Agilent InfinityLab LC Series
1290 Infinity II High Speed Pump

User Manual
Notices


No part of this manual may be reproduced in any form or by any means (including electronic storage and retrieval or translation into a foreign language) without prior agreement and written consent from Agilent Technologies, Inc. as governed by United States and international copyright laws.

Manual Part Number
G7120-90001

Edition
09/2016

Printed in Germany
Agilent Technologies
Hewlett-Packard-Strasse 8
76337 Waldbronn

Warranty

The material contained in this document is provided “as is,” and is subject to being changed, without notice, in future editions. Further, to the maximum extent permitted by applicable law, Agilent disclaims all warranties, either express or implied, with regard to this manual and any information contained herein, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. Agilent shall not be liable for errors or for incidental or consequential damages in connection with the furnishing, use, or performance of this document or of any information contained herein. Should Agilent and the user have a separate written agreement with warranty terms covering the material in this document that conflict with these terms, the warranty terms in the separate agreement shall control.

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.

Technology Licenses

The hardware and/or software described in this document are furnished under a license and may be used or copied only in accordance with the terms of such license.

Restricted Rights Legend

If software is for use in the performance of a U.S. Government prime contract or subcontract, Software is delivered and licensed as “Commercial computer software” as defined in DFAR 252.227-7014 (June 1995), or as a “commercial item” as defined in FAR 2.101(a) or as “Restricted computer software” as defined in FAR 52.227-19 (June 1987) or any equivalent agency regulation or contract clause. Use, duplication or disclosure of Software is subject to Agilent Technologies’ standard commercial license terms, and non-DOD Departments and Agencies of the U.S. Government will receive no greater than Restricted Rights as defined in FAR 52.227-19(c)(1-2) (June 1987). U.S. Government users will receive no greater than Limited Rights as defined in FAR 52.227-14 (June 1987) or DFAR 252.227-7015 (b)(2) (November 1995), as applicable in any technical data.
This manual covers the Agilent 1290 Infinity II High Speed Pump (G7120A).

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

2 Site Requirements and Specifications
This chapter provides information on environmental requirements, physical and performance specifications.

3 Using the Pump
This chapter explains the operational parameters of the Agilent 1290 Infinity II High Speed Pump.

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

5 Troubleshooting and Diagnostics
Overview about the troubleshooting and diagnostic features.

6 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.

7 Maintenance
This chapter describes the maintenance of the High Speed Pump.

8 Parts and Materials for Maintenance
This chapter provides information on parts for maintenance.
In This Guide...

9 Identifying Cables
This chapter provides information on cables used with the modules.

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

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

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

1 Introduction 9
  Product Description 10
  Pump Principle 11
  Leak and Waste Handling 13

2 Site Requirements and Specifications 19
  Site Requirements 20
  Physical Specifications 23
  Performance Specifications 24

3 Using the Pump 27
  Magnets 28
  Turn on/off 29
  Status Indicators 30
  Best Practices 31
  Normal Phase Applications 34
  Purging the Pump 36
  Solvent Information 38
  Solvent Recommendation for Agilent 1290 Infinity and 1290 Infinity II Pumps 46
  Algae Growth in HPLC Systems 48
  Setting up the Pump with the Instrument Control Interface 49

4 Optimizing Performance 59
  Delay Volume and Extra-Column Volume 60
  How to Configure the Optimum Delay Volume 61
  How to Achieve Higher Resolution 63
  Using Solvent Calibration Tables 66

5 Troubleshooting and Diagnostics 67
  User Interfaces 68
  Agilent Lab Advisor Software 69
  Pump Leak Rate Test 70
  System Pressure Test 75
9 Identifying Cables  171
  Cable Overview  172
  Analog Cables  174
  Remote Cables  176
  CAN/LAN Cables  180
  Agilent Module to PC  181
  USB  182

10 Hardware Information  183
  Firmware Description  184
  Electrical Connections  187
  Interfaces  189
  Setting the 8-bit Configuration Switch  195
  Early Maintenance Feedback  198
  Instrument Layout  199

11 LAN Configuration  201
  What You Have to Do First  202
  TCP/IP parameter configuration  203
  Configuration Switch  204
  Initialization mode selection  205
  Dynamic Host Configuration Protocol (DHCP)  207
  Link configuration selection  210
  Manual Configuration  211
  PC and User Interface Software Setup Setup  216

12 Appendix  219
  General Safety Information  220
  Radio Interference  227
  Sound Emission  228
  Agilent Technologies on Internet  229
1

Introduction

Product Description 10
Pump Principle 11
Leak and Waste Handling 13
Waste Concept 17

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

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

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

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

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

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

Figure 1  Overview of the High Speed Pump
Pump Principle

The 1290 Infinity II Highspeed Pump features a dual pump head design for generation of binary gradients.

A solvent selection valve allows to choose from two solvents per pump head. However, this valve cannot be switched during a run.

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

Delivery cycle:

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

   At the same time, piston one draws solvent from the solvent reservoir. The two piston chambers are isolated by a check valve (outlet ball valve).

2. Shortly before the end of the delivery stroke of piston two, piston one reverses its direction. The check valve (passive inlet valve) at the inlet to piston chamber one closes while the solvent in piston chamber one gets compressed to system operating pressure.

3. Piston two reverses while piston one delivers the set flow rate into the flow path and re-fills piston chamber two.

4. When piston two has reached the end of its intake stroke it reverses and the delivery cycle starts again with step 1).

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

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

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

Pump Principle

Figure 2 The hydraulic path
Leak and Waste Handling

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

The solvent cabinet is designed to store a maximum volume of 8 L solvent. The maximum volume for an individual bottle stored in the solvent cabinet should not exceed 2 L. For details, see the usage guideline for the Agilent 1200 Infinity Series Solvent Cabinets (a printed copy of the guideline has been shipped with the solvent cabinet, electronic copies are available on the Internet).

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

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

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

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

Leak and Waste Handling

Figure 3  Infinity II Leak Waste Concept (flexible rack installation)
Figure 4  Infinity II Single Stack Leak Waste Concept (bench installation)
Leak and Waste Handling

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

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

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

Site Requirements 20
Physical Specifications 23
Performance Specifications 24

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

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

Power Consideration

The module power supply has wide ranging capabilities and accepts any line voltage in the range mentioned in Table 1 on page 23. 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**

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.

**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**

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.
Site Requirements and Specifications

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** 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** Unintended use of supplied 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** Power cords

Solvents may damage electrical cables.

➔ Prevent electrical cables from getting in contact with solvents.

➔ Exchange electrical cables after contact with solvents.
2 Site Requirements and Specifications

Site Requirements

**Bench Space**

The module dimensions and weight (see Table 1 on page 23) 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.

---

**WARNING**

**Heavy weight**

The module is heavy (>22 kg (>46 lbs)).

➔ Carry the module at least with 2 people.

➔ Avoid back strain or injury by following all precautions for lifting heavy objects.

➔ Ensure that the load is as close to your body as possible.

➔ Ensure that you can cope with the weight of your load.

---

**Condensation**

**CAUTION**

Condensation within the module

Condensation can damage the system electronics.

➔ Do not store, ship or use your module under conditions where temperature fluctuations could cause condensation within the module.

➔ If your module was shipped in cold weather, leave it in its box and allow it to warm slowly to room temperature to avoid condensation.
## Physical Specifications

**Table 1**  Physical Specifications

<table>
<thead>
<tr>
<th>Type</th>
<th>Specification</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>21.0 kg (46.3 lbs)</td>
<td></td>
</tr>
<tr>
<td>Dimensions (height × width × depth)</td>
<td>200 x 396 x 436 mm (7.9 x 15.6 x 17.2 inches)</td>
<td></td>
</tr>
<tr>
<td>Line voltage</td>
<td>100 – 240 V~, ± 10 %</td>
<td>Wide-ranging capability</td>
</tr>
<tr>
<td>Line frequency</td>
<td>50 or 60 Hz, ± 5 %</td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>210 VA / 180 W</td>
<td></td>
</tr>
<tr>
<td>Ambient operating temperature</td>
<td>4 – 55 °C (39 – 131 °F)</td>
<td></td>
</tr>
<tr>
<td>Ambient non-operating temperature</td>
<td>-40 – 70 °C (-40 – 158 °F)</td>
<td></td>
</tr>
<tr>
<td>Humidity</td>
<td>&lt; 95 % r.h. at 40 °C (104 °F)</td>
<td>Non-condensing</td>
</tr>
<tr>
<td>Operating altitude</td>
<td>Up to 3000 m (9842 ft)</td>
<td></td>
</tr>
<tr>
<td>Non-operating altitude</td>
<td>Up to 4600 m (15092 ft)</td>
<td>For storing the module</td>
</tr>
<tr>
<td>Safety standards: IEC, EN, CSA, UL</td>
<td>Installation category II, Pollution degree 2</td>
<td>For indoor use only.</td>
</tr>
<tr>
<td>ISM Classification</td>
<td>ISM Group 1 Class B</td>
<td>According to CISPR 11</td>
</tr>
</tbody>
</table>
## Performance Specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydraulic system</td>
<td>Two dual pistons in series, pumps with proprietary servo-controlled variable stroke design and smooth motion control.</td>
</tr>
<tr>
<td>Pump resolution step size</td>
<td>300 pL step size</td>
</tr>
<tr>
<td>Settable flow range</td>
<td>0.001 – 5 mL/min, in 0.001 mL/min increments (executed in 300 pL/step increments).</td>
</tr>
<tr>
<td>Flow precision</td>
<td>$\leq 0.07 % \text{ RSD or } 0.005 \text{ min SD, whatever is greater}$</td>
</tr>
<tr>
<td>Flow accuracy</td>
<td>$\pm 1 % \text{ or } 10 \mu\text{L/min, whatever is greater}$</td>
</tr>
<tr>
<td>Pressure range</td>
<td>up to 130 MPa (1300 bar) at 0 – 2 mL/min ramping down to 80 MPa (800 bar) at 5 mL/min</td>
</tr>
<tr>
<td>Pressure pulsation</td>
<td>$&lt;1 %$ amplitude or $&lt;0.5 \text{ MPa (5 bar), whatever is greater}$</td>
</tr>
<tr>
<td>Compressibility</td>
<td>Automatic</td>
</tr>
<tr>
<td>compensation</td>
<td></td>
</tr>
<tr>
<td>Recommended pH-range</td>
<td>1.0 – 12.5, solvents with pH &lt;2.3 should not contain acid which attack stainless steel.</td>
</tr>
<tr>
<td>Gradient formation</td>
<td>High pressure binary mixing</td>
</tr>
<tr>
<td>Delay volume</td>
<td>As low as 45 µL (10 µL without mixer)</td>
</tr>
<tr>
<td>Composition precision</td>
<td>$&lt;0.15 % \text{ RSD or } 0.01 \text{ min SD, whatever is greater}$</td>
</tr>
<tr>
<td>Composition accuracy</td>
<td>$\pm 0.35 %$ absolute</td>
</tr>
<tr>
<td>Number of solvents</td>
<td>2 out of maximum 26 solvents</td>
</tr>
<tr>
<td>Solvent selection valve</td>
<td>Internal 4-solvent selection valve included. External 2x 12 solvent valve as option, fully integrated in the pump control interface.</td>
</tr>
<tr>
<td>Feature</td>
<td>Specification</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Integrated degassing unit</td>
<td>Included</td>
</tr>
<tr>
<td>Number of channels: 2</td>
<td></td>
</tr>
<tr>
<td>Internal volume per channel: 1.5 mL</td>
<td></td>
</tr>
<tr>
<td>Materials in contact with solvent: TFE/PDD Copolymer, FEP, PEEK, PPS.</td>
<td></td>
</tr>
<tr>
<td>Automatic Purge Valve</td>
<td>Included</td>
</tr>
<tr>
<td>Active Seal wash</td>
<td>Included</td>
</tr>
<tr>
<td>Intelligent System Emulation Technology (ISET)</td>
<td>Included</td>
</tr>
<tr>
<td>Instrument Control</td>
<td>Lab Advisor B.02.06 or above</td>
</tr>
<tr>
<td>LC and CE Drivers A.02.11 or above</td>
<td></td>
</tr>
<tr>
<td>For details about supported software versions refer to the compatibility matrix of your version of the LC and CE Drivers</td>
<td></td>
</tr>
<tr>
<td>Local Control</td>
<td>Agilent Instant Pilot (G4208A) B.02.19 or above</td>
</tr>
<tr>
<td>Communications</td>
<td>Controller-area network (CAN), RS232C, APG remote: ready, start, stop and shutdown signals, LAN</td>
</tr>
<tr>
<td>Safety and maintenance</td>
<td>Extensive diagnostics, error detection and display through included Agilent LabAdvisor, leak detection, safe leak handling, leak output signal for shutdown of the pumping system. Low voltage in major maintenance areas.</td>
</tr>
<tr>
<td>GLP feature</td>
<td>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.</td>
</tr>
<tr>
<td>Housing</td>
<td>All materials are recyclable.</td>
</tr>
</tbody>
</table>
2 Site Requirements and Specifications
Performance Specifications
This chapter explains the operational parameters of the Agilent 1290 Infinity II High Speed Pump.
Magnets

1. This stack exemplarily shows the magnets’ positions in the modules.
Turn on/off

1

2

Power switch
(1) On
(2) Off

3
Status Indicators

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

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

Daily / Weekly tasks

**Daily tasks**
- Replace solvents and solvent bottles for mobile phases based on water/buffer.
- Replace solvents and solvent bottles for organic mobile phase latest every second day.
- Check presence of seal wash solvent.
- Purge each channel with fresh solvent at 2.5 – 3 mL/min for 5 min.
- Equilibrate your system with composition of your application for 15 min. Use conditioning for 1290 systems.

**Weekly tasks**
- Change seal wash solvent (10 % / 90 % isopropanol/water) and bottle.
- Flush all channels with water at 2.5 – 3 mL/min for 5 min to remove salt deposits if buffer applications were used.
- Inspect solvent filters for dirt or blockages. Clean or exchange if no flow is coming out of the solvent line when removed from the degasser inlet.

Power up / Shut-down the pump

**Power up the pump**
- Use new or different mobile phase (as required).
- Purge each channel with 2.5 – 3 mL/min for 5 min. Open the purge valve (1260) or use the purge command (1290).
- Equilibrate your system with composition of your application for 15 min. Use conditioning for 1290 systems.

**Long-term shut-down of the system**
- Flush system with water to remove buffer.
- Remove all samples from the sampler and store according to good laboratory practice.
- Use recommended solvents to store the system.
- Power off the system.
Prepare the pump

**Purge**

Use the Purge function to:
- fill the pump,
- exchange a solvent,
- remove air bubbles in tubes and pump heads.

**Condition**

Use the Conditioning function:
- daily when starting the pump,
- to minimize pressure ripple by dissolving air bubbles in pump heads.

**NOTE**

Condition your complete system with solvents and composition of your application (for example 50 %/50 % A/B at 0.5 mL/min).

**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.
Normal Phase Applications

Current passive inlet valves and outlet ball valves used with 1260 and 1290 Infinity pumps do not work well with applications using non-polar solvents as for normal phase applications (e.g. hexane and heptane). With such applications, pressure drops could be observed. They are a result of particles electrostatically charging up in insulating solvents and sticking to the balls inside the valves, such that the valves do not close properly any more after some time of use (can be hours).

For normal phase applications, a second type of valves is available, which has a design based on the existing one for 1260 and 1290 Infinity valves. These valves use a new material for valve balls, which is a conductive ceramic and replaces non-conductive ruby balls. The balls do not charge up electrostatically and show good performance in normal phase.

The valves are marked with N for non-polar or normal phase.

Agilent recommends using these valves for (and only for) normal phase applications.

**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.

The N-Valves have been tested successfully in using hexane at pressures below 100 bar; heptane can be used as a substitute for neurotoxic hexane.
Seals for Normal Phase Applications

For running normal phase applications on 1200 Infinity Series pumps, yellow PE seals are required, which exist as piston seals and wash seals. Seal wash is very uncommon for normal phase applications (no buffers needed), but wash seals are needed for seal wash pump heads.

1290 Infinity pumps use PE seals by default. In combination with ceramic pistons, PE seals are used for both reversed phase (1200 bar) and normal phase applications.

1260 Infinity pumps use sapphire pistons and black PTFE piston and wash seals by default (600 bar). Such PTFE seals create small wear particles in normal phase applications, which can clog valves and other parts in the flow path.

PE seals have a limited life time when used with normal phase solvents and sapphire pistons. Agilent recommends a maximum pressure of 200 bar for this combination, which shall also be applied for pressure tests.

Choice of Normal Phase Valves and Seals

**Table 3**  Recommended valves and seals for normal phase applications

<table>
<thead>
<tr>
<th></th>
<th>1260 Infinity</th>
<th>1290 Infinity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlet valves</td>
<td>1260 Infinity Inlet Valve Type N (G1312-60166)</td>
<td>1290 Infinity Inlet Valve Type N (G4220-60122) 1290 Infinity Quat Inlet Valve Type N (G4204-60122)</td>
</tr>
<tr>
<td>Outlet valves</td>
<td>1260 Infinity Outlet Valve Type N/SFC (G1312-60167)</td>
<td>1290 Infinity Outlet Valve Type N (G4220-60128)</td>
</tr>
<tr>
<td>Seals</td>
<td>PE seals (pack of 2) (0905-1420) Wash Seal PE (0905-1718)</td>
<td></td>
</tr>
</tbody>
</table>
Using the Pump

Purging the Pump

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

1. Initiate a purge in the controlling software with a Purge flow set to 3 – 5 ml/min per channel.

2. Flush all tubes with at least 30 ml of solvent.

### Table 4  Choice of Priming Solvents for Different Purposes

<table>
<thead>
<tr>
<th>Activity</th>
<th>Solvent</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>After an installation</td>
<td>Isopropanol</td>
<td>Best solvent to flush air out of the system</td>
</tr>
<tr>
<td>When switching between reverse phase and normal phase (both times)</td>
<td>Isopropanol</td>
<td>Isopropanol is miscible with both normal phase and reverse phase solvents.</td>
</tr>
<tr>
<td>After an installation</td>
<td>Ethanol or Methanol</td>
<td>Alternative to Isopropanol (second choice) if no Isopropanol is available</td>
</tr>
<tr>
<td>To clean the system when using buffers</td>
<td>Bidistilled water</td>
<td>Best solvent to re-dissolve buffer crystals</td>
</tr>
<tr>
<td>After a solvent change</td>
<td>Bidistilled water</td>
<td>Best solvent to re-dissolve buffer crystals</td>
</tr>
<tr>
<td>Before turning off system for an extended period of time</td>
<td>Organic or 10 % isopropanol in water</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE**  The pump should never be used for priming/purging empty tubings (never let the pump run dry). Use a syringe to draw enough solvent for completely filling the tubings to the pump inlet before continuing to prime with the pump.
If the system has been run dry or air has diffused into the pump it might require additional steps to get rid of the air again. Following the procedure below will give the best and fastest results.

1. Turn on the Prime function.
2. Purge the system with 10 ml, 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.
5. Observe the pressure fluctuations. The system is air free as soon as the pressure is stable.
6. Change solvents and column according to the analytical conditions and purge the system to change solvents.
Solvent Information

Introduction

Observe the following recommendations on the use of solvents.

- Follow recommendations for avoiding the growth of algae, see “Algae Growth in HPLC Systems” on page 48.
- Small particles can permanently block capillaries and valves. Therefore, always filter solvents through 0.22 μm filters.
- Avoid or minimize the use of solvents that may corrode parts in the flow path. Consider specifications for the pH range given for different materials like flow cells, valve materials etc. and recommendations in subsequent sections.

Materials in Flow Path

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

<table>
<thead>
<tr>
<th>Part</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degasser chamber</td>
<td>TFE/PDD copolymer, PFA (internal tubings); PEEK (inlets); FEP (tubings); ETFE (fittings)</td>
</tr>
<tr>
<td>Ultra clean tubings¹</td>
<td>PFA (tubings), PEEK (fittings)</td>
</tr>
<tr>
<td>Microfluidic structures²</td>
<td>SST</td>
</tr>
<tr>
<td>SSV</td>
<td>PEEK, FEP, PFA, Al₂O₃-based ceramic, ruby, sapphire, SST</td>
</tr>
<tr>
<td>Passive inlet valve</td>
<td>SST, gold, ruby, ZrO₂-based ceramic, tantalum</td>
</tr>
<tr>
<td>Outlet valve</td>
<td>SST, gold, ruby, ZrO₂-based ceramic, tantalum</td>
</tr>
<tr>
<td>Pump head</td>
<td>SST</td>
</tr>
<tr>
<td>Pistons</td>
<td>ZrO₂-based ceramic</td>
</tr>
<tr>
<td>Piston/wash seals</td>
<td>UHMW-PE, SST</td>
</tr>
<tr>
<td>Pressure sensor</td>
<td>SST</td>
</tr>
<tr>
<td>Automatic purge valve</td>
<td>Polyimide, SST, DLC</td>
</tr>
</tbody>
</table>

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

² Jet Weaver, Heat Exchanger
Material Information

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

Disclaimer

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

PEEK

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

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

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

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 very sensitive to high pressure. Therefore Agilent uses stainless-steel cladded PEEK capillaries in bio-inert systems. The use of stainless steel cladded PEEK capillaries keeps the flow path free of steel and ensures pressure stability to at least 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 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 to 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 (ST)**

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

- Solutions of alkali halides, their respective acids (for example, lithium iodide, potassium chloride, and so on) and aqueous solutions of halogens.
- High concentrations of inorganic acids like nitric acid, sulfuric acid and organic solvents especially at higher temperatures (replace, if your chromatography method allows, by phosphoric acid or phosphate buffer which are less corrosive against stainless steel).
- Halogenated solvents or mixtures which form radicals and/or acids, for example:
  
  \[2 \text{CHCl}_3 + \text{O}_2 \rightarrow 2 \text{COCl}_2 + 2 \text{HCl}\]

  This reaction, in which stainless steel probably acts as a catalyst, occurs quickly with dried chloroform if the drying process removes the stabilizing alcohol.

- Chromatographic grade ethers, which can contain peroxides (for example, THF, dioxane, di-isopropylether). Such ethers should be filtered through dry aluminium oxide which adsorbs the peroxides.
- Solutions of organic acids (acetic acid, formic acid, and so on) in organic solvents. For example, a 1 % solution of acetic acid in methanol will attack steel.
- Solutions containing strong complexing agents (for example, EDTA, ethylene diamine tetra-acetic acid).
- Mixtures of carbon tetrachloride with 2-propanol or THF.

**Titanium (Ti)**

Titanium is highly resistant to oxidizing acids (for example, nitric, perchloric and hypochlorous acid) over a wide range of concentrations and temperatures. This is due to a thin oxide layer on the surface, which is stabilized by oxidizing compounds. Non-oxidizing acids (for example, hydrochloric, sulfuric and phosphoric acid) can cause slight corrosion, which increases with acid concentration and temperature. For example, the corrosion rate with 3 % HCl (about pH 0.1) at room temperature is about 13 μm/year. At room temperature, titanium is resistant to concentrations of about 5 % sulfuric acid (about pH 0.3). Addition of nitric acid to hydrochloric or sulfuric acids
significantly reduces corrosion rates. Titanium is sensitive to acidic metal chlorides like FeCl₃ or CuCl₂. 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 (SiO₂)**

Fused silica is used in 1290 Infinity Flow Cells and capillaries. 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)**

Fluorinated polymers like PTFE (polytetrafluoroethylene), 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, 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.

**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.
Solvent Handling

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 48.
- For buffer concentrations of 0.1 M or higher using the seal wash function periodically with a runtime of 0.3 min every 3 min is strongly recommended.
- Filter buffer solutions to avoid increased wear or blockages that are caused by undissolved crystals. Always use solvent inlet filters.
- Avoid conditions where mixing of buffers and organic solvents may cause precipitation, as this impairs the reproducibility of chromatographic experiments and may also reduce the system life time. For example in reversed phase chromatography, avoid buffers (especially phosphate buffers) with a concentration higher than 20 mmol/L. For phosphate buffers, avoid compositions containing more than 65 % acetonitrile or other organic solvents.
- Use a minimum flow rate of 5 μL/min or 1 % composition per solvent channel (whatever is greater) to avoid cross-flow. Cross-flow can be caused by micro leaks in pump heads and can result in buffer precipitation in pump heads, channel blocking, or reduced pump head life time through wear of seals and pistons.
- Consider using an inline filter, for example Inline filter (G1311-60006).
- Never leave buffers in a system without flow. Before shutting down a system, flush it extensively with warm water to avoid clogging of valves, capillaries, or flow cells or reducing the life time of your column. If the system is not used for some time, for example more than a day depending on lab temperature, fill all solvent lines with organic solvent or water with at least 10 % isopropanol.
- Regularly maintain the LC system.
Handling of Acetonitrile

Acetonitrile is a solvent that is frequently used in reversed-phase chromatography. Despite of its common use, it can be a source of issues if not handled correctly. Acetonitrile degrades through polymerization and such polymers can stick to surfaces in LC systems and e.g. cause issues with valve performance and therefore affect retention time precision. Polymers can also show up as background noise in MS detectors.

When using acetonitrile:

• Use high-quality solvents from renowned suppliers.
• Use fresh solvents and filter them.
• Minimize exposure to light and air/oxygen.
• Choose a bottle size which fits to your application and usage.
• Acids accelerate polymerization. If possible avoid such additives or refresh solvents more frequently.
• Pure acetonitrile polymerizes 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 124) or ultrasonicate them, e.g. in methanol.

Handling of Acids

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

Please note that for non-volatile acids like phosphoric acid or perchloric acid concentrations increase after evaporation of water. This means that originally diluted acids can damage parts over time, e.g. because of liquid, which has left the solvent path through micro leaks. Such systems should be flushed regularly with pure water and may require shorter maintenance cycles. Using the seal wash function should be considered for protecting pump heads.
Solvent Recommendation for Agilent 1290 Infinity and 1290 Infinity II Pumps

While the Agilent 1290 Infinity and 1290 Infinity II pumps guarantee a very high performance with a huge variety of different solvents, other solvents may cause harm to the pump or the entire UHPLC system. No modifications are necessary when using standard reverse phase applications with water and other polar protic solvents in combination with most polar aprotic solvent. Normal phase applications with non-halogenated non-polar solvents work well when the standard valves are replaced with normal phase valves (see “Normal Phase Applications” on page 46).

Several solvents are not recommended to be used with Agilent 1290 Infinity and 1290 Infinity II systems, amongst them are halogenated organic solvents as they can release hydrogen halides causing corrosion on stainless steel parts throughout the system.

Due to its unique properties, THF should also not be used as solvent in Agilent 1290 Infinity and 1290 Infinity II pumps as it leads to fast degeneration of internal pump parts resulting in very early part failures.

These and other uncommon LC solvents might work well when diluted to lower concentrations or when used for only very short time.

Normal Phase Applications

Current valves used with 1260 and 1290 Infinity pumps do not work well with applications using non-polar solvents as for normal phase applications (e.g. hexane and heptane). With such applications, pressure drops could be observed. They are a result of particles electrostatically charging up in insulating solvents and sticking to the balls inside the valves, such that the valves do not close properly any more after some time of use (can be hours). For normal phase applications, a second type of valves is available, which has a design based on the existing one for 1260 and 1290 Infinity valves. These valves use a new material for valve balls, which is a conductive ceramic and replaces non-conductive ruby balls. The balls do not charge up electrostatically and show good performance in normal phase.
The valves are marked with "N" for non-polar or normal phase. Agilent recommends using these valves for (and only for) normal phase applications. The N-Valves have been tested successfully in using hexane at pressures below 100 bar; heptane can be used as a substitute for neurotoxic hexane.

**Seals for Normal Phase Applications**

For running normal phase on 1200 Infinity Series pumps, yellow PE seals are required, which exist as piston seals and wash seals. Seal wash is very uncommon for normal phase applications (no buffers needed), but wash seals are needed for seal wash pump heads.

1290 Infinity pumps use PE seals by default. In combination with ceramic pistons, PE seals are used for both reversed phase (1200 bar) and normal phase applications.
Algae Growth in HPLC Systems

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

Instrumental Problems Associated With Algae

Algae deposit and grow everywhere within the HPLC system causing:

- 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.
- Small pore high pressure solvent filters, usually placed before the injector to plug resulting in high system pressure.
- PTFE frits blockage leading to increased system pressure.
- Column filters to plug giving high system pressure.
- Flow cell windows of detectors to become dirty 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 about 0.2 μm filters.
- Never leave mobile phase in the instrument for several days without flow.
- Always discard old mobile phase.
- Use the amber solvent bottle (Solvent bottle, amber (9301-1450)) supplied with the instrument for your aqueous mobile phase.
- If possible add a few mg/l sodium azide or a few percent organic solvent to the aqueous mobile phase.
Setting up the Pump with the Instrument Control Interface

Overview

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

Instrument Configuration

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

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

The Binary Pump configuration parameters are in two sections:

- Communication
- Options

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

- Device name,
- Type ID,
- Serial number,
- Firmware revision,
- Button Connection settings
Using the Pump
Setting up the Pump with the Instrument Control Interface

Options:

- **Pressure Unit:**
  select the pressure units from the drop-down list (bar, psi or MPa).

- **Seal wash installed:**
  This check box is marked to indicate that an optional seal wash has been detected during autoconfiguration.

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

**Configure Solvent Type Catalogs:** Displays the **Solvent Type Catalogs** dialog box, which allows you to import and export solvent calibration data. See “Importing Solvent Calibration Tables” on page 66.

Please refer to the online help of your user interface for more detailed information.
The Pump User Interface (Dashboard Panel)

Module Graphic

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

Indicates that an External Contacts board is installed.

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

Indicates that the ISET option is installed but with no active method (gray) or installed and active (orange). (G4220A only)

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

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

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

The following pump signals are displayed:

<table>
<thead>
<tr>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow</td>
<td>The current solvent flow rate (in mL/min).</td>
</tr>
<tr>
<td>Pressure</td>
<td>The current pump pressure (in bar, psi or MPa, see “Instrument Configuration” on page 49).</td>
</tr>
<tr>
<td>Pressure Limit</td>
<td>The current maximum pressure limit.</td>
</tr>
<tr>
<td>Composition A:B</td>
<td>The current solvent composition. When a solvent selection valve is fitted, the channels are shown in the graphic.</td>
</tr>
<tr>
<td>Tuning</td>
<td>The signal represents the current effort the pump drives have to take to maintain the current system status.</td>
</tr>
</tbody>
</table>

### Context Menu

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

- **Control**: Displays the pump’s Control dialog box.
- **Method**: Displays the pump’s Method Setup dialog box.
- **Set Error Method**: Sets the method that is loaded if an error occurs to the method that is currently available in the hardware.
- **Identify Device**: Causes the LED on the front of the module to blink for a few seconds.
- **Switch Pump On/Off**: Toggles the status of the pump, on or off.
- **Switch solvent selection Valve A**: Allows you to switch the solvent inlet line for channel A from inlet line 1 to 2.
- **Bottle Fillings**: Displays the Bottle Fillings dialog box.
- **Prepare Pump**: Allows you to control the Purge, Condition or the Prime function.
- **Seal Wash Purge**: Allows you to refill the Seal Wash lines once the Seal Wash solvent has been changed.
### Prepare Pump Dialog

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purge</strong></td>
<td>Time: 0 – 100.00 min in steps of 0.01.</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>Flow: 0.000 – 5.000 mL/min for each channel, in steps of 0.001</td>
<td>• <strong>Off</strong>: Turns off the purge.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• <strong>On</strong>: The device is purged.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Purge Flow, Time and Composition during purge have to be defined. As soon as the duration time of the purge ends, the module automatically switches to analytical conditions again.</td>
</tr>
<tr>
<td><strong>Prime</strong></td>
<td></td>
<td>Select On to start priming, Off to turn priming off. The Prime function is helpful for filling empty solvent lines or if air has entered the pump heads. The module draws solvent, at high speed with both pump drives simultaneously, and dispenses it against the waste position of the Multi Purpose Valve. This is done 20 times, before the process comes to an end.</td>
</tr>
<tr>
<td><strong>Conditioning</strong></td>
<td>at least 200 bar (&gt; 500 bar is better).</td>
<td>Use this function if you see excessive pressure or composition ripple, and you are sure that the solvent type (aqueous/organic or specific solvent/solvent mix) is correctly set, and there is no evidence of leakage in the pump. Conditioning may be necessary if the pump may contain air, for example after running out of solvent, after a long period of standby or after service or repair.</td>
</tr>
</tbody>
</table>
3 Using the Pump

Setting up the Pump with the Instrument Control Interface

Control Settings

The pump control parameters are in two sections:

- Pump
- Automatic Turn On

Table 6 Pump control parameters

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

Method Parameter Settings

The Binary Pump method setup parameters are in eight sections:

- Flow
- Solvents A and B
- Stop time
- Post time
- Pressure limits
- Timetable
- Advanced
- External Contacts
### Table 7  Method parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow</td>
<td>0.00 – 5.00 mL/min in steps of 0.001.</td>
<td>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.</td>
</tr>
<tr>
<td>Solvents A and B</td>
<td>For each channel, you can select which of the two solvents to deliver. You can set the percentage of solvent B to any value from 0 through 100 %. Solvent A always delivers the remaining volume: 100 - %B. The solvent B check boxes allow you to turn the solvent B channels on (checked) or off (cleared). When the <strong>Use solvent types</strong> check box in the <strong>Compressibility</strong> section is checked (see “Advanced Settings” on page 57), you click the down arrow and select either a <strong>Generic</strong> solvent or a calibrated <strong>Solvent</strong>.</td>
<td></td>
</tr>
<tr>
<td>Stoptime</td>
<td>0.01 – 99999 min or <strong>As Injector/No Limit</strong> (an infinite run time).</td>
<td>The stoptime sets a time limit for your analysis. After the stoptime, all gradients are stopped and the pump parameters return to their initial values. The pump can be used as a stoptime master for the complete analytical system. The pump also stops the detectors if they have a <strong>No Limit</strong> stoptime setting. If no limit is given, a method will have to be stopped manually.</td>
</tr>
<tr>
<td>Posttime</td>
<td>0.01 – 99999 min or <strong>Off</strong> (0.0 min ).</td>
<td>Your instrument remains in a not ready state during the posttime to delay the start of the next analysis. You can use the <strong>Posttime</strong> to allow your column to equilibrate after changes in solvent composition (for example after gradient elution).</td>
</tr>
</tbody>
</table>
| Pressure Limits    | **Max**: 1300 bar (18850 psi ) for flow rates up to 2 mL/min. For flow rates between 2 mL/min and 5 mL/min , the maximum pressure ramps down to 800 bar (11600 psi). **Min**: any value between 0 and the upper pressure limit setting. | Sets the maximum and minimum pressure limits for the pump.  
  - **Max** is the maximum pressure limit at which the pump will switch itself off, protecting the analytical system against over-pressure.  
  - **Min** is the minimum limit at which the pump will switch itself off, for example, if any solvent reservoir is empty, this prevents system damage by pumping air. |

Timetable          | See “Timetable Settings” on page 58         |
### Table 7  Method parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced</td>
<td></td>
<td>See “Advanced Settings” on page 57</td>
</tr>
<tr>
<td>External Contacts</td>
<td></td>
<td>The <strong>External Contacts</strong> section enables you to set up the switching of the external contacts.</td>
</tr>
</tbody>
</table>

**NOTE**

The **External Contacts** section is present only when a BCD/external contacts board is installed.
Advanced Settings

The Binary Pump advanced method setup parameters are in three sections:
- **Minimum Stroke**
- **Compressibility**
- **Maximum Flow Gradient**

### Table 8  Advanced method parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Minimum Stroke</strong></td>
<td>20 – 100 µL</td>
<td>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 Jet Weaver geometry. <strong>Synchronized</strong>: Select this option to synchronize the strokes for both channels; the values for Channel B are set to the same as those for Channel A. This is done to avoid floating disturbances affecting instrument performance.</td>
</tr>
</tbody>
</table>
| **Compressibility**    |                                             | The compressibility of the mobile phase has an effect on the performance of the pump. For best flow accuracy and mixing performance, you can set the parameter according to the mobile phase being used. **Use solvent types**:  
  - Clear this check box to display the compressibility fields, which allow you to enter compressibility values.  
  - When the check box is selected, the compressibility fields are not displayed, and the enhanced compressibility calibration is enabled. Select the required calibrated solvents from the drop-down lists using the combo boxes in the **Solvents** section. |
| **Maximum Flow Gradient** | 1.000 – 1000.000 mL/min/min in steps of 0.001 mL/min/min  
Default value: 100.000 mL/min/min | You can set a limit on the rate of change of the solvent flow to protect your analytical column. You can set individual values for **Flow ramp up** and **Flow ramp down**. |
3 Using the Pump
Setting up the Pump with the Instrument Control Interface

Timetable Settings

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

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

The following parameters can be changed:

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

Delay Volume and Extra-Column Volume 60
Delay Volume 60
How to Configure the Optimum Delay Volume 61
How to Achieve Higher Resolution 63
Using Solvent Calibration Tables 66

This chapter gives hints on how to optimize the performance or use additional devices.
Delay Volume and Extra-Column Volume

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

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

Delay Volume

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

The delay volume in a system includes the volume in the pump from the point of mixing, connections between pump and autosampler, volume of the flow path through the autosampler and connections between autosampler and column.
How to Configure the Optimum Delay Volume

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

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

The following different Jet Weaver configurations are available:

- The Jet Weaver 35 μL/ 100 μL (G4220-60027) has two alternative volumes in the same unit.
  
  The switch from the lower volume, 35 μL, to the higher volume, 100 μL, is done by uninstalling it, turning it around from front to back and re-installing it, see “Change Configuration or Replace the Jet Weaver” on page 118. The delay volume is increased by approximately 31 μL and the baseline performance with additives like TFA will be improved. The configuration of the Jet Weaver is logged automatically by an attached RFID tag.

- The 380 μL Jet Weaver high performance mixer is optionally available for demanding applications, which use solvents in different channels (for example A versus B), that differ strongly in their UV/Vis absorption, for example by using trifluoroacetic acid (TFA) as a modifier, which has a high absorbance.

NOTE

Before disconnecting a Jet Weaver from the flow path, flush it with organic solvent. Avoid leaving water or buffers inside the Jet Weaver, which may cause the growth of microorganisms like algae or bacteria.
4 Optimizing Performance
How to Configure the Optimum Delay Volume

Solvent packages created by the pump may persist until the solvent reaches the detector flow cell. Absorption fluctuations can then show up as baseline noise, also referred to as mixing noise. Applications like impurity quantitation or lowest level compound detection require minimizing this noise. The 380 μL Jet Weaver strongly improves mixing and therefore reduces baseline noise and improves sensitivity in detection. Patented Agilent microfluidic technology offers high mixing performance at a low internal volume of 380 μL.
How to Achieve Higher Resolution

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

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

Resolution between two peaks is described by the resolution equation:

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

where

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

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

The resolution equation shows that the next most significant term is the plate count or efficiency, $N$, and this can be optimized in a number of ways. $N$ is inversely proportional to the particle size and directly proportional to the length of a column and so smaller particle size and a longer column will give a higher plate number. The pressure rises with the inverse square of the particle
size and proportionally with the length of the column. This is the reason that the 1290 Infinity LC system was designed to go to 1200 bar so that it can run sub-two-micron particles and column length can be increased to 100 mm or 150 mm. There are even examples of 100 mm and 150 mm columns linked to give 250 mm length. 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. Experiment 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).
This shows that $k$ and hence resolution can be increased by having a shallower gradient (2 to 5 %/min change is a guideline), higher flow rate and a smaller volume column. This equation also shows how to speed up an existing gradient – if the flow is doubled but the gradient time is halved, $k^*$ remains constant and the separation looks the same but happens in half the time. Recently published research has shown how a shorter STM column (at temperatures above 40 °C) can generate higher peak capacity than a longer STM column by virtue of running it faster. (Refer to Petersson et al., J.Sep.Sci, 31, 2346-2357, 2008, Maximizing peak capacity and separation speed in liquid chromatography).
Using Solvent Calibration Tables

Importing Solvent Calibration Tables

RC.NET based Agilent graphical user interfaces (ChemStation, EZChrom Elite, OpenLab etc.) include data for most commonly used solvents in HPLC. This data contains solvent properties and is used for optimum pump control in order to ensure best flow and composition accuracy.

If your solvent is not included to the software, please check the Agilent website http://www.agilent.com/en-us/firmwareDownload?whid=69761 for additional libraries (registration required), which also provides updates and optimized data.

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.

Importing Solvent Calibration in ChemStation

1. Go to menu Instrument > Instrument configuration.
2. In the Instrument Configuration screen choose your module and click Configure.
3. Click Configure Solvent Type Catalogs.
4. In Solvent Type Catalogs click Import.
5. Navigate to the location of the solvent calibration table and click Open.
6. The new solvent will now appear in the Solvent Type Catalogs.
5 Troubleshooting and Diagnostics

Overview about the troubleshooting and diagnostic features.
User Interfaces

• Depending on the user interface, the available tests and the screens/reports may vary.

• Preferred tool should be Agilent Lab Advisor Software, see “Agilent Lab Advisor Software” on page 69.

• The Agilent OpenLab ChemStation C.01.03 and above do not include any maintenance/test functions.

• Screenshots used within these procedures are based on the Agilent Lab Advisor Software.
Agilent Lab Advisor Software

The Agilent Lab Advisor Software 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. By the push of a button, a detailed diagnostic report can be generated. Upon request, the user can send this report to Agilent for a significantly improved troubleshooting and repair process.

The Agilent Lab Advisor software is available in two versions:

- Lab Advisor Basic
- Lab Advisor Advanced

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

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

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

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

The Pump Leak Rate Tests is a diagnostic test to check the integrity and tightness of the pump components. The test is started from the Services & Diagnostics section of any 1290 Infinity or Infinity II pump in the Agilent Lab Advisor Software. The test is first evaluating the tightness from the outlet valve downstream to the purge valve. 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. 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 included tested.

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

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

   The test runs automatically without any further user interaction.

Evaluation:

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

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

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

If the test does not pass, check the system for leaks or call a local Agilent representative.
Figure 6 on page 71 and Figure 7 on page 72 show a typical test run.
5 Troubleshooting and Diagnostics

Pump Leak Rate Test

Figure 7 Dynamic (primary) Leak Test
Troubleshooting the Pump Leak Rate Test

**Secondary Leak > 3 µL/min**

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

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

- Air in the primary pump chamber
  - Check for air in the solvent inlet lines and the Tuning signal
    - Purge the lines, Prime and Condition the pump head
- Abort due to over pressure
  - Check solvent and solvent settings
    - Purge and condition the pump head with water
- Leak in Inlet Valve
  - Check for moving air bubbles in tubing directly to the Inlet Valve
    - Purge the lines with water to remove dirt
    - Knock at the valve, clean or replace it
- Outlet valve not properly assembled
  - Re-tighten the outlet valve
  - Check the position of the gold seal
Troubleshooting and Diagnostics

Pump Leak Rate Test

- Leaky piston seals and/or position dependent leaks on the piston
  - Remove the SW tubes from the support ring and check for leaks
  - Replace the piston seals and clean the pistons
    - Ensure that seals are lubricated when pushed in
    - Use abrasive mesh >5000 grit
System Pressure Test

The System Pressure Test is performed to evaluate the leak tightness of the system up to the point where the system is capped off. The test is started from the Services & Diagnostics section of any 1290 Infinity or Infinity II pump in the Agilent Lab Advisor Software or from the G4208A Instant Pilot. Modules like pump, sampler, column compartments as well as accessories like valves or columns can be included into the flow path for this test.

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

The test runs automatically without any further user interaction.

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

- For a pressure setting \( \leq 1000 \) bar, the allowed leak limit is \( \leq 5 \mu L/min \)
- For a pressure setting \( > 1000 \) bar, the allowed leak limit is \( \leq 15 \mu L/min \)

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.
5 Troubleshooting and Diagnostics

System Pressure Test

Figure 8 on page 76 shows a typical test run.

Figure 8  System Pressure Test
6 Error Information

What Are Error Messages 79

General Error Messages 80
  Timeout 80
  Shutdown 80
  Remote Timeout 81
  Lost CAN Partner 81
  Leak Sensor Short 82
  Leak Sensor Open 82
  Compensation Sensor Open 83
  Compensation Sensor Short 83
  Fan Failed 84
  Leak 85
  Open Cover 85
  Cover Violation 86

Pump Error Messages 87
  Pressure of binary pump above upper limit 87
  Pressure below lower limit 87
  Target pressure not reached for binary pump degasser 88
  Degasser’s pressure limit violation 88
  Solvent counter exceeded limit 89
  Waste counter limit exceeded 89
  Flow rate limit exceeded 90
  Binary pump shutdown during analysis 90
  Reading the pump encoder tag failed 91
  Writing the pump encoder tag failed 91
  Pump drive blocked or encoder failed 92
  Drive current too low 92
  Drive Encoder failed 92
This chapter describes the meaning of error messages, and provides information on probable causes and suggested actions how to recover from error conditions.
What Are Error Messages

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

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

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

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

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

Timeout

Error ID: 0062

The timeout threshold was exceeded.

Probable cause

1. The analysis was completed successfully, and the timeout function switched off the module as requested.
2. A not-ready condition was present during a sequence or multiple-injection run for a period longer than the timeout threshold.

Suggested actions

Check the logbook for the occurrence and source of a not-ready condition. Restart the analysis where required.

Shutdown

Error ID: 0063

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

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

Probable cause

1. Leak detected in another module with a CAN connection to the system.
2. Leak detected in an external instrument with a remote connection to the system.
3. Shut-down in an external instrument with a remote connection to the system.
4. The degasser failed to generate sufficient vacuum for solvent degassing.

Suggested actions

Fix the leak in the external instrument before restarting the module.
Fix the leak in the external instrument before restarting the module.
Check external instruments for a shut-down condition.
Check the vacuum degasser for an error condition. Refer to the Service Manual for the degasser or the pump that has the degasser built-in.
Remote Timeout

Error ID: 0070

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

Probable cause

1. Not-ready condition in one of the instruments connected to the remote line.
2. Defective remote cable.
3. Defective components in the instrument showing the not-ready condition.

Suggested actions

1. Ensure the instrument showing the not-ready condition is installed correctly, and is set up correctly for analysis.
2. Exchange the remote cable.
3. Check the instrument for defects (refer to the instrument’s documentation).

Lost CAN Partner

Error ID: 0071

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

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

Probable cause

1. CAN cable disconnected.
2. Defective CAN cable.
3. Defective main board in another module.

Suggested actions

- Ensure all the CAN cables are connected correctly.
- Ensure all CAN cables are installed correctly.
- Exchange the CAN cable.
- Switch off the system. Restart the system, and determine which module or modules are not recognized by the system.
6 Error Information
General Error Messages

Leak Sensor Short

Error ID: 0082

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

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

Probable cause

1 Defective leak sensor.
2 Leak sensor incorrectly routed, being pinched by a metal component.
3 Power switch assembly defective

Suggested actions

Please contact your Agilent service representative.
Please contact your Agilent service representative.
Please contact your Agilent service representative.

Leak Sensor Open

Error ID: 0083

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

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

Probable cause

1 Leak sensor not connected to the Power Switch board.
2 Defective leak sensor.
3 Leak sensor incorrectly routed, being pinched by a metal component.
4 Power switch assembly defective

Suggested actions

Please contact your Agilent service representative.
Please contact your Agilent service representative.
Please contact your Agilent service representative.
Please contact your Agilent service representative.
Compensation Sensor Open

Error ID: 0081

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

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

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Loose connection between the power switch board and the main board</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>2  Defective power switch assembly</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>

Compensation Sensor Short

Error ID: 0080

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

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

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Defective power switch assembly</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>2  Loose connection between the power switch board and the main board</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>
**Fan Failed**

**Error ID: 0068**

The cooling fan in the module has failed.

The hall sensor on the fan shaft is used by the main board 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.

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Fan cable disconnected.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>2 Defective fan.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>3 Defective main board.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>
Error Information

Leak

Error ID: 0064
A leak was detected in the module.
The signals from the two temperature sensors (leak sensor and board-mounted temperature-compensation sensor) are used by the leak algorithm to determine whether a leak is present. When a leak occurs, the leak sensor is cooled by the solvent. This changes the resistance of the leak sensor which is sensed by the leak-sensor circuit on the main board.

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

Open Cover

Error ID: 0205
The top foam has been removed.
The sensor on the main board detects when the top foam is in place. If the foam is removed, the fan is switched off, and the error message is generated.

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

Error ID: 7461

The top foam has been removed.

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

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 The top foam was removed during operation.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>2 Foam not activating the sensor.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>
Pump Error Messages

These errors are pump specific.

Pressure of binary pump above upper limit

Error ID: 22014

The pressure has exceeded the upper pressure limit.
• Parameter: Measured pressure

Probable cause
1 Blockage in flow path after the pressure sensor.

Probable cause
2 Inappropriate settings (pressure limit, flow rate).

Suggested actions
• 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.

Suggested actions
• Decrease flow rate.
• Increase pressure limit.

Pressure below lower limit

Error ID: 22015

The pressure has dropped below the lower limit.
• Parameter: None

Probable cause
1 Leak

Probable cause
2 Bottle empty

Probable cause
3 Wrong solvent (viscosity)

Probable cause
4 Inappropriate setting

Probable cause
5 Column degradation

Suggested actions
Check for leaks.

Suggested actions
Check bottle filling.

Suggested actions
Check solvent.

Suggested actions
Check flow rate and lower pressure limit.

Suggested actions
Replace column.
Target pressure not reached for binary pump degasser

Error ID: 22031
The target pressure of the binary pump degasser has not been reached within the expected time.
- Parameter: Pressure in mbar

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

Degasser's pressure limit violation

Error ID: 22032
Pressure too far above the limit.

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

Error ID: 22055

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

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

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

Waste counter limit exceeded

Error ID: 22056

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

- Parameter: None

Probable cause | Suggested actions
--- | ---
1 The waste container is full. | Empty waste container.
2 Inappropriate setting for waste counter. | Reset waste counter.
| | Adjust waste counter limit.
6 Error Information
Pump Error Messages

Flow rate limit exceeded

Error ID: 22064

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

- Parameter: None

Probable cause

<table>
<thead>
<tr>
<th></th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Leak</td>
</tr>
<tr>
<td>2</td>
<td>Bottle empty.</td>
</tr>
<tr>
<td>3</td>
<td>Shutoff valve closed.</td>
</tr>
<tr>
<td>4</td>
<td>Drift of pressure sensor (unlikely for short tests taking some minutes).</td>
</tr>
</tbody>
</table>

Binary pump shutdown during analysis

Error ID: 22065

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

- Parameter: 0 for off, 1 for standby.

Probable cause

<table>
<thead>
<tr>
<th></th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pump has been shut down.</td>
</tr>
</tbody>
</table>

Suggested actions

- Restart pump.
Reading the pump encoder tag failed

**Error ID: 22402**

Reading the pump encoder tag has failed.
• Parameter: 1 – 4 referring to pump drive

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Defect connection between encoder and main board.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>2 Missing or defect tag Defect connection between tag and encoder.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>

Writing the pump encoder tag failed

**Error ID: 22405**

Writing the pump encoder tag has failed.
• Parameter: 1 – 4 referring to pump drive

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Defect connection between encoder and main board.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>2 Defect tag Defect connection between tag and encoder.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>
**Pump drive blocked or encoder failed**

Error ID: 22406

Pump drive blocked or encoder failed.

- Parameter: None

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Blockage of the pump drive Drive encoder failed.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>

**Drive current too low**

Error ID: 22407

The current consumption of the pump drive is too low.

- Parameter: 1 – 4 referring to pump drive

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Drive motor defect.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>2 Wrong/missing connection of pump drive to main board.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>

**Drive Encoder failed**

Error ID: 22408

Drive encoder failed during pump drive calibration.

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Internal error.</td>
<td>Contact Agilent support.</td>
</tr>
</tbody>
</table>
Error Information
Pump Error Messages

Drive current too high

Error ID: 22409

The current consumption of the pump drive is too high.
• Parameter: 1 – 4 referring to pump drive

Probable cause

1 Blockage of system before pressure sensor.
2 Drive motor defect.

Suggested actions

Check for blockage of e.g. outlet valve filter frit, purge valve, heat exchanger.

Drive timeout

Error ID: 22410

Drive is blocked mechanically, fails during initialization.
• Parameter: 1 – 4 referring to pump drive

Probable cause

1 Blockage of pump drive Drive motor defect.

Suggested actions

Please contact your Agilent service representative.

Overcurrent of pump drive

Error ID: 22411

The current consumption of the pump drive is too high.
• Parameter: 1 – 4 referring to pump drive

Probable cause

1 Blockage of system before pressure sensor.
2 Drive motor defect.

Suggested actions

Check for blockage of e.g. outlet valve filter frit, purge valve, heat exchanger.

Please contact your Agilent service representative.
Error Information

Pump Error Messages

Overcurrent of solvent selection valve (SSV)

Error ID: 22412
Overcurrent of solvent selection valve (SSV).
• Parameter: None

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Valve defect.</td>
<td>Replace the solvent selection valve.</td>
</tr>
</tbody>
</table>

Deliver underrun

Error ID: 22413
Internal error.
• Parameter: None

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Internal error.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>

Defect connection between main board and pump drive encoder

Error ID: 22414
Defect connection between main board and pump drive encoder.
• Parameter: 1 – 4 referring to pump drive

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Defect connection between main board and pump drive encoder.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>2 Defect encoder.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>
Pump drive encoder defect

Error ID: 22415

Defect pump drive encoder.
• Parameter: 1 – 4 referring to pump drive

Probable cause
1 Defect encoder.

Suggested actions
Please contact your Agilent service representative.

Purge valve failed

Error ID: 22417

Lost steps of the purge valve encoder.
• Parameter: None

Probable cause
1 Purge valve drive mechanically blocked or defect.

Suggested actions
• Check installation of purge valve head.
• Please contact your Agilent service representative.

Reading of purge valve tag failed

Error ID: 22420

Reading the purge valve tag failed.
• Parameter: None

Probable cause
1 Reading of purge valve tag failed.
2 Purge valve head tag defect or empty.
3 Purge valve tag reader is defect.

Suggested actions
Check cable connection.
Replace purge valve head.
Please contact your Agilent service representative.
### Pump drive encoder rollover

**Error ID: 22424**

Invalid pump drive encoder signals have been detected.
- Parameter: 1 – 4 referring to pump drive

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Pump drive encoder is defect.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>

### Drive position limit

**Error ID: 22425**

Internal error.
- Parameter: 1 – 4 referring to pump drive

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Internal error.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>

### Insufficient power of drive encoder LED

**Error ID: 22426**

Insufficient power of drive encoder LED.
- Parameter: 1 – 4 referring to pump drive

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Pump drive encoder is defect.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>
Drive encoder error

Error ID: 22427-22430

An error has occurred for the pump drive encoder.
• Parameter: 1 – 4 referring to pump drive

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

Writing the purge valve tag failed

Error ID: 22431

Writing the purge valve tag failed.
• Parameter: None

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

Current of primary pump drive too high

Error ID: 22433

The current of the primary pump drive is too high.
• Parameter: 1 or 4 referring to pump drive.

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

Error ID: 22434

The current of the secondary pump drive is too high.

- Parameter: 2 or 3 referring to pump drive

Probable cause

1. Blockage of flow path between secondary pump head and pressure sensor, e.g. of the heat exchanger.
2. Secondary pump drive is defect.

Suggested actions

- Check for blockages in the flow path.
- Please contact your Agilent service representative.

Unknown purge valve type

Error ID: 22435

The type information of the purge valve is invalid.

- Parameter: None

Probable cause

1. Wrong valve head installed.
2. Valve head has invalid RFID tag content.

Suggested actions

- Check or replace purge valve head.
- Check or replace purge valve head.

Pump drive encoder error

Error ID: 22437

The pump drive encoder has generated no signal.

- Parameter: 1 – 4 referring to pump drive

Probable cause

1. Pump drive encoder is defect.

Suggested actions

- Please contact your Agilent service representative.
Pump drive error

Error ID: 22438, 22439

The pump drive failed during calibration.

- Parameter: 1 – 4 referring to pump drive

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Pump drive motor defect or mechanically blocked.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>

Pump drive stroke blocked

Error ID: 22441

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

- Parameter: 1 – 4 referring to pump drive

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Wiper shifted</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>2 Pump head blocks piston movement</td>
<td>Replace, clean or repair pump head.</td>
</tr>
<tr>
<td>3 Pump drive motor is mechanically blocked.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>
Pump drive stop not found

Error ID: 22442

The maximum stroke is too long.
- Parameter: 1 – 4 referring to pump drive

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Wiper shifted</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>2 Pump drive spindle is defec</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>

Pressure sensor calibration wrong or missing

Error ID: 22443

Pressure sensor calibration wrong or missing.
- Parameter: None

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Pressure sensor calibration wrong or missing.</td>
<td>• Replace pressure sensor.</td>
</tr>
<tr>
<td></td>
<td>• Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>
Seal wash pump was missing when tried to turn on

Error ID: 22499

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

**Probable cause**  
1. Defect cable connection to seal wash pump.  
2. Defect seal wash pump motor.  
3. Defective main board.

**Suggested actions**  
Check cable connection.  
Please contact your Agilent service representative.  
Please contact your Agilent service representative.

Invalid degasser pressure signal

Error ID: 29253

The degasser pressure signal is invalid.

**Probable cause**  
1. Degasser might be disconnected  
2. Pressure sensor might be defective

**Suggested actions**  
Please contact your Agilent service representative.  
Please contact your Agilent service representative.
6 Error Information
Pump Error Messages
This chapter describes the maintenance of the High Speed Pump.
Introduction to Maintenance

Figure 9 on page 104 shows the main user accessible assemblies of the Agilent 1290 Infinity II High Speed Pump. These parts can be accessed from the front (simple repairs) and don’t require to remove the pump from the system stack.

Figure 9   Maintenance parts

Figure 10 on page 105 shows the flow connections between these main assemblies.
Figure 10  The hydraulic path

**Recommended Interval for Preventive Maintenance**

The recommended interval for preventive maintenance is:

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

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

A “typical” application can be characterized as follows:

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

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

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

➔ When working with these substances observe appropriate safety procedures (for example by wearing goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the vendor, and follow good laboratory practice.

➔ The volume of substances should be reduced to the minimum required for the analysis.

➔ Do not operate the instrument in an explosive atmosphere.

---

**WARNING**  Electrical shock

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

➔ Do not remove the cover of the module.

➔ Only certified persons are authorized to carry out repairs inside the module.

---

**WARNING**  Personal injury or damage to the product

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

➔ Use your Agilent products only in the manner described in the Agilent product user guides.
**WARNING**

Heavy weight

The module is heavy (>22 kg (>46 lbs)).

➔ Carry the module at least with 2 people.

➔ Avoid back strain or injury by following all precautions for lifting heavy objects.

➔ Ensure that the load is as close to your body as possible.

➔ Ensure that you can cope with the weight of your load.

---

**CAUTION**

Safety standards for external equipment

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

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

To keep the module case clean, use a soft cloth slightly dampened with water, or a solution of water and mild detergent.

**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.
Install Fittings and Capillaries

**WARNING**
Solvent can spray under high pressure.

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

**CAUTION**
Deformation of fittings and seals

Liquid drops under high pressure up to 1200 bar 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

<table>
<thead>
<tr>
<th>Parts required</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5067-5767</td>
<td>Door assy 200 left IF II</td>
</tr>
<tr>
<td></td>
<td>5067-5768</td>
<td>Door assy 200 right IF II</td>
</tr>
</tbody>
</table>

NOTE
The figures shown in this procedure exemplarily show the Infinity II Multisampler module. The principle of how to remove and/or install doors works in the same way for all Infinity II modules.
7  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 move the door in until the release buttons click into their final position.
Replace the Shutoff Valve Panel

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

Parts required

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

Preparations
In order to avoid leaks, remove tubings from the solvent bottles.

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

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

3 Remove the shutoff valve panel by pulling it downwards.

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

### When

No or invalid pressure signal

### Tools required

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8710-2412</td>
<td>Hex key 2.5 mm, 15 cm long, straight handle</td>
</tr>
<tr>
<td>8710-0510</td>
<td>Wrench open 1/4 — 5/16 inch</td>
</tr>
<tr>
<td></td>
<td>Screwdriver</td>
</tr>
</tbody>
</table>

### Parts required

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G7104-60001</td>
<td>Pressure sensor 1300 bar</td>
</tr>
</tbody>
</table>

### Preparations

Turn off pump flow, switch off pump

### NOTE

This procedure describes how to replace the pressure sensor.

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

1. Remove capillary connections between the pressure sensor and purge valve.
2. Remove the screws that fix the pressure sensor to the chassis.
Replace the Pressure Sensor

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

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

5 Fix the pressure sensor to the instrument chassis.

6 Connect the capillaries from the valve to the pressure sensor: connect port 3 to the pressure sensor inlet and port 2 to the outlet.
# Replace the Solvent Selection Valve (SSV)

**When**

In case of problems with the solvent selection valve

<table>
<thead>
<tr>
<th>Parts required</th>
<th>#</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>G7120-60029</td>
<td>SSV Valve Assembly</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>G4220-60035</td>
<td>Tubing kit 140 mm, 2/pk</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SSV to shutoff valve or degassing unit</td>
</tr>
</tbody>
</table>

1. Close shut-off valve.

2. Remove tubing connections between the SSV and the solvent shut-off valves and the SSV and the degassing unit inlets.

3. Push down the SSV panel for removing it.

4. Remove the connector by pushing up the small clip at the bottom of the connector.
Replace the Solvent Selection Valve (SSV)

5  Install a new SSV by inserting the connector and clipping the SSV panel to the module top panel. Then re-install all tubing connections, open shut-off valve and purge valve.
7 Maintenance
Change Configuration or Replace the Jet Weaver

Change Configuration or Replace the Jet Weaver

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

**Tools required**
<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8710-0510</td>
<td>¼ inch wrench</td>
</tr>
<tr>
<td></td>
<td>3 mm hex key</td>
</tr>
</tbody>
</table>

**Parts required**
<table>
<thead>
<tr>
<th>#</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>G4220-60027</td>
<td>Jet Weaver 35 µL/100 µL</td>
</tr>
<tr>
<td>1</td>
<td>G4220-60012</td>
<td>Jet Weaver 380 µL (OPTIONAL)</td>
</tr>
<tr>
<td>1</td>
<td>G4220-87000</td>
<td>Capillary ST 0.17 mm x 300 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Valve to Jet Weaver</td>
</tr>
</tbody>
</table>
1. Remove capillary connections from the Jet Weaver.

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

3. Remove the Jet Weaver.

4. Install new Jet Weaver or flip the Jet Weaver for backside.

**NOTE**

The standard Jet Weaver (Jet Weaver 35 µL/ 100 µL (G4220-60027)) has a front and a rear side with different internal volumes (35 / 100 µL) that are optimized for a low delay volume or best mixing performance.

The optional Jet Weaver (Jet Weaver 380 µL (G4220-60012)) is recommended for applications which are challenging with respect to mixing noise (e.g. TFA applications) and has just one side.
7 Maintenance
Change Configuration or Replace the Jet Weaver

5 Fix the Jet Weaver with the screws.

6 Reinstall the capillary connections.

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

When
In case of wear of the seal wash pump

Parts required

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5065-4445</td>
<td>Peristaltic pump with Pharmed tubing</td>
</tr>
<tr>
<td>5065-9978</td>
<td>Tubing, 1 mm i.d., 3 mm o.d., silicone, 5 m</td>
</tr>
</tbody>
</table>

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

1. Press the clips.
2. Pull the pump to the front.
3. Insert the pump clips to the holes in the pump housing.
4. Fix the seal wash tubings to the peristaltic pump inlet (1) and from the peristaltic pump outlet to the primary pump head inlet (2).
Replace the Inlet Valve

When

If Inlet valve is defective.

Tools required

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G4220-20012</td>
<td>Wrench, 14 mm</td>
</tr>
<tr>
<td>G4220-20012</td>
<td>Torque wrench 2 – 25 Nm</td>
</tr>
</tbody>
</table>

Parts required

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G4220-60022</td>
<td>Inlet valve</td>
</tr>
<tr>
<td>G4220-60022</td>
<td>(primary pump head)</td>
</tr>
</tbody>
</table>

NOTE

For best performance and life time and for avoiding leaks, use a torque wrench set to 10 Nm for fixing the inlet valve.

1. Close the shut off valves to avoid solvent leaks.
2. Unscrew the tubing at the inlet valve.
### Maintenance

#### Replace the Inlet Valve

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>With a 14 mm wrench, unscrew the inlet valve and remove it.</td>
</tr>
<tr>
<td>4</td>
<td>Install inlet valve and tighten it at 10 Nm with a torque wrench (14 mm).</td>
</tr>
<tr>
<td>5</td>
<td>Attach the inlet tubing at the inlet valve.</td>
</tr>
<tr>
<td>6</td>
<td>Open the shut off valves and purge the system to remove air.</td>
</tr>
</tbody>
</table>
Release a Stuck Inlet Valve

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

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

1. Remove the capillary connection from the outlet of the secondary pump head.
2. Unscrew the tubing at the inlet valve.
3. Attach a Luer lock syringe with adapter to the tubing and fill it with solvent.
4. Reconnect tubing to inlet valve.
5 Unscrew tubing at degassing unit and attach the syringe to it.

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

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

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

9 Purge the system to remove air.
7 Maintenance
Remove the Pump Head Assembly

Remove the Pump Head Assembly

<table>
<thead>
<tr>
<th>Tools required</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>G7120-68708</td>
<td>HPLC System Tool Kit-Infinity-II</td>
</tr>
</tbody>
</table>

**NOTE**

This procedure describes the replacement of the left pump head assembly (channel A). Similarly, the right pump head assembly (channel B) can be replaced. One pump head assembly consists of two pump heads, which are both removed at the same time.

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

2. Open the doors.

3. Close all shut-off valves.

4. Remove the seal wash tubes.
Remove the Pump Head Assembly

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

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

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

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

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

10. Open the four screws holding the pump heads.

NOTE
Open the screws step by step, not screw by screw.
7 Maintenance
Remove the Pump Head Assembly

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)

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

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

Maintenance of Long Life Pump Heads requires no special tool.

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

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

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.

<table>
<thead>
<tr>
<th>Tools required</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>G7120-68708</td>
<td>HPLC System Tool Kit-Infinity-II</td>
</tr>
<tr>
<td></td>
<td>5043-1400</td>
<td>Pump Head Holder</td>
</tr>
<tr>
<td></td>
<td>5067-6197</td>
<td>Seal Handling Device</td>
</tr>
<tr>
<td></td>
<td>8660-0852</td>
<td>Abrasive mesh</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Isopropanol</td>
</tr>
</tbody>
</table>

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

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

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

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

#### Pump Head Maintenance (Tool Free)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3</strong></td>
<td>Turn the pump head assembly upside down.</td>
</tr>
<tr>
<td><img src="image1" alt="Image" /></td>
<td><img src="image2" alt="Image" /></td>
</tr>
<tr>
<td><strong>4</strong></td>
<td>Remove the link plate by gently pulling it off the pump head assembly.</td>
</tr>
<tr>
<td><img src="image3" alt="Image" /></td>
<td>The two pump chambers are now isolated.</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td>Remove the inlet valve and the outlet valve from the primary pump head.</td>
</tr>
<tr>
<td><img src="image4" alt="Image" /></td>
<td><img src="image5" alt="Image" /></td>
</tr>
<tr>
<td><strong>6</strong></td>
<td>Binary/High Speed Pumps only: Remove the high pressure filter from the secondary pump head.</td>
</tr>
<tr>
<td><img src="image6" alt="Image" /></td>
<td><img src="image7" alt="Image" /></td>
</tr>
</tbody>
</table>

**NOTE**

Clean the valves by sonication, if appropriate. A good cleaning solution is 50% isopropanol in water.
7 Pump Head Maintenance (Tool Free)

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

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

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

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

11 Remove the seal holder from the spring housing.

12 Screw the pin of the seal handling device into the piston seal.
13 Pull out the Seal Handling Device with the piston seal in a straight movement with only gentle force.

14 Repeat for the other pump chamber.

15 Screw the pin of the seal handling device into the wash seal.

**NOTE**

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

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

**Pump Head Maintenance (Tool Free)**

17. Repeat for the other seal holder.

18. Clean the piston with abrasive paper.

19. Rinse pump heads and pistons with isopropanol.
Replace the Heat Exchanger

Tools required

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrench, 19 mm</td>
<td></td>
</tr>
<tr>
<td>5023-2501</td>
<td>Screwdriver Torx-T10</td>
</tr>
<tr>
<td>5067-5688</td>
<td>Torque wrench 1 – 25 Nm with 14 mm wrench</td>
</tr>
<tr>
<td>G4220-20013</td>
<td>4 mm hex bit</td>
</tr>
<tr>
<td>G4220-20015</td>
<td>Adapter ¼ in square to hex</td>
</tr>
<tr>
<td>G4220-20041</td>
<td>Bit Torx 10x25 mm</td>
</tr>
</tbody>
</table>

Parts required

<table>
<thead>
<tr>
<th>#</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>G4220-81013</td>
<td>Heat Exchanger Channel A (secondary pump head only)</td>
</tr>
<tr>
<td>OR 1</td>
<td>G4220-81012</td>
<td>Heat Exchanger Channel B (secondary pump head only)</td>
</tr>
</tbody>
</table>

Preparations

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

**CAUTION**

Loss of small spacer fitting

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

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

1. Remove the 19 mm screw at the front of the secondary pump head.
2. Remove the front plate.
# Maintenance

## Pump Head Maintenance (Tool Free)

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Remove the screw at the bottom of the pump head. Do not drop the golden spacer fitting.</td>
</tr>
<tr>
<td>4</td>
<td>Lift out the heat exchanger.</td>
</tr>
<tr>
<td>5</td>
<td>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.</td>
</tr>
<tr>
<td>6</td>
<td>Use the 19 mm screw for fixing the front plate.</td>
</tr>
<tr>
<td>7</td>
<td>Insert and fix the screw.</td>
</tr>
</tbody>
</table>

![Step 3 Diagram](image1)

![Step 4 Diagram](image2)

![Step 5 Diagram](image3)

![Step 6 Diagram](image4)

![Step 7 Diagram](image5)
Assemble LongLife Pump Heads

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

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

### Parts required

<table>
<thead>
<tr>
<th>#</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0905-1719</td>
<td>PE Seal</td>
</tr>
<tr>
<td>2</td>
<td>0905-1175</td>
<td>Wash seal (PTFE)</td>
</tr>
</tbody>
</table>

### 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.

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

**NOTE**

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

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.

**NOTE**

The Seal Handling Device has a cavity to fit over the pins of the seal wash tubings.
7 Maintenance
Pump Head Maintenance (Tool Free)

11 Place the seal holder onto the spring housing.

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

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

**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.

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

**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.

**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 5 Nm in a crosswise manner.**

![5 Nm](image)

**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!**

![Mounting Pump Head](image)

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

![10 Nm](image)

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

![16 Nm](image)
### 7 Maintenance

#### Pump Head Maintenance (Tool Free)

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>Remove the pump head from the module again.</td>
</tr>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>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.</td>
</tr>
<tr>
<td><img src="image2.png" alt="Image" /></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Counter the outlet valve and tighten the lock screw of the heat exchanger capillary with a torque wrench set to 3 Nm.</td>
</tr>
<tr>
<td><img src="image3.png" alt="Image" /></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Attach the seal wash tubing interconnecting the two pump heads.</td>
</tr>
<tr>
<td><img src="image4.png" alt="Image" /></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Insert the screws that later fix the pump head assembly to the module housing.</td>
</tr>
<tr>
<td><img src="image5.png" alt="Image" /></td>
<td></td>
</tr>
</tbody>
</table>
Install the Pump Head Assembly

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

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

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.

**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.
7 Maintenance
Install the Pump Head Assembly

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

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

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

5 Replace the seal wash tubes.

6 Open the shut-off valves.

7 Close the doors.

8 Perform a Pump Leak Rate Test.
Replace the Outlet Valve

When
If Outlet valve is defective.

Tools required

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8710-0510</td>
<td>Wrench open 1/4 --- 5/16 inch</td>
</tr>
<tr>
<td>8710-2603</td>
<td>Spanner-double open ended 12X14 mm Chrome</td>
</tr>
<tr>
<td>G4220-20012</td>
<td>Torque wrench 2 – 25 Nm</td>
</tr>
<tr>
<td>G4220-20041</td>
<td>Bit Torx 10x25 mm</td>
</tr>
</tbody>
</table>

Parts required

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G4220-60028</td>
<td>Outlet valve</td>
</tr>
<tr>
<td></td>
<td>(primary pump head)</td>
</tr>
<tr>
<td>G4220-20020</td>
<td>Internal gold seal for Outlet Valve</td>
</tr>
</tbody>
</table>

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.
7  Maintenance
Replace the Outlet Valve

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

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

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

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

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

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Remove the pump head from the module again.</td>
</tr>
<tr>
<td>8</td>
<td>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.</td>
</tr>
<tr>
<td>9</td>
<td>Counter the outlet valve and tighten the lock screw of the heat exchanger capillary with a torque wrench set to 3 Nm.</td>
</tr>
</tbody>
</table>

**Next Steps:**

10. Place the cap on the Outlet Valve.
11. Mount the pump head assembly to the module, reconnect all hydraulic connections, and power up the pump.
12. Open the shut off valves and purge the system to remove air.
7 Maintenance
Replace the Purge Valve Head

Replace the Purge Valve Head

When
In case of problems with the purge valve

Parts required

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5067-4236</td>
<td>Purge valve head</td>
</tr>
<tr>
<td>5067-4655</td>
<td>Capillary ST, 0.25 mm x 235 mm</td>
</tr>
<tr>
<td>G4220-87000</td>
<td>Capillary ST 0.17 mm x 300 mm</td>
</tr>
<tr>
<td>01090-87308</td>
<td>Capillary ST, 0.25 mm x 130 mm</td>
</tr>
</tbody>
</table>

Preparations
Remove all capillary connections to the purge valve

**CAUTION**

Potential damage of valve head or malfunction of valve
When the pump is switched on, the valve tag is accessed (read/write) and used for correctly positioning the valve.

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

➔ Switch off the pump before working on the purge valve.

**CAUTION**

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

➔ Protect the optical parts from dust and other pollutions.

1 Remove all capillary connections.
2 Unscrew the black union nut.
3 Remove the head of the purge valve by pulling it to the front.

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

5 Install all flow connections:
   - Port 1: Channel B
   - Port 2: Pressure sensor, out
   - Port 3: Pressure sensor, in
   - Port 4: Channel A
   - Ports 5 and 8: Waste capillaries, channels A and B
   - Port 9: Central port, connected to the Jet Weaver inlet
Replace Parts of the High Pressure Filter Assembly

When

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

Tools required

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5067-5688</td>
<td>Torque wrench 1 – 25 Nm with 14 mm wrench</td>
</tr>
<tr>
<td>8710-0510</td>
<td>Wrench open 1/4 — 5/16 inch</td>
</tr>
</tbody>
</table>

Parts required

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5067-4728</td>
<td>Seal cap</td>
</tr>
<tr>
<td>01018-22707</td>
<td>PTFE frits (pack of 5)</td>
</tr>
</tbody>
</table>

**CAUTION**

Leakage or damaged connection

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

饥饿 Do not open the outlet of the primary pump head.

**NOTE**

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

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Remove the capillary connection from the outlet of the secondary pump head.</td>
</tr>
<tr>
<td>2</td>
<td>Use a 14 mm hex wrench for opening the filter assembly of the secondary pump head.</td>
</tr>
<tr>
<td>3</td>
<td>Replace the filter frit and seal cap as desired. Please note the correct orientation of the filter frit.</td>
</tr>
<tr>
<td>4</td>
<td>Re-install the filter assembly using the torque wrench (14 mm hex bit) set to 16 Nm.</td>
</tr>
<tr>
<td>5</td>
<td>Reconnect the capillary from the purge valve to the high pressure filter assembly.</td>
</tr>
</tbody>
</table>
Replace the Module Firmware

When

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

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

Tools required

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agilent Lab Advisor software</td>
</tr>
<tr>
<td>Instant Pilot G4208A (only if supported by module)</td>
</tr>
</tbody>
</table>

Parts required

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Firmware, tools and documentation from Agilent web site</td>
</tr>
</tbody>
</table>

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.

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

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9301-0411</td>
<td>Syringe; Plastic</td>
</tr>
<tr>
<td>9301-1337</td>
<td>Syringe adapter</td>
</tr>
<tr>
<td>G7120-44000</td>
<td>Protective Foam</td>
</tr>
</tbody>
</table>

Preparations
Flush both solvent channels with isopropanol.

**WARNING**
Heavy weight
The module is heavy (>22 kg (>46 lbs)).

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

**CAUTION**
Mechanical damage
➔ For shipping the module, insert the Protective Foam to protected the module from mechanical damage.
➔ Be careful not to damage tubing or capillary connections while inserting the module in the Protective Foam.
Prepare the Pump Module for Transport

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

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

3. Remove tubing and capillary connections to other modules and the solvent cabinet. Remove tubing plugs.
4 Remove the shutoff valve panel by pulling it downwards.

5 You may keep internal tubing and capillary connections.

6 Remove cable connections to other modules. Remove the module from the stack.
7  **Maintenance**  
Prepare the Pump Module for Transport

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

8  Close the front cover.

9  For transport or shipment, put the module and accessory kit to the original shipment box.
8
Parts and Materials for Maintenance

Overview of Maintenance Parts  158
Flow Connections  160
Pump Heads  162
  Pump Head Assembly Parts  163
  Primary Pump Head Parts  165
  Secondary Pump Head Parts  166
Purge Valve  167
Cover Parts  168
Accessory Kit  169
HPLC System Tool Kit  170

This chapter provides information on parts for maintenance.
Overview of Maintenance Parts

Figure 11  Overview of main assemblies
Overview of Maintenance Parts

<table>
<thead>
<tr>
<th>Item</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>G4220-60027</td>
<td>Jet Weaver 35 µL/100 µL</td>
</tr>
<tr>
<td>1</td>
<td>G4220-60012</td>
<td>Jet Weaver 380 µL (OPTIONAL)</td>
</tr>
<tr>
<td>2</td>
<td>G7120-60029</td>
<td>SSV Valve Assembly</td>
</tr>
<tr>
<td>3</td>
<td>5065-4445</td>
<td>Peristaltic pump with Pharmed tubing</td>
</tr>
<tr>
<td>4</td>
<td>G7104-60001</td>
<td>Pressure sensor 1300 bar</td>
</tr>
<tr>
<td>5</td>
<td>5067-4236</td>
<td>Purge valve head</td>
</tr>
<tr>
<td>6</td>
<td>G4220-60350</td>
<td>Long Life Pump Head Channel A</td>
</tr>
<tr>
<td>7</td>
<td>G4220-60360</td>
<td>Long Life Pump Head Channel B</td>
</tr>
</tbody>
</table>
Flow Connections

Figure 12  Flow connections of the High Speed Pump
<table>
<thead>
<tr>
<th>Item</th>
<th>#</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>5067-4655</td>
<td>Capillary ST, 0.25 mm x 235 mm purge valve to pump head assemblies channel A and B</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>5065-4445</td>
<td>Peristaltic pump with Pharmed tubing</td>
</tr>
<tr>
<td>3, 5</td>
<td>1</td>
<td>5065-9978</td>
<td>Tubing, 1 mm i.d., 3 mm o.d., silicone, 5 m</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>G4220-60035</td>
<td>Tubing kit 140 mm, 2/pk SSV to shutoff valve or degassing unit</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>5067-4661</td>
<td>Tubing kit 270 mm for connection of degassing unit to inlet valve (set of 2 tubes)</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>G4220-87000</td>
<td>Capillary ST 0.17 mm x 300 mm Valve to Jet Weaver</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>01090-87308</td>
<td>Capillary ST, 0.25 mm x 130 mm purge valve to pressure sensor</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>G7120-40004</td>
<td>Valve Holder Left (not shown)</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>5067-4124</td>
<td>Shutoff valve (not shown)</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>G7120-60007</td>
<td>Bottle Head Assembly (not shown)</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>G7120-68070</td>
<td>Ultra Clean Tubing Kit (includes bottle head assemblies and tubing connections within the pump)</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>G4220-60070</td>
<td>Tubing Kit 140 mm - Ultra Clean Tubing (tubes from SSV to shutoff valve or degassing unit to MCGV)</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>G7120-60017</td>
<td>Bottle Head Assembly Ultra Clean Tubing (bottle heads and tubing to shutoff panel / degasser)</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>5067-5760</td>
<td>Solvent Cabinet Kit (not shown)</td>
</tr>
</tbody>
</table>
Pump Heads

The following pages contain parts information for LongLife Pump Heads.

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

Long Life Pump Head Channel A (G4220-60350)

<table>
<thead>
<tr>
<th>Item</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>G4220-60660</td>
<td>Secondary Pump Head Assembly Pendulum</td>
</tr>
<tr>
<td>2</td>
<td>G4220-60661</td>
<td>Primary Pump Head Assembly Pendulum</td>
</tr>
<tr>
<td>3</td>
<td>G4220-60022</td>
<td>Inlet valve</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(primary pump head)</td>
</tr>
<tr>
<td>4</td>
<td>G4220-60028</td>
<td>Outlet valve</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(primary pump head)</td>
</tr>
<tr>
<td>5</td>
<td>5042-9966</td>
<td>Cap Outlet Valve</td>
</tr>
<tr>
<td>6</td>
<td>G4280-60026</td>
<td>High Pressure Filter Assembly (secondary pump head)</td>
</tr>
<tr>
<td>7</td>
<td>G4220-81013</td>
<td>Heat Exchanger Channel A (secondary pump head only)</td>
</tr>
<tr>
<td>8</td>
<td>G4220-40001</td>
<td>Link Plate</td>
</tr>
<tr>
<td>9</td>
<td>0960-2971</td>
<td>RF Transponder</td>
</tr>
</tbody>
</table>
## Parts and Materials for Maintenance

### Pump Heads

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

Long Life Pump Head Channel B (G4220-60360)
Primary Pump Head Parts

Primary Pump Head Assembly Pendulum (G4220-60661)

<table>
<thead>
<tr>
<th>Item</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5067-5975</td>
<td>Plunger Assy ZrO₂ LL</td>
</tr>
<tr>
<td>2</td>
<td>0515-6154</td>
<td>Screw-Socket-HD-Cap Hex-Recess M5X0.8 40</td>
</tr>
<tr>
<td>3</td>
<td>G4220-60046</td>
<td>Preload-Support Assembly LL</td>
</tr>
<tr>
<td>4</td>
<td>0905-1175</td>
<td>Wash seal (PTFE)</td>
</tr>
<tr>
<td>5</td>
<td>G4220-60616</td>
<td>Seal Holder Integrated Assembly EM/LL</td>
</tr>
<tr>
<td>6</td>
<td>0905-1719</td>
<td>PE Seal</td>
</tr>
<tr>
<td>7</td>
<td>G4220-60533</td>
<td>Body Head Primary EM/LL</td>
</tr>
</tbody>
</table>
## Secondary Pump Head Parts

Secondary Pump Head Assembly Pendulum (G4220-60660)

<table>
<thead>
<tr>
<th>Item</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5067-5975</td>
<td>Plunger Assy ZrO$_2$ LL</td>
</tr>
<tr>
<td>2</td>
<td>0515-6154</td>
<td>Screw-Socket-HD-Cap Hex-Recess M5X0.8 40</td>
</tr>
<tr>
<td>3</td>
<td>G4220-60046</td>
<td>Preload-Support Assembly LL</td>
</tr>
<tr>
<td>4</td>
<td>0905-1175</td>
<td>Wash seal (PTFE)</td>
</tr>
<tr>
<td>5</td>
<td>G4220-60616</td>
<td>Seal Holder Integrated Assembly EM/LL</td>
</tr>
<tr>
<td>6</td>
<td>0905-1719</td>
<td>PE Seal</td>
</tr>
<tr>
<td>7</td>
<td>G4220-25513</td>
<td>Body Head Secondary EM/LL</td>
</tr>
<tr>
<td>8</td>
<td>G4220-20001</td>
<td>Spacer Fitting</td>
</tr>
<tr>
<td>9</td>
<td>G4220-20028</td>
<td>Headless screw for 1290 Infinity pump heads</td>
</tr>
<tr>
<td>10</td>
<td>G4220-20000</td>
<td>LID</td>
</tr>
<tr>
<td>11</td>
<td>G4220-20003</td>
<td>Pump Head Screw</td>
</tr>
</tbody>
</table>
# Purge Valve

<table>
<thead>
<tr>
<th>Item</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5067-4236</td>
<td>Purge valve head</td>
</tr>
<tr>
<td>1</td>
<td>1535-4857</td>
<td>Stator screws</td>
</tr>
<tr>
<td>2</td>
<td>5068-0004</td>
<td>Purge Valve Stator</td>
</tr>
<tr>
<td>3</td>
<td>5068-0201</td>
<td>Purge Valve Rotor Seal, polyimide, 1300 bar</td>
</tr>
<tr>
<td>4</td>
<td>1535-4045</td>
<td>Bearing ring</td>
</tr>
</tbody>
</table>
## Cover Parts

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G7120-68713</td>
<td>Cabinet Kit Infinity II 200 (includes sides, bottom, top, leak adapter top and Status Indicator Insert)</td>
</tr>
<tr>
<td>5043-0286</td>
<td>Base Cover</td>
</tr>
<tr>
<td>5067-5908</td>
<td>Top Cover</td>
</tr>
<tr>
<td>G4224-60200</td>
<td>Side Cover Right 200</td>
</tr>
<tr>
<td>G4224-60201</td>
<td>Side Cover Left 200</td>
</tr>
<tr>
<td>5043-0856</td>
<td>Leak Adapter (not shown)</td>
</tr>
<tr>
<td>5067-5767</td>
<td>Door assy 200 left IF II</td>
</tr>
<tr>
<td>5067-5768</td>
<td>Door assy 200 right IF II</td>
</tr>
</tbody>
</table>
Accessory Kit

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

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0100-1816</td>
<td>Fitting Waste Tube to Purge Valve</td>
</tr>
<tr>
<td>0890-2207</td>
<td>Tubing/Sleeving-Flex</td>
</tr>
<tr>
<td>5043-1013</td>
<td>Tubing Clip</td>
</tr>
<tr>
<td>5067-4124</td>
<td>Shutoff valve</td>
</tr>
<tr>
<td>5500-1245</td>
<td>Capillary ST 0.17 mm x 400 mm SI/SI</td>
</tr>
<tr>
<td>5181-1519</td>
<td>CAN cable, Agilent module to module, 1 m</td>
</tr>
<tr>
<td>5500-1155</td>
<td>Tube Connector, 90 degree, ID 6.4</td>
</tr>
<tr>
<td>5965-0050</td>
<td>CARTON-CORRUGATED</td>
</tr>
<tr>
<td>9222-0518</td>
<td>Bag - plastics</td>
</tr>
<tr>
<td>9301-1337</td>
<td>Syringe adapter</td>
</tr>
<tr>
<td>9301-6476</td>
<td>Syringe with luerlock 5 mL Polypropylene</td>
</tr>
<tr>
<td>G4220-60035</td>
<td>Tubing kit 140 mm, 2/pk</td>
</tr>
<tr>
<td>5063-6527</td>
<td>Tubing assembly, i.d. 6 mm, o.d. 9 mm, 1.2 m (to waste)</td>
</tr>
<tr>
<td>5500-1156</td>
<td>T-Tube Connector ID6.4</td>
</tr>
<tr>
<td>5500-1169</td>
<td>Y Tube Connector ID6.4</td>
</tr>
<tr>
<td>5500-1217</td>
<td>Capillary ST 0.17 mm x 900 mm SI/SX ps-ps</td>
</tr>
<tr>
<td>G7120-60005</td>
<td>Valve Holder left assembly INF II</td>
</tr>
<tr>
<td>01200-90091</td>
<td>1290 Infinity Pump Quick Reference Sheet</td>
</tr>
<tr>
<td>5067-6197</td>
<td>Seal Handling Device</td>
</tr>
<tr>
<td>5043-1400</td>
<td>Pump Head Holder</td>
</tr>
</tbody>
</table>
HPLC System Tool Kit

HPLC System Tool Kit-Infinity-II (G7120-68708) contains the following items:

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9301-0411</td>
<td>Syringe; Plastic</td>
</tr>
<tr>
<td>9301-1337</td>
<td>Syringe adapter</td>
</tr>
<tr>
<td>0100-1710</td>
<td>Mounting Tool for Tubing Connections</td>
</tr>
<tr>
<td>8710-0510</td>
<td>Wrench open 1/4 — 5/16 inch</td>
</tr>
<tr>
<td>8710-1924</td>
<td>Wrench open 14 mm</td>
</tr>
<tr>
<td>01018-23702</td>
<td>Insert tool</td>
</tr>
<tr>
<td>0100-1681</td>
<td>Syringe adapter luer/barb</td>
</tr>
<tr>
<td>8710-2394</td>
<td>Hex key 9/64 inch 15 cm long T-handle</td>
</tr>
<tr>
<td>8710-1534</td>
<td>Wrench, 4 mm both ends, open end</td>
</tr>
<tr>
<td>8710-2409</td>
<td>Wrench open end, 5/16 — 3/8 inch</td>
</tr>
<tr>
<td>8710-0899</td>
<td>Pozidriv screwdriver</td>
</tr>
<tr>
<td>5974-0052</td>
<td>Case (LC tool KIT)</td>
</tr>
<tr>
<td>5974-0055</td>
<td>Corrigated carton for LC tool KIT</td>
</tr>
<tr>
<td>5023-2500</td>
<td>Spanner double open ended SW-5</td>
</tr>
<tr>
<td>5023-2504</td>
<td>Hex driver SW-4 slitted</td>
</tr>
<tr>
<td>5023-2503</td>
<td>Hex driver SW-5 slitted</td>
</tr>
<tr>
<td>5023-2502</td>
<td>Hex driver SW-6.35, slitted</td>
</tr>
<tr>
<td>5023-2501</td>
<td>Screwdriver Torx-T10</td>
</tr>
<tr>
<td>5023-2499</td>
<td>Hex Key Set</td>
</tr>
<tr>
<td>5043-1361</td>
<td>Hex Key Set Driver</td>
</tr>
<tr>
<td>8720-0025</td>
<td>Wrench, 1/2 inch &amp; 9/16 inch</td>
</tr>
<tr>
<td>5067-6127</td>
<td>Blank Nut SL</td>
</tr>
<tr>
<td>G7120-90120</td>
<td>1290 IF-II System tool Kit Tech Note ENG</td>
</tr>
</tbody>
</table>
This chapter provides information on cables used with the modules.
## Cable Overview

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

### Analog cables

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>35900-60750</td>
<td>Agilent 35900A A/D converter</td>
</tr>
<tr>
<td>01046-60105</td>
<td>Analog cable (BNC to general purpose, spade lugs)</td>
</tr>
</tbody>
</table>

### Remote cables

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5188-8029</td>
<td>ERI to general purpose</td>
</tr>
<tr>
<td>5188-8044</td>
<td>Remote Cable ERI – ERI</td>
</tr>
<tr>
<td>5188-8045</td>
<td>Remote Cable APG – ERI</td>
</tr>
<tr>
<td>5061-3378</td>
<td>Remote Cable to 35900 A/D converter</td>
</tr>
<tr>
<td>01046-60201</td>
<td>Agilent module to general purpose</td>
</tr>
</tbody>
</table>

### CAN cables

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5181-1516</td>
<td>CAN cable, Agilent module to module, 0.5 m</td>
</tr>
<tr>
<td>5181-1519</td>
<td>CAN cable, Agilent module to module, 1 m</td>
</tr>
</tbody>
</table>
### LAN cables

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5023-0203</td>
<td>Cross-over network cable, shielded, 3 m (for point to point connection)</td>
</tr>
<tr>
<td>5023-0202</td>
<td>Twisted pair network cable, shielded, 7 m (for point to point connection)</td>
</tr>
</tbody>
</table>

### RS-232 cables (not for FUSION board)

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS232-61601</td>
<td>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’s also called &quot;Null Modem Cable&quot; 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.</td>
</tr>
<tr>
<td>5181-1561</td>
<td>RS-232 cable, 8 m</td>
</tr>
</tbody>
</table>

### USB cables

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5188-8050</td>
<td>USB A M-USB Mini B 3 m (PC-Module)</td>
</tr>
<tr>
<td>5188-8049</td>
<td>USB A F-USB Mini B M OTG (Module to Flash Drive)</td>
</tr>
</tbody>
</table>
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**

<table>
<thead>
<tr>
<th>p/n 35900-60750</th>
<th>35900</th>
<th>Pin Agilent module</th>
<th>Signal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>Not connected</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Shield</td>
<td>Analog -</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Center</td>
<td>Analog +</td>
</tr>
</tbody>
</table>
## Identifying Cables

### Analog Cables

#### Agilent Module to BNC Connector

<table>
<thead>
<tr>
<th>p/n 8120-1840</th>
<th>Pin BNC</th>
<th>Pin Agilent module</th>
<th>Signal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Shield</td>
<td>Shield</td>
<td>Analog -</td>
</tr>
<tr>
<td></td>
<td>Center</td>
<td>Center</td>
<td>Analog +</td>
</tr>
</tbody>
</table>

#### Agilent Module to General Purpose

<table>
<thead>
<tr>
<th>p/n 01046-60105</th>
<th>Pin</th>
<th>Pin Agilent module</th>
<th>Signal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td>Not connected</td>
</tr>
<tr>
<td>2</td>
<td>Black</td>
<td></td>
<td>Analog -</td>
</tr>
<tr>
<td>3</td>
<td>Red</td>
<td></td>
<td>Analog +</td>
</tr>
</tbody>
</table>
## Remote Cables

### ERI (Enhanced Remote Interface)

5188-8029 ERI to general purpose

<table>
<thead>
<tr>
<th>Pin</th>
<th>Color Code</th>
<th>Enhanced Remote</th>
<th>Classic Remote</th>
<th>Active (TTL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>white</td>
<td>IO1</td>
<td>START REQUEST</td>
<td>Low</td>
</tr>
<tr>
<td>2</td>
<td>brown</td>
<td>IO2</td>
<td>STOP</td>
<td>Low</td>
</tr>
<tr>
<td>3</td>
<td>green</td>
<td>IO3</td>
<td>READY</td>
<td>High</td>
</tr>
<tr>
<td>4</td>
<td>yellow</td>
<td>IO4</td>
<td>POWER ON</td>
<td>High</td>
</tr>
<tr>
<td>5</td>
<td>grey</td>
<td>IO5</td>
<td>NOT USED</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>pink</td>
<td>IO6</td>
<td>SHUT DOWN</td>
<td>Low</td>
</tr>
<tr>
<td>7</td>
<td>blue</td>
<td>IO7</td>
<td>START</td>
<td>Low</td>
</tr>
<tr>
<td>8</td>
<td>red</td>
<td>IO8</td>
<td>PREPARE</td>
<td>Low</td>
</tr>
<tr>
<td>9</td>
<td>black</td>
<td></td>
<td>1wire DATA</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>violet</td>
<td>DGND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>grey-pink</td>
<td>+5V ERI out</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>red-blue</td>
<td>PGND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>white-green</td>
<td>PGND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>brown-green</td>
<td>+24V ERI out</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>white-yellow</td>
<td>+24V ERI out</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NC</td>
<td>yellow-brown</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Identifying Cables

Remote Cables

5188-8044 ERI to ERI (Connector D_Subminiature 15 pin)

Table 9  5188-8044 ERI to ERI

<table>
<thead>
<tr>
<th>p/n 5188-8044</th>
<th>Pin (ERI)</th>
<th>Signal</th>
<th>Pin (ERI)</th>
<th>Active (TTL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
<td>GND</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Start Request</td>
<td>1</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Stop</td>
<td>2</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Ready</td>
<td>3</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Power on</td>
<td>5</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Future</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Shut Down</td>
<td>6</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Start</td>
<td>7</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Prepare</td>
<td>8</td>
<td>Low</td>
</tr>
</tbody>
</table>

Ground        Cable Shielding  NC

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

<table>
<thead>
<tr>
<th>p/n 5188-8045</th>
<th>Pin (ERI)</th>
<th>Signal</th>
<th>Pin (APG)</th>
<th>Active (TTL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
<td>GND</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Start Request</td>
<td>9</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Stop</td>
<td>8</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Ready</td>
<td>7</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Power on</td>
<td>6</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Future</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Shut Down</td>
<td>4</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Start</td>
<td>3</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Prepare</td>
<td>2</td>
<td>Low</td>
</tr>
</tbody>
</table>

Ground        Cable Shielding  NC
Identifying Cables
Remote Cables

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

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

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

### Agilent Module to General Purpose

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

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

**CAN Cables**

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5181-1516</td>
<td>CAN cable, Agilent module to module, 0.5 m</td>
</tr>
<tr>
<td>5181-1519</td>
<td>CAN cable, Agilent module to module, 1 m</td>
</tr>
</tbody>
</table>

**LAN Cables**

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5023-0203</td>
<td>Cross-over network cable, shielded, 3 m (for point to point connection)</td>
</tr>
<tr>
<td>5023-0202</td>
<td>Twisted pair network cable, shielded, 7 m (for point to point connection)</td>
</tr>
</tbody>
</table>
**Agilent Module to PC**

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS232-61601</td>
<td>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’s also called &quot;Null Modem Cable&quot; 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.</td>
</tr>
<tr>
<td>5181-1561</td>
<td>RS-232 cable, 8 m</td>
</tr>
</tbody>
</table>
To connect a USB Flash Drive use a USB OTG cable with Mini-B plug and A socket.

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5188-8050</td>
<td>USB A M-USB Mini B 3 m (PC-Module)</td>
</tr>
<tr>
<td>5188-8049</td>
<td>USB A F-USB Mini B M OTG (Module to Flash Drive)</td>
</tr>
</tbody>
</table>
10 Hardware Information

Firmware Description  184
Electrical Connections  187
  Serial Number Information  188
  Rear View of the Module  188
Interfaces  189
  Overview Interfaces  191
Setting the 8-bit Configuration Switch  195
  Special Settings  197
Early Maintenance Feedback  198
Instrument Layout  199

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

The firmware of the instrument consists of two independent sections:

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

**Resident System**

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

- the complete communication capabilities (CAN, LAN, USB and RS-232C)
- 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-232C)
- 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 remote,
- error handling,
- diagnostic functions,
- or module specific functions like
  - internal events such as lamp control, filter movements,
  - raw data collection and conversion to absorbance.
**Firmware Updates**

Firmware updates can be done using the following tools (latest version should be used):

- Agilent Lab Advisor software with files on the hard disk (*)
- Firmware Update Tool with local files on the hard disk (*)
- Instant Pilot (G4208A) with files on a USB Flash Disk


The file naming conventions are:

PPPP_RVVV_XXX.dll, 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.
Some modules are limited in downgrading due to their main board 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 are use and the feature set of the original are lost. After re-branding (e.g. from G1314B to G1314C), the original feature set is available again.

All these specific informations are described in the documentation provided with the firmware update tools.

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

Electrical Connections

- The CAN bus is a serial bus with high speed data transfer. The two connectors for the CAN bus are used for internal module data transfer and synchronization.

- The REMOTE connector may be used in combination with other analytical instruments from Agilent Technologies if you want to use features such as start, stop, common shut down, prepare, and so on.

- With the appropriate software, the RS-232C connector may be used to control the module from a computer through a RS-232C connection. This connector is activated and can be configured with the configuration switch.

- The power input socket accepts a line voltage of 100 – 240 VAC ± 10 % with a line frequency of 50 or 60 Hz. Maximum power consumption varies by module. There is no voltage selector on your module because the power supply has wide-ranging capability. There are no externally accessible fuses, because automatic electronic fuses are implemented in the power supply.

**NOTE**

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

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

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

Rear View of the Module

![Rear View of the Module](image)

Figure 14  Rear view of the High Speed Pump
## Interfaces

The Agilent InfinityLab LC Series modules provide the following interfaces:

<table>
<thead>
<tr>
<th>Table 10</th>
<th>Agilent InfinityLab LC Series Interfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Module</strong></td>
<td><strong>CAN</strong></td>
</tr>
<tr>
<td><strong>Pumps</strong></td>
<td></td>
</tr>
<tr>
<td>G7104A Flexible Pump</td>
<td>2</td>
</tr>
<tr>
<td>G7110B Isocratic Pump</td>
<td>2</td>
</tr>
<tr>
<td>G7111A/B Quaternary Pump</td>
<td>2</td>
</tr>
<tr>
<td>G7112B Binary Pump</td>
<td>2</td>
</tr>
<tr>
<td>G7120A High Speed Pump</td>
<td>2</td>
</tr>
<tr>
<td><strong>Samplers</strong></td>
<td></td>
</tr>
<tr>
<td>G7129A/B Vialsampler</td>
<td>2</td>
</tr>
<tr>
<td>G7167A/B Multisampler</td>
<td>2</td>
</tr>
<tr>
<td><strong>Detectors</strong></td>
<td></td>
</tr>
<tr>
<td>G7114A/B VWD</td>
<td>2</td>
</tr>
<tr>
<td>G7115A DAD</td>
<td>2</td>
</tr>
<tr>
<td>G7117A/B/C DAD</td>
<td>2</td>
</tr>
<tr>
<td>G7121A/B FLD</td>
<td>2</td>
</tr>
<tr>
<td>G7162A/B RID</td>
<td>2</td>
</tr>
<tr>
<td>G7165A MWD</td>
<td>2</td>
</tr>
<tr>
<td><strong>Fraction Collectors</strong></td>
<td></td>
</tr>
<tr>
<td>G7159B FC</td>
<td>2</td>
</tr>
<tr>
<td>G7166A VFC</td>
<td>2</td>
</tr>
</tbody>
</table>
### Hardware Information

#### Interfaces

**Table 10**  Agilent InfinityLab LC Series Interfaces

<table>
<thead>
<tr>
<th>Module</th>
<th>CAN</th>
<th>USB</th>
<th>LAN (on-board)</th>
<th>RS-232</th>
<th>Analog</th>
<th>APG (A) / ERI (E)</th>
<th>Special</th>
</tr>
</thead>
<tbody>
<tr>
<td>Others</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G7116A/B MCT</td>
<td>2</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Requires a HOST module via CAN</td>
</tr>
<tr>
<td>G7122A Degasser</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>

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

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

CAN

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

LAN

The modules have either an interface slot for an 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 Flex Cube). These are hosted modules and require a Host module with firmware B.06.40 or later or with additional G1369C LAN Card.

NOTE

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

RS-232C (Serial)

The RS-232C connector is used to control the module from a computer through RS-232C connection, using the appropriate software. This connector can be configured with the configuration switch module at the rear of the module. Refer to Communication Settings for RS-232C.

NOTE

There is no configuration possible on main boards with on-board LAN. These are pre-configured for
- 19200 baud,
- 8 data bit with no parity and
- one start bit and one stop bit are always used (not selectable).
The RS-232C is designed as DCE (data communication equipment) with a 9-pin male SUB-D type connector. The pins are defined as:

**Table 11**  RS-232C Connection Table

<table>
<thead>
<tr>
<th>Pin</th>
<th>Direction</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>In</td>
<td>DCD</td>
</tr>
<tr>
<td>2</td>
<td>In</td>
<td>RxD</td>
</tr>
<tr>
<td>3</td>
<td>Out</td>
<td>TxD</td>
</tr>
<tr>
<td>4</td>
<td>Out</td>
<td>DTR</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Ground</td>
</tr>
<tr>
<td>6</td>
<td>In</td>
<td>DSR</td>
</tr>
<tr>
<td>7</td>
<td>Out</td>
<td>RTS</td>
</tr>
<tr>
<td>8</td>
<td>In</td>
<td>CTS</td>
</tr>
<tr>
<td>9</td>
<td>In</td>
<td>RI</td>
</tr>
</tbody>
</table>

**Figure 15**  RS-232 Cable
Analog Signal Output

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

APG Remote

The APG Remote 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.

Remote control 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).
## Hardware Information

### Interfaces

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

### Table 12  Remote Signal Distribution

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DGND</td>
<td>Digital ground</td>
</tr>
<tr>
<td>2</td>
<td>PREPARE</td>
<td>(L) Request to prepare for analysis (for example, calibration, detector lamp on). Receiver is any module performing pre-analysis activities.</td>
</tr>
<tr>
<td>3</td>
<td>START</td>
<td>(L) Request to start run / timetable. Receiver is any module performing run-time controlled activities.</td>
</tr>
<tr>
<td>4</td>
<td>SHUT DOWN</td>
<td>(L) System has serious problem (for example, leak: stops pump). Receiver is any module capable to reduce safety risk.</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Not used</td>
</tr>
<tr>
<td>6</td>
<td>POWER ON</td>
<td>(H) All modules connected to system are switched on. Receiver is any module relying on operation of others.</td>
</tr>
<tr>
<td>7</td>
<td>READY</td>
<td>(H) System is ready for next analysis. Receiver is any sequence controller.</td>
</tr>
<tr>
<td>8</td>
<td>STOP</td>
<td>(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.</td>
</tr>
<tr>
<td>9</td>
<td>START REQUEST</td>
<td>(L) Request to start injection cycle (for example, by start key on any module). Receiver is the autosampler.</td>
</tr>
</tbody>
</table>

### Special Interfaces

The module includes a DC-Out (24 VDC) power line that is intended to be used with certain modules that operate as CAN slaves, for example external valves. The line has a limited output of 0.5 A (1.7 A as of August 2011) and is self resetting.
Setting the 8-bit Configuration Switch

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

All modules with on-board LAN:

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

**NOTE**

For normal operation use the default (best) settings.

![Figure 16](image)  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.
### 10 Hardware Information

Setting the 8-bit Configuration Switch

#### Table 13 8-bit Configuration Switch (with on-board LAN)

<table>
<thead>
<tr>
<th>Mode</th>
<th>Function</th>
<th>Link Configuration</th>
<th>Init Mode Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW 1</td>
<td>SW 2</td>
<td>SW 3</td>
<td>SW 4</td>
</tr>
<tr>
<td>LAN</td>
<td>0</td>
<td>0</td>
<td>Link Configuration</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Auto-negotiation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10 MBit, half-duplex</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10 MBit, full-duplex</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>100 MBit, half-duplex</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>100 MBit, full-duplex</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Using Stored</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DHCP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Using Default</td>
</tr>
<tr>
<td>TEST</td>
<td>1</td>
<td>1</td>
<td>System</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Boot Resident System</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Revert to Default Data (Coldstart)</td>
</tr>
</tbody>
</table>

**Legend:**

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

**NOTE**

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

**NOTE**

For explanation of "Boot Resident System" and "Revert to Default Data (Coldstart)" refer to "Special Settings" on page 197.
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 14 Boot Resident Settings (On-board LAN)

<table>
<thead>
<tr>
<th>Mode Select</th>
<th>SW1</th>
<th>SW2</th>
<th>SW3</th>
<th>SW4</th>
<th>SW5</th>
<th>SW6</th>
<th>SW7</th>
<th>SW8</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEST/BOOT</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Forced Cold Start

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

CAUTION

Loss of data

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

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

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

Table 15 Forced Cold Start Settings (On-board LAN)

<table>
<thead>
<tr>
<th>Mode Select</th>
<th>SW1</th>
<th>SW2</th>
<th>SW3</th>
<th>SW4</th>
<th>SW5</th>
<th>SW6</th>
<th>SW7</th>
<th>SW8</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEST/BOOT</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
Early Maintenance Feedback

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

EMF Counters

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

Using the EMF Counters

The user-settable EMF limits for the EMF Counters enable the early maintenance feedback to be adapted to specific user requirements. The useful maintenance cycle is dependent on the requirements for use. Therefore, the definition of the maximum limits need to be determined based on the specific operating conditions of the instrument.

Setting the EMF Limits

The setting of the EMF limits must be optimized over one or two maintenance cycles. Initially the default EMF limits should be set. When instrument performance indicates maintenance is necessary, take note of the values displayed by the EMF counters. Enter these values (or values slightly less than the displayed values) as EMF limits, and then reset the EMF counters to zero. The next time the EMF counters exceed the new EMF limits, the EMF flag will be displayed, providing a reminder that maintenance needs to be scheduled.
Instrument Layout

The industrial design of the module incorporates several innovative features. It uses Agilent’s E-PAC concept for the packaging of electronics and mechanical assemblies. This concept is based upon the use of expanded polypropylene (EPP) layers of foam plastic spacers in which the mechanical and electronic boards components of the module are placed. This pack is then housed in a metal inner cabinet which is enclosed by a plastic external cabinet. The advantages of this packaging technology are:

- virtual elimination of fixing screws, bolts or ties, reducing the number of components and increasing the speed of assembly/disassembly,
- the plastic layers have air channels molded into them so that cooling air can be guided exactly to the required locations,
- the plastic layers help cushion the electronic and mechanical parts from physical shock, and
- the metal inner cabinet shields the internal electronics from electromagnetic interference and also helps to reduce or eliminate radio frequency emissions from the instrument itself.
10 Hardware Information
Instrument Layout
11 LAN Configuration

What You Have to Do First 202
TCP/IP parameter configuration 203
Configuration Switch 204
Initialization mode selection 205
Dynamic Host Configuration Protocol (DHCP) 207
  General Information (DHCP) 207
  Setup (DHCP) 208
Link configuration selection 210
Manual Configuration 211
  With Telnet 212
PC and User Interface Software Setup Setup 216
  PC Setup for Local Configuration 216
  User Interface Software Setup 217

This chapter provides information on connecting the module to the Agilent ChemStation PC.
What You Have to Do First

The module has an on-board LAN communication interface.

1. Note the MAC (Media Access Control) address for further reference. The MAC or hardware address of the LAN interfaces is a world wide unique identifier. No other network device will have the same hardware address. The MAC address can be found on a label at the rear of the module (see Figure 18 on page 202).

![Figure 17 MAC-Label](image)

2. Connect the instrument’s LAN interface (see Figure 18 on page 202) to:
   - the PC network card using a crossover network cable (point-to-point) or
   - a hub or switch using a standard LAN cable.
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 208
• by manually setting the parameters using Telnet
• by manually setting the parameters using the Instant Pilot (G4208A)

The LAN interface differentiates between several initialization modes. The initialization mode (short form ‘init mode’) defines how to determine the active TCP/IP parameters after power-on. The parameters may be derived from non-volatile memory or initialized with known default values. The initialization mode is selected by the configuration switch, see Table 17 on page 205.
Configuration Switch

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

![Configuration switch](image)

**Figure 19** 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 16** Factory Default Settings

| Link Configuration | speed and duplex mode determined by auto-negotiation, for details see “Link configuration selection” on page 210 |
Initialization mode selection

The following initialization (init) modes are selectable:

Table 17  Initialization Mode Switches

<table>
<thead>
<tr>
<th>SW 6</th>
<th>SW 7</th>
<th>SW 8</th>
<th>Init Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
<td>Using Stored</td>
</tr>
<tr>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
<td>Using Default</td>
</tr>
<tr>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>DHCP ¹</td>
</tr>
</tbody>
</table>

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

Using Stored

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

Figure 20  Using Stored (Principle)
LAN Configuration

Initialization mode selection

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 18 on page 206.

![Figure 21 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 18 Using Default Parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP address</td>
<td>192.168.254.11</td>
</tr>
<tr>
<td>Subnet Mask</td>
<td>255.255.255.0</td>
</tr>
<tr>
<td>Default Gateway</td>
<td>not specified</td>
</tr>
</tbody>
</table>

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).

![DHCP Diagram]

**Figure 22** DHCP (Principle)

**NOTE**

1. It may take some time until the DHCP server has updated the DNS server with the hostname information.

2. It may be necessary to fully qualify the hostname with the DNS suffix, e.g. 0030d3177321.country.company.com.

3. The DHCP server may reject the hostname proposed by the card and assign a name following local naming conventions.
LAN Configuration
Dynamic Host Configuration Protocol (DHCP)

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 Main Board). This MAC address is on a label on the card or at the rear of the main board, e.g. 0030d3177321.

On the Instant Pilot the MAC address can be found under Details in the LAN section.

![System Info]( Figure 23  LAN Setting on Instant Pilot)
2 Set the Configuration Switch to DHCP either on the G1369C LAN Interface Card or the main board of above mentioned modules.

**Table 19**  G1369C LAN Interface Card (configuration switch on the card)

<table>
<thead>
<tr>
<th>SW 4</th>
<th>SW 5</th>
<th>SW 6</th>
<th>SW 7</th>
<th>SW 8</th>
<th>Initialization Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>DHCP</td>
</tr>
</tbody>
</table>

**Table 20**  LC Modules with 8-bit configuration switch (B-firmware) (configuration switch at rear of the instrument)

<table>
<thead>
<tr>
<th>SW 6</th>
<th>SW 7</th>
<th>SW 8</th>
<th>Initialization Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>DHCP</td>
</tr>
</tbody>
</table>

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 207).
LAN Configuration

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>
<thead>
<tr>
<th>SW 3</th>
<th>SW 4</th>
<th>SW 5</th>
<th>Link Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>manually set to 10 Mbps, half-duplex</td>
</tr>
<tr>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
<td>manually set to 10 Mbps, full-duplex</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>manually set to 100 Mbps, half-duplex</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>manually set to 100 Mbps, full-duplex</td>
</tr>
</tbody>
</table>

speed and duplex mode determined by auto-negotiation
Manual Configuration

Manual configuration only alters the set of parameters stored in the non-volatile memory of the module. It never affects the currently active parameters. Therefore, manual configuration can be done at any time. A power cycle is mandatory to make the stored parameters become the active parameters, given that the initialization mode selection switches are allowing it.

Figure 24  Manual Configuration (Principle)
With Telnet

Whenever a TCP/IP connection to the module is possible (TCP/IP parameters set by any method), the parameters may be altered by opening a Telnet session.

1. Open the system (DOS) prompt window by clicking on Windows START button and select “Run...”. Type “cmd” and press OK.

2. Type the following at the system (DOS) prompt:
   - `c:\>telnet <IP address> or`
   - `c:\>telnet <host name>`

   ![Figure 25](image)
   **Figure 25**  Telnet - Starting a session

   where <IP address> may be the assigned address from a Bootp cycle, a configuration session with the Handheld Controller, or the default IP address (see “Configuration Switch” on page 204).

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

   ![Figure 26](image)
   **Figure 26**  A connection to the module is made
3 Type
? and press enter to see the available commands.

<table>
<thead>
<tr>
<th>Command</th>
<th>Syntax</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>?</td>
<td></td>
<td>displays syntax and descriptions of commands</td>
</tr>
<tr>
<td>/</td>
<td></td>
<td>displays current LAN settings</td>
</tr>
<tr>
<td>ip</td>
<td>&lt;x.x.x.x&gt;</td>
<td>sets new IP address</td>
</tr>
<tr>
<td>sm</td>
<td>&lt;x.x.x.x&gt;</td>
<td>sets new subnet mask</td>
</tr>
<tr>
<td>gw</td>
<td>&lt;x.x.x.x&gt;</td>
<td>sets new default gateway</td>
</tr>
<tr>
<td>exit</td>
<td></td>
<td>exits shell and saves all changes</td>
</tr>
</tbody>
</table>

Figure 27  Telnet Commands

Table 22  Telnet Commands

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.
11 LAN Configuration

Manual Configuration

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

![Figure 28](image1.png)

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.

![Figure 29](image2.png)

Telnet - Change IP settings

information about the LAN interface
MAC address, initialization mode
Initialization mode is Using Stored
active TCP/IP settings
TCP/IP status - here ready
connected to PC with controller software (e.g. Agilent ChemStation), here not connected

change of IP setting to
Initialization mode is Using Stored
active TCP/IP settings
stored TCP/IP settings in non-volatile memory

connected to PC with controller software (e.g. Agilent ChemStation), here not connected
7 When you have finished typing the configuration parameters, type **exit** and press **Enter** to exit with storing parameters.

**Figure 30** 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 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 205).

![Changing the TCP/IP settings of the PC](image)

**Figure 31** Changing the TCP/IP settings of the PC
User Interface Software Setup

Install your user interface software according to the provided User Interface Software Setup Guide.
11 LAN Configuration
PC and User Interface Software Setup Setup
12

Appendix

General Safety Information 220
   General Safety Information 220
   Safety Standards 220
   General 220
   Before Applying Power 221
   Ground the Instrument 221
   Do Not Operate in an Explosive Atmosphere 222
   Do Not Remove the Instrument Cover 222
   Do Not Modify the Instrument 222
   In Case of Damage 222
   Solvents 223
   Safety Symbols 224

Radio Interference 227
Sound Emission 228
Agilent Technologies on Internet 229

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

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

**WARNING**

Ensure the proper usage of the equipment.
The protection provided by the equipment may be impaired.

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

Safety Standards

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

General

Do not use this product in any manner not specified by the manufacturer. The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.
Before Applying Power

**WARNING**  
Wrong voltage range, frequency or cabling  
Personal injury or damage to the instrument

➔ Verify that the voltage range and frequency of your power distribution matches to the power specification of the individual instrument.

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

➔ Make all connections to the unit before applying power.

---

**NOTE**  
Note the instrument’s external markings described under “Safety Symbols” on page 224.

---

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.
General Safety Information

Do Not Operate in an Explosive Atmosphere

**WARNING**  
Presence of flammable gases or fumes  
Explosion hazard

→ Do not operate the instrument in the presence of flammable gases or fumes.

Do Not Remove the Instrument Cover

**WARNING**  
Instrument covers removed  
Electrical shock

→ Do Not Remove the Instrument Cover

→ Only Agilent authorized personnel are allowed to remove instrument covers.  
Always disconnect the power cables and any external circuits before removing the instrument cover.

Do Not Modify the Instrument

Do not install substitute parts or perform any unauthorized modification to the product. Return the product to an Agilent Sales and Service Office for service and repair to ensure that safety features are maintained.

In Case of Damage

**WARNING**  
Damage to the module  
Personal injury (for example electrical shock, intoxication)

→ Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.
Solvents

**WARNING**

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

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

➔ When working with these substances observe appropriate safety procedures (for example by wearing goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the vendor, and follow good laboratory practice.

➔ Do not use solvents with an auto-ignition temperature below 200 °C (392 °F). Do not use solvents with a boiling point below 56 °C (133 °F).

➔ Avoid high vapor concentrations. Always keep the temperature in the sample compartment at least 25 K below the boiling point of the solvent used.

➔ Do not operate the instrument in an explosive atmosphere.

➔ 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.
# Appendix
## General Safety Information

### Safety Symbols

<table>
<thead>
<tr>
<th>Table 23</th>
<th>Symbols</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Symbol]</td>
<td>The apparatus is marked with this symbol when the user should refer to the instruction manual in order to protect risk of harm to the operator and to protect the apparatus against damage.</td>
</tr>
<tr>
<td>![Symbol]</td>
<td>Indicates dangerous voltages.</td>
</tr>
<tr>
<td>![Symbol]</td>
<td>Indicates a protected ground terminal.</td>
</tr>
<tr>
<td>![Symbol]</td>
<td>The apparatus is marked with this symbol when hot surfaces are available and the user should not touch it when heated up.</td>
</tr>
<tr>
<td>![Symbol]</td>
<td>Cooling unit is designed as vapor-compression refrigeration system. Contains fluorinated greenhouse gas (refrigerant) according to the Kyoto protocol. For specifications of refrigerant, charge capacity, carbon dioxide equivalent (CDE), and global warming potential (GWP) see instrument label.</td>
</tr>
<tr>
<td>![Symbol]</td>
<td>Confirms that a manufactured product complies with all applicable European Community directives. The European Declaration of Conformity is available at: <a href="http://regulations.corporate.agilent.com/DoC/search.htm">http://regulations.corporate.agilent.com/DoC/search.htm</a></td>
</tr>
<tr>
<td>![Symbol]</td>
<td>Manufacturing date.</td>
</tr>
<tr>
<td>![Symbol]</td>
<td>Power symbol indicates On/Off. The apparatus is not completely disconnected from the mains supply when the power switch is in the Off position.</td>
</tr>
<tr>
<td>![Symbol]</td>
<td>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.</td>
</tr>
</tbody>
</table>
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.

### Table 23  Symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
</table>
| ![Magnetic field symbol](image) | 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. |
| ![Pinching or crushing hazard symbol](image) | Indicates a pinching or crushing hazard |
| ![Piercing or cutting hazard symbol](image) | 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.

Abstract


NOTE

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

Product Category:

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

NOTE

Do not dispose of in domestic household waste

To return unwanted products, contact your local Agilent office, or see http://www.agilent.com for more information.
Radio Interference

Cables supplied by Agilent Technologies are screened to provide optimized protection against radio interference. All cables are in compliance with safety or EMC regulations.

Test and Measurement

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

Manufacturer’s Declaration

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

This product has a sound pressure emission (at the operator position) < 70 dB.
- Sound Pressure Lp < 70 dB (A)
- At Operator Position
- Normal Operation
- According to ISO 7779:1988/EN 27779/1991 (Type Test)
Agilent Technologies on Internet

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

http://www.agilent.com
Index

Index

8
8-bit configuration switch on-board LAN 195

A
Agilent Lab Advisor software 69
Agilent Lab Advisor 69
Agilent on internet 229
User Interface Software Setup 216
ambient non-operating temperature 23
ambient operating temperature 23
analog signal 193
apg remote 193
assembling
LongLife pump head 137

B
bench space 22
binary pump shutdown during analysis 90

c (Continued)

C
cable
CAN 180
LAN 180
overview 172
RS-232 181
cables
analog 174
remote 176
CAN cable 180
capillaries 110
cleaning 109
compensation sensor open 83
compensation sensor short 83
condensation 22
configuration switches 204
current of primary pump drive too high 97
current of secondary pump drive too high 98

d (Continued)
defect connection between main board and pump drive encoder 94
degasser’s pressure limit violation 88
delay volume configure 61
description 60
optimize 61
deliver underrun 94
DHCP
general information 207
setup 208
dimensions 23
disassembling
LongLife pump head 130
doors
install 111
remove 111
drive current too high 93
drive current too low 92
drive encoder error 97
drive Encoder failed 92
drive position limit 96
drive timeout 93
drive timeout 93
fan failed 84
flow rate limit exceeded 90
ignition without cover 85, 85
insufficient power of drive encoder LED 96
leak sensor open 82
leak sensor short 82
leak 85
lost CAN partner 81
overcurrent of pump drive 93
overcurrent of solvent selection valve (SSV) 94
pressure below lower limit 87
pressure exceeded upper pressure limit 87
pressure sensor calibration wrong or missing 100
pump drive blocked or encoder failed 92
pump drive encoder defect 95
pump drive encoder error 98
pump drive encoder rollover 96
pump drive error 99
pump drive stop not found 100
pump drive stroke blocked 99
purge valve failed 95
reading of purge valve tag failed 95
reading the pump encoder tag failed 91
remote timeout 81
seal wash pump was missing when tried to turn on 101
shutdown 80
solvent counter exceeded limit 89
target pressure not reached for binary pump degasser 88
timeout 80
unknown purge valve type 98
waste counter limit exceeded 89
writing the pump encoder tag failed 91
writing the purge valve tag failed 97
extra-column volume 60
resident system 184
update tool 185
updates 185, 152
upgrade/downgrade 152
fittings 110
flow connections 160
flow rate limit exceeded 90
frequency range 23
general error messages 80
handling acetonitrile 45
handling acids 45
handling buffers 44
heat exchanger
replace 135
high pressure filter assembly
replace 150
humidity 23
initialization mode selection 205
inlet valve
release 124
replace 122
stuck 124
installation
bench space 22
power considerations 20
site requirements 19
installing
pump head assembly 143
install
doors 111
instrument layout 199
insufficient power of drive encoder LED 96
interfaces 68
Infinity II 189
internet 229
jet weaver
change configuration 118
replace 118
LAN
cable 180
configuration switch 204
configuration 201
first steps 202
initialization mode selection 205
link configuration selection 210
manual configuration with telnet 212
manual configuration 211
PC and User Interface Software Setup 216
TCP/IP parameter configuration 203
using default 206
using stored 205
leak sensor open 82
leak sensor short 82
leak 85
line frequency 23
line voltage 23
link configuration selection 210
LongLife pump head
assembling 137
disassembling 130
lost CAN partner 81
MAC
address 202
Index

maintenance feedback 198
introduction 104
replacing firmware 152
manual configuration of LAN 211
message cover violation 86
ignition without cover 85, 85
remote timeout 81
module firmware replace 152

N
non-operating altitude 23
non-operating temperature 23
normal phase 34
seals 35

O
operating Altitude 23
operating temperature 23
optimization
achieving higher resolution 63
outlet valve replace 145
overcurrent of pump drive 93
overcurrent of solvent selection valve (SSV) 94
overview cable 172

P
parts
primary pump head 165
pump heads 162
secondary pump head 166
PC and User Interface Software Setup 216
performance specifications 24
performance Optimization 59
physical specifications 23
power considerations 20
power consumption 23
power cords 21
pressure below lower limit 87
pressure exceeded upper pressure limit 87
pressure sensor calibration wrong or missing 100
pressure sensor replace 114
primary pump head parts 165
product description 10
pump drive blocked or encoder failed 92
pump drive encoder defect 95
pump drive encoder error 98
pump drive encoder rollover 96
pump drive error 99
pump drive stop not found 100
pump drive stroke blocked 100
pump error messages 87
pump head assembly installing 143
remove 126
pump head LongLife 130, 137
pump leak rate test 70
purge valve failed 95
purge valve head replace 148
purging 36

R
radio interference 227
reading the pump encoder tag failed 91
remote cables 176
remove doors 111
pump head assembly 126
repairs replacing firmware 152
replace high pressure filter assembly 150
inlet valve 122
jet weaver 118
outlet valve 145
pressure sensor 114
purge valve head 148
seal wash pump 121
solvent selection valve 116
resolution Optimization 63
RS-232C cable 181

S
safety class I 220
safety general information 220
standards 23
symbols 224
seal wash pump was missing when tried to turn on 101
secondary pump head parts 166
serial number information 188
shutdown 80
shutoff valve panel replacing 113
shutoff valves replacing 113
site requirements 19
<table>
<thead>
<tr>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>power cords 21</td>
</tr>
<tr>
<td>solvent counter exceeded limit 89</td>
</tr>
<tr>
<td>solvent handling 44</td>
</tr>
<tr>
<td>solvent selection valve replace 116</td>
</tr>
<tr>
<td>special interfaces 194</td>
</tr>
<tr>
<td>special settings</td>
</tr>
<tr>
<td>boot-resident 197</td>
</tr>
<tr>
<td>forced cold start 197</td>
</tr>
<tr>
<td>specification</td>
</tr>
<tr>
<td>physical 23</td>
</tr>
<tr>
<td>specifications 19</td>
</tr>
<tr>
<td>SSV replace 116</td>
</tr>
<tr>
<td>system pressure test 75</td>
</tr>
<tr>
<td>T</td>
</tr>
<tr>
<td>target pressure not reached for binary pump degasser 88</td>
</tr>
<tr>
<td>TCP/IP parameter configuration 203</td>
</tr>
<tr>
<td>telnet</td>
</tr>
<tr>
<td>configuration 212</td>
</tr>
<tr>
<td>temperature sensor 85</td>
</tr>
<tr>
<td>tests</td>
</tr>
<tr>
<td>pump leak rate test 70</td>
</tr>
<tr>
<td>system pressure test 75</td>
</tr>
<tr>
<td>timeout 80</td>
</tr>
<tr>
<td>transport</td>
</tr>
<tr>
<td>prepare 153</td>
</tr>
<tr>
<td>troubleshooting</td>
</tr>
<tr>
<td>error messages 79</td>
</tr>
<tr>
<td>U</td>
</tr>
<tr>
<td>unknown purge valve type 98</td>
</tr>
<tr>
<td>V</td>
</tr>
<tr>
<td>voltage range 23</td>
</tr>
<tr>
<td>W</td>
</tr>
<tr>
<td>waste counter limit exceeded 89</td>
</tr>
<tr>
<td>waste</td>
</tr>
<tr>
<td>electrical and electronic equipment 226</td>
</tr>
<tr>
<td>WEEE directive 226</td>
</tr>
<tr>
<td>weight 23</td>
</tr>
<tr>
<td>writing the pump encoder tag failed 91</td>
</tr>
<tr>
<td>writing the purge valve tag failed 97</td>
</tr>
</tbody>
</table>
In This Book

This manual contains technical reference information about the Agilent 1290 Infinity II High Speed Pump (G7120A).

• introduction and specifications,
• using and optimizing,
• troubleshooting and diagnose,
• maintenance,
• parts identification,
• hardware information,
• safety and related information.