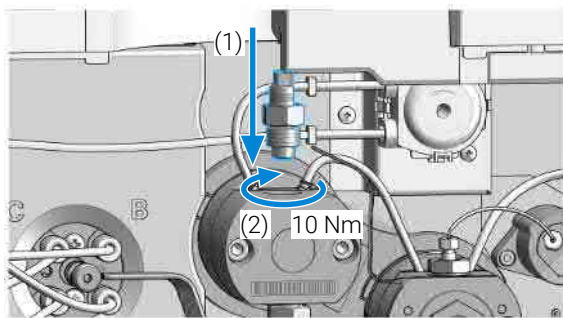


- 5 Mount the pump head to the module. Do not fix the screws at this stage!

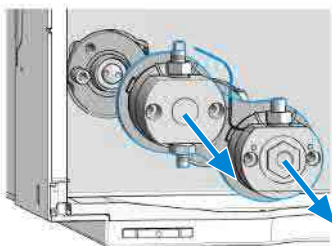


Maintenance**Replace the Outlet Valve (G7104A)**

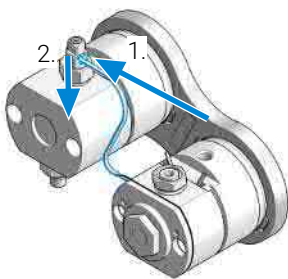
- 6 Insert the new outlet valve and tighten it using a torque wrench with a 14 mm bit set to 10 Nm.



- 7 Remove the pump head from the module again.

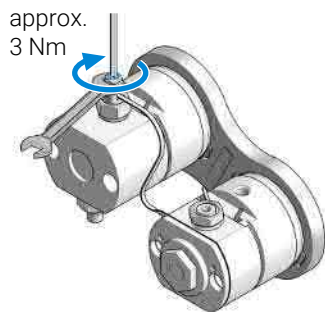


- 8 Position the entrance slit for the heat exchanger capillary to face exactly to it, and then seat the heat exchanger capillary back into the outlet valve by moving it into the valve and pressing it down.



Maintenance**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.




- 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

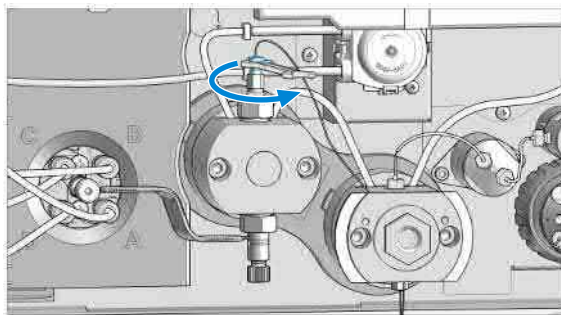
Qty.	p/n	Description
1	 8710-0510	Open-end wrench 1/4-5/16 inch
1		Spanner-double open ended 14 mm

Parts required

Qty.	p/n	Description
1	 G7131-60028	Outlet Valve biocompatible

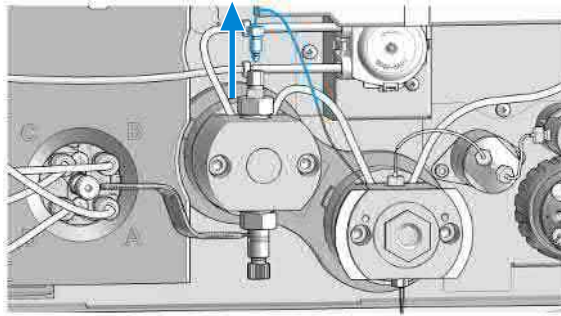
Preparations

- 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.



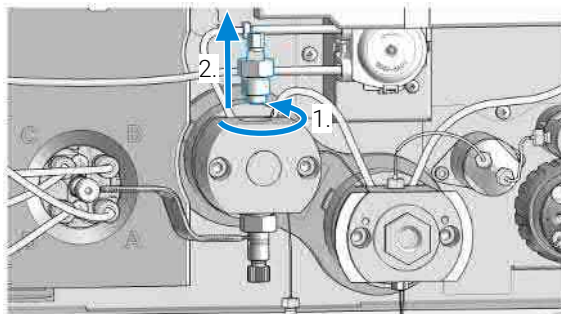
Maintenance**Replace the Outlet Valve (G7131A)**

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

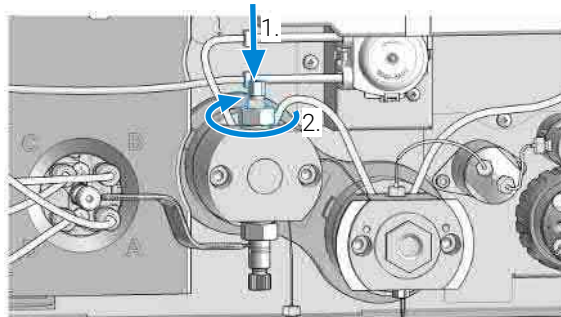
**NOTE**

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

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

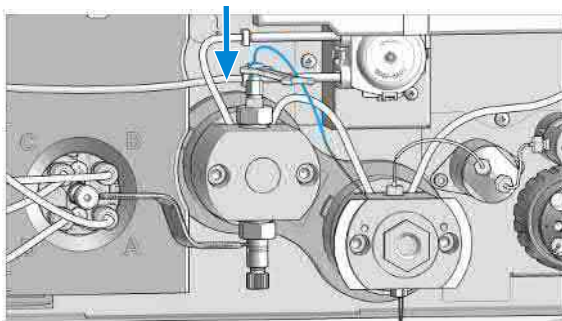


- 5 Insert the outlet valve into the pump head (1). Using a torque wrench, set approx. 10 Nm and close the outlet valve (2).

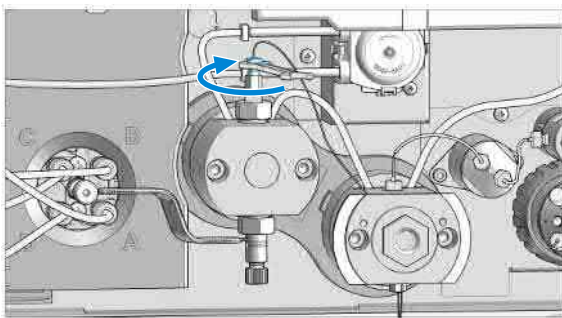


Maintenance**Replace the Outlet Valve (G7131A)**

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



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

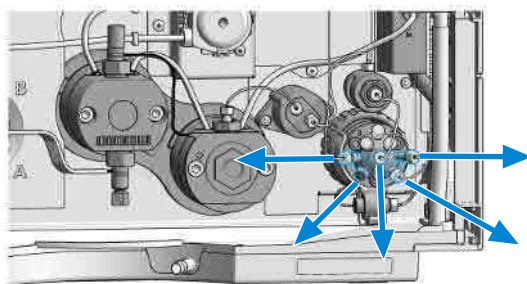


- 8 Reconnect all hydraulic connections, and power up the pump.
- 9 Open the shutoff valves and purge the system to remove air.

Replace the Multipurpose Valve

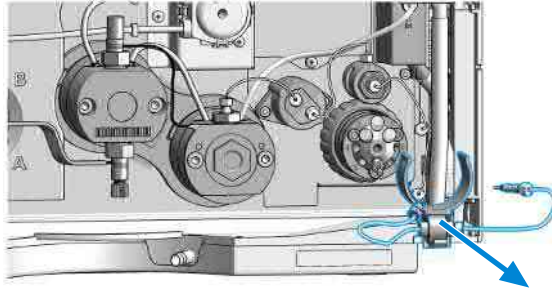
Tools required	Qty.	p/n	Description
	1	 5023-2502	Hex driver SW-6.35, slitted
Parts required	Qty.	p/n	Description
	1	 0100-1259	Plug-Screw 1032- Fitting
	1	 01080-83202	Blank nut
	1	 5067-4237	6-column selector valve head, 1300 bar
	2	 5500-1253	Capillary ST 0.17 mm x 130 mm SX/S (optional)
	1	 5067-6704	Multipurpose Valve Biocompatible
	1	 5043-0277	PEEK blank nut for bio-compatible devices
	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.

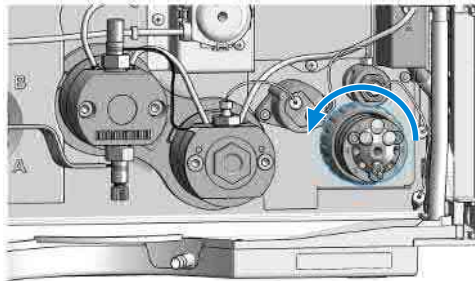


Maintenance**Replace the Multipurpose Valve**

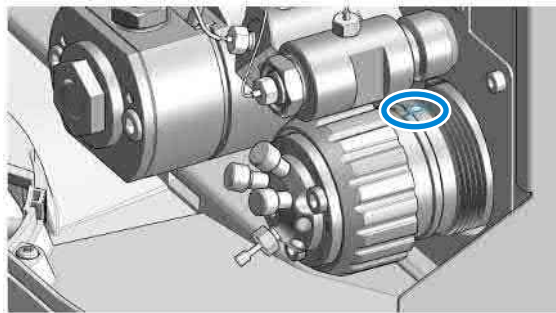
- 2 Remove the clamp with the inline filter (if installed).



- 3 Unscrew the black union nut and remove the head of the purge valve by pulling it to the front.

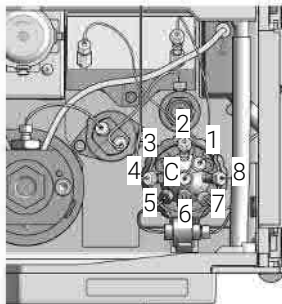


- 4 Put the new valve head onto the valve drive such that the lobe fits to the groove. Screw the valve head onto the valve drive using the union nut.



Maintenance

Replace the Multipurpose Valve









- 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 (5067-5416 (Capillary ST 0.17 x 120 mm, SLV/SV) or 5500-1284 (Capillary MP35N 0.17 mm x 120 mm SI/SX)).

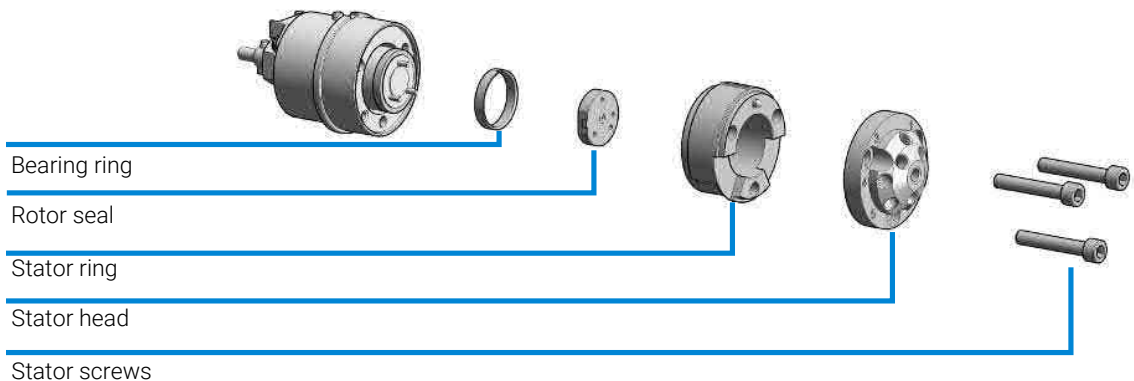
If the optional Jet Weaver is not installed, connect ports 1 and 2 with a capillary (5500-1253 (Capillary ST 0.17 mm x 130 mm SX/S) or).

Replace Parts of the Multipurpose Valve (G7104A)





Tools required	Qty.	p/n	Description
	1	 8710-2394	Hex key 9/64 inch 15 cm long T-handle
Parts required	Qty.	p/n	Description
	1	 1535-4045	Bearing ring
	1	 5068-0202	Rotor seal, Multipurpose Valve, PEEK, 1300 bar
	1	 5068-0120	Stator ring
	1	 5068-0001	Stator head
	1	 1535-4857	Stator screws, 10/pk

Preparations

- Remove all capillary connections from the Multipurpose Valve.
- Use the 9/64 inch hex key for opening the valve head.
 - Replace parts as required.
 - Reassemble the valve head mounted to the valve drive.

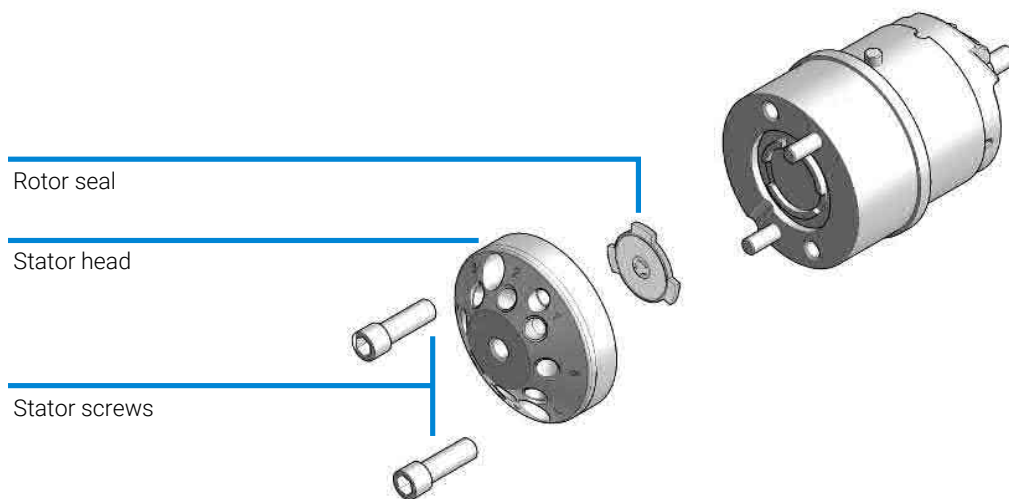


Replace Parts of the Multipurpose Valve (G7131A)

Tools required	Qty.	p/n	Description
	1	 8710-2394	Hex key 9/64 inch 15 cm long T-handle
Parts required	Qty.	p/n	Description
	1	 5068-0379	Rotor Seal Biocompatible, Multipurpose Valve Biocompatible, PEEK, 1300 bar
	1	 5068-0378	Stator head biocompatible
	1	 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.

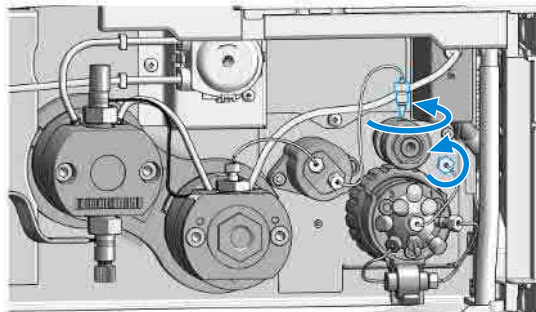
Tools required

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

Parts required

Qty.	p/n	Description
1	G4204-60004	Outlet filter Quaternary Pump/Flexible Pump , OR
1	5067-5716	Frit for 1290 pump outlet filter (2/pk) (amount needed: 1 frit/pump head assembly) , OR
1	G7131-60004	Outlet Filter Flex Biocompatible , OR
1	5320-0048	Frit for pump outlet filter biocompatible 2/pk

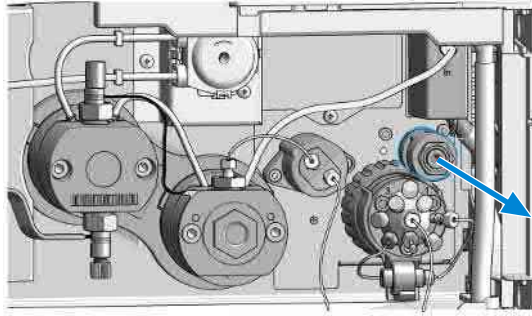
- 1 Remove the capillary from the high pressure outlet filter to the pressure sensor (1) and from the high pressure outlet filter to the Multipurpose valve (2).



Maintenance

Replace the High Pressure Outlet Filter or Filter Frit

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



- 3 Unscrew the high pressure outlet filter.



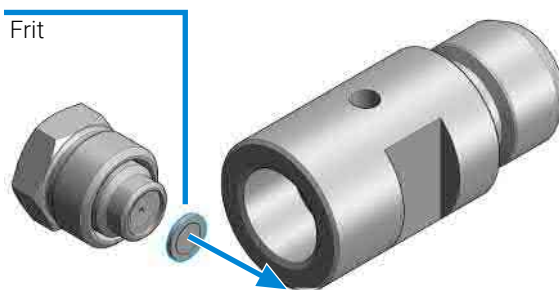
WARNING

Sharp blade

Risk of cutting with the knife.

- Be careful when handling the knife.

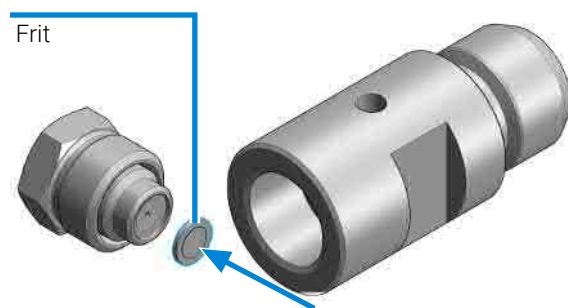
- 4 Remove the filter frit with the sharp side of the blade of a knife.



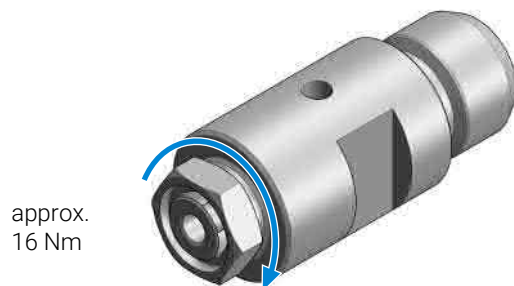
Maintenance

Replace the High Pressure Outlet Filter or Filter Frit

- 5 Insert new filter frit.

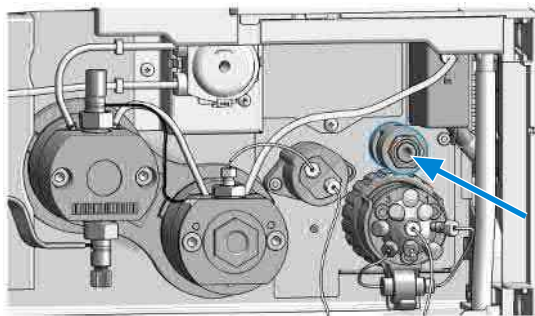


- 6 Reassemble the high pressure outlet filter (approx. 16 Nm).

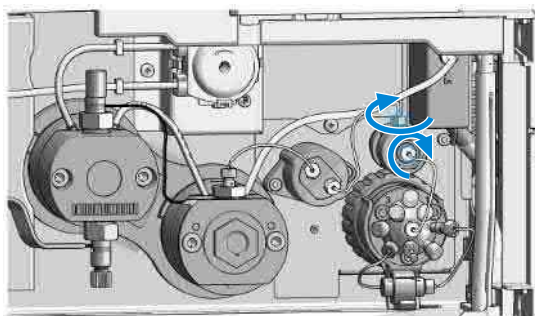


Maintenance**Replace the High Pressure Outlet Filter or Filter Frit**




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



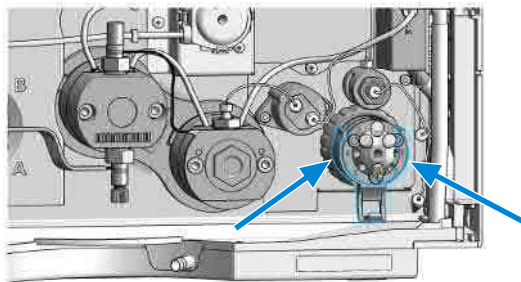
- 8 Mount the capillary connection to the pressure sensor (1) and to the Multipurpose valve (2).



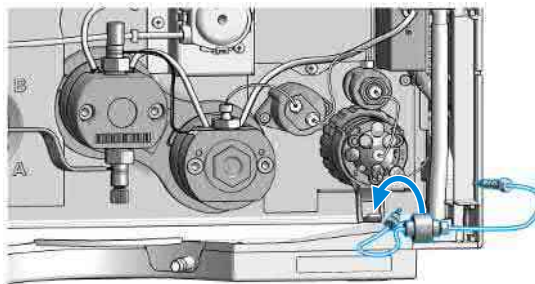
Install the Inline Filter

Tools required	Qty.	p/n	Description
	1	 8710-0510	Open-end wrench 1/4-5/16 inch
Parts required	Qty.	p/n	Description
	1	 G7104-68000	Inline Filter Upgrade Kit , OR
	1	 G7131-68000	Inline Filter Upgrade Kit Biocompatible
Preparations	<ul style="list-style-type: none"> • Turn the pump off. 		

- 1 Remove the capillary between ports 5 and 8 from the Multipurpose Valve.
- 2 Clip the inline filter clamp to the Multipurpose Valve.



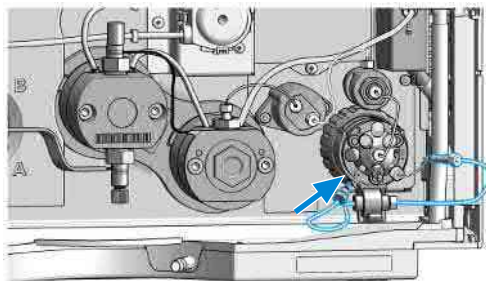
- 3 Connect the 90 mm capillary (part of the upgrade kit) to the filter outlet.
- 4 Fix the inline filter to the clamp.



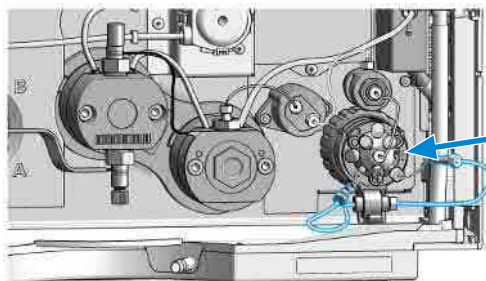
Maintenance

Install the Inline Filter



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



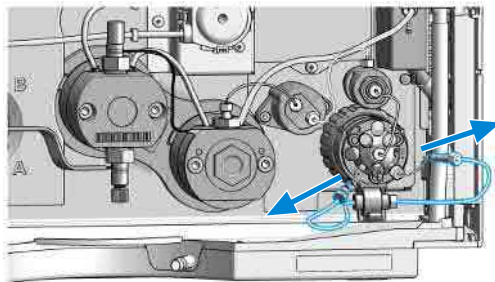
- 6 Install the removable capillary of the inline filter to port 8 of the Multipurpose Valve.



Remove the Inline Filter

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

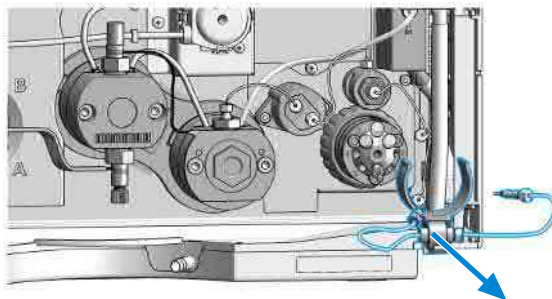
1 Remove the capillaries from the Multipurpose Valve to the inline filter.



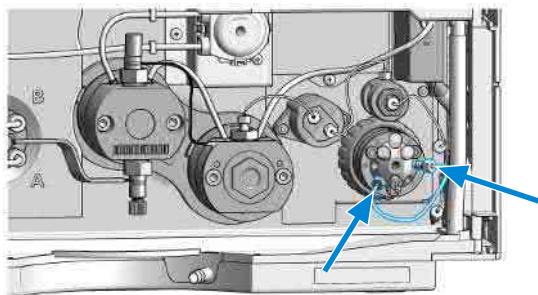
Maintenance

Remove 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	Qty.	p/n	Description	
	1	 8710-0510		Open-end wrench 1/4-5/16 inch
Parts required	Qty.	p/n	Description	
	1	 5023-0271		Frit 0.3 µm for inline filter, 5/pk
	1	 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.

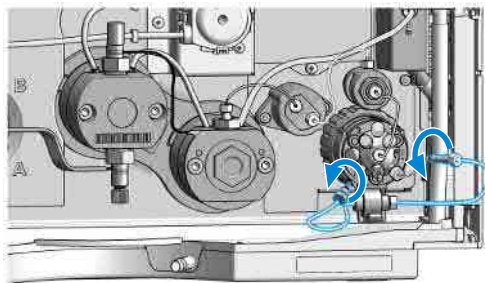
The size/position of this capillary in its fitting is incompatible, so it may get stuck irreversibly to the valve.

- 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 5067-5416 (Capillary ST 0.17 x 120 mm, SLV/SV) or 5500-1284 (Capillary MP35N 0.17 mm x 120 mm SI/SX) 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.

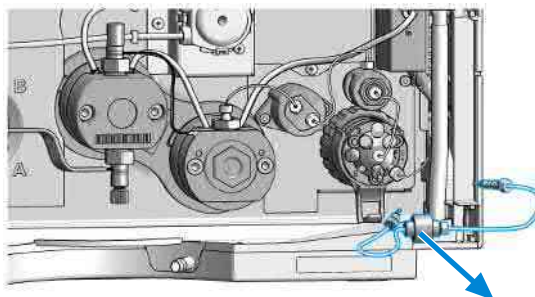
- 1 Remove the capillaries from the Multi Purpose Valve to the inline filter.



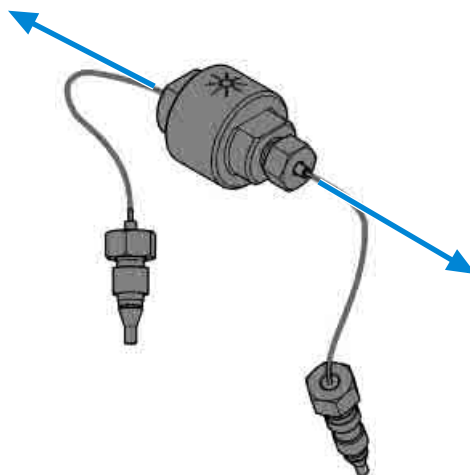
Maintenance

Replace Parts of the Inline Filter

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

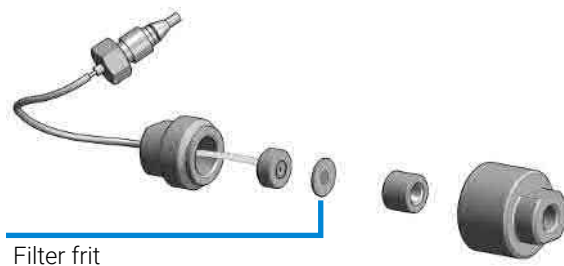


- 3 Use two 5/16 wrenches for opening the inline filter.

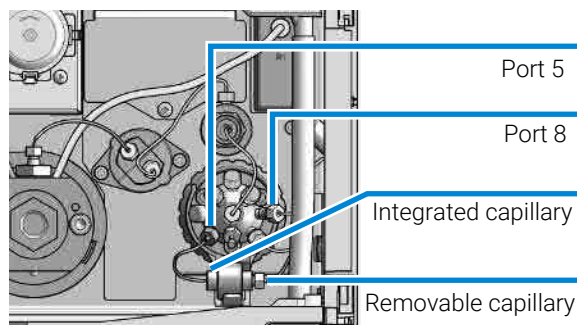


Maintenance**Replace Parts of the Inline Filter**

- 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.

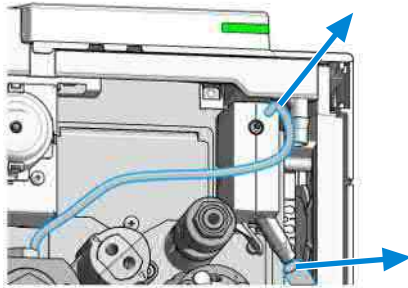


Replace the Seal Wash Sensor

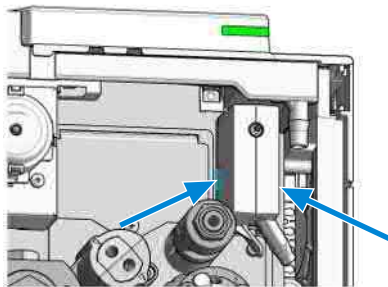
Parts required	Qty.	p/n	Description
	1	 5067-6172	Seal Wash Sensor Pre Assembly

Preparations

- Shut-down the pump.
 - Remove the seal wash tubing from the seal wash solvent bottle.
- 1 Remove the solvent inlet and outlet tubes from the seal wash sensor.



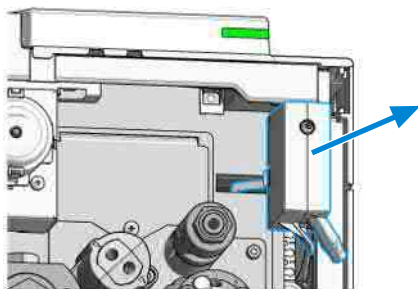
- 2 Press at the sides of the seal wash sensor.



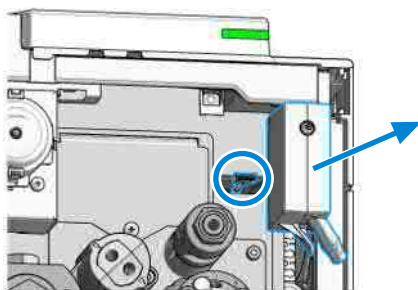
Maintenance

Replace the Seal Wash Sensor

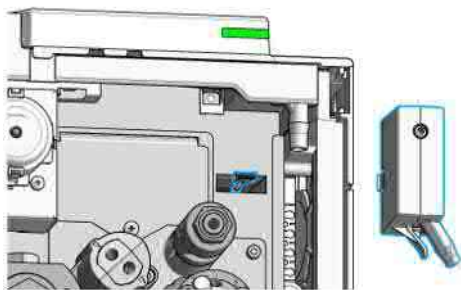
- 3 Remove the seal wash sensor from the module chassis.



- 4 Remove the cable.



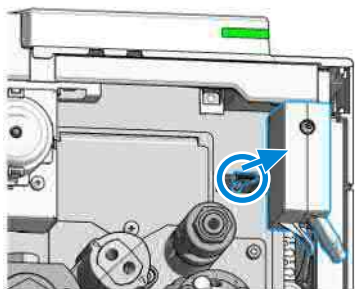
- 5 Remove the seal wash sensor completely.



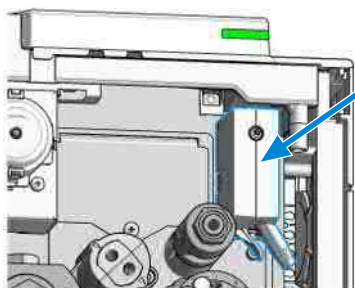
Maintenance

Replace the Seal Wash Sensor

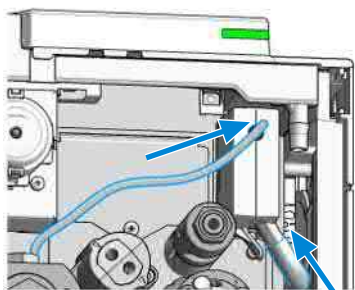
- 6 Connect the cable to the new seal wash sensor.



- 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

Install a newer firmware

- It fixes known problems of older versions, or
- It introduces new features, or
- It ensures keeping all systems at the same (validated) revision

When

Install an older firmware

- It ensures keeping all systems at the same (validated) revision, or
- It ensures compatibility after adding a new module to the system, or
- A third-party control software requires a special version

Software required

- Agilent Lab Advisor software

Tools required

Qty.	p/n	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

Qty.	p/n	Description
1	 9301-0411	Syringe, Plastic
1	 9301-1337	Syringe adapter
1	 G7104-44000	Transport protection foam (G7104A/C)
1	 G7131-98000	Transport protection foam (G7131A/C)

CAUTION

Mechanical damage

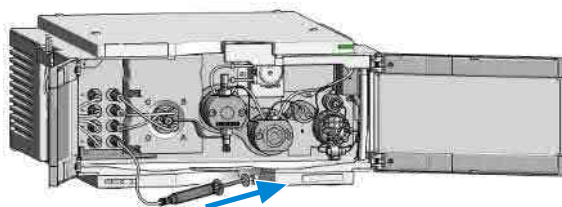
- For shipping the module, insert the Protective Foam to protect the module from mechanical damage.
- Be careful not to damage tubing or capillary connections while inserting the module in the Protective Foam.

- 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.

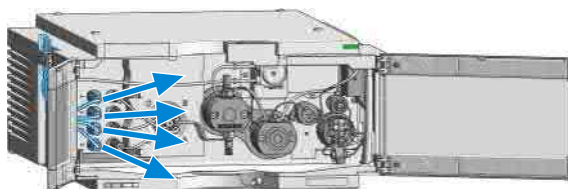
Maintenance

Prepare the Pump Module for Transport

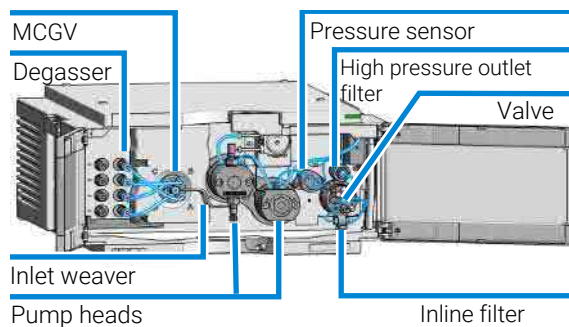
- 8 Disconnect the degasser outlet tubings at the MCGV one after another. Use a syringe for removing liquid from the degasser and the solvent tubings.



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

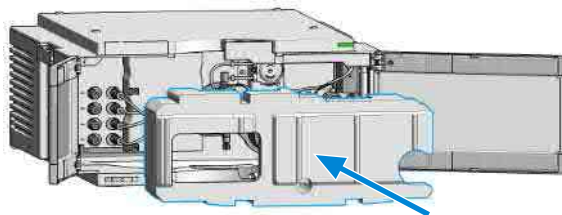


- 10 You may keep internal tubing and capillary connections.



Maintenance**Prepare the Pump Module for Transport**

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



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

9 Parts and Materials for Maintenance

This chapter provides information on parts for maintenance.

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HPLC System Tool Kit 322

Overview of Main Assemblies (G7104A)

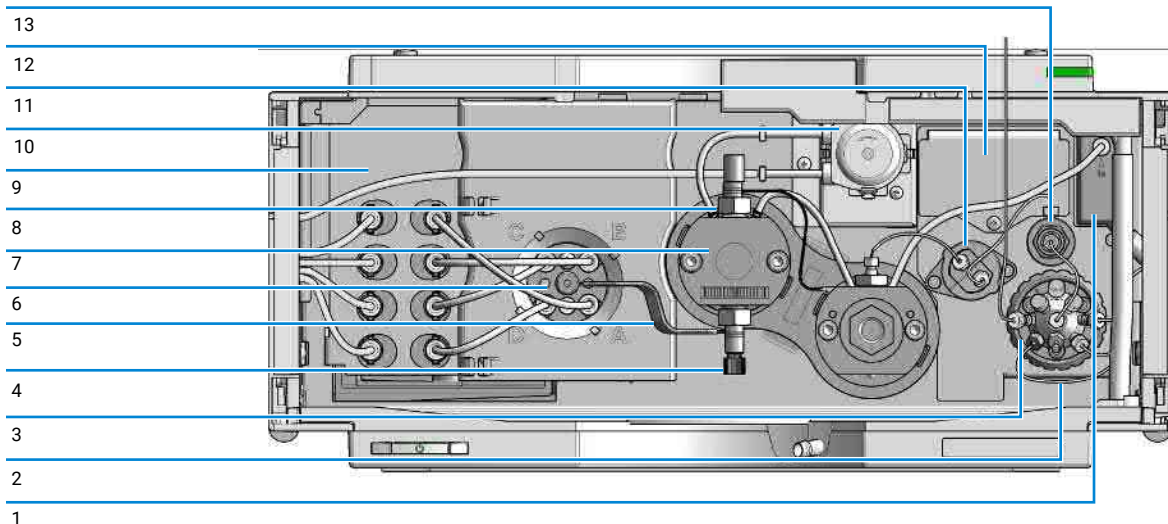




















Figure 24: Overview of main assemblies

#	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: stainless steel (optional)
	 5023-0271	Frit 0.3 µm for inline filter, 5/pk (optional)
	 G4204-40000	Clamp for Inline Filter (optional)
3	 5067-4237	6-column selector valve head, 1300 bar
4	 G4204-60022	Inlet Valve Quaternary Pump/Flexible Pump
5	 G4204-81090	Quaternary Pump/Flexible Pump Inlet Weaver Assembly
6	 G7111-67701	Four-Channel Gradient Valve (4CGV)
	 5041-8365	Blank plug for MCGV

Parts and Materials for Maintenance

Overview of Main Assemblies (G7104A)

#	p/n	Description
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 cartridge
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 1290 pump outlet filter (2/pk) (amount needed: 1 frit/pump head assembly)

Overview of Main Assemblies (G7131A)

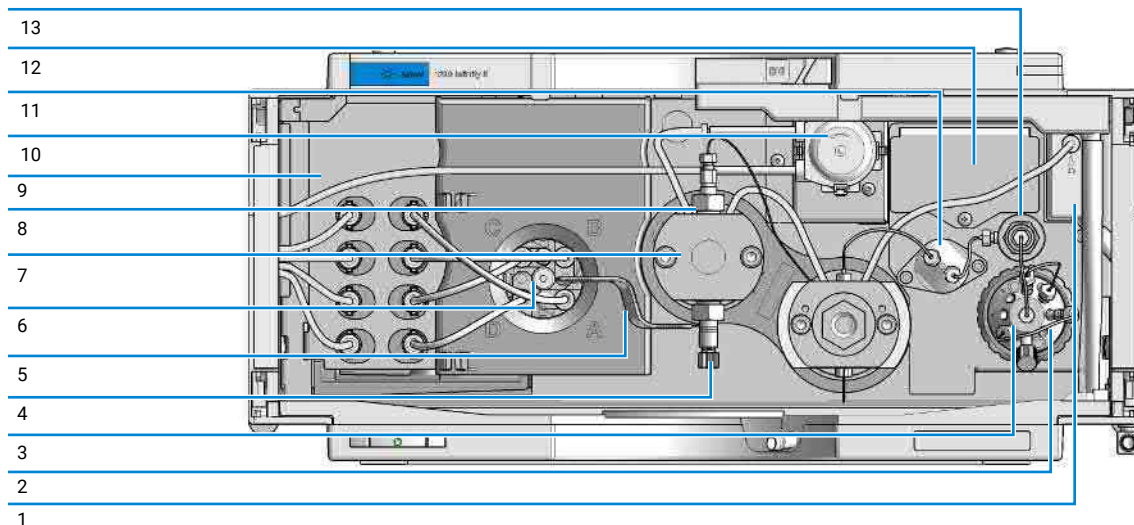




















Figure 25: Overview of main assemblies

#	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	Bio Inline Filter for Infinity II Bio Flexible Pumps
	 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	Four-Channel Gradient Valve (4CGV)
	 5041-8365	Blank plug for MCGV
7	 G7131-60300	Biocompatible Pump Head Flexible

Parts and Materials for Maintenance

Overview of Main Assemblies (G7131A)

#	p/n	Description
8	 G7131-60028	Outlet Valve biocompatible
9	 G1311-60070	Degasser 4 Channels for Quaternary Pump
10	 5065-4445	Peristaltic pump cartridge
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)

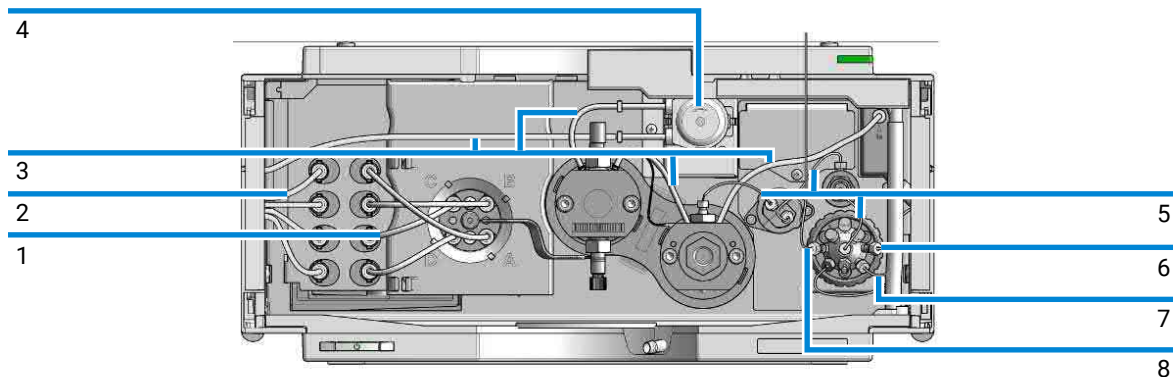





Figure 26: Flow connections of the pump

#	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	Silicone tubing, 1 mm i.d., 3 mm o.d., 5 m, re-order number
4	5065-4445	Peristaltic pump cartridge
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)

Parts and Materials for Maintenance

Flow Connections (G7104A)

#	p/n	Description
	 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)

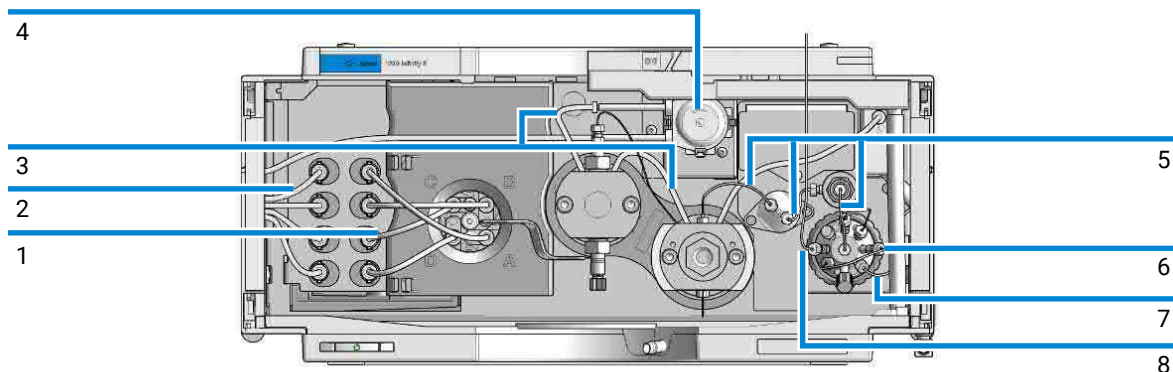




Figure 27: Flow connections of the pump

#	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	Silicone tubing, 1 mm i.d., 3 mm o.d., 5 m, re-order number
4	 5065-4445	Peristaltic pump cartridge
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)

Parts and Materials for Maintenance

Flow Connections (G7131A)

#	p/n	Description
	 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.

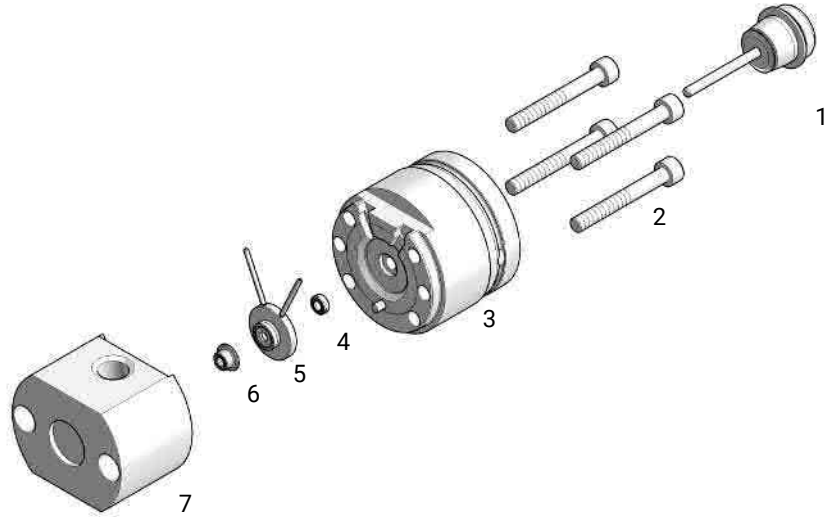
For parts information on other pump head types, please refer to *Agilent 1290 Infinity II Easy Maintenance Pump Head Technical Note (1290IF-IF2_EM-PumpHead_TN.pdf, SD-29000158)* and to *Agilent 1290 Infinity Pump Head Maintenance Technical Note (1290IF_PumpHeadMaintenance_TN.pdf, SD-29000403)*.

Pump Head Assembly Parts

G4204-60350 (Long Life Pump Head Quat)

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

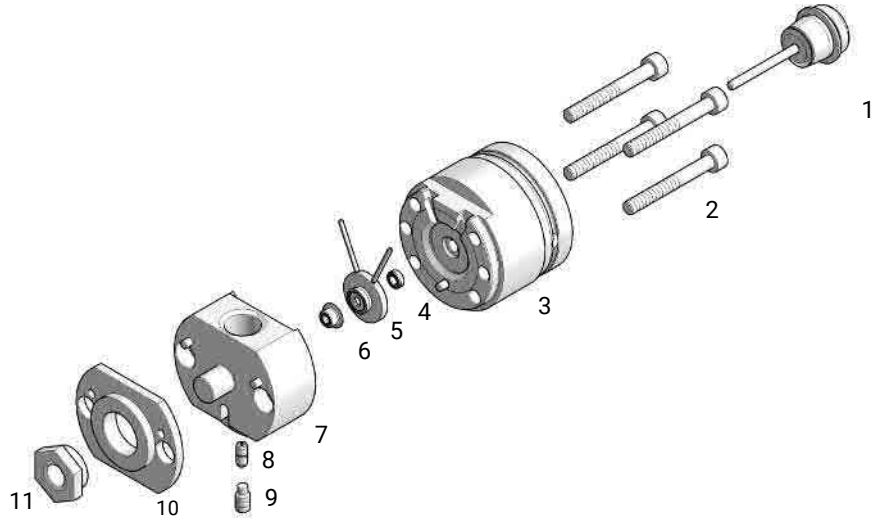
Primary Pump Head Parts



G4220-60661 (Primary Pump Head Assembly Pendulum)

#	p/n	Description
1	5067-5975	Plunger Assy ZrO2 LL
2	5810-0009	Screw M5x40 A4-80 Lubric Silver
3	G4220-60046	Preload-Support Assembly LL
4	0905-1175	Wash seal (PTFE)
5	G4220-60616	Seal Holder Integrated Assembly EM/LL
6	0905-1719	Metering Seal, 100 µL
7	G4220-60533	Body Head Primary EM/LL

Secondary Pump Head Parts



G4220-60660 (Secondary Pump Head Assembly Pendulum)

#	p/n	Description
1	5067-5975	Plunger Assy ZrO2 LL
2	5810-0009	Screw M5x40 A4-80 Lubric Silver
3	G4220-60046	Preload-Support Assembly LL
4	0905-1175	Wash seal (PTFE)
5	G4220-60616	Seal Holder Integrated Assembly EM/LL
6	0905-1719	Metering Seal, 100 µL
7	G4220-25513	Body Head Secondary EM/LL
8	G4220-20001	Spacer Fitting
9	5023-3119	Screw M5x10 Planar Front
10	G4220-20000	LID
11	G4220-20003	Pump Head Screw

Pump Heads (G7131A)

Pump Head Assembly Parts

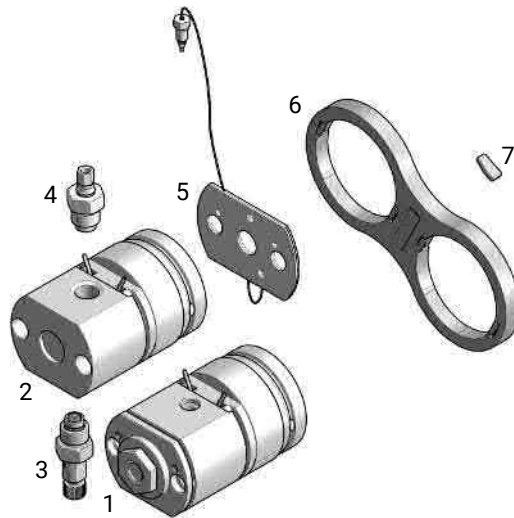







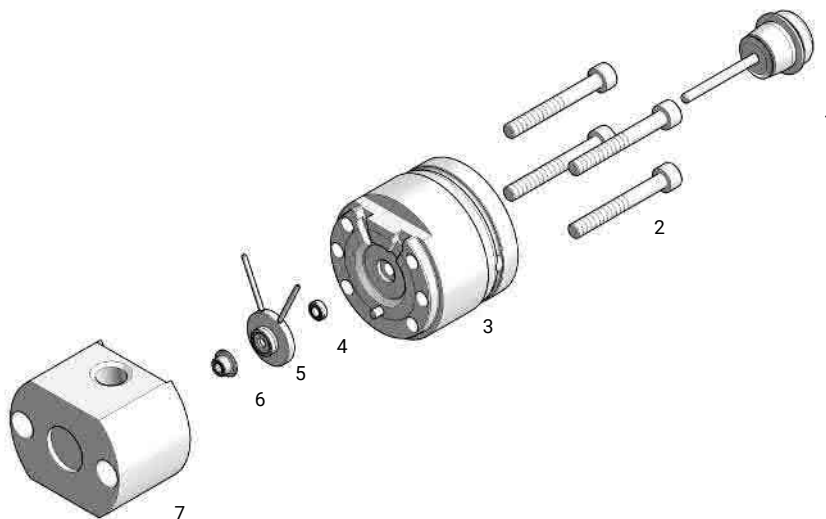


Figure 28: Pump head assembly parts

G7131-60300 (Biocompatible Pump Head Flexible)

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

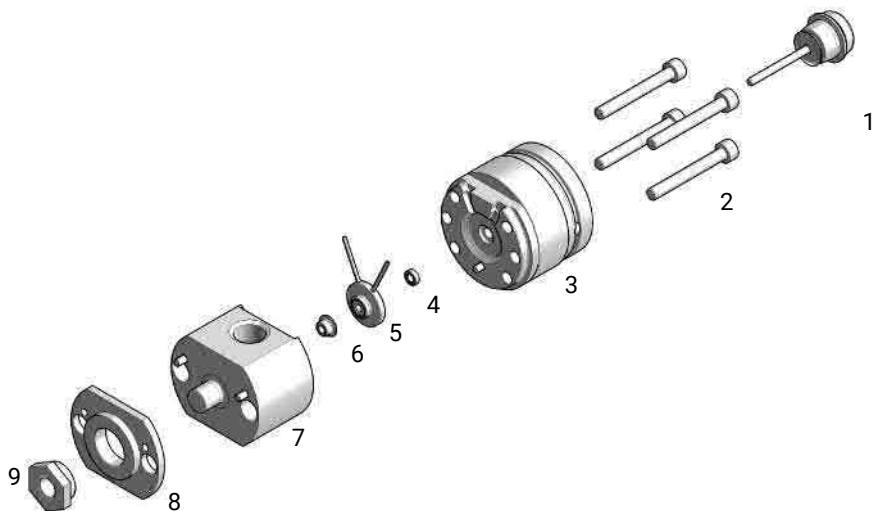
Primary Pump Head Parts



G7131-60641 (Primary Pump Head Assembly biocompatible)

#	p/n	Description
1	5067-5975	Plunger Assy ZrO2 LL
2	5810-0009	Screw M5x40 A4-80 Lubric Silver
3	G4220-60046	Preload-Support Assembly LL
4	0905-1731	Bio-Inert Wash Seal
5	G7131-60616	Seal Holder Integrated Assembly biocompatible
6	G7131-20009	Metering Seal PTFE (Bio), 100 µL
7	G7131-60533	Body Head Primary biocompatible

Secondary Pump Head Parts



G7131-60640 (Secondary Pump Head Assembly biocompatible)

#	p/n	Description
1	5067-5975	Plunger Assy ZrO2 LL
2	5810-0009	Screw M5x40 A4-80 Lubric Silver
3	G4220-60046	Preload-Support Assembly LL
4	0905-1731	Bio-Inert Wash Seal
5	G7131-60616	Seal Holder Integrated Assembly biocompatible
6	G7131-20009	Metering Seal PTFE (Bio), 100 µL
7	G7132-60000	Body Head Secondary biocompatible
8	G4220-20000	LID
9	G4220-20003	Pump Head Screw

Multipurpose Valve (G7104A)

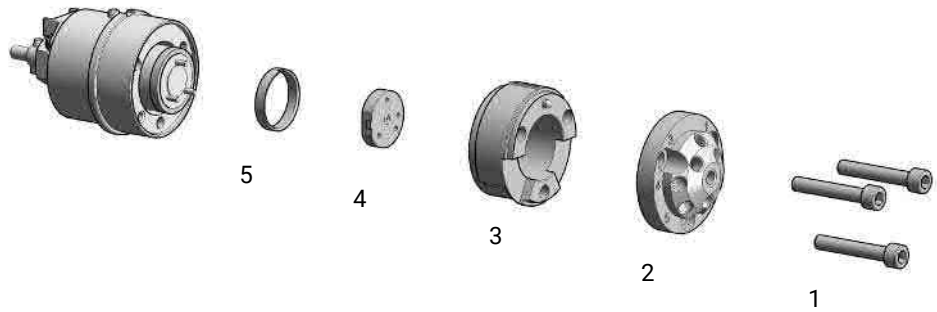








Figure 29: Multipurpose Valve parts

#	p/n	Description
	 5067-4237	6-column selector valve head, 1300 bar
1	 1535-4857	Stator screws, 10/pk
2	 5068-0001	Stator head
3	 5068-0120	Stator ring
4	 5068-0202	Rotor seal, Multipurpose Valve, PEEK, 1300 bar
5	 1535-4045	Bearing ring

Multipurpose Valve (G7131A)

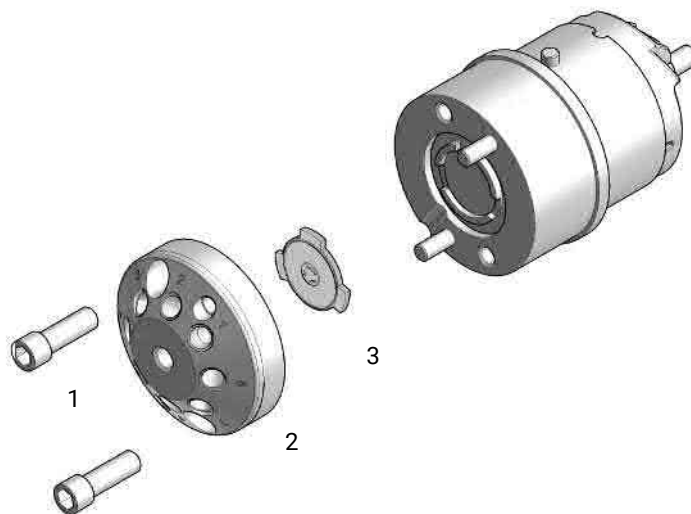
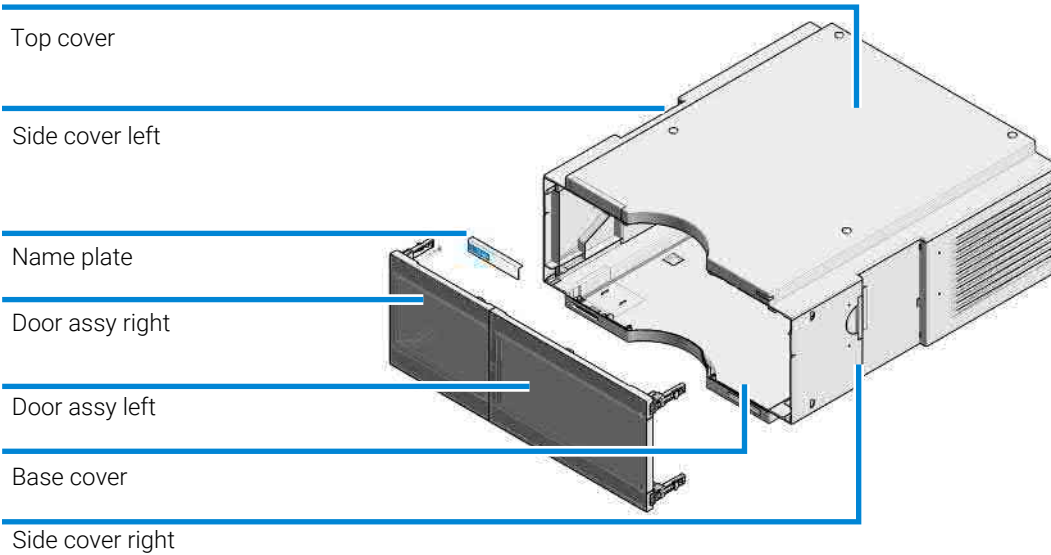











Figure 30: Biocompatible Multipurpose Valve parts

#	Qty.	p/n	Description
	1	5067-6704	Multipurpose Valve Biocompatible
1	2	5428-0006	Stator screws biocompatible
2	1	5068-0378	Stator head biocompatible
3	1	5068-0379	Rotor Seal Biocompatible, Multipurpose Valve Biocompatible, PEEK, 1300 bar


















Cover Parts



p/n	Description
 G7104-68713	Cabinet Kit 180 Infinity II
 5043-0286	Base Cover
 G7104-60200	Cover Side Right 180
 G7104-60201	Cover Side Left 180
	Top Cover Kit
 5043-0856	Leak Adapter (not shown)
 5360-0017	Door 180mm left
 5360-0018	Door 180mm right
 5431-0117	Name Plate 1260 Infinity III
 5431-0119	Name Plate 1290 Infinity III

Accessory Kit (G7104A)

G7104-68705 (Accessory Kit)

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

Accessory Kit (G7131A)

G7131-68755 (Accessory Kit biocompatible)

Qty.	p/n	Description
2	 5043-1013	Tubing Clip IF-II
3	 5063-6527	Tubing, Silicon Rubber, 1.2 m, ID/OD 6 mm/9 mm
1	 5067-5443	Inlet tubing
1	 5181-1519	CAN cable, Agilent module to module, 1 m
6	 5500-1155	Tube Connector, 90 degree, ID 6.4
1	 5500-1419	Capillary MP35N 0.17 mm x 500 mm, SI/SI
1	 9301-6476	Syringe with luerlock 5 mL Polypropylene
1	 G1311-90107	Algae note
1	 9301-1337	Syringe adapter
1	 5500-1156	T-Tube Connector ID6.4
3	 5500-1169	Tubing connector, Y-shaped, ID 6.4 mm
1	 G7132-90110	1290 Infinity II Bio Best Practice Sheet
1	 5067-6197	Seal Handling Device
1	 G7132-42000	Bio Pump Head Holder
1	 5067-6658	Biocompatible Frit Assembly

HPLC System Tool Kit





10

Identifying Cables

This chapter provides information on cables used with the modules.

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Remote Cables 328

BCD Cables 332

CAN/LAN Cables 334

RS-232 Cables 335

USB 336

Cable Overview

NOTE

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

Analog cables

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

Remote cables

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

CAN cables

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

LAN cables

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

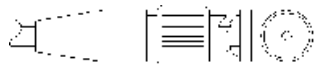
RS-232 cables

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

USB cables


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

Analog Cables

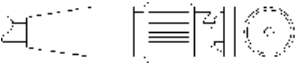


One end of these cables provides a BNC connector to be connected to Agilent modules. The other end depends on the instrument to which connection is being made.

Agilent Module to 35900 A/D converters

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

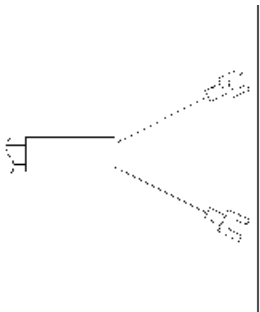
Agilent Module to BNC Connector

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

Identifying Cables

Analog Cables

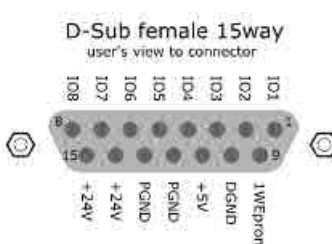
Agilent Module to General Purpose

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).

Identifying Cables

Remote Cables

- 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	

Identifying Cables

Remote Cables

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

Table 16: 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		

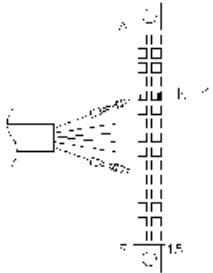


One end of these cables provides an Agilent Technologies APG (Analytical Products Group) remote connector to be connected to Agilent modules. The other end depends on the instrument to be connected to.

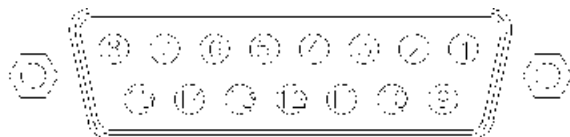
Agilent Module to Agilent 35900 A/D Converters

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

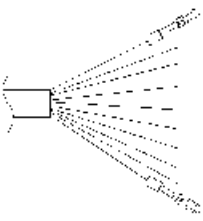
p/n 01046-60201	Wire Color	Pin Agilent module	Signal Name	Active (TTL)
	White	1	Digital ground	
	Brown	2	Prepare run	Low
	Gray	3	Start	Low
	Blue	4	Shut down	Low
	Pink	5	Not connected	
	Yellow	6	Power on	High
	Red	7	Ready	High
	Green	8	Stop	Low
	Black	9	Start request	Low

BCD Cables

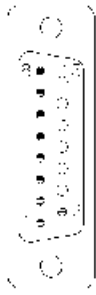


One end of these cables provides a 15-pin BCD connector to be connected to the Agilent modules. The other end depends on the instrument to be connected to

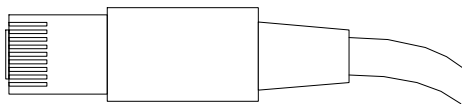
Agilent Module to General Purpose

p/n G1351-81600	Wire Color	Pin Agilent module	Signal Name	BCD Digit
	Green	1	BCD 5	20
	Violet	2	BCD 7	80
	Blue	3	BCD 6	40
	Yellow	4	BCD 4	10
	Black	5	BCD 0	1
	Orange	6	BCD 3	8
	Red	7	BCD 2	4
	Brown	8	BCD 1	2
	Gray	9	Digital ground	Gray
	Gray/pink	10	BCD 11	800
	Red/blue	11	BCD 10	400
	White/green	12	BCD 9	200
	Brown/green	13	BCD 8	100
	not connected	14		
	not connected	15	+ 5 V	Low

Agilent Module to 3396 Integrators

p/n 03396-60560	Pin 3396	Pin Agilent module	Signal Name	BCD Digit
	1	1	BCD 5	20
	2	2	BCD 7	80
	3	3	BCD 6	40
	4	4	BCD 4	10
	5	5	BCD0	1
	6	6	BCD 3	8
	7	7	BCD 2	4
	8	8	BCD 1	2
	9	9	Digital ground	
	NC	15	+ 5 V	Low

CAN/LAN Cables



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

Can Cables

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

LAN Cables

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

RS-232 Cables

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

USB

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

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



11

Hardware Information

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

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Instrument Layout 347

Early Maintenance Feedback (EMF) 348

Module-Specific Hardware Information 350

Setting the 8-bit Configuration Switch (On-Board LAN) 350

General Hardware Information

This section provides detailed hardware information on firmware that is valid for this module.

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,

Hardware Information

General Hardware Information

- 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.

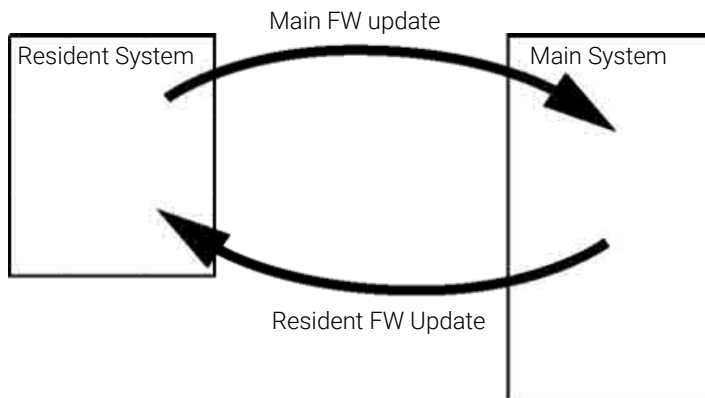


Figure 31: Firmware update mechanism

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.
- One analog output provides signals for integrators or data handling systems.
- 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.

Hardware Information

General Hardware Information

- 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.
- With the appropriate software, the LAN connector may be used to control the module from a computer through a LAN 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.

WARNING

Electric shock due to insufficient insulation of connected instruments

Personal injury or damage to the instrument

- **Any other instruments connected to this instrument shall be approved to a suitable safety standard and must include reinforced insulation from the mains.**

NOTE

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

Rear View of the Module

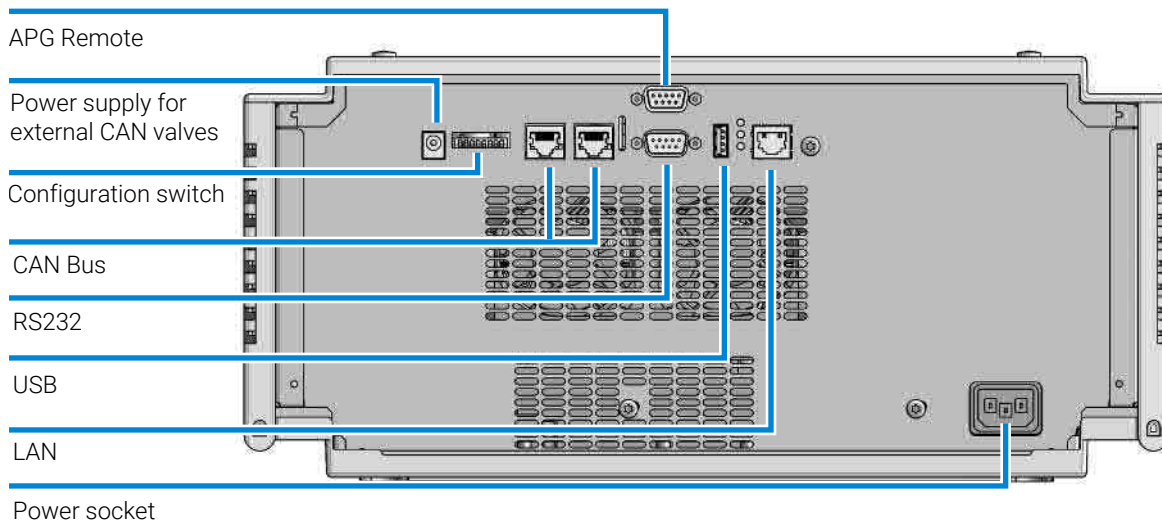


Figure 32: Rear view of the Flexible Pump

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

Interfaces

The Agilent InfinityLab LC Series modules provide the following interfaces:

Table 17: Agilent InfinityLab LC Series interfaces

Module	CAN	USB	LAN (on-board)	RS-232	Analog	APG (A) / ERI (E)	Special
Pumps							
G7104A/C	2	No	Yes	Yes	1	A	
G7110B	2	Yes	Yes	No	No	E	
G7111A/B, G5654A	2	Yes	Yes	No	No	E	
G7112B	2	Yes	Yes	No	No	E	
G7120A, G7132A	2	No	Yes	Yes	1	A	
G7161A/B	2	Yes	Yes	No	No	E	
Samplers							
G7129A/B/C	2	Yes	Yes	No	No	E	
G7167A/B/C, G7137A, G5668A, G3167A	2	Yes	Yes	No	No	E	
G7157A	2	Yes	Yes	No	No	E	
Detectors							
G7114A/B	2	Yes	Yes	No	1	E	
G7115A	2	Yes	Yes	No	1	E	
G7117A/B/C	2	Yes	Yes	No	1	E	
G7121A/B	2	Yes	Yes	No	1	E	
G7162A/B	2	Yes	Yes	No	1	E	
G7165A	2	Yes	Yes	No	1	E	
Fraction Collectors							
G7158B	2	Yes	Yes	No	No	E	
G7159B	2	Yes	Yes	No	No	E	

Module	CAN	USB	LAN (on-board)	RS-232	Analog	APG (A) / ERI (E)	Special
G7166A	2	No	No	No	No	No	Requires a host module with on-board LAN with minimum FW B.06.40 or C.06.40, or with additional G1369C LAN Card
G1364E/F, G5664B	2	Yes	Yes	No	No	E	THERMOSTAT for G1330B
Others							
G1170A	2	No	No	No	No	No	Requires a host module with on-board LAN or with additional G1369C LAN Card.
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

LAN connection is made between at least one of the Agilent modules and the Control PC.

- If an Assist Hub is installed, connect the LAN to the Lab LAN port of this module.
 - If an Assist Hub is NOT installed and a detector (DAD/MWD/FLD/VWD/RID) is installed, connect the LAN to this module.
 - If an Assist Hub is NOT installed and there are multiple detectors with spectral capabilities, consider using additional LAN connections for each detector.
 - If an Assist Hub is installed, connect additional LAN connections from the detectors and pumps to the Assist Hub.
- CAN connectors as interface to other modules
 - LAN connector as interface to the control software
 - RS-232C as interface to a computer

Hardware Information

General Hardware Information

- USB (Universal Series Bus) as interface to a computer
- REMOTE connector as interface to other Agilent products
- Analog output connector 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

LAN connection is made between at least one of the Agilent modules and the Control PC.

- If an Assist Hub is installed, connect the LAN to the Lab LAN port of this module.
- If an Assist Hub is NOT installed and a detector (DAD/MWD/FLD/VWD/RID) is installed, connect the LAN to this module.
- If an Assist Hub is NOT installed and there are multiple detectors with spectral capabilities, consider using additional LAN connections for each detector.
- If an Assist Hub is installed, connect additional LAN connections from the detectors and pumps to the Assist Hub.

USB

The USB interface replaces the RS-232 Serial interface in new generation modules. For details on USB refer to [USB \(Universal Serial Bus\)](#) on page 347.

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 18: 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.

Hardware Information

General Hardware Information

Pin	Signal	Description
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

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:

Hardware Information

General Hardware Information

- 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.

Early Maintenance Feedback (EMF)

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 needs 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.

Module-Specific Hardware Information

Setting the 8-bit Configuration Switch (On-Board LAN)

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.

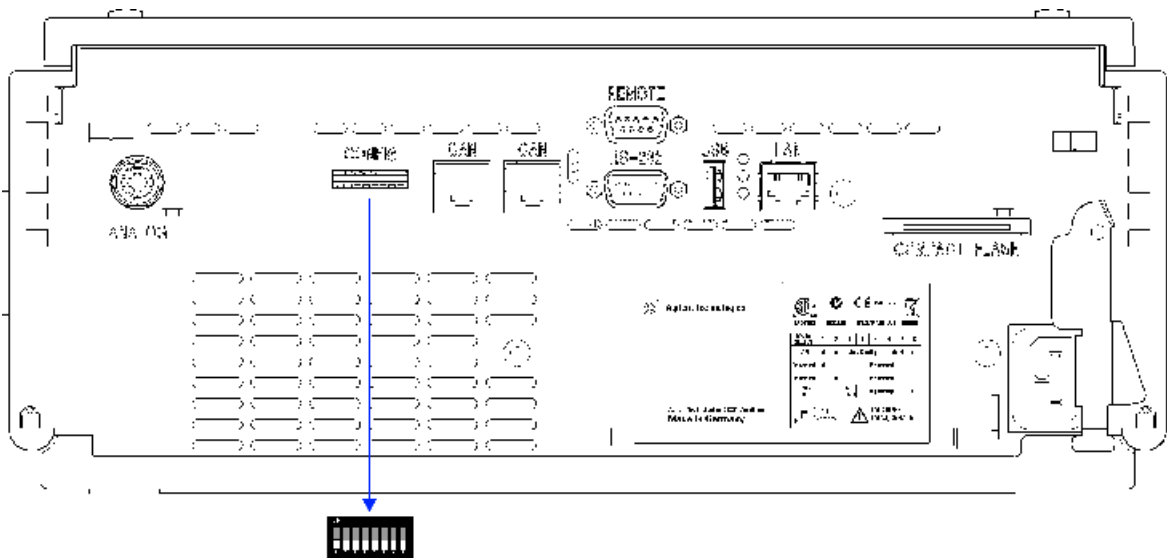


Figure 33: Location of Configuration Switch (example shows a G4212A DAD)

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 19: 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), SW (switch)

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 351.

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 20: 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

Legend:

0 (switch down), 1 (switch up), SW (switch)

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.

Hardware Information

Module-Specific Hardware Information

Table 21: 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

Legend:

0 (switch down), 1 (switch up), SW (switch)

12

LAN Configuration

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

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User Interface Software Setup 369

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 35](#) on page 355).


G4204-65800		Part number of the pump main board
AA ZZ 210 MSSA		Revision code, vendor, year and week of assembly
MAC 003xD31x6Exx		MAC address
Made in Germany		Country of origin

Figure 34: MAC label

- 2 Connect the instrument's LAN interface (see [Figure 35](#) on page 355) to
 - the PC network card using a crossover network cable (point-to-point) or
 - a hub or switch using a standard LAN cable.

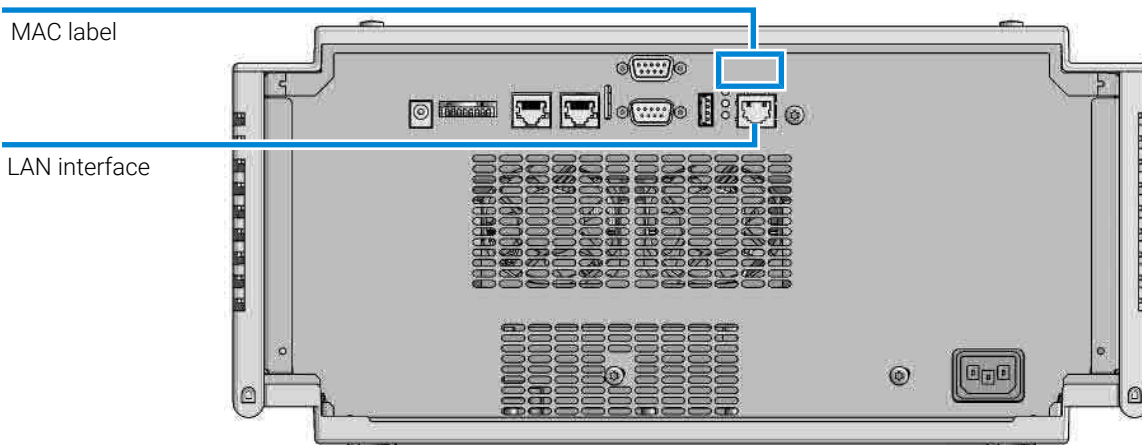


Figure 35: Location of LAN interface and MAC label

TCP/IP Parameter Configuration

To operate properly in a network environment, the LAN interface must be configured with valid TCP/IP network parameters. These parameters are:

- IP address
- Subnet Mask
- Default Gateway

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

- by automatically requesting the parameters from a network-based DHCP Server (using the so-called Dynamic Host Configuration Protocol). This mode requires a LAN-onboard Module or a G1369C LAN Interface card, see [Setup \(DHCP\)](#) on page 360
- by manually setting the parameters using Telnet
- by manually setting the parameters using the Local Controller

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 non-volatile memory or initialized with known default values. The initialization mode is selected by the configuration switch, see [Table 23](#) on page 358.

Configuration Switch

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

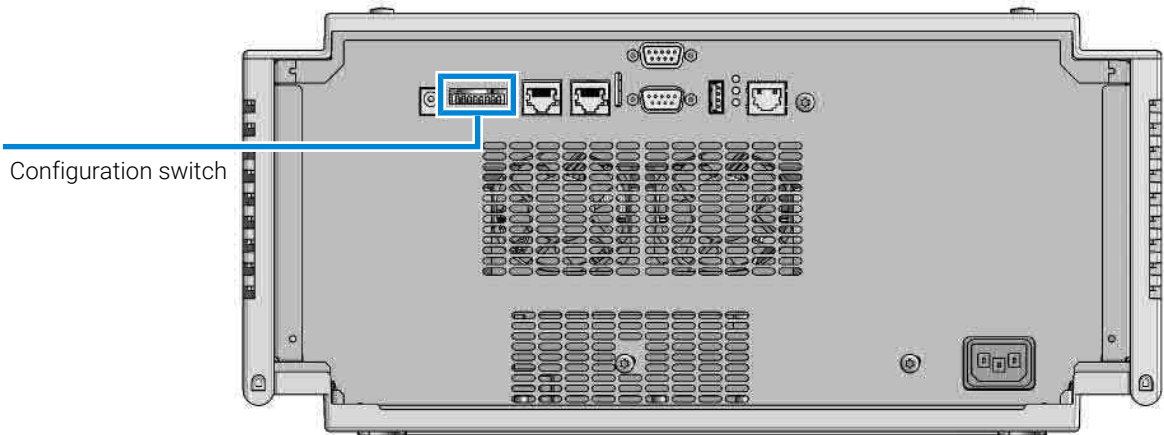


Figure 36: Location of Configuration Switch

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.

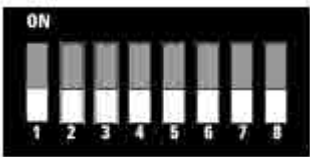
Table 22: Factory Default Settings

Link Configuration	speed and duplex mode determined by auto-negotiation, for details see Link Configuration Selection on page 363
--------------------	--

Initialization Mode Selection

The following initialization (init) modes are selectable:

Table 23: Initialization Mode Switches (SW)

	SW 6	SW 7	SW 8	Init Mode
	OFF	ON	OFF	Using Stored
	OFF	ON	ON	Using Default
	ON	OFF	OFF	DHCP ¹

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.

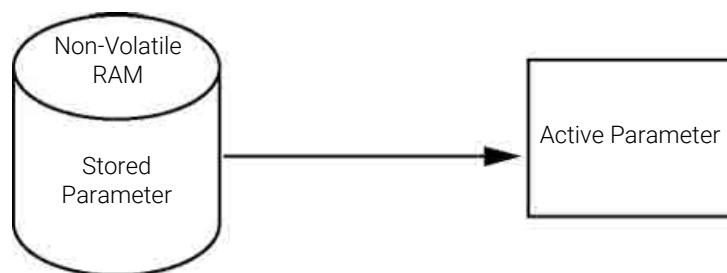


Figure 37: Using Stored (principle)

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 24](#) on page 359.

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

LAN Configuration

Initialization Mode Selection

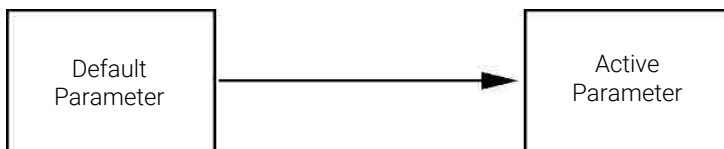


Figure 38: Using Default (principle)

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 24: 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 39: DHCP (principle)

NOTE

- It may take some time until the DHCP server has updated the DNS server with the hostname information.
- It may be necessary to fully qualify the hostname with the DNS suffix, e.g. *0030d3177321.country.company.com*.
- The DHCP server may reject the hostname proposed by the card and assign a name following local naming conventions.

Setup (DHCP)

The DHCP functionality is available on all Agilent HPLC modules with on-board LAN Interface or LAN Interface Card G1369C, and "B"-firmware (B.06.40 or above) or modules with "D"-firmware. All modules should use latest firmware from the same set.

- 1 Note the MAC address of the LAN interface (provided with G1369C LAN Interface Card or mainboard). This MAC address is on a label on the card or at the rear of the mainboard, for example, *0030d3177321*.

On the Local Controller the MAC address can be found under **Details** in the LAN section.

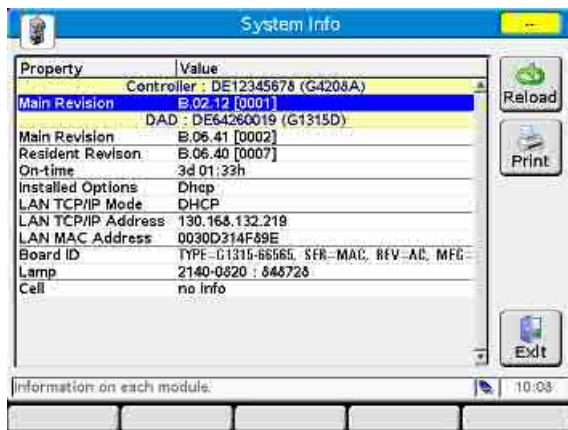


Figure 40: LAN setting on Instant Pilot

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

Table 25: 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

LAN Configuration

Dynamic Host Configuration Protocol (DHCP)

Table 26: 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 360).

Link Configuration Selection

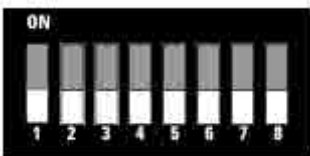
The LAN interface supports 10 or 100 Mbps operation in full- or half-duplex modes. In most cases, full-duplex is supported when the connecting network device - such as a network switch or hub - supports IEEE 802.3u auto-negotiation specifications.

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 27: Link Configuration Switches (SW)

	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.

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>`

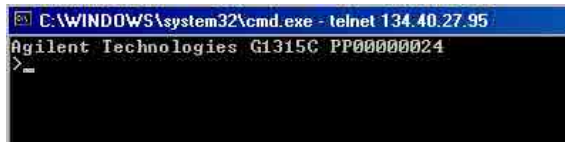


```
C:\WINDOWS\system32\cmd.exe
C:\>telnet 134.40.27.95
```

Figure 41: 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 357).

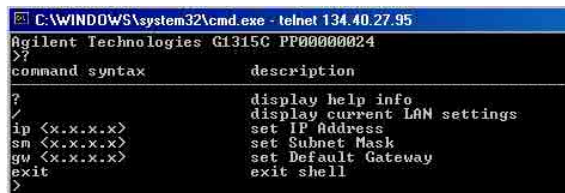
When the connection was established successfully, the module responds with the following:



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

Figure 42: 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 43: Telnet commands

Table 28: Telnet commands

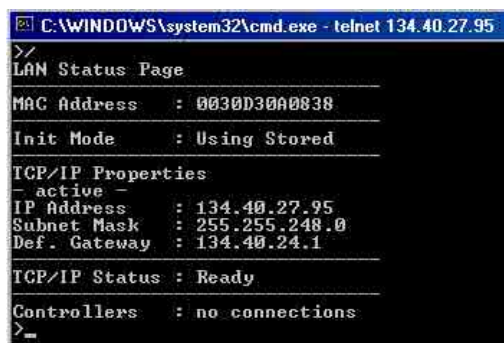
Value	Description
?	displays syntax and descriptions of commands
/	displays current LAN settings
ip <x.x.x.x>	sets new ip address
sm <x.x.x.x>	sets new subnet mask
gw <x.x.x.x>	sets new default gateway
exit	exits shell and saves all changes

4 To change a parameter follows the style:

- parameter value, for example: `ip 134.40.27.230`

Then press [Enter], where parameter refers to the configuration parameter you are defining, and value refers to the definitions you are assigning to that parameter. Each parameter entry is followed by a carriage return.

5 Use the "/" and press Enter to list the current settings.



```

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
>_

```

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

Telnet - Current settings in "Using Stored" mode

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

```

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
>_

```

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

Telnet - Change IP settings

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

```

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

Connection to host lost.
C:\>_

```

Figure 44: Closing the telnet session

NOTE

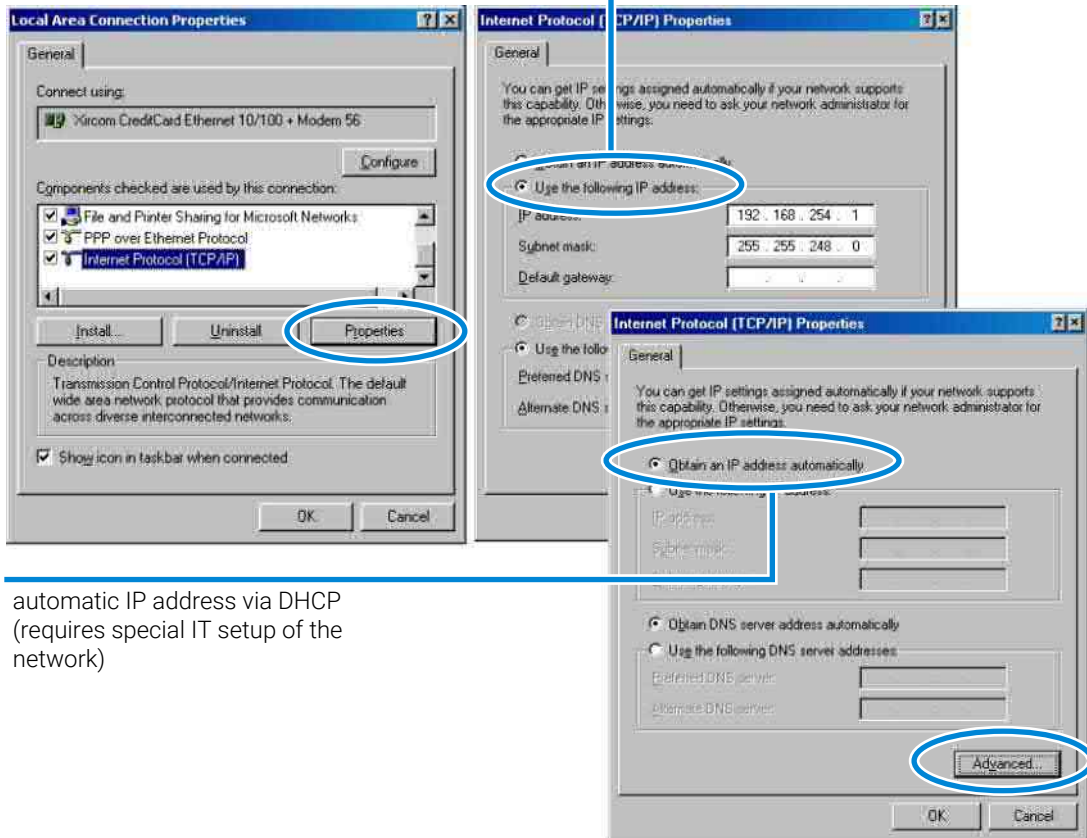
If the Initialization Mode Switch is changed now to “Using Stored” mode, the instrument will take the stored settings when the module is re-booted. In the example above it would be 134.40.27.99.

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 358).

FIXED IP address



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

Figure 45: 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*.

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

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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.

WARNING

Use of unsupplied cables

Using cables not supplied by Agilent Technologies can lead to damage of the electronic components or personal injury.

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

NOTE

Note the instrument's external markings described under [Safety Symbols](#) on page 377.

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.
-

Solvent Information

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.

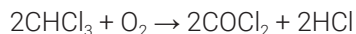
NOTE

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.

Recommendations on the Use of Solvents

Observe the following recommendations on the use of solvents.

- Brown glass ware can avoid growth of algae.
- Follow the recommendations for avoiding the growth of algae, see [Algae Growth in HPLC Systems](#) on page 376
- 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 such as flow cells, valve materials etc. and recommendations in subsequent sections.
- Avoid the use of the following steel-corrosive solvents:
 - solutions of alkali halides and their respective acids (for example, lithium iodide, potassium chloride, and so on),
 - high concentrations of inorganic acids like sulfuric acid and nitric acid, especially at higher temperatures (if your chromatography method allows, replace by phosphoric acid or phosphate buffer which are less corrosive against stainless steel),
 - halogenated solvents or mixtures which form radicals and/or acids, for example:



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) should be filtered through dry aluminium oxide which adsorbs the peroxides,
 - solvents containing strong complexing agents (e.g. EDTA),
 - mixtures of carbon tetrachloride with 2-propanol or THF.
- Avoid the use of dimethyl formamide (DMF). Polyvinylidene fluoride (PVDF), which is used in leak sensors, is not resistant to DMF.

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 μm filters.
- Never leave mobile phase in the instrument for several days without flow.
- Always discard old mobile phase.
- Use the amber solvent bottle (9301-6526 (Solvent bottle, amber, 1000 mL)) 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.

Magnets

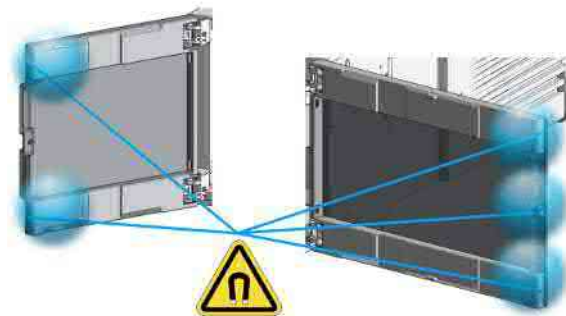








Figure 46: Magnets in doors of pumps, autosamplers, detectors, and fraction collectors

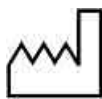
Safety Symbols

Table 29: 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.
	Indicates flammable material used. Consult the Agilent Information Center / User Manual before attempting to install or service this equipment. Follow all safety precautions.
	Confirms that a manufactured product complies with all applicable European Community directives. The European Declaration of Conformity is available at: http://regulations.corporate.agilent.com/DoC/search.htm

Appendix

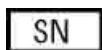
General Safety Information



Manufacturing date.



Product Number



Serial Number



Power symbol indicates On/Off.

The apparatus is not completely disconnected from the mains supply when the on/off 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.



Magnetic field

Magnets produce a far-reaching, strong magnetic field. They could damage TVs and laptops, computer hard drives, credit and ATM cards, data storage media, mechanical watches, hearing aids and speakers. Keep magnets at least 25 mm away from devices and objects that could be damaged by strong magnetic fields.



Indicates a pinching or crushing hazard



Indicates a piercing or cutting hazard.

WARNING

A WARNING

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

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

CAUTION

A CAUTION

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

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

Material Information

This section provides detailed information about materials used in the HPLC system and general information about solvent/material compatibility.

Materials Used in the Bio LC System

For the Bio LC System, Agilent Technologies uses highest-quality materials in the flow path (also referred to as wetted parts). Life scientists accept these materials, as they are known for optimum inertness to biological samples and ensure best compatibility with common samples and solvents over a wide pH range. To enable chromatography at very high pressures, while maintaining inertness the metal alloy MP35N is used instead of stainless steel throughout the system.

The MP35N is a nonmagnetic, nickel-cobalt-chromium-molybdenum alloy with an excellent resistance to sulfation, oxidation, saline solutions, and most mineral acids. Its superior properties guaranty reliable performance, even under UHPLC conditions.

Table 30: Used biocompatible materials

Module	Materials
Agilent 1290 Infinity III Bio High-Speed Pump (G7132A)	MP35N, gold, ceramic, ruby, PTFE, PEEK, UHMW-PE, tantalum, TFE/PDD copolymer, PFA, FEP, FFKM, ETFE, DLC coated MP35N
Agilent 1290 Infinity III Bio Flexible Pump (G7131A)	MP35N, gold, ceramic, ruby, PEEK, UHMW-PE, tantalum, TFE/PDD copolymer, PFA, FEP, titanium, DLC coated MP35N, FFKM, ETFE
Agilent 1290 Infinity III Bio Multisampler (G7137A)	Standard: MP35N, gold, DLC coated MP35N, PEEK, UHMW-PE Multi Wash: PEEK, FFKM, titanium, PTFE, PPS, MP35N, gold, DLC coated MP35N, UHMW-PE
Agilent 1290 Infinity III Bio Online Sample Manager	PEEK, FFKM, titanium, PTFE, PPS, MP35N, gold, DLC coated MP35N, UHMW-PE
Biocompatible Flow Cells:	

Module	Materials
G7117-60020 (Max-Light Cartridge Cell LSS (10 mm, V(σ) 1.0 μ L)) (for Agilent 1290 Infinity III DAD (G7117A/B))	MP35N, fused silica, PEEK
G1314-60188 (Bio standard flow cell VWD, 10 mm, Cell Vol. 14 μ L, Sapphire, MP35N) (for Agilent 1290 Infinity III VWD (G7114B))	Sapphire, MP35N, FEP
G1314-60189 (Bio micro flow cell VWD, 3 mm, Cell Vol. 2 μ L, Sapphire, MP35N) (for Agilent 1290 Infinity III VWD (G7114B))	Sapphire, MP35N, FEP
Biocompatible Heat Exchangers, Valves and Capillaries:	
G7116-60071 (Quick Connect Bio Heat Exchanger Standard Flow), G7116-60081 (Quick Connect Bio Heat Exchanger High Flow), G7116-60091 (Quick Connect Bio Heat Exchanger Ultra Low Dispersion) (for Agilent 1290 Infinity III Multicolumn Thermostat (G7116B))	MP35N
G5641A (2-position/10-port valve, bio 1300 bar)	MP35N coated with DLC, PEEK
G4235A (12-position/13-port solvent selection valve)	PEEK, ceramic (Al_2O_3 based)
Bio connection capillaries	MP35N

NOTE

To ensure optimum biocompatibility of your Bio LC System, do not include non-Bio standard modules or parts to the flow path. Do not use any parts that are not labeled as Agilent "Bio". For solvent compatibility of these materials, see [General Information About Solvent/Material Compatibility](#) on page 382.

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 ²	PFA (tubings), PEEK (fittings)

² Ultra clean tubings are available for the use with high-end MS detectors. They are also compatible to THF.

Appendix

Material Information

Part	Materials
Microfluidic structures ³	SST
MCGV	PEEK, FEP, PFA, Al ₂ O ₃ -based ceramic, ruby, sapphire, SST
Passive inlet valve	SST, gold, ruby, ZrO ₂ -based ceramic, tantalum
Outlet valve	SST, gold, ruby, ZrO ₂ -based ceramic, tantalum
Pump head	SST
Pistons	ZrO ₂ -based ceramic
Piston/wash seals	UHMW-PE, SST
Pressure sensor	SST
Multipurpose Valve	Polyimide, SST, DLC

³ 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 ⁴	PFA (tubings), PEEK (fittings)
Microfluidic structures ⁵	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 ₂ -based ceramic
Piston/wash seals	Gold and UHMW-PE
Pressure sensor	MP35N
Multipurpose Valve	DLC coated MP35N and PEEK-based rotor seal

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.

⁴ Ultra clean tubings are available for the use with high-end MS detectors. They are also compatible to THF.

⁵ Inlet Weaver, Jet Weaver, Heat Exchanger

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.

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/III 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.

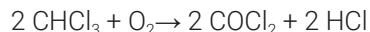
Tantalum (Ta)

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.

Appendix

Material Information

- 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 FeCl_3 or CuCl_2 . Titanium is subject to corrosion in anhydrous methanol, which can be avoided by adding a small amount of water (about 3 %). Slight corrosion is possible with ammonia > 10 %.

Diamond-Like Carbon (DLC)

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

Fused Silica and Quartz (SiO_2)

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

Gold

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

Zirconium Oxide (ZrO₂)

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

Platinum/Iridium

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

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

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

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

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

Sapphire, Ruby, and Al₂O₃-Based Ceramics

Sapphire, ruby, and ceramics based on aluminum oxide Al₂O₃ are inert to almost all common acids, bases, and solvents. There are no documented incompatibilities for HPLC applications.


At-a-Glance Details About Agilent Capillaries

The following section provides useful information about Agilent capillaries and its characteristics.

Syntax for capillary description

Type - Material - Capillary dimensions - Fitting Left/Fitting right

Table 31: Example for a capillary description












Code provided with the part	Meaing of the code
Color code: 	Material of the product is MP35N, the inner diameter is 0.20 or 0.25 mm
Capillary	The part is a connection capillary
MP35N	Material of the part is MP35N
0.25 x 80 mm	The part has an inner diameter of 0.25 mm and a length of 80 mm
SI/SI	Left fitting: Swagelok + 1.6 mm Port id, Intermediate Right fitting: Swagelok + 1.6 mm Port id, Intermediate

To get an overview of the code in use, see

- Color: [Table 32](#) on page 389
- Type: [Table 33](#) on page 389
- Material: [Table 34](#) on page 390
- Dimension: [Table 35](#) on page 390
- Fittings: [Table 36](#) on page 391

Color Coding Guide

Table 32: 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

NOTE

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.

Abbreviation Guide for Type

Table 33: Type (gives some indication on the primary function, like a loop or a connection capillary)

Key	Description
Capillary	Connection capillaries
Loop	Loop capillaries
Seat	Autosampler needle seats

Appendix

At-a-Glance Details About Agilent Capillaries

Key	Description
Tube	Tubing
Heat exchanger	Heat exchanger

Abbreviation Guide for Material

Table 34: Material (indicates which raw material is used for the capillary)

Key	Description
ST	Stainless steel
Ti	Titanium
PK	PEEK
FS/PK	PEEK-coated fused silica ⁶
PK/ST	Stainless steel-coated PEEK ⁷
PFFE	PTFE
FS	Fused silica
MP35N	Nickel-cobalt-chromium-molybdenum alloy

Abbreviation Guide for Capillary Dimensions

Table 35: Capillary dimensions (indicates inner diameter (id), length, and volume of the capillary)

Description
id (mm) x Length (mm)
Volume (μL)

⁶ Fused silica in contact with solvent

⁷ Stainless steel-coated PEEK

Abbreviation Guide for Fitting Left/Fitting Right

Table 36: Fitting left/fitting right (indicates which fitting is used on both ends of the capillary)

Key	Description
W	Swagelok + 0.8 mm Port id
S	Swagelok + 1.6 mm Port id
M	Metric M4 + 0.8 mm Port id
E	Metric M3 + 1.6 mm Port id
U	Swagelok union
L	Long
X	Extra long
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

Waste Electrical and Electronic Equipment (WEEE) Directive

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



NOTE

Do not dispose of in domestic household waste
To return unwanted products, contact your local Agilent office, or see <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.

RFID Statement

Brasil

Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados. Para mais informações, consulte o site da Anatel: <https://www.gov.br/anatel/pt-br>.

Este produto não é apropriado para uso em ambientes domésticos, pois poderá causar interferências eletromagnéticas que obrigam o usuário a tomar medidas necessárias para minimizar estas interferências.

Canada

Statement according to RSS GEN Issue 5:

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil contient des émetteurs / récepteurs exemptés de licence conformes aux RSS (RSS) d'Innovation, Sciences et Développement économique Canada. Le fonctionnement est soumis aux deux conditions suivantes:

1. Cet appareil ne doit pas causer d'interférences
2. Cet appareil doit accepter toutes les interférences, y compris celles susceptibles de provoquer un fonctionnement indésirable de l'appareil.

Mexico

La operación de este equipo está sujeta a las siguientes dos condiciones:

1. es posible que este equipo o dispositivo no cause interferencia perjudicial y
2. este equipo o dispositivo debe aceptar cualquier interferencia, incluyendo la que pueda causar su operación no deseada.

USA

1. User Information according to FCC 15.21: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
2. Part 15 Statement according to FCC 15.19:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause interference.
- This device must accept any interference, including interference that may cause undesired operation.

CAUTION

Do not change or modify the equipment.

Changes or modifications not expressly approved by Agilent could void your authority to operate the equipment.

NOTE

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Table 37: Operating frequencies and maximum power levels

Technology	Operating Frequencies/ Bands	Maximum Transmit Power Level
RFID	125 kHz	26.8 dBm

Agilent certifies that the SDoC procedure has been followed for the host device (according to SRD-REF specification on instrument label).

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

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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 III Flexible Pump (G7104A) and Agilent 1290 Infinity III 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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