# Agilent 1260 Infinity Diode Array and Multiple Wavelength Detector

User Manual

Agilent Technologies

# Notices



## Manual Part Number

G1315-90015 Rev. C

## Edition

07/2018

Printed in Germany

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## Safety Notices

**CAUTION**

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

**WARNING**

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

# In This Guide...

This manual covers the Agilent 1260 Infinity Diode Array and Multiple Wavelength Detector modules:

- G1315C - 1260 DAD VL+
- G1365C - 1260 MWD
- G1315D - 1260 DAD VL
- G1365D - 1260 MWD VL

## 1 Introduction

This chapter gives an introduction to the detector, instrument overview and internal connectors.

## 2 Site Requirements and Specifications

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

## 3 Installing the Module

This chapter gives information about the preferred stack setup for your system and the installation of your module.

## 4 Using the Detector

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

## 5 How to optimize the Detector

This chapter provides information on how to optimize the detector.

## 6 Troubleshooting and Diagnostics

This chapter gives an overview about the troubleshooting and diagnostic features and the different user interfaces.

## 7 Error Information

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

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# Contents

# 1
# Introduction



This chapter gives an introduction to the detector, instrument overview and internal connectors.

# Introduction to the Detector

The detector is designed for highest optical performance, GLP compliance and easy maintenance. It includes the following features:

- 80 Hz data acquisition rate for (ultra-) fast LC applications (requires internal hard disk, G1315C and G1365C only),
- data recovery (DRC) feature provides data-never-lost insurance (requires internal hard disk, G1315C and G1365C only),
- RFID tags for all flow cells and UV-lamps provides traceable information about these assemblies,
- long-life deuterium with RFID tag and tungsten lamps for highest intensity and lowest detection limit over a wavelength range of 190 – 950 nm,
- no loss in sensitivity for up to eight wavelengths simultaneous,
- programmable slit from 1 – 16 nm for complete optimization of sensitivity, linearity and spectral resolution,
- optional flow-cell cartridges with RFID tag (standard 10 mm13 µL, semi-micro 6 mm5 µL, micro 3 mm2 µL, 80 nL, 500 nL, 10 mm, high pressure 10 mm1.7 µL and prep-cells) are available and can be used depending on the application needs,
- easy front access to lamps and flow cell for fast replacement, and
- built-in holmium oxide filter for fast wavelength accuracy verification,
- built-in temperature control for improved baseline stability,
- additional diagnostic signals for temperature and lamp voltage monitoring,

For specifications, see “Performance Specifications” on page 24.

# Optical System

The optical system of the detector is shown in Figure below. Its illumination source is a combination of a deuterium-arc-discharge lamp for the ultraviolet (UV) wavelength range and a tungsten lamp for the visible (VIS) and short-wave near-infrared (SWNIR) wavelength range. The image of the filament of the tungsten lamp is focused on the discharge aperture of the deuterium lamp by means of a special rear-access lamp design which allows both light sources to be optically combined and share a common axis to the source lens. The achromat (source lens) forms a single, focused beam of light through the flow cell. Each cell room and lamp are separated by a quartz window which can be cleaned or replaced. In the spectrograph, light is being dispersed onto the diode array by a holographic grating. This allows simultaneous access to all wavelength information.

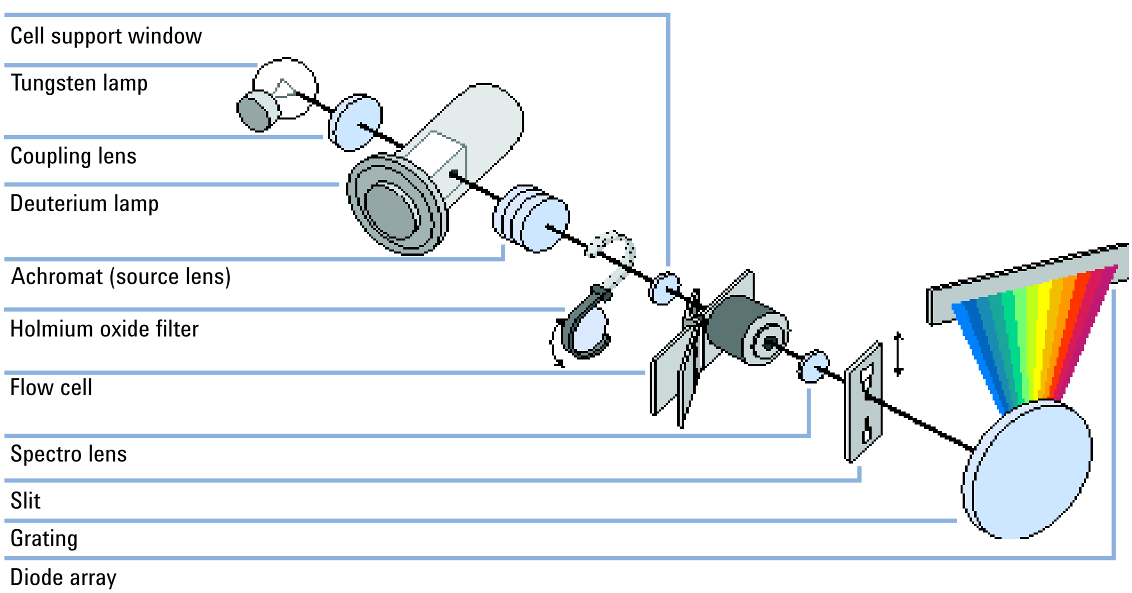


**Figure 1** Optical System of the Detector

**Lamps** The light source for the UV-wavelength range is a deuterium lamp with a shine-through aperture. As a result of plasma discharge in low-pressure deuterium gas, the lamp emits light over the 190 nm to approximately 800 nm wavelength range. The light source for the visible and SWNIR wavelength range is a low noise tungsten lamp. This lamp emits light over the wavelength range 470 – 950 nm.

**Achromat (Source Lens)** The achromat receives the light from both lamps and focuses it so that the beam passes through the flow cell.

**Holmium Oxide Filter** The holmium oxide filter is electromechanically actuated. During the holmium filter test it moves into the light path.

**Cell Support Window** The cell support window assembly separates the holmium filter area from the flow cell area.

**Flow Cell Compartment** The optical unit has a flow cell compartment for easy access to flow cells. A variety of optional flow cells can be inserted using the same quick, simple mounting system. The flow cell can be removed to check the optical and electronic performance of the detector without having influences from the flow cell.

**Spectrograph** The spectrograph material is ceramic to reduce thermal effects to a minimum. The spectrograph consists of the spectrograph lens, the variable entrance slit, the grating and the photodiode array with front-end electronics. The spectrograph lens refocuses the light beam after it has passed through the flow cell. The sampling interval of the diode array is < 1 nm over the wavelength range 190 – 950 nm. Depending on the wavelength this varies from 1.0 to 1.25 diodes per nanometer (for example a diode every 0.8 to 1 nm).

For a small wavelength range, the small non-linearity could be neglected. With the wavelength range from 190 – 950 nm a new approach is required to achieve wavelength accuracy over the full range. Each spectrograph is calibrated individually. The calibration data is stored in the spectrograph on an EEPROM. Based on these data, the built-in processors calculate absorbance data with linear intervals (1.0, 2.0, ...) between data points. This results in an excellent wavelength accuracy and instrument-to-instrument reproducibility.

**Variable Entrance Slit System** The micro-slit system makes use of the mechanical properties of silicon combined with the precise structuring capabilities of bulk micro-machining. It combines the required optical functions — slit and shutter — in a simple and compact component. The slit width is directly controlled by the micro-processor of the instrument and can be set as method parameter.

**Grating** The combination of dispersion and spectral imaging is accomplished by using a concave holographic grating. The grating separates the light beam into all its component wavelengths and reflects the light onto the photodiode array.

**Diode Array** The diode array is a series of 1024 individual photodiodes and control circuits located on a ceramic carrier. With a wavelength range from 190 – 950 nm the sampling interval is < 1 nm.

# System Overview

## Leak and Waste Handling

The 1200 Infinity Series has been designed for safe leak and waste handling. It is important that all security concepts are understood and instructions are carefully followed.

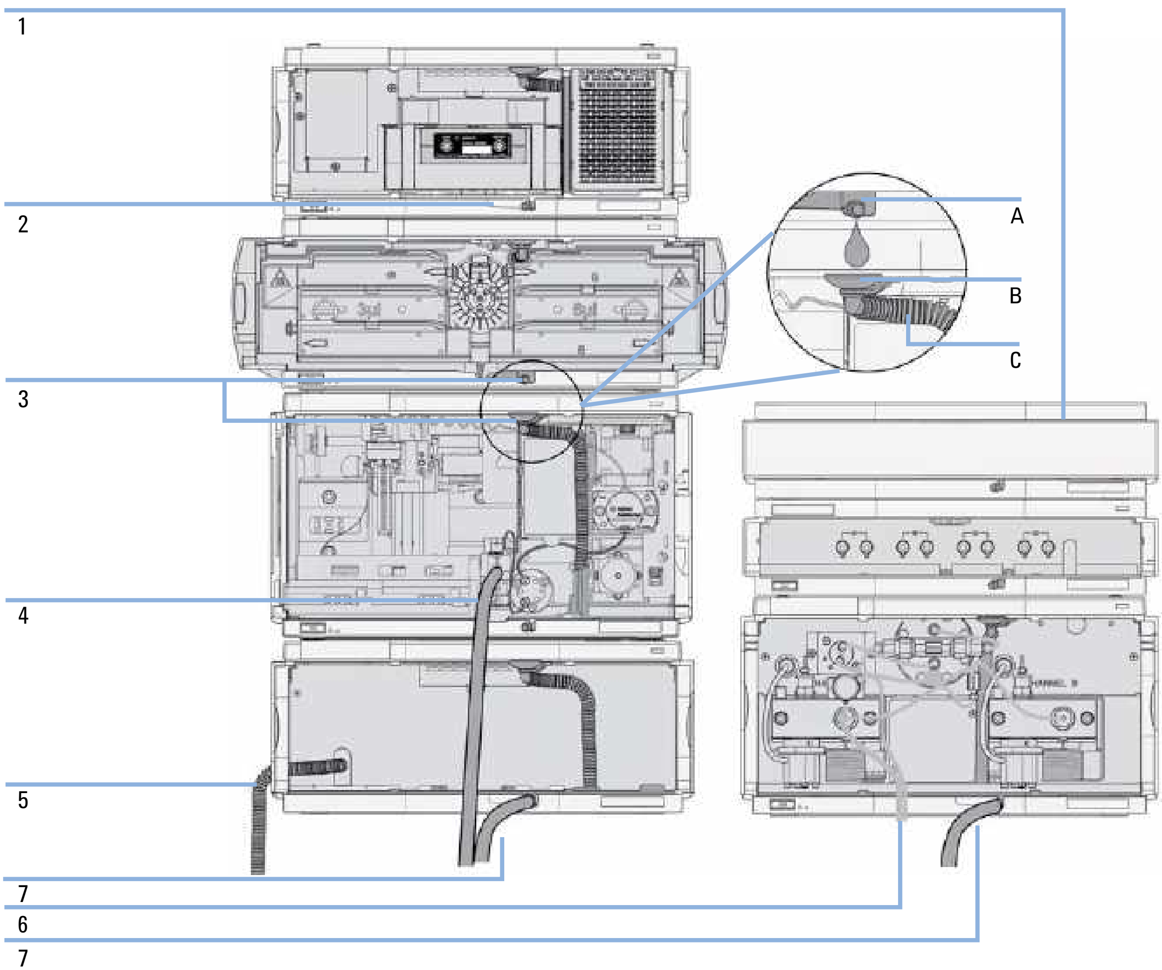


**Figure 2** Leak and waste handling concept (overview - typical stack configuration as an example)

The solvent cabinet (1) is designed to store a maximum volume of 6 L solvent. The maximum volume for an individual bottle stored in the solvent cabinet should not exceed 2.5 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).

The leak pan (2) (individually designed in each module) guides solvents to the front of the module. The concept covers also leakages on internal parts (e.g. the detector’s flow cell). The leak sensor in the leak pan stops the running system as soon as the leak detection level is reached.

The leak pan's outlet port (3, A) guides excessive overfill from one module to the next, as the solvent flows into the next module’s leak funnel (3, B) and the connected corrugated waste tube (3, C). The corrugated waste tube guides the solvent to the next lower positioned module’s leak tray and sensor.

The waste tube of the sampler’s needle wash port (4) guides solvents to waste.

The condense drain outlet of the autosampler cooler (5) guides condensate to waste.

The waste tube of the purge valve (6) guides solvents to waste.

The waste tube connected to the leak pan outlet on each of the bottom instruments (7) guides the solvent to a suitable waste container.

# Bio-inert Materials

For the Agilent 1260 Infinity Bio-inert LC system, Agilent Technologies uses highest quality materials in the flow path (also referred to as wetted parts), which are widely accepted by life scientists, as they are known for optimum inertness to biological samples and ensure best compatibility with common samples and solvents over a wide pH range. Explicitly, the complete flow path is free of stainless steel and free of other alloys containing metals such as iron, nickel, cobalt, chromium, molybdenum or copper, which can interfere with biological samples. The flow downstream of the sample introduction contains no metals whatsoever.

**Table 1** Bio-inert materials used in Agilent 1260 Infinity Systems

| Module | Materials |
|---|---|
| Agilent 1260 Infinity Bio-inert Quaternary Pump (G5611A) | Titanium, gold, platinum-iridium, ceramic, ruby, PTFE, PEEK |
| Agilent 1260 Infinity Bio-inert High-Performance Autosampler (G5667A) | Upstream of sample introduction:<br>• Titanium, gold, PTFE, PEEK, ceramic<br>Downstream of sample introduction:<br>• PEEK, ceramic |
| Agilent 1260 Infinity Bio-inert Manual Injector (G5628A) | PEEK, ceramic |
| Agilent 1260 Infinity Bio-inert Analytical Fraction Collector (G5664A) | PEEK, ceramic, PTFE |
| **Bio-inert Flow Cells:** | |
| Standard flow cell bio-inert, 10 mm, 13 µL, 120 bar ( 12 MPa) for MWD/DAD, includes Capillary Kit Flow Cells BIO (p/n G5615-68755) (G5615-60022) (*for Agilent 1260 Infinity Diode Array Detectors DAD G1315C/D*) | PEEK, ceramic, sapphire, PTFE |
| Max-Light Cartridge Cell Bio-inert ( 10 mm, V(s) 1.0 µL) (G5615-60018) and Max-Light Cartridge Cell Bio-inert ( 60 mm, V(s) 4.0 µL) (G5615-60017) (*for Agilent 1200 Infinity Series Diode Array Detectors DAD G4212A/B*) | PEEK, fused silica |
| Bio-inert flow cell, 8 µL, 20 bar (pH 1–12) includes Capillary Kit Flow Cells BIO (p/n G5615-68755) (G5615-60005) (*for Agilent 1260 Infinity Fluorescence Detector FLD G1321B*) | PEEK, fused silica, PTFE |

**Table 1** Bio-inert materials used in Agilent 1260 Infinity Systems

| Module | Materials |
|---|---|
| Bio-inert heat-exchanger G5616-60050<br>(*for Agilent 1290 Infinity Thermostatted Column Compartment G1316C*) | PEEK (steel-cladded) |
| Bio-inert Valve heads | G4235A, G5631A, G5639A: PEEK, ceramic ($Al_2O_3$ based) |
| Bio-inert Connection capillaries | Upstream of sample introduction:<br>• Titanium<br>Downstream of sample introduction:<br>• Agilent uses stainless-steel-cladded PEEK capillaries, which keep the flow path free of steel and provide pressure stability to more than 600 bar. |

**NOTE** To ensure optimum bio-compatibility of your Agilent 1260 Infinity Bio-inert LC system, do not include non-inert standard modules or parts to the flow path. Do not use any parts that are not labeled as Agilent “Bio-inert”. For solvent compatibility of these materials, see “Material Information” on page 93.

# 2
# Site Requirements and Specifications



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

# Site Requirements

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

## Power Considerations

The module power supply has wide ranging capability. It accepts any line voltage in the range described in Table 2 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**

**Hazard of electrical shock or damage of your instrumentation**

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

→ Connect your instrument to the specified line voltage only.

**WARNING**

**The 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. electrical shock, when the cover is opened and the module is connected to power.**

→ Always unplug the power cable before opening the cover.

→ Do not connect the power cable to the instrument while the covers are removed.

**CAUTION**

Inaccessible power plug.

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

→ Make sure the power connector of the instrument can be easily reached and unplugged.

→ Provide sufficient space behind the power socket of the instrument to unplug the cable.

## Power Cords

Different power cords are offered as options with 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.

**WARNING** **Absence of ground connection or use of unspecified power cord**

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

→ Never operate your instrumentation from a power outlet that has no ground connection.

→ Never use a power cord other than the Agilent Technologies power cord designed for your region.

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**WARNING** **Use of unsupplied cables**

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

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

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**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 the power cords that Agilent Technologies supplies with this instrument for any other equipment.

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## Bench Space

The module dimensions and weight (see Table 2 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.

## Environment

Your detector will work within the specifications at ambient temperatures and relative humidity described in Table 2 on page 23.

ASTM drift tests require a temperature change below 2 °C/hour (3.6 °F/hour) over one hour period. Our published drift specification (refer also to "Performance Specifications G1315C" on page 24) is based on these conditions. Larger ambient temperature changes will result in larger drift.

Better drift performance depends on better control of the temperature fluctuations. To realize the highest performance, minimize the frequency and the amplitude of the temperature changes to below 1 °C/hour (1.8 °F/hour). Turbulences around one minute or less can be ignored.

**NOTE** The module is designed to operate in a typical electromagnetic environment (EN61326-1) where RF transmitters, such as mobile phones, should not be used in close proximity.

**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 2** Physical Specifications

| Type | Specification | Comments |
|---|---|---|
| Weight | 11.5 kg (26 lbs) | |
| Dimensions (height × width × depth) | 140 x 345 x 435 mm (5.5 x 13.5 x 17 inches) | |
| Line voltage | 100 – 240 V~, ± 10 % | Wide-ranging capability |
| Line frequency | 50 or 60 Hz, ± 5 % | |
| Power consumption | 160 VA / 160 W / 546 BTU | Maximum |
| Ambient operating temperature | 0–55 °C (32–131 °F) | |
| Ambient non-operating temperature | -40 – 70 °C (-40 – 158 °F) | |
| Humidity | < 95 % r.h. at 40 °C (104 °F) | Non-condensing |
| Operating altitude | Up to 3000 m (9842 ft) | |
| Non-operating altitude | Up to 4600 m (15092 ft) | For storing the module |
| Safety standards: IEC, EN, CSA, UL | Installation category II, Pollution degree 2 | For indoor use only. |
| ISM Classification | ISM Group 1 Class B | According to CISPR 11 |

# Performance Specifications

## Specifications

### Performance Specifications G1315C

**Table 3** Performance Specifications G1315C

| Type | Specification | Comments |
|---|---|---|
| Detection type | 1024-element photodiode array | |
| Light source | Deuterium and tungsten lamps | The UV-lamp is equipped with RFID tag that holds lamp typical information. |
| Data rate | up to 80 Hz | |
| Wavelength range | 190 – 950 nm | |
| Short term noise (ASTM) Single and Multi-Wavelength | $< \pm 0.7 \cdot 10^{-5}$ AU at 254 and 750 nm | see *"Specification Conditions"* below |
| Drift | $< 0.9 \cdot 10^{-3}$ AU/h at 254 nm | see *"Specification Conditions"* below |
| Linear absorbance range | > 2 AU (5 %) at 265 nm | see *"Specification Conditions"* below |
| Wavelength accuracy | ± 1 nm | Self-calibration with deuterium lines, verification with holmium oxide filter |
| Wavelength bunching | 1 – 400 nm | Programmable in steps of 1 nm |
| Slit width | 1, 2, 4 , 8, 16 nm | Programmable slit |
| Diode width | < 1 nm | |

**Table 3** Performance Specifications G1315C

| Type | Specification | Comments |
| --- | --- | --- |
| Flow cells | Standard: 13 µL volume, 10 mm cell path length and 120 bar (1740 psi) pressure maximum<br>Standard bio-inert: 13 µL volume, 10 mm cell path length and 120 bar (1740 psi) pressure maximum<br>Semi-micro: 5 µL volume, 6 mm cell path length and 120 bar (1740 psi) pressure maximum<br>Micro: 2 µL volume, 3 mm cell path length, 120 bar (1740 psi) pressure maximum<br>Semi-nano: 500 nL volume, 10 mm cell path length and 50 bar (725 psi) pressure maximum<br>Nano: 80 nL volume, 6 mm cell path length and 50 bar (725 psi) pressure maximum<br>High pressure: 1.7 µL volume, 6 mm cell path length and 400 bar (5800 psi) pressure maximum<br>Prep SST: 3 mm cell path length and 120 bar (1740 psi) pressure maximum<br>Prep Quartz:0.3 mm cell path length and 20 bar (290 psi) pressure maximum<br>Prep Quartz: 0.06 mm cell path length and 20 bar (290 psi) pressure maximum | All flow cells are equipped with RFID tags that hold cell typical information.<br>pH range 1.0—9.5 (12.5 solvent dependent with bio-inert version) |
| Time programmable | Wavelength, polarity, peak width, lamp bandwidth, autobalance, wavelength range, threshold, spectra storage mode | |
| Spectral tools | Data analysis software for spectra evaluation, including spectral libraries and peak purity functions | |

**Table 3** Performance Specifications G1315C

| Type | Specification | Comments |
| --- | --- | --- |
| Control and data evaluation | Agilent ChemStation for LC (32-bit) | For 1260 systems:<br>• Revision B.04.02 DSP2 or above<br>For 1100/1200 systems:<br>• Revision B.01.03 or above |
| Local Control | Agilent Instant Pilot (G4208A) | For 1260 systems:<br>• B.02.11 or above<br>For other systems:<br>• B.02.09 or above |
| Analog outputs | Recorder/integrator: 100 mV or 1 V, output range 0.001 – 2 AU, two outputs | |
| Communications | Controller-area network (CAN), RS-232C, APG Remote: ready, start, stop and shut-down signals, LAN | |
| Safety and maintenance | Extensive diagnostics, error detection and display (through control module and ChemStation), leak detection, safe leak handling, leak output signal for shutdown of pumping system. Low voltages in major maintenance areas. | |
| GLP features | RFID for electronics records of flow cell and UV lamp conditions (path length, volume, product number, serial number, test passed, usage) Early maintenance feedback (EMF) for continuous tracking of instrument usage in terms of lamp burn time with user-setable limits and feedback messages. Electronic records of maintenance and errors. Verification of wavelength accuracy with built-in holmium oxide filter. | |
| Housing | All materials recyclable. | |
| Others | Electronic temperature control (ETC) for the complete optical unit | |

## Performance Specifications G1315D

**Table 4** Performance Specifications G1315D

| Type | Specification | Comments |
|---|---|---|
| Detection type | 1024-element photodiode array | |
| Light source | Deuterium and tungsten lamps | The UV-lamp is equipped with RFID tag that holds lamp typical information. |
| Data rate | up to 20 Hz | |
| Wavelength range | 190 – 950 nm | |
| Short term noise (ASTM) Single and Multi-Wavelength | $< \pm 0.7 \cdot 10^{-5}$ AU at 254 and 750 nm | see *"Specification Conditions"* below |
| Drift | $< 0.9 \cdot 10^{-3}$ AU/h at 254 nm | see *"Specification Conditions"* below |
| Linear absorbance range | > 2 AU (5 %) at 265 nm | see *"Specification Conditions"* below |
| Wavelength accuracy | ± 1 nm | Self-calibration with deuterium lines, verification with holmium oxide filter |
| Wavelength bunching | 1 – 400 nm | Programmable in steps of 1 nm |
| Slit width | 1, 2, 4 , 8, 16 nm | Programmable slit |
| Diode width | < 1 nm | |

**Table 4** Performance Specifications G1315D

| Type | Specification | Comments |
|---|---|---|
| Flow cells | Standard: 13 µL volume, 10 mm cell path length and 120 bar (1740 psi) pressure maximum<br>Standard bio-inert: 13 µL volume, 10 mm cell path length and 120 bar (1740 psi) pressure maximum<br>Semi-micro: 5 µL volume, 6 mm cell path length and 120 bar (1740 psi) pressure maximum<br>Micro: 2 µL volume, 3 mm cell path length, 120 bar (1740 psi) pressure maximum<br>Semi-nano: 500 nL volume, 10 mm cell path length and 50 bar (725 psi) pressure maximum<br>Nano: 80 nL volume, 6 mm cell path length and 50 bar (725 psi) pressure maximum<br>High pressure: 1.7 µL volume, 6 mm cell path length and 400 bar (5800 psi) pressure maximum<br>Prep SST: 3 mm cell path length and 120 bar (1740 psi) pressure maximum<br>Prep Quartz:0.3 mm cell path length and 20 bar (290 psi) pressure maximum<br>Prep Quartz: 0.06 mm cell path length and 20 bar (290 psi) pressure maximum | All flow cells are equipped with RFID tags that hold cell typical information.<br>pH range 1.0—9.5 (12.5 solvent dependent with bio-inert version) |
| Time programmable | Wavelength, polarity, peak width, lamp bandwidth, autobalance, wavelength range, threshold, spectra storage mode | |
| Spectral tools | Data analysis software for spectra evaluation, including spectral libraries and peak purity functions | |
| Control and data evaluation | Agilent ChemStation for LC (32-bit) | For 1260 systems:<br>• Revision B.04.02 DSP2 or above<br>For 1100/1200 systems:<br>• Revision B.01.03 SR-2 / B.02.01 SR-2 or above |

**Table 4** Performance Specifications G1315D

| Type | Specification | Comments |
|---|---|---|
| Local Control | Agilent Instant Pilot (G4208A) | For 1260 systems:<br>• B.02.11 or above<br>For other systems:<br>• B.02.09 or above |
| Analog outputs | Recorder/integrator: 100 mV or 1 V, output range 0.001 – 2 AU, two outputs | |
| Communications | Controller-area network (CAN), RS-232C, APG Remote: ready, start, stop and shut-down signals, LAN | |
| Safety and maintenance | Extensive diagnostics, error detection and display (through control module and ChemStation), leak detection, safe leak handling, leak output signal for shutdown of pumping system. Low voltages in major maintenance areas. | |
| GLP features | RFID for electronics records of flow cell and UV lamp conditions (path length, volume, product number, serial number, test passed, usage)<br>Early maintenance feedback (EMF) for continuous tracking of instrument usage in terms of lamp burn time with user-setable limits and feedback messages. Electronic records of maintenance and errors. Verification of wavelength accuracy with built-in holmium oxide filter. | |
| Housing | All materials recyclable. | |
| Others | Electronic temperature control (ETC) for the complete optical unit | |

## Performance Specifications G1365C

**Table 5** Performance Specifications G1365C

| Type | Specification | Comments |
|---|---|---|
| Detection type | 1024-element photodiode array | |
| Light source | Deuterium and tungsten lamps | The UV-lamp is equipped with RFID tag that holds lamp typical information. |
| Data rate | up to 80 Hz | |
| Wavelength range | 190 – 950 nm | |
| Short term noise (ASTM) Single and Multi-Wavelength | $< \pm 0.7 \cdot 10^{-5}$ AU at 254 and 750 nm | see *"Specification Conditions"* below |
| Drift | $< 0.9 \cdot 10^{-3}$ AU/h at 254 nm | see *"Specification Conditions"* below |
| Linear absorbance range | > 2 AU (5 %) at 265 nm | see *"Specification Conditions"* below |
| Wavelength accuracy | ± 1 nm | Self-calibration with deuterium lines, verification with holmium oxide filter |
| Wavelength bunching | 1 – 400 nm | Programmable in steps of 1 nm |
| Slit width | 1, 2, 4 , 8, 16 nm | Programmable slit |
| Diode width | < 1 nm | |

**Table 5** Performance Specifications G1365C

| Type | Specification | Comments |
|---|---|---|
| Flow cells | Standard: 13 µL volume, 10 mm cell path length and 120 bar (1740 psi) pressure maximum<br>Standard bio-inert: 13 µL volume, 10 mm cell path length and 120 bar (1740 psi) pressure maximum<br>Semi-micro: 5 µL volume, 6 mm cell path length and 120 bar (1740 psi) pressure maximum<br>Micro: 2 µL volume, 3 mm cell path length, 120 bar (1740 psi) pressure maximum<br>Semi-nano: 500 nL volume, 10 mm cell path length and 50 bar (725 psi) pressure maximum<br>Nano: 80 nL volume, 6 mm cell path length and 50 bar (725 psi) pressure maximum<br>High pressure: 1.7 µL volume, 6 mm cell path length and 400 bar (5800 psi) pressure maximum<br>Prep SST: 3 mm cell path length and 120 bar (1740 psi) pressure maximum<br>Prep Quartz:0.3 mm cell path length and 20 bar (290 psi) pressure maximum<br>Prep Quartz: 0.06 mm cell path length and 20 bar (290 psi) pressure maximum | All flow cells are equipped with RFID tags that hold cell typical information.<br>pH range 1.0—9.5 (12.5 solvent dependent with bio-inert version) |
| Time programmable | Wavelength, polarity, peak width, lamp bandwidth, autobalance, wavelength range, threshold, spectra storage mode | |

**Table 5** Performance Specifications G1365C

| Type | Specification | Comments |
|---|---|---|
| Control and data evaluation | Agilent ChemStation for LC (32-bit) | For 1260 systems:<br>• Revision B.04.02 DSP2 or above<br>For 1100/1200 systems:<br>• Revision B.01.03 or above |
| Local Control | Agilent Instant Pilot (G4208A) | For 1260 systems:<br>• B.02.11 or above<br>For other systems:<br>• B.02.09 or above |
| Analog outputs | Recorder/integrator: 100 mV or 1 V, output range 0.001 – 2 AU, two outputs | |
| Communications | Controller-area network (CAN), RS-232C, APG Remote: ready, start, stop and shut-down signals, LAN | |
| Safety and maintenance | Extensive diagnostics, error detection and display (through control module and ChemStation), leak detection, safe leak handling, leak output signal for shutdown of pumping system. Low voltages in major maintenance areas. | |
| GLP features | RFID for electronics records of flow cell and UV lamp conditions (path length, volume, product number, serial number, test passed, usage) Early maintenance feedback (EMF) for continuous tracking of instrument usage in terms of lamp burn time with user-setable limits and feedback messages. Electronic records of maintenance and errors. Verification of wavelength accuracy with built-in holmium oxide filter. | |
| Housing | All materials recyclable. | |
| Others | Electronic temperature control (ETC) for the complete optical unit | |

## Performance Specifications G1365D

**Table 6** Performance Specifications G1365D

| Type | Specification | Comments |
|---|---|---|
| Detection type | 1024-element photodiode array | |
| Light source | Deuterium and tungsten lamps | The UV-lamp is equipped with RFID tag that holds lamp typical information. |
| Data rate | up to 20 Hz | |
| Wavelength range | 190 – 950 nm | |
| Short term noise (ASTM) Single and Multi-Wavelength | $< \pm 0.7 \cdot 10^{-5}$ AU at 254 and 750 nm | see *"Specification Conditions"* below |
| Drift | $< 0.9 \cdot 10^{-3}$ AU/h at 254 nm | see *"Specification Conditions"* below |
| Linear absorbance range | > 2 AU (5 %) at 265 nm | see *"Specification Conditions"* below |
| Wavelength accuracy | ± 1 nm | Self-calibration with deuterium lines, verification with holmium oxide filter |
| Wavelength bunching | 1 – 400 nm | Programmable in steps of 1 nm |
| Slit width | 1, 2, 4 , 8, 16 nm | Programmable slit |
| Diode width | < 1 nm | |

**Table 6** Performance Specifications G1365D

| Type | Specification | Comments |
|---|---|---|
| Flow cells | Standard: 13 µL volume, 10 mm cell path length and 120 bar (1740 psi) pressure maximum<br>Standard bio-inert: 13 µL volume, 10 mm cell path length and 120 bar (1740 psi) pressure maximum<br>Semi-micro: 5 µL volume, 6 mm cell path length and 120 bar (1740 psi) pressure maximum<br>Micro: 2 µL volume, 3 mm cell path length, 120 bar (1740 psi) pressure maximum<br>Semi-nano: 500 nL volume, 10 mm cell path length and 50 bar (725 psi) pressure maximum<br>Nano: 80 nL volume, 6 mm cell path length and 50 bar (725 psi) pressure maximum<br>High pressure: 1.7 µL volume, 6 mm cell path length and 400 bar (5800 psi) pressure maximum<br>Prep SST: 3 mm cell path length and 120 bar (1740 psi) pressure maximum<br>Prep Quartz:0.3 mm cell path length and 20 bar (290 psi) pressure maximum<br>Prep Quartz: 0.06 mm cell path length and 20 bar (290 psi) pressure maximum | All flow cells are equipped with RFID tags that hold cell typical information.<br>pH range 1.0—9.5 (12.5 solvent dependent with bio-inert version) |
| Time programmable | Wavelength, polarity, peak width, lamp bandwidth, autobalance, wavelength range, threshold, spectra storage mode | |

**Table 6** Performance Specifications G1365D

| Type | Specification | Comments |
|---|---|---|
| Control and data evaluation | Agilent ChemStation for LC (32-bit) | For 1260 systems:<br>• Revision B.04.02 DSP2 or above<br>For 1100/1200 systems:<br>• Revision B.01.03 SR-2 / B.02.01 SR-2 or above |
| Local Control | Agilent Instant Pilot (G4208A) | For 1260 systems:<br>• B.02.11 or above<br>For other systems:<br>• B.02.09 or above |
| Analog outputs | Recorder/integrator: 100 mV or 1 V, output range 0.001 – 2 AU, two outputs | |
| Communications | Controller-area network (CAN), RS-232C, APG Remote: ready, start, stop and shut-down signals, LAN | |
| Safety and maintenance | Extensive diagnostics, error detection and display (through control module and ChemStation), leak detection, safe leak handling, leak output signal for shutdown of pumping system. Low voltages in major maintenance areas. | |
| GLP features | RFID for electronics records of flow cell and UV lamp conditions (path length, volume, product number, serial number, test passed, usage) Early maintenance feedback (EMF) for continuous tracking of instrument usage in terms of lamp burn time with user-setable limits and feedback messages. Electronic records of maintenance and errors. Verification of wavelength accuracy with built-in holmium oxide filter. | |
| Housing | All materials recyclable. | |
| Others | Electronic temperature control (ETC) for the complete optical unit | |

## Specification Conditions

ASTM: “Standard Practice for Variable Wavelength Photometric Detectors Used in Liquid Chromatography”.

Reference conditions: cell path length 10 mm, wavelength 254 and 750 nm with reference wavelength 360 nm/100 nm, slit width 4 nm, time constant 2 s (equal to response time 4 s), flow 1 mL/min LC-grade Methanol.

Linearity: Linearity is measured with caffeine at 265 nm/4 nm with slit width 4 nm and TC 2 s (or with RT 4 s) with 10 mm pathlength.

For environmental conditions refer to *"Environment"*.

**NOTE** The specifications are based on the standard RFID tag lamp (2140-0820) and may be not achieved when other lamp types or aged lamps are used.

**NOTE** Mobile devices used close to the intstrument could affect the detector's short term noise level.

ASTM drift tests require a temperature change below 2 °C/hour (3.6 °F/hour) over one hour period. Our published drift specification is based on these conditions. Larger ambient temperature changes will result in larger drift. Better drift performance depends on better control of the temperature fluctuations. To realize the highest performance, minimize the frequency and the amplitude of the temperature changes to below 1 °C/hour (1.8 °F/hour). Turbulences around one minute or less can be ignored.

Performance tests should be done with a completely warmed up optical unit (> two hours). ASTM measurements require that the detector should be turned on at least 24 h before start of testing.

### Time Constant versus Response Time

According to ASTM E1657-98 „Standard Practice of Testing Variable-Wavelength Photometric Detectors Used in Liquid Chromatography” the time constant is converted to response time by multiplying by the factor 2.2.

# 3 Installing the Module



This chapter gives information about the preferred stack setup for your system and the installation of your module.

# Unpacking the Detector

## Damaged Packaging

If the delivery packaging shows signs of external damage, please call your Agilent Technologies sales and service office immediately. Inform your service representative that the instrument may have been damaged during shipment.

**CAUTION**

"Defective on arrival" problems

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

→ Notify your Agilent sales and service office about the damage.

→ An Agilent service representative will inspect the instrument at your site and initiate appropriate actions.

## Delivery Checklist

Ensure all parts and materials have been delivered with the detector. The delivery checklist is shown below. Please report missing or damaged parts to your local Agilent Technologies sales and service office.

**Table 7** Detector Checklist

| Description | Quantity |
|---|---|
| Detector | 1 |
| CompactFlash Card | 1 (installed) G1315C/G1365C only |
| Power cable | 1 |
| Cross-over network cable | 1 |
| Twisted pair network cable | 1 |
| Flow cell | As ordered |
| *User Manual* on Documentation CD (part of the shipment - not module specific) | 1 per order |
| Accessory kit (G1315-68755) | 1 |

# Optimizing the Stack Configuration

If your detector is part of a complete Agilent 1200 Series system, you can ensure optimum performance by installing the following configuration. This configuration optimizes the system flow path, ensuring minimum delay volume.

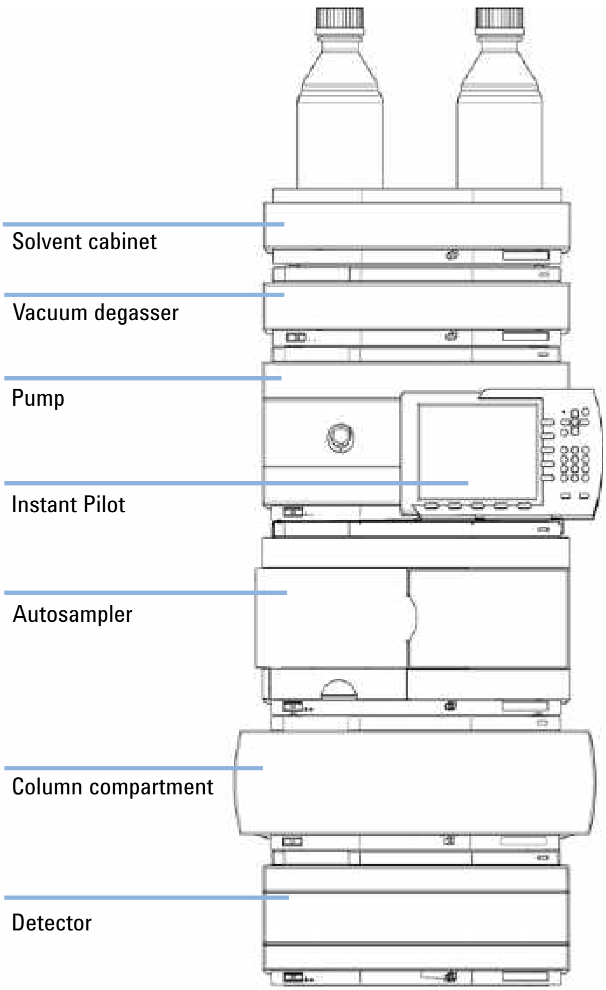



**Figure 3** Recommended Stack Configuration for 1260 Infinity (Front View)

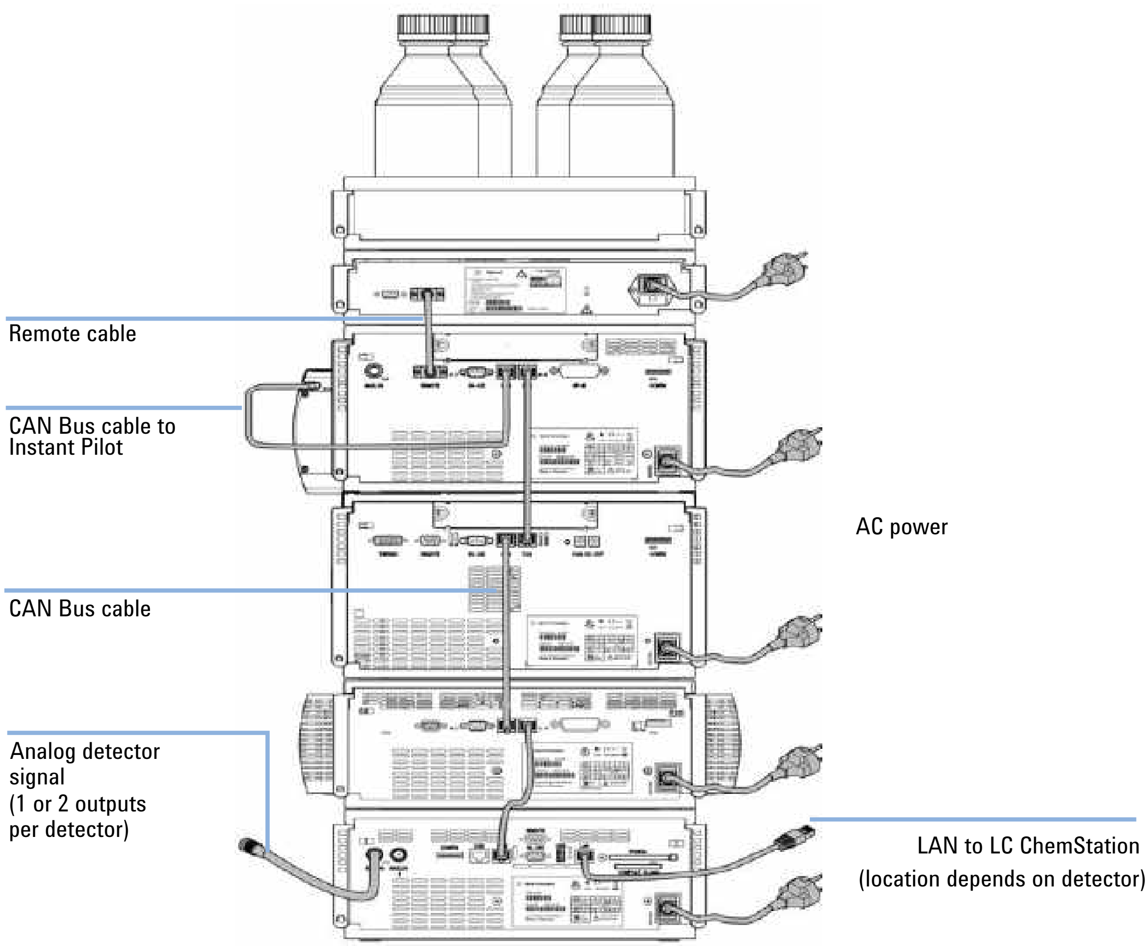



**Figure 4** Recommended Stack Configuration for 1260 Infinity (Rear View)

## Two Stack Configuration

To avoid excessive height of the stack when the autosampler thermostat is added to the system it is recommended to form two stacks. Some users prefer the lower height of this arrangement even without the autosampler thermostat. A slightly longer capillary is required between the pump and autosampler. (See Figure 5 on page 42 and Figure 6 on page 43).

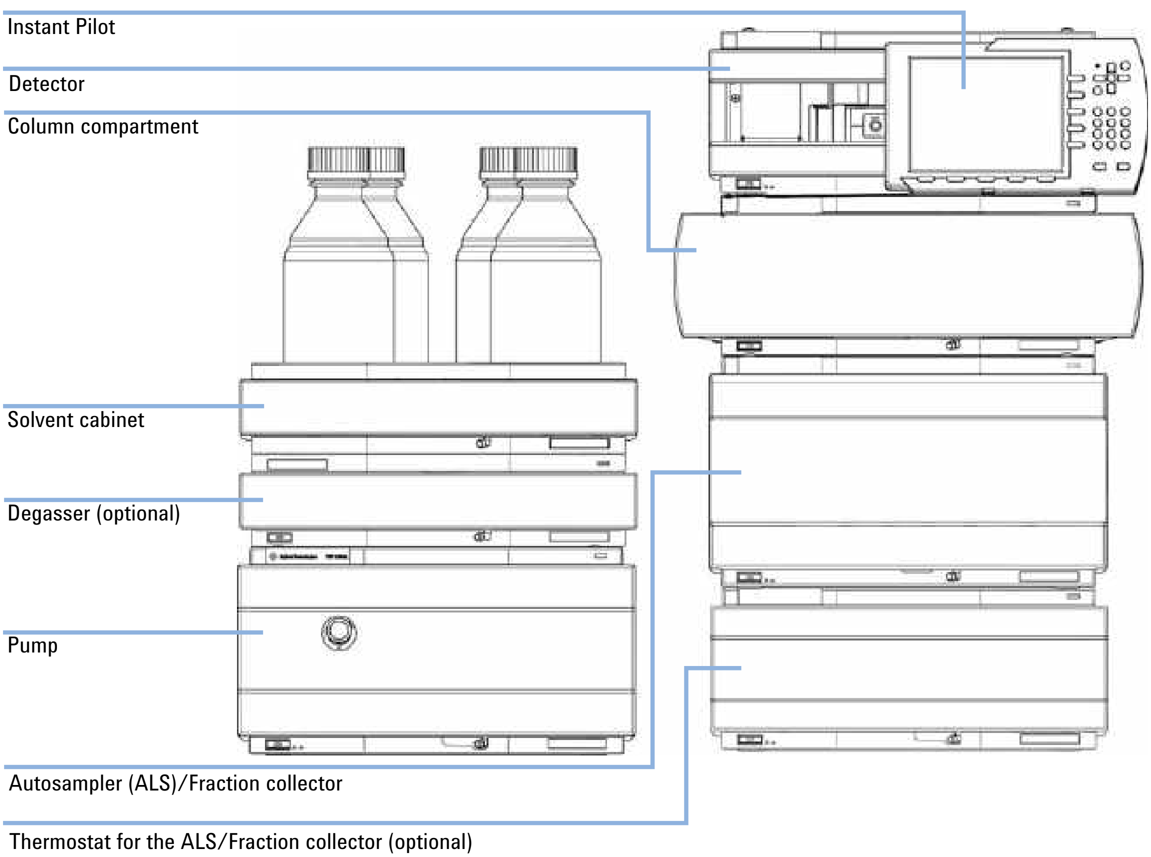



**Figure 5** Recommended Two Stack Configuration for 1260 Infinity (Front View)

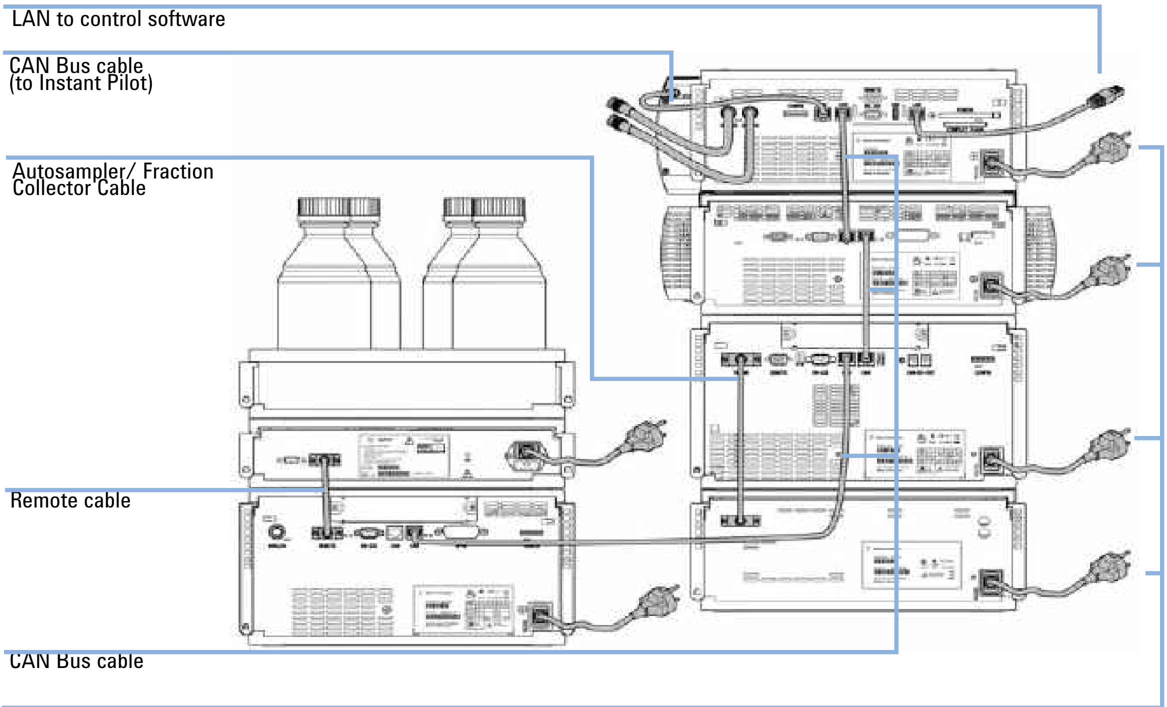



**Figure 6** Recommended Two Stack Configuration for 1260 Infinity (Rear View)

# Installation Information on Leak and Waste Handling

The Agilent 1200 Infinity Series has been designed for safe leak and waste handling. It is important that all security concepts are understood and instructions are carefully followed.

**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.

→ Never exceed the maximal permissible volume of solvents (6 L) in the solvent cabinet.

→ Do not use bottles that exceed the maximum permissible volume as specified in the usage guideline for the Agilent 1200 Infinity Series Solvent Cabinets.

→ Arrange the bottles as specified in the usage guideline for the solvent cabinet.

→ A printed copy of the guideline has been shipped with the solvent cabinet, electronic copies are available on the Internet.

**NOTE**

**Recommendations for Solvent Cabinet**

For details, see the usage guideline for the Agilent 1200 Infinity Series Solvent Cabinets.

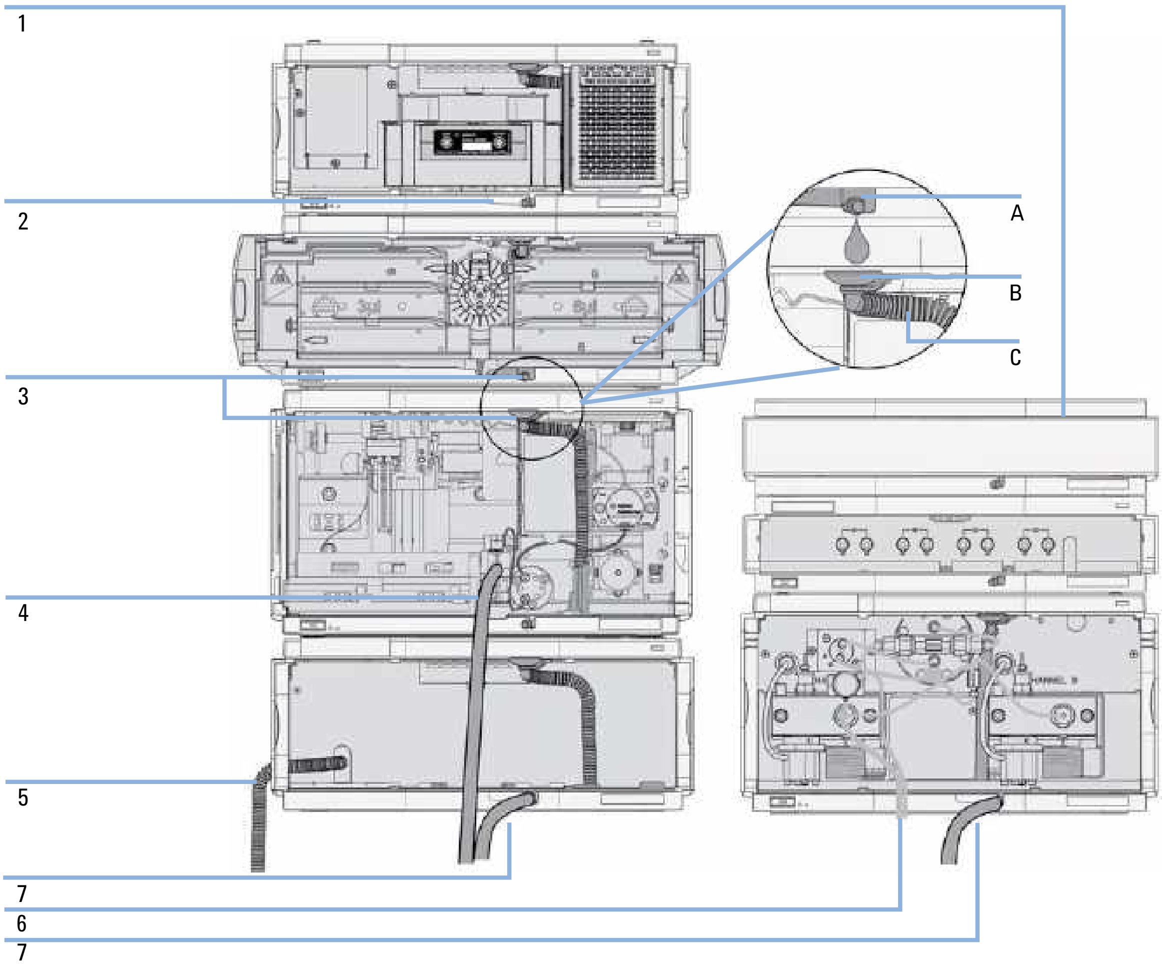



**Figure 7** Leak and waste handling (overview - typical stack configuration as an example)

| | |
|---|---|
| 1 | Solvent cabinet |
| 2 | Leak pan |
| 3 | Leak pan's outlet port (A), leak funnel (B) and corrugated waste tube (C) |
| 4 | Waste tube of the sampler’s needle wash |
| 5 | Condense drain outlet of the autosampler cooler |
| 6 | Waste tube of the purge valve |
| 7 | Waste tube |

1 Stack the modules according to the adequate stack configuration.

   The leak pan outlet of the upper module must be vertically positioned above the leak tray of the lower module, see Figure 7 on page 45.

2 Connect data and power cables to the modules, see section *Installing the Module* below.

3 Connect capillaries and tubes to the modules, see section *Flow Connections to the module* below or the relevant system manual.

**WARNING**

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

→ Keep solvent path free from blockages.

→ Keep the flow path closed (in case the pump in the system is equipped with a passive inlet valve, solvent may leak out due to hydrostatic pressure, even if your instrument is off).

→ Avoid loops.

→ Tubes must not sag.

→ Do not bend tubes.

→ Do not immerse tube end in waste liquid.

→ Do not intubate tubes in other tubes.

→ For correct tubing follow instructions on label attached to the module.


**Figure 8** Warning label (illustration for correct waste tubing)

# Installing the Detector

| Parts required | Description |
|---|---|
| | Power cord |
| | LAN cable (cross-over or twisted pair network cable) |

All modules in the stack should have the latest firmware installed. If other revisions are required, check with the Agilent support for best match.

**Hardware required** Detector (as ordered)

**Software required** Appropriate control software or G4208A Instant Pilot (optional).

**Preparations**
- Locate bench space
- Provide power connections
- Unpack the module

**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.

**NOTE**

Before adding a G1315C/D and G1365C/D into an existing system assure that the existing modules have been updated to firmware revision A.06.02/B.01.02 or above. Otherwise the ChemStation "Performance Specifications" on page 24 will not recognize modules.

**NOTE**

For G1315C and G1365C assure that the CompactFlash Card is installed in the rear of the module (required for operation).

1 Note the MAC address of the LAN interface (rear of the module, under the configuration switch, see Figure 9 on page 49). It's required for "LAN Configuration" on page 261.
2 Place the module in the stack or on the bench in a horizontal position.
3 Ensure the line power switch at the front of the module is OFF.
4 Connect the power cable to the power connector at the rear of the module.

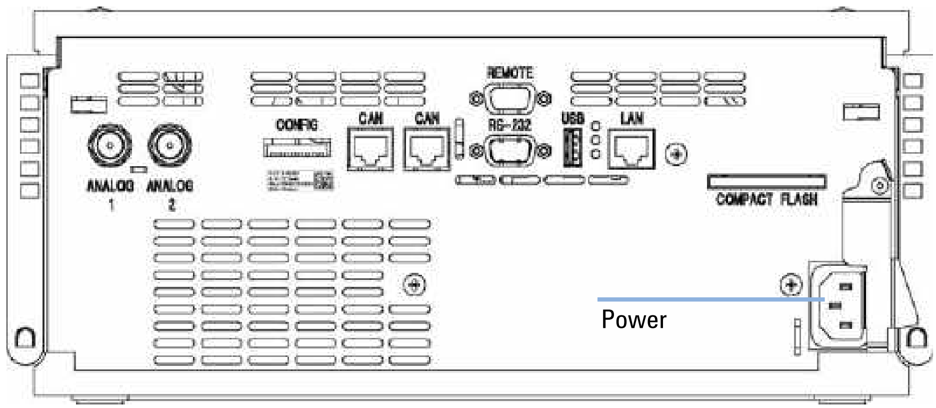



**Figure 9** Rear View of Detector

5 Connect the CAN cable to other Agilent 1200 Series modules.
6 Connect the LAN cable (e.g. from a Agilent ChemStation as controller) to the detector's LAN connector.

**NOTE** In multi-detector configurations the LAN of the G1315C/D and G1365C/D must be used due to its higher data load.

7 Connect the analog cable(s) (optional).
8 Connect the APG remote cable (optional) for non-Agilent 1200 Series instruments.

9 Turn on power by pushing the button at the lower left hand side of the module. The status LED should be green.

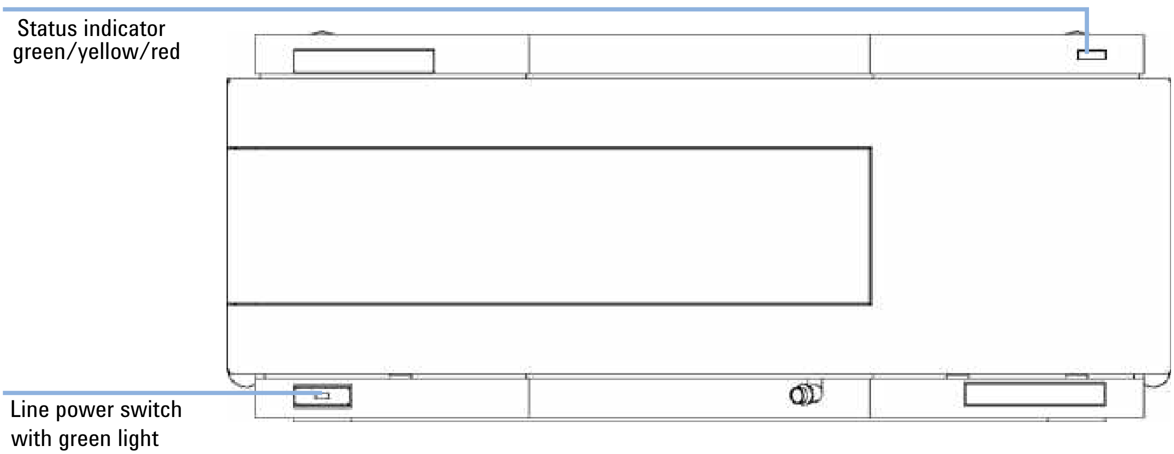



**Figure 10** Front View of Detector

**NOTE** The module is turned on when the line power switch is pressed and the green indicator lamp is illuminated. The module is turned off when the line power switch is protruding and the green light is off.

**NOTE** The module was shipped with default configuration settings. To change these settings see "Configuration Switch" on page 264.

# Flow Connections to the Detector

| Parts required | p/n | Description |
|---|---|---|
| | G1315-68755 | Accessory kit |
| **Hardware required** | Other modules | |
| **Preparations** | Detector is installed in the LC system. | |

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.

NOTE

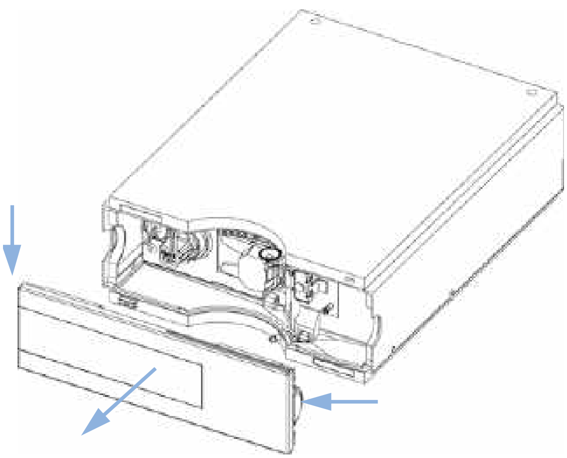
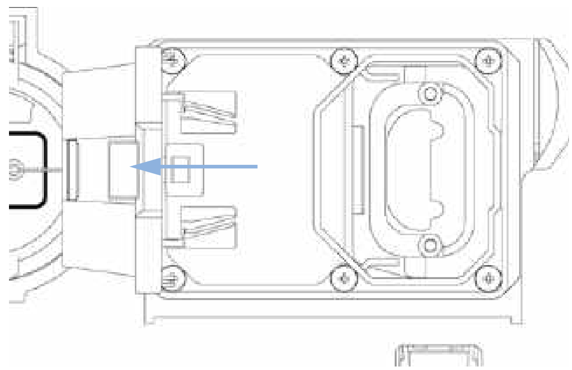
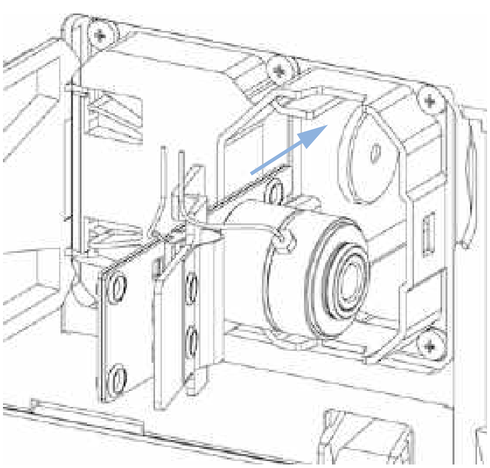
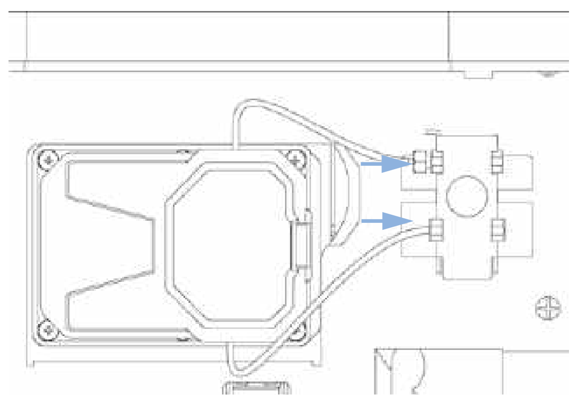
The flow cell is shipped with a filling of isopropanol (also recommended when the instrument and/or flow cell is shipped to another location). This is to avoid breakage due to subambient conditions.

NOTE

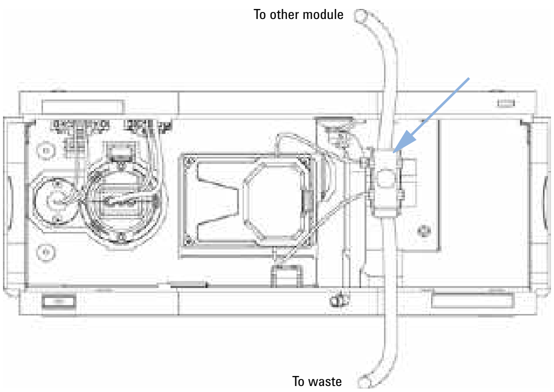
The detector should be operated with the front cover in place to protect the flow cell area against strong drafts from the outside and to cover the deuterium lamp.

Some types of the Agilent deuterium lamps show a light ring during operation. This is not harmful, refer to "UV-Radiation" on page 298.

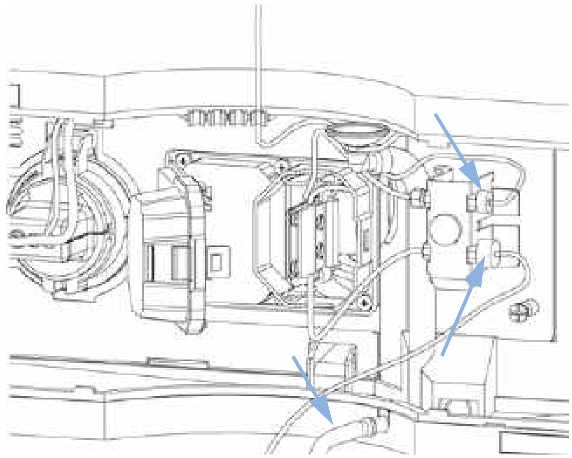
**NOTE** The heat exchanger/capillary and the cell body can be fixed mirror symmetrically to have both capillaries routed to the bottom or to the top (depending on the routing of the capillaries to the column). For details see “Replacing Capillaries on a Standard Flow Cell” on page 182.

| | |
|---|---|
| **1** Press the release buttons and remove the front cover to gain access to the flow cell area.  | **2** Press the release button and open the flow cell door.  |
| **3** Insert the flow cell.  | **4** Connect the flow cell capillaries to the capillary holder (top is inlet, bottom is outlet).  |

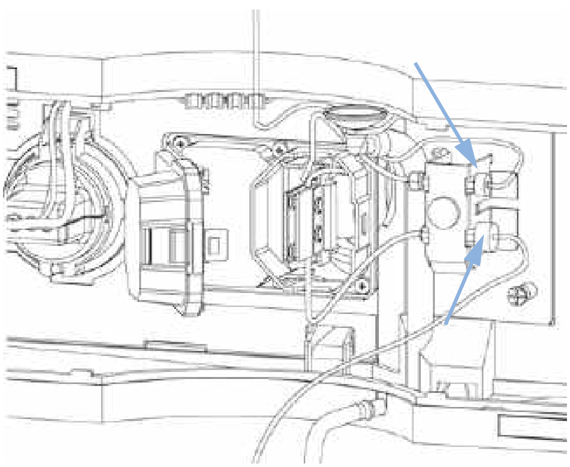
5 If another Agilent module is positioned on top of the detector, route the tubing assembly waste from the accessory kit behind the capillary holder and connect the top end to the other module's waste outlet.



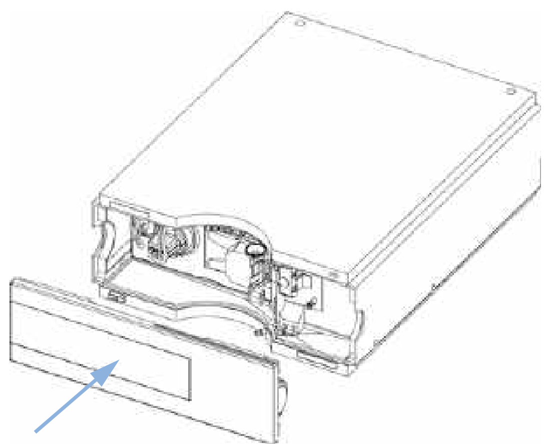

6 Connect the capillary from the column to the capillary holder (top). Connect the PTFE waste tubing to the flow cell outlet fitting (bottom) and the corrugated waste tubing to the leak outlet.



7 Remove the flow cell and establish a flow and observe for leaks.



8 Insert the flow cell, close the cover and replace the front cover.



The installation of the detector is complete now.

# Installing Capillaries

In May 2013, Agilent has introduced new UHP-FF fittings, which are designed for improved robustness and ease of use. Previous fittings require careful handling. Therefore it is important to know, which fittings are used in the system.

The figure below illustrates the differences between new and previous capillaries.

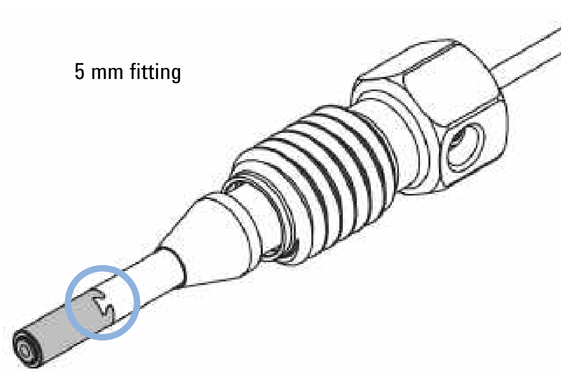



**Figure 11** New bio-inert capillary and UHP-FF fitting with nose

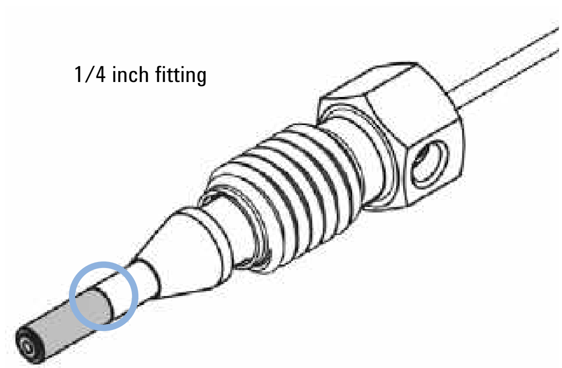



**Figure 12** Previous bio-inert capillary and fitting

**NOTE** For handling instructions of capillaries and fittings, used in modules before delivery of the new UHP-FF fittings (introduced in May 2013), refer to "Installation of Stainless Steel Cladded PEEK Capillaries" on page 302.

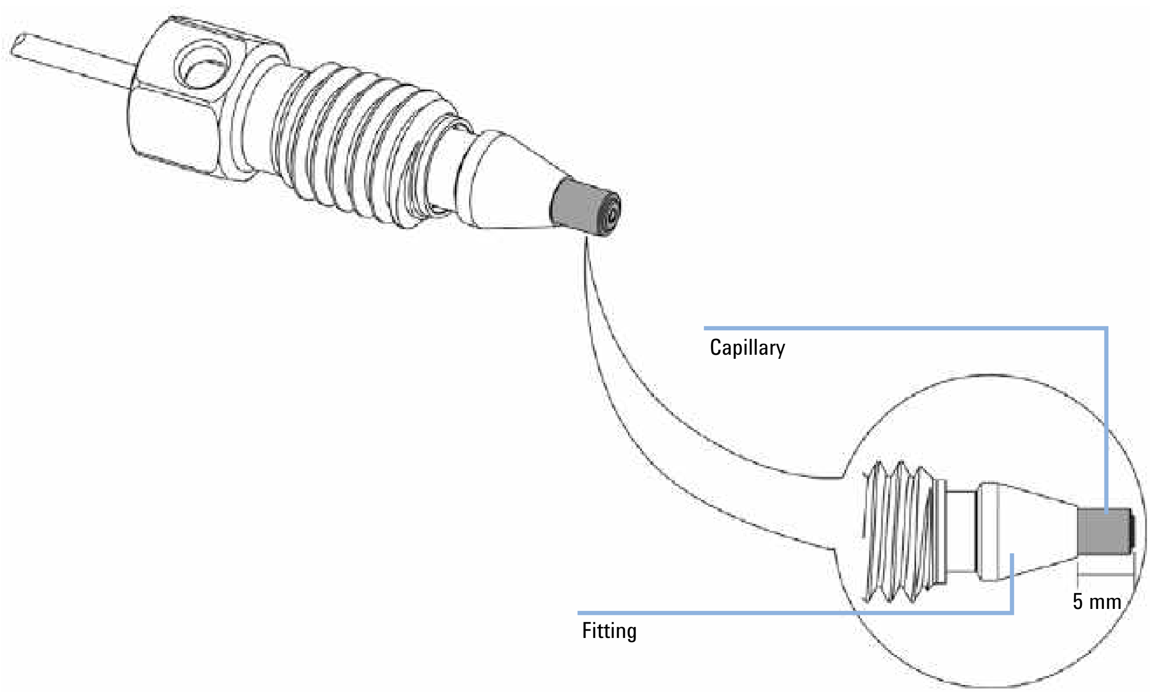
**NOTE** To work on bio-inert capillaries produced before May 2013, you will need a 1/4 inch wrench instead of the 5 mm mounting tool.

# Installing UHP-FF Fittings

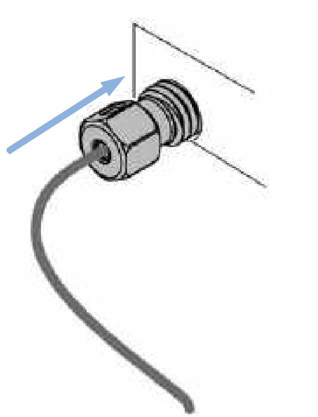
| Tools required | p/n | Description |
|---|---|---|
| | 5043-0915 | Fitting mounting tool<br>for bio-inert capillaries |

| Parts required | p/n | Description |
|---|---|---|
| | Capillaries and Fittings | For details refer to the part section of the manual. |

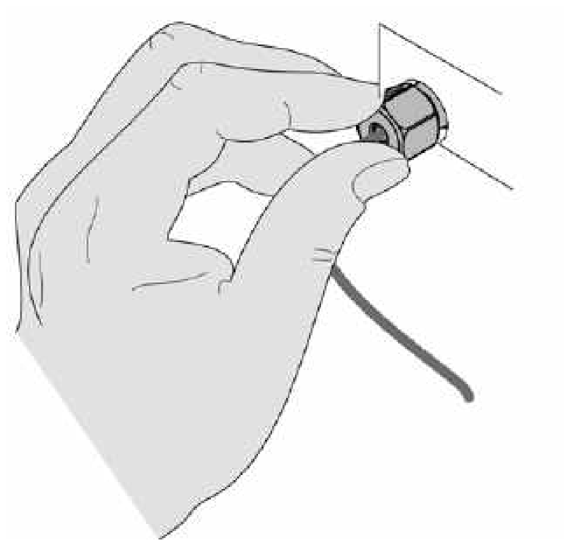
1 Slide the fitting on the capillary. Let the capillary jut out 5 mm.



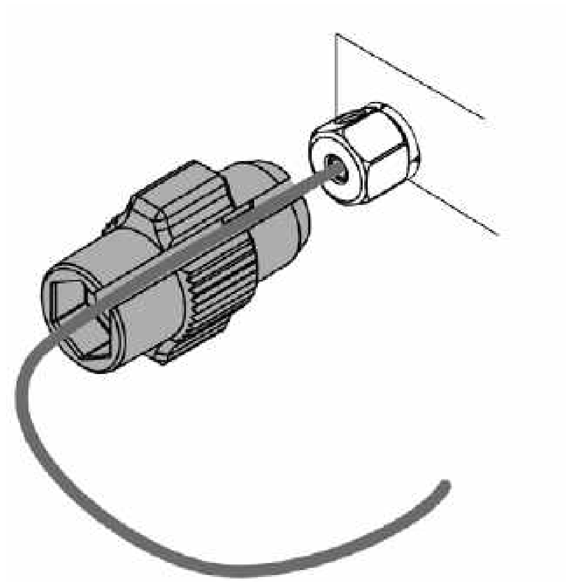
2 Insert the fitting to the receiving port and push the capillary to the bottom of the port.



3 Finger tighten the nut into the port until snug.



4 Use Fitting mounting tool (5043-0915) or a 5 mm hex wrench for fixing the fitting (maximum torque 0.8 Nm).



**CAUTION**

Potential damage of capillaries

➔ Do not remove fittings from used capillaries.

5 When using UHP-FF fittings with bioinert capillaries, do not try to remove fittings from these capillaries. Bio-inert capillaries are using a PEEK front end, which may expand under pressure especially when being in contact with some organic solvents. If a fitting is moved across an expanded PEEK end, there is a risk of damaging the capillary by ripping off its end. Before re-installing such capillaries, push the ferrule towards the rear site for a small distance.

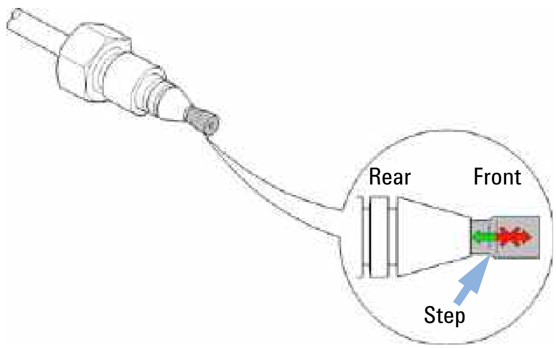



**Figure 13** Capillary fitting

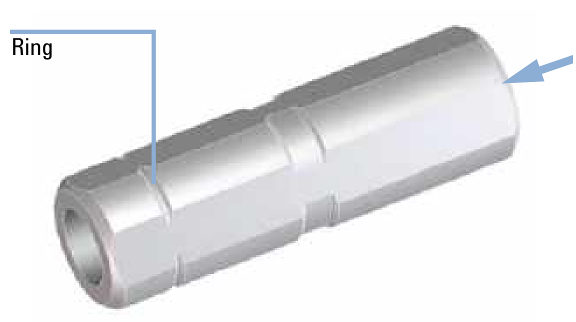
## Installation of the Bio-inert Zero Dead Volume (ZDV) Union

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

**CAUTION**

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

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

<table>
<tr>
<td>1 Install the capillary at the end marked with a ring/indentation.<br><br></td>
<td>2 Install the second capillary at the other end.<br><br></td>
</tr>
</table>

# Setting up the LAN access

Please follow the instructions in “LAN Configuration” on page 261

# 4
# Using the Detector



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

# Leak and Waste Handling

**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.
- ➔ Never exceed the maximal permissible volume of solvents (6 L) in the solvent cabinet.
- ➔ Do not use bottles that exceed the maximum permissible volume as specified in the usage guideline for the Agilent 1200 Infinity Series Solvent Cabinets.
- ➔ Arrange the bottles as specified in the usage guideline for the solvent cabinet.
- ➔ A printed copy of the guideline has been shipped with the solvent cabinet, electronic copies are available on the Internet.
- ➔ The residual free volume in the appropriate waste container must be large enough to collect the waste liquid.
- ➔ Check the filling level of the waste container regularly.
- ➔ To achieve maximal safety, check the correct installation regularly.

**NOTE**

**Recommendations for Solvent Cabinet**

For details, see the usage guideline for the Agilent 1200 Infinity Series Solvent Cabinets.

For details on correct installation, see “Installation Information on Leak and Waste Handling” on page 44.

# Setting up an Analysis

This chapter may be used to

- Prepare the system,
- Get to know the set up of an HPLC analysis and
- Use it as an instrument check to demonstrate that all modules of the system are correctly installed and connected. It is not a test of the instrument performance.
- Learn about special settings

## Before Using the System

### Solvent Information

Observe recommendations on the use of solvents in chapter “Solvents”.

### Priming and Purging the System

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

**Table 8** Choice of Priming Solvents for Different Purposes

| Activity | Solvent | Comments |
|---|---|---|
| After an installation | Isopropanol | Best solvent to flush air out of the system |
| When switching between reverse phase and normal phase (both times) | Isopropanol | Best solvent to flush air out of the system |
| After an installation | Ethanol or Methanol | Alternative to Isopropanol (second choice) if no Isopropanol is available |
| Cleaning the system when using buffers | Bidistilled water | Best solvent to re-dissolve buffer crystals |
| After a solvent change | Bidistilled water | Best solvent to re-dissolve buffer crystals |
| After the installation of normal phase seals (P/N 0905-1420) | Hexane + 5% Isopropanol | Good wetting properties |

**NOTE** The pump should never be used for priming empty tubings (never let the pump run dry). Use a syringe to draw enough solvent to completely fill the tubings up to the pump inlet before you continue priming with the pump.

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

   Pump for approximately 10 minutes before starting your application.

# Requirements and Conditions

## Parts and Material required

Table 9 on page 65 lists the parts and material you need for the set up of the analysis. Some of these are optional (not required for the basic system).

**Table 9** Parts and Material required

| | |
|---|---|
| Agilent 1260 Infinity system | Pump (plus degassing) |
| | Autosampler |
| | Detector, standard flow cell installed |
| | • Agilent ChemStation or<br>• Instant Pilot G4208 (optional for basic operation) or<br>with with the appropriate revisions, see "Performance Specifications" on page 24. |
| | System should be correctly set up for LAN communication with the Data System |
| Column: | Zorbax Eclipse XDB C18, 150 mm x 4.6 mm, 5 µm (993967-906) |
| Standard: | Agilent isocratic checkout sample (01080-68704). This 0.5 mL ampoule contains 0.15 wt.% dimethylphthalate, 0.15 wt.% diethylphthalate, 0.01 wt.% biphenyl, 0.03 wt.% o-terphenyl in methanol. |

## Conditions

A single injection of the isocratic test standard is made under the conditions given in Table 10 on page 65:

**Table 10** Conditions

| | |
|---|---|
| Flow | 1.5 mL/min |
| Stoptime | 8 minutes |
| Solvent | 100 % (30 % water/70 % Acetonitrile) |
| Temperature | Ambient |
| Wavelength | sample 254 nm (4 nm bandwidth) reference 360 nm (100 nm bandwidth) |
| Injection Volume | 1 µL |

## Typical Chromatogram

A typical chromatogram for this analysis is shown in Figure 14 on page 66. The exact profile of the chromatogram will depend on the chromatographic conditions. Variations in solvent quality, column packing, standard concentration and column temperature will all have a potential effect on peak retention and response.

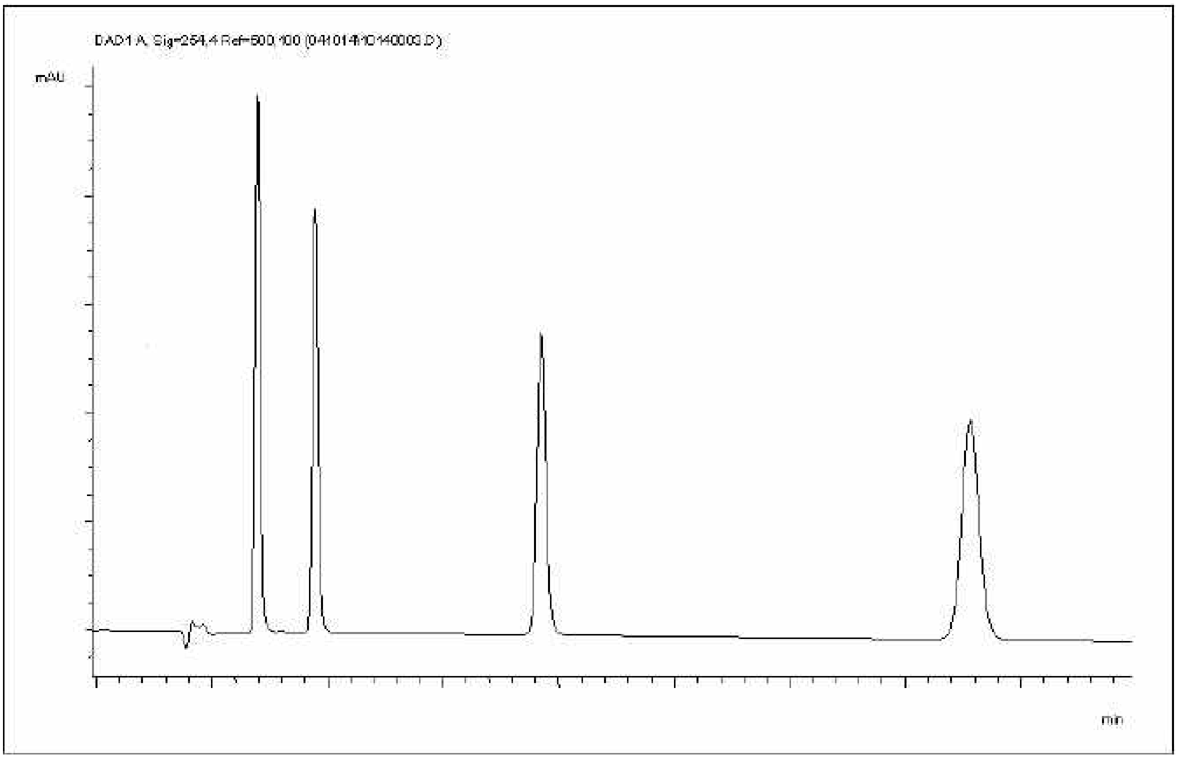



**Figure 14** Typical Chromatogram with UV-detector

## Optimization of the System

The settings used for this analysis are specific for this purpose. For other applications the system can be optimized in various ways. Please refer to the section "Optimizing the Detector" on page 91.

## Preparing the HPLC System

1 Turn on the Agilent ChemStation PC and the monitor.
2 Turn on the HPLC modules.
3 Start the Agilent ChemStation software. If the pump, autosampler, thermostatted column compartment and detector are found, the ChemStation screen should look like shown in Figure below.

   The System status is red (Not Ready).

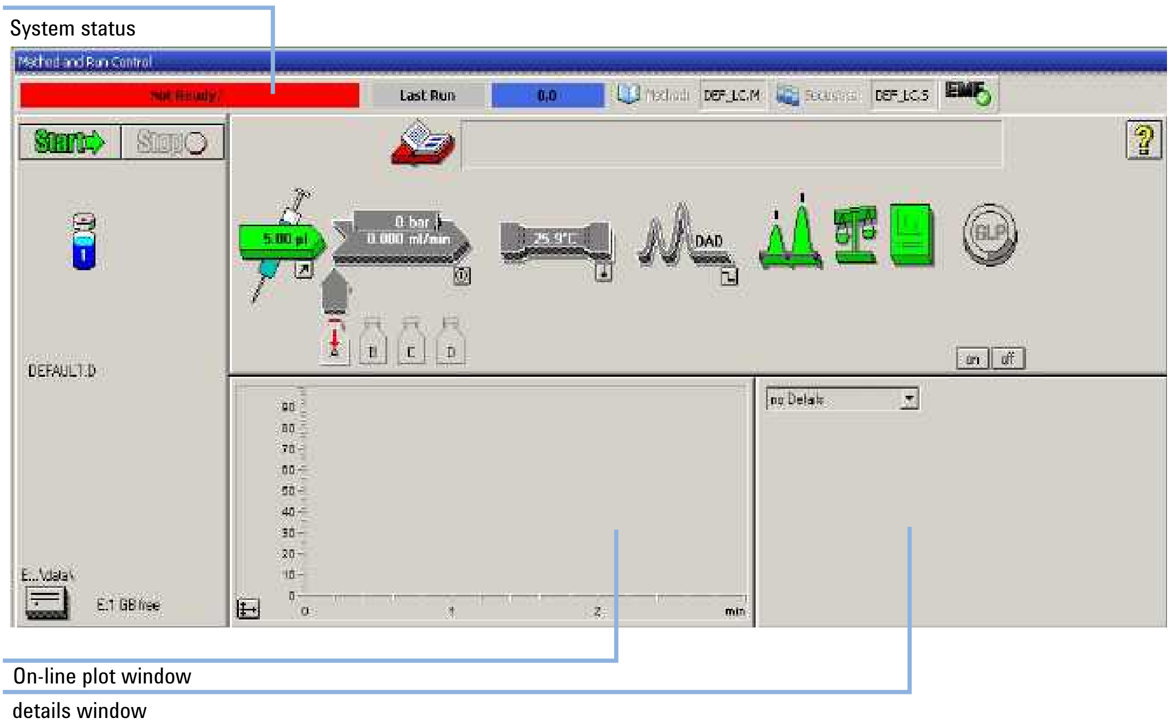



**Figure 15** Initial ChemStation screen (Method and Run Control)

4 Turn on the detector lamp, pump and autosampler by clicking the **System On** button or the buttons below the module icons on the graphical user interface (GUI). After some time, the pump, thermostatted column compartment and detector module will turn to green.

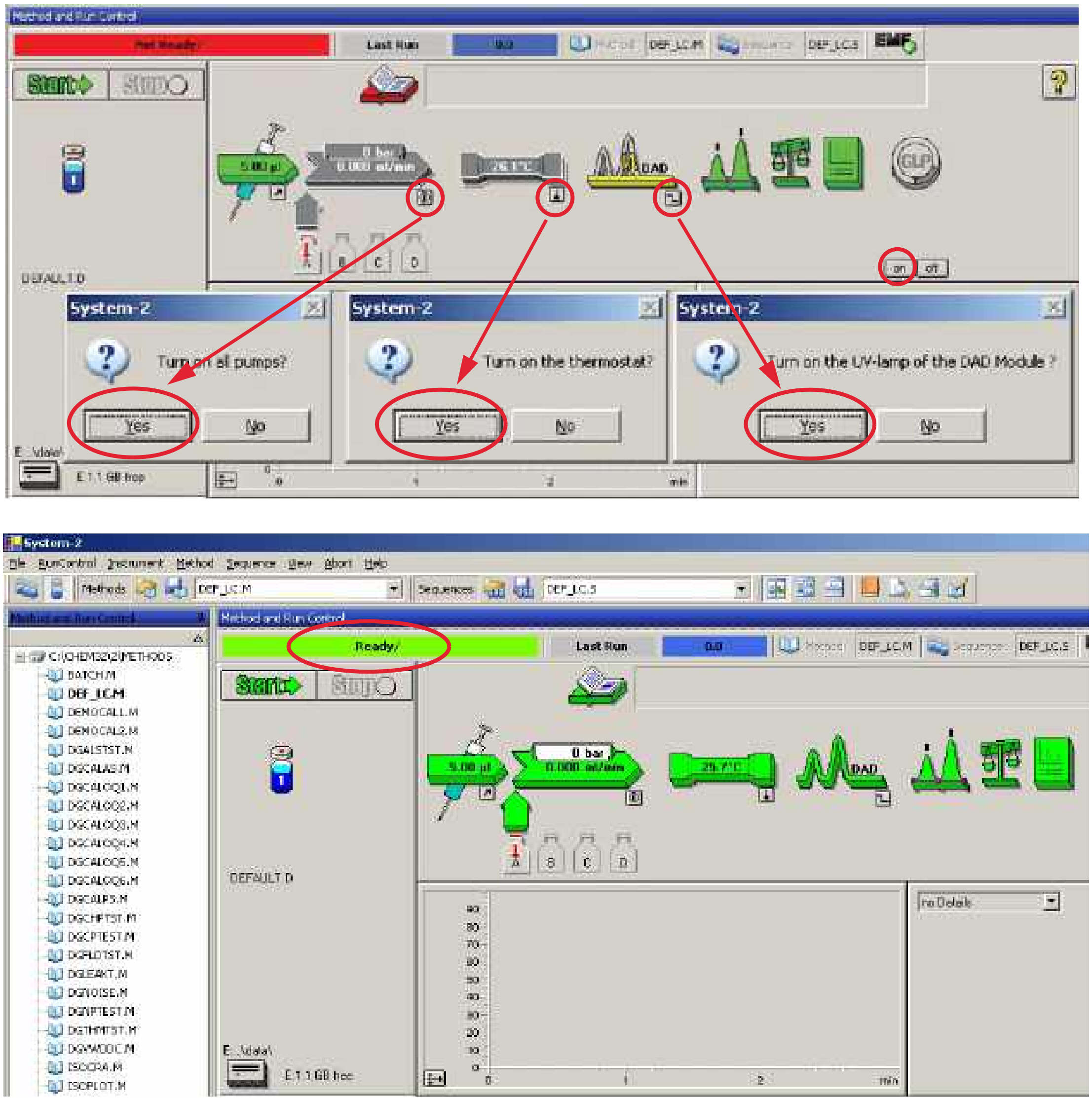



**Figure 16** Turning on the HPLC Module

5 Purge the pump. For more information see “Priming and Purging the System” on page 63.

6 Allow the detector to warm up at least 60 minutes to provide a stable baseline (see example in Figure 17 on page 70 and Table 11 on page 70).

**NOTE** For reproducible chromatography, the detector and lamp should be on for at least one hour. Otherwise the detector baseline may still drift (depending on the environment). See also section *Wander/Drift Problems Due to Temperature Changes* in the *Service Manual.*.

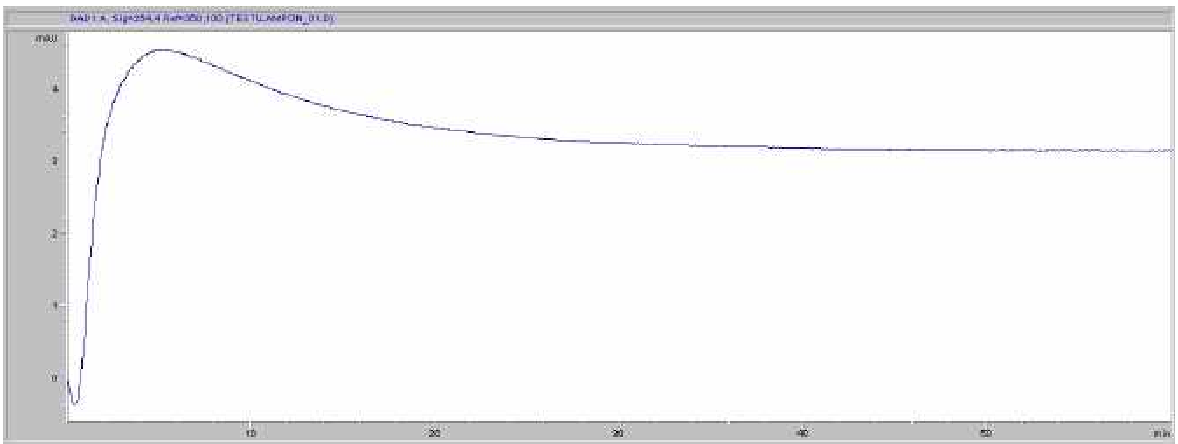


**Figure 17** Stabilization of Baseline (both lamps turned on at the same time)

**Table 11** Baseline drift after lamp turn on (example from Figure above)

| Time [minutes] | Drift [mAU/hr] |
| --- | --- |
| 17 - 20 | 2.6 |
| 27 - 30 | 0.8 |
| 37 - 40 | 0.4 |
| 47 - 50 | 0.2 |
| 57 - 60 | < 0.2 |

7 For the isocratic pump, fill the solvent bottle with the mixture of HPLC-grade bi-distilled water (30 %) and acetonitrile (70 %). For binary- and quaternary pumps you can use separate bottles.

8 Click on the **Load Method** button and select DEF_LC.M and press **OK**. Alternative double-click on the method in the method window. The default LC method parameters are transferred into the modules.

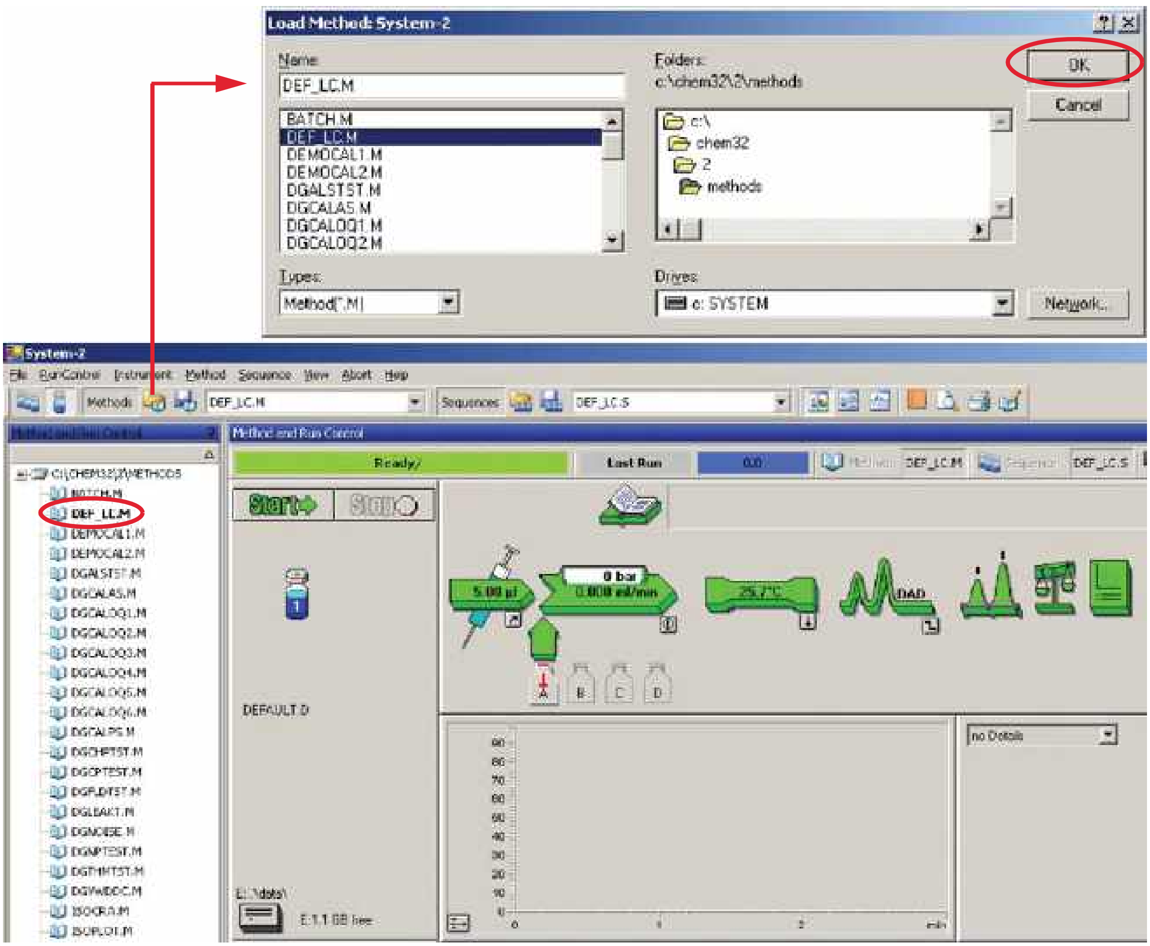
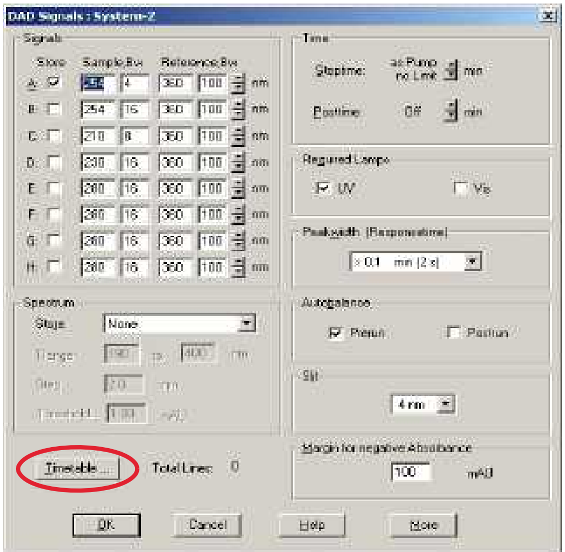



**Figure 18** Loading Default LC Method

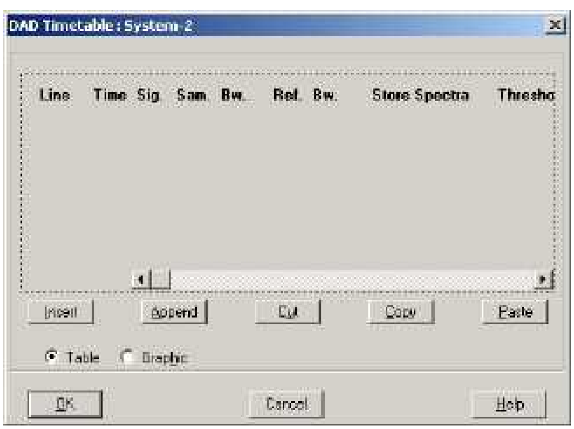
9 Click on the module icons (see Figure below) and open the **Setup** of these modules. Figure on page 73 shows the detector settings (do not change the detector parameters at this time).


**Figure 19** Open the module menu

**10** Enter the pump parameters mentioned under Table 10 on page 65.




- up to 8 signals (A to H) with individual wavelength settings can be selected.
- spectrum settings, “Spectrum Settings (DAD only)” on page 86
- stop and post time can be set (if required)
- depending on the application, the lamps can be selected (one or both).
- peak width depends on the peaks in the chromatogram, “Peakwidth Settings” on page 88
- autobalance to zero absorbance (on the analog output plus offset) at begin and/or end of run.
- mechanical slit width can be changed for further optimization, “Slit Settings” on page 90
- margin for negative absorbance, “Margin for Negative Absorbance Settings” on page 91
- Under **More** additional diagnostic signals can be added for troubleshooting purpose, see section “Diagnostic Signals” in the *Service Manual*.




- time table for programmable actions during the run. NOTE: The Agilent G1315C/D and G1365C/D time table can contain a maximum of 60 rows.

**11** Pump the water/acetonitrile (30/70 %) mobile phase through the column for 10 minutes for equilibration.

**12** Click the button and select **Change...** to open the Signal Plot information. Select the **Pump: Pressure** and the **DAD A: Signal 254,4** as signals. Change the Y-range for the DAD to 1 mAU and the offset to 20% and the pressure offset to 50%. The X-axis range should be 15 minutes. Press **OK** to exit this screen.

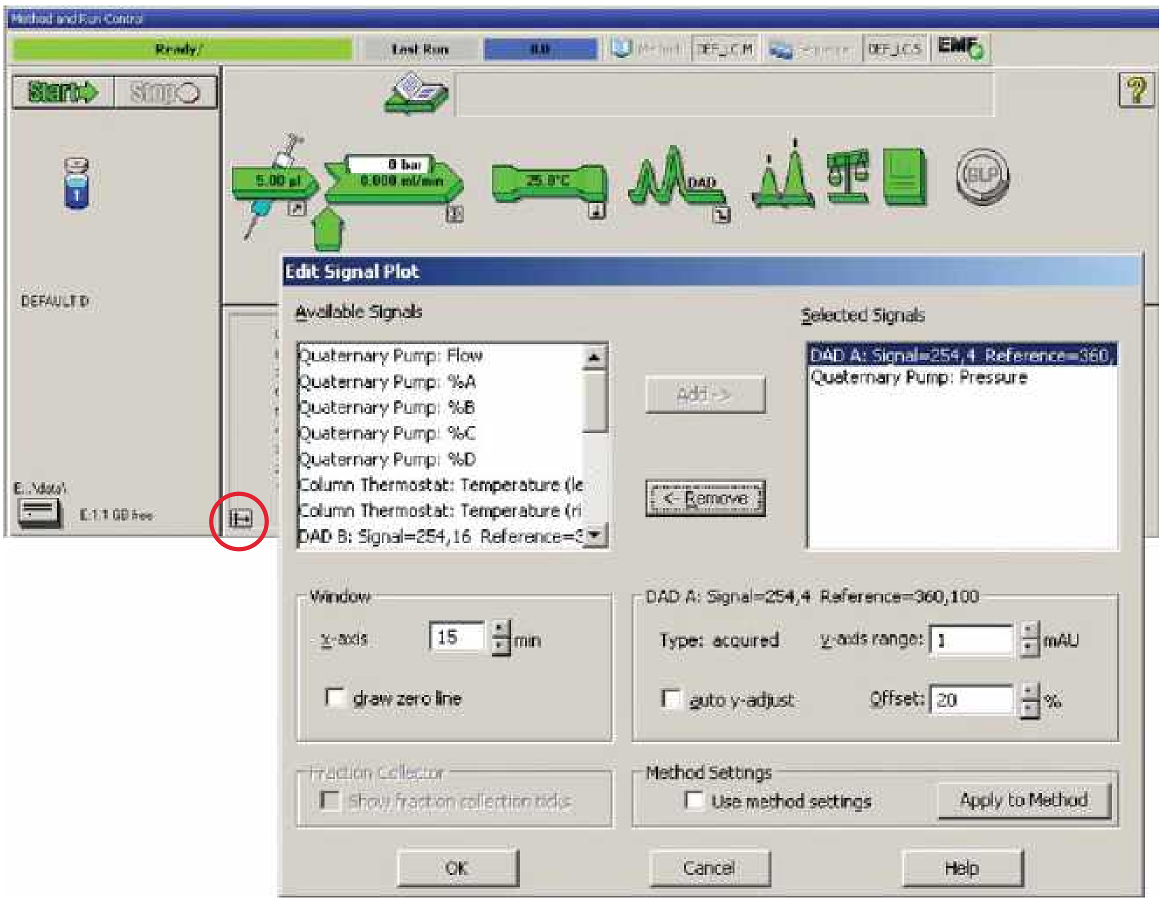



**Figure 20** Edit Signal Plot Window

The Online Plot (Figure 21 on page 75) shows both, the pump pressure and the detector absorbance signals. Pressing **Adjust** the signals can be reset to the offset value and **Balance** would do a balance on the detector.

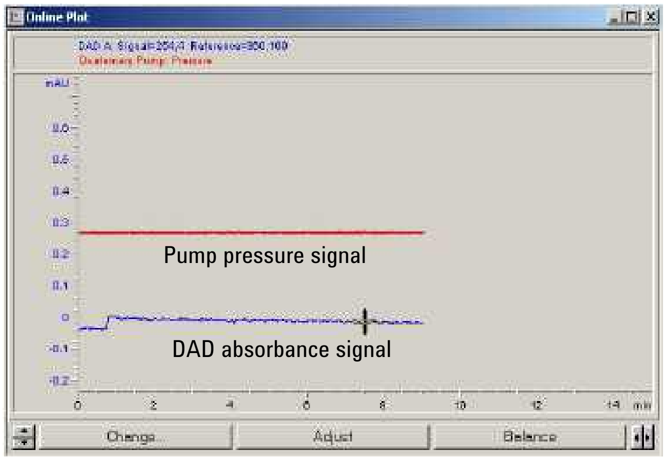



**Figure 21** Online Plot Window

**13** If both baselines are stable, set the Y-range for the detector signal to 100 mAU.

**NOTE** If you start with a new UV-lamp for the first time, the lamp may show initial drift for some time (burn-in effect).

14 Select the menu item **RunControl -> Sample Info** and enter information about this application (see figure below). Press **OK** to leave this screen.

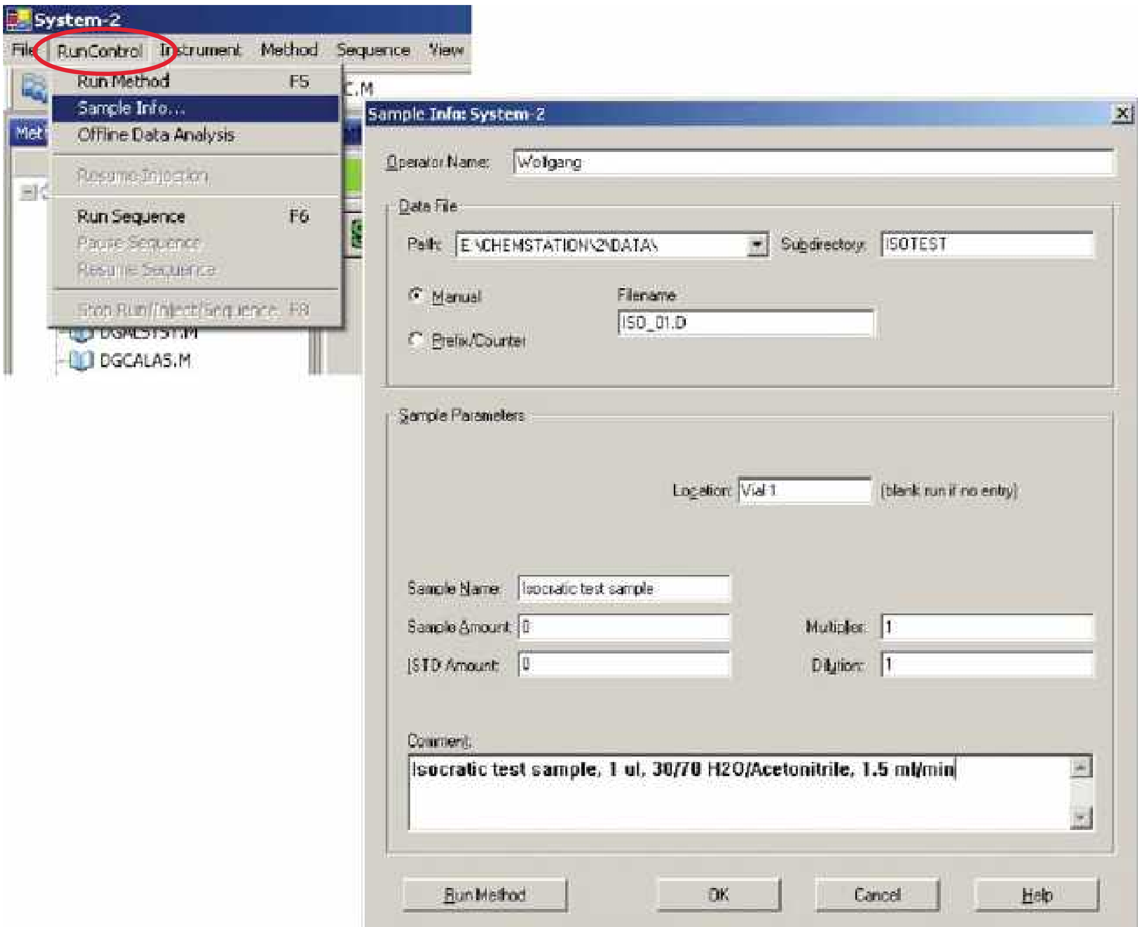



**Figure 22** Sample Information

15 Fill the content of an isocratic standard sample ampoule into a vial and seal the vial with a cap and place the vial into autosampler tray (position #1).

## Running the Sample and Verifying the Results

1 To start a run select the menu item **RunControl -> Run Method**.

2 This will start the modules and the online plot on the Agilent ChemStation will show the resulting chromatogram.

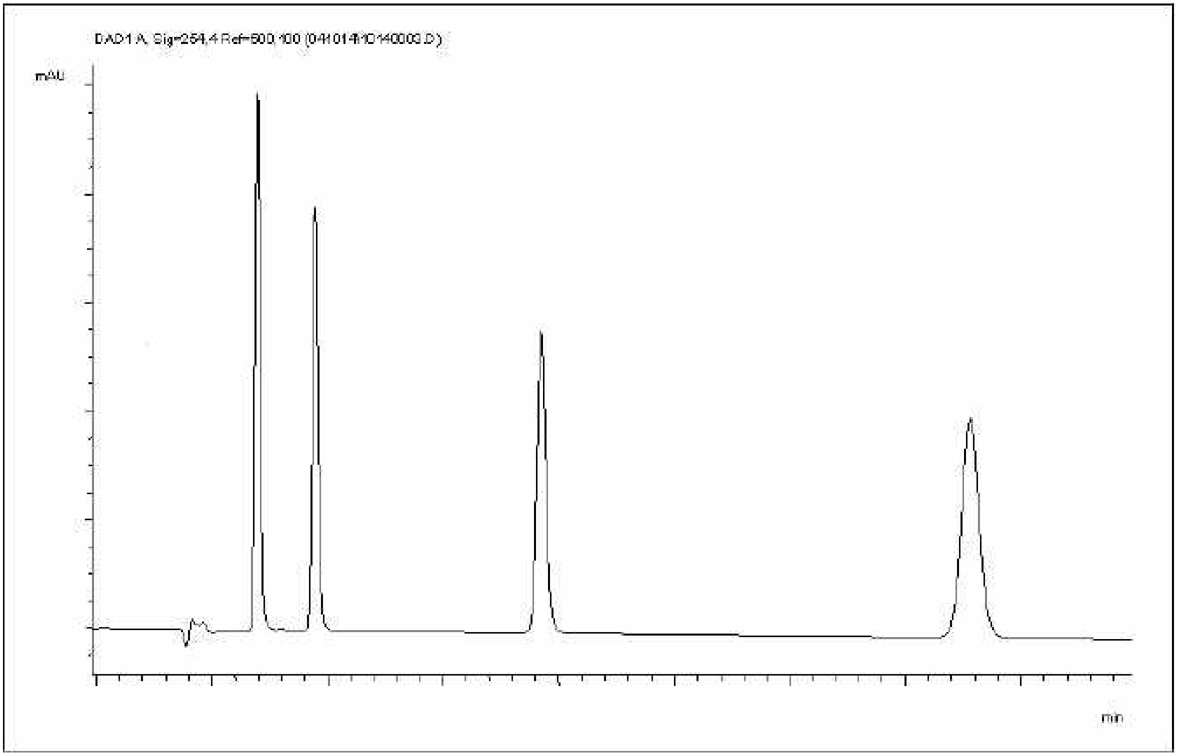



**Figure 23** Chromatogram with Isocratic Test Sample

**NOTE** Information about using the Data Analysis functions can be obtained from the *Using your ChemStation* manual supplied with your system.

# Special Settings of the Detector

In this chapter special settings of the G1315C/D and G1365C/D are described (based on the Agilent ChemStation B.02.01).

## Control Settings

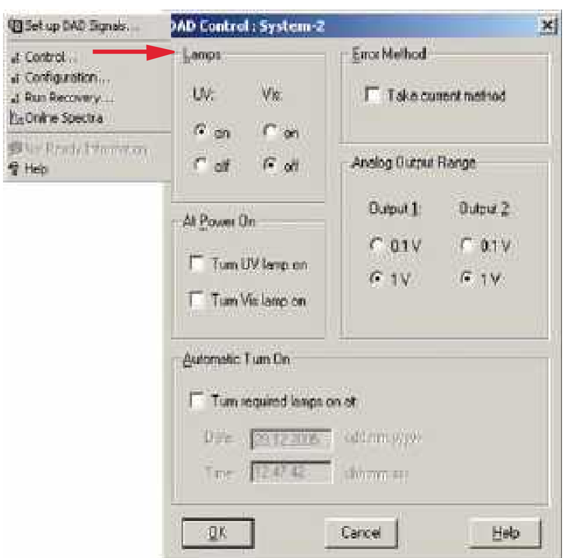



**Figure 24** Detector control settings

- **Lamps**: turn on and off of UV- and Vis lamp
- **At Power On**: automatic lamp-on at power on.
- **Error Method**: take error method or current method (in case of an error)
- **Analog Output Range**: can be set to either 100 mV or 1 V full scale, "Analog Output Settings" on page 85
- **Automatic Turn On**: lamps can be programmed (detector must be on for this).
- **Help**: online help.

## Configuration Settings

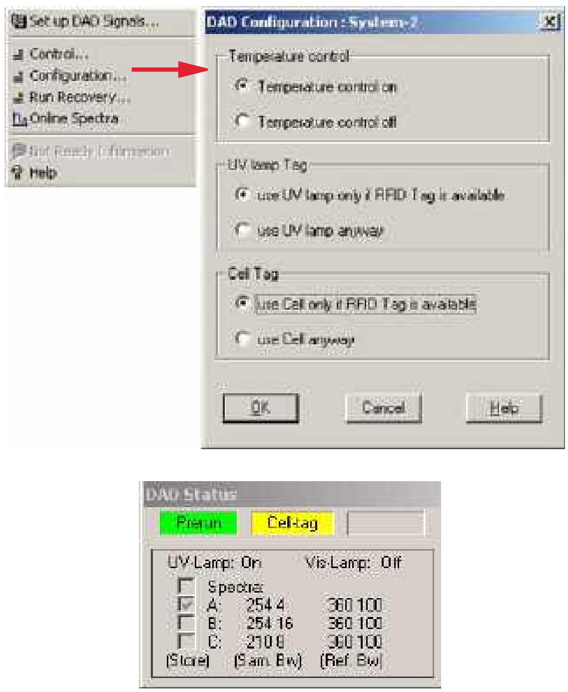



**Figure 25**Detector configuration settings

- **Temperature Control**: the optical unit is kept on constant temperature and improves the baseline stability in unstable environments. See also note below.
- **UV lamp tag**: for Agilent lamps with I.D. tags. If no I.D. tag lamp is used, detector icon will become grey (lamp tag not ready) and analysis is disabled.
- **Cell tag**: for Agilent flow cells with I.D. tags. If no I.D. tag cell is used, detector icon will become grey (cell tag not ready) and analysis is disabled.
- **Help**: online help.

The detector status shows “Cell-tag” in yellow in case the flow cell with the I.D. tag is not inserted. The detector icon is gray and the system is not ready.

**NOTE**

If the flow cell temperature is critical for your chromatography, you may set the Temperature Control to off. This will lower the optical unit and flow cell temperature by some degree C.

For more details see “Principle of Temperature Control” in the *Service Manual*.

## Online Spectra (DAD only)

1 To view the online spectra during the run select **Online Spectra**.

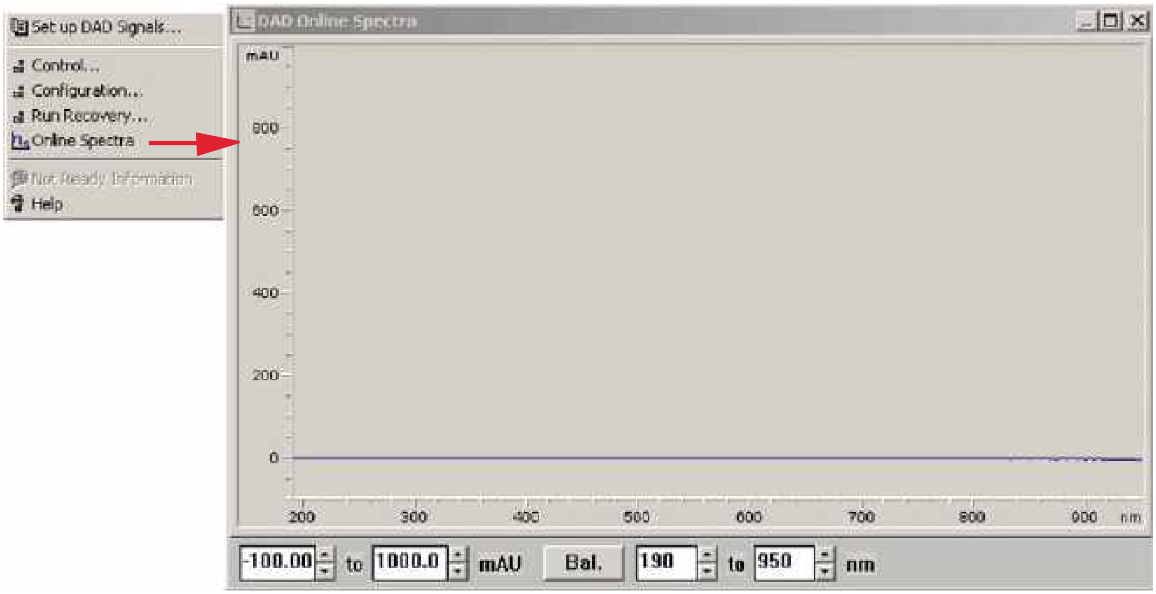



**Figure 26** Online Spectra Window

2 Change the absorbance and wavelength range according your needs.

## Run Recovery Settings

**CAUTION**

For this recovery mode the CompactFlash Card must be in the detector.

If the LAN communiaction is interruppted, no data is stored.

→ Have the CompactFlash Card always inserted.

The detector supports run buffering, which means that an amount of run data (*.uv and *.ch files) is stored in a storage medium (CompactFlash Card) in the detector until either it is overwritten or the detector undergoes a power cycle.

If there is a temporary network failure or the PC is not able to constantly take the data, the stored data is transferred to the ChemStation automatically when the network connection is restored or the PC can take the data, so that no loss of data occurs.

If there is a permanent network failure, the Run Recovery dialog box allows you to restore the stored data to the data directory. From there you can copy the files to the directory where the files are corrupted or not complete.

**NOTE**

On very large recovery files it may take a long time to restore it to the Agilent ChemStation.

A sequence will be stopped in case of a network problem.

**NOTE**

When during recovery an error “Method/Sequence stopped” appears, the instrument logbook shows an entry “No Run data available in device“.

In this case refer to “No Run Data Available In Device” on page 141.

# Automated Run Recovery in case of temporary communication failures

**Table 12** Automated Run Recovery in case of temporary communication failures

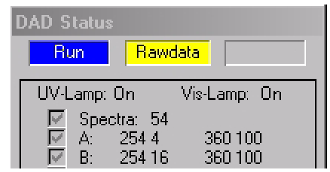
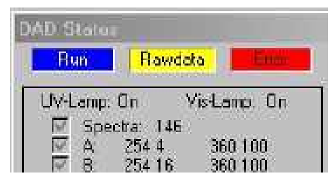
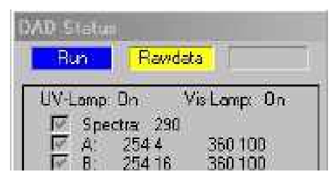
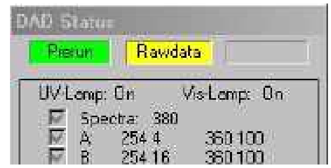
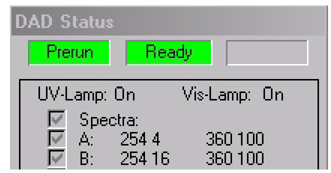
| Situation | Reaction | On ChemStation |
|---|---|---|
| All OK | • Run in progress - Data Analysis<br>• Run / Rawdata<br>• Elapsed run time is running<br>• Spectra counter is running<br>• Data are stored on PC and on card |  |
| LAN breaks | • Run in progress - Data Analysis<br>• Run / Rawdata<br>• Error Power Fail<br>• Elapsed run time stops<br>• Spectra counter stops<br>• Data continues to be stored on card |  |
| LAN recovers | • Run in progress - Data Analysis<br>• Run / Rawdata<br>• Error Power Fail cleared<br>• Elapsed run time continues at actual time<br>• Data continues to be stored on PC and on card<br>• ChemStation tries already to add missing data (depends on the data load). |  |

**Table 12** Automated Run Recovery in case of temporary communication failures

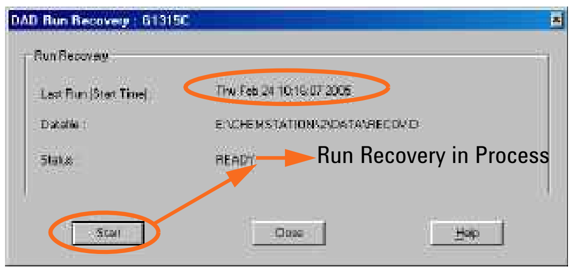
| Situation | Reaction | On ChemStation |
| --- | --- | --- |
| Stop time elapsed | • Run in progress - Data Analysis<br>• Prerun / Rawdata<br>• Elapsed run time stops<br>• Spectra counter continues<br>• ChemStation continues to add missing data |  |
| Run ends | • Ready<br>• Run finished<br>• Prerun / Ready |  |

**NOTE** If the detector status window is not opened, you will realize only the Power Fail error and the long Run In Progress information until the data is recovered from disk.

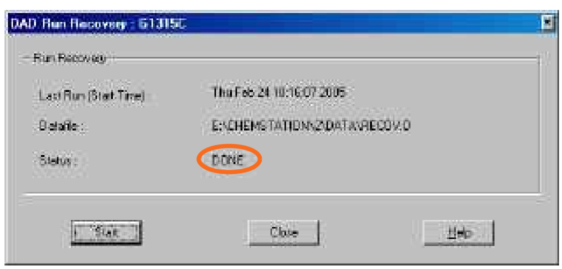
## Manual Run Recovery in case of permanent communication failures


see Note below

Start a recover




After a recover




**NOTE**

When during recovery an error "Method/Sequence stopped" appears, the instrument logbook shows an entry "No Run data available in device".

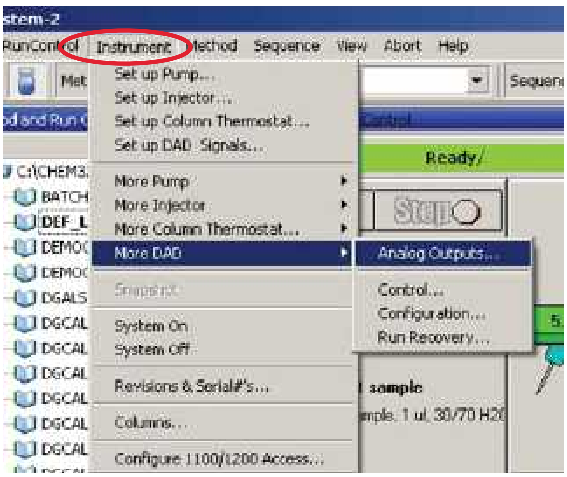
In this case refer to "No Run Data Available In Device" on page 141.

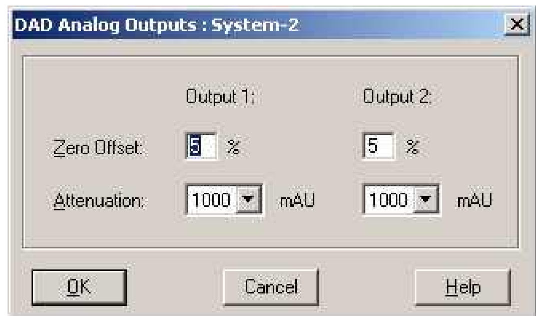
# Analog Output Settings

To change the Output Range of the analog outputs see “Control Settings” on page 78.

1 To change the offset and the attenuation select **Analog Outputs**.

2 Change the ranges for absorbance and wavelength according your needs.




**Zero Offset Limits**: 1 to 99 % in steps of 1 %
**Attenuation Limits**: 0.98 to 2000 mAU at discrete values for either 100 mV or 1 V full scale

**Figure 27** Analog Output Settings

3 Change the values if required.

## Spectrum Settings (DAD only)

To change the Spectra settings open.

1 To change the Spectra settings select **Setup Detector Signals**.
2 In the section Spectrum click on the drop-down list and chose a parameter. Table 13 on page 87 shows the possible parameters.
3 Change the Range, Step width and Threshold according to your needs.

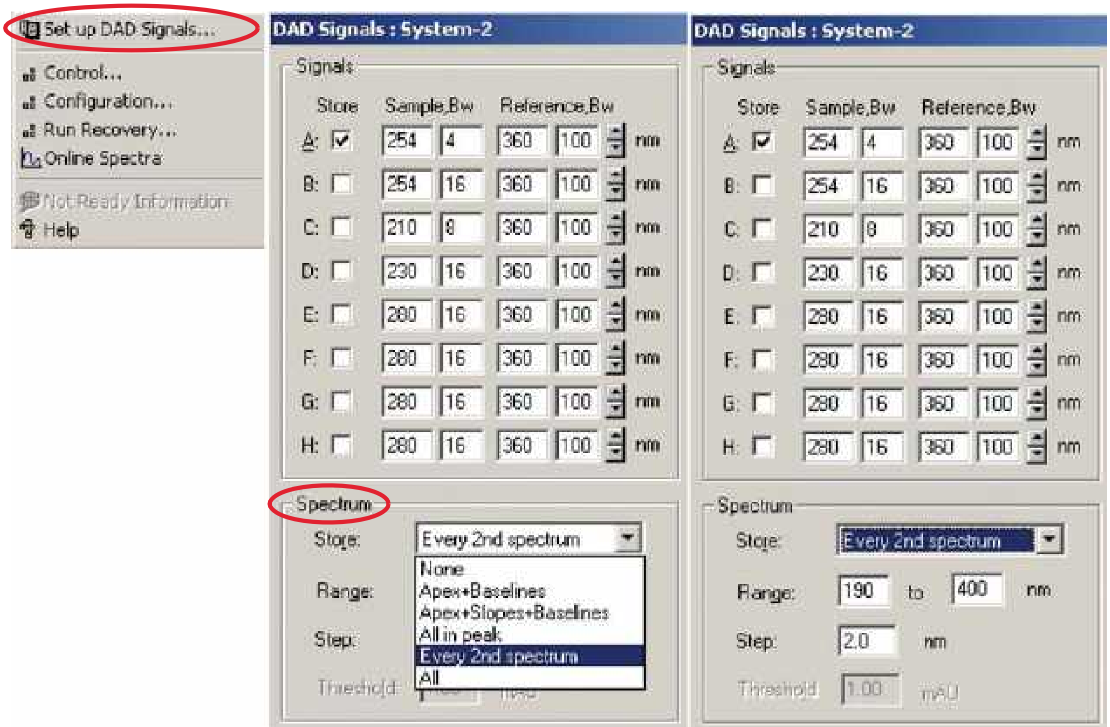



**Figure 28** Spectra Settings

**Table 13** Spectrum Settings

| | |
|---|---|
| Store | Defines at which points on "signal A" spectra will be taken and saved. Signal A is used to control the "peak controlled spectra acquisition"; the other signals have no influence on spectra acquisition. |
| None | No spectra are taken. |
| Apex + Baselines | Spectra are taken at the apex and baselines of the peak. |
| Apex + Slopes + Baselines | Spectra are taken at the apex, baselines, upslope, and downslope of the peak. |
| All in Peak | All spectra within the peak are taken. |
| NOTE | The three spectra acquisition types mentioned above are also referred to as peak-controlled spectra acquisition. The peak detection is done by the detector firmware based on the threshold and peakwidth parameters you set for the DAD. If you want to use peak-controlled spectra storage, make sure that you set these parameters to recognize all the peaks of interest. The integration algorithm also includes peak detection based on the threshold and peakwidth parameters set in the integration events. |
| Every 2nd spectrum | Spectra are taken continuously as for All, but only every second spectrum is stored; other spectra are discarded. This reduces the amount of data storage necessary. |
| All | Spectra are taken continuously depending on the setting of the Peakwidth. Eight spectra are acquired per Peakwidth. The acquisition time for one spectrum is slightly less than the Peakwidth divided by 8, that is, greater than or equal to 0.01s and less than or equal to 2.55s. |
| NOTE | If there are no peaks in Signal A, there are no spectra. You cannot process spectra present in other signals. |
| Range | Range defines the wavelength range for spectral storage.<br>Limits: 190 to 950 nm in steps of 1 nm for both low and high values. The high value must be greater than the low value by at least 2 nm. |
| Step | Step defines the wavelength resolution for spectral storage.<br>Limits: 0.10 to 100.00 nm in steps of 0.1 nm. |
| Threshold | The threshold is the height in mAU of the smallest expected peak. The peak detector ignores any peaks which are lower than the threshold value and does not save spectra.<br>Limits: 0.001 to 1000.00 mAU in steps of 0.001 mAU. Usable for modes Apex + Baselines, Apex + Slopes + Baselines and All in Peak |

# Peakwidth Settings

**NOTE**

Do not use peak width shorter than necessary

Do not use 0.025 sec response time (no filtering/high noise and no need (actually ultra-fast LC doesn't deliver peaks < 0.0025 min / < 0.15 sec)

1 To change the Peakwidth settings select **Setup Detector Signals**.
2 In the section Peakwidth (Responsetime) click on the drop-down list.
3 Change the Peakwidth according to your needs.


Peakwidth enables you to select the peak width (response time) for your analysis. The peak width is defined as the width of a peak, in minutes, at half the peak height. Set the peak width to the narrowest expected peak in your chromatogram. The peak width sets the optimum response time for your detector. The peak detector ignores any peaks that are considerably narrower, or wider, than the peak width setting. The response time is the time between 10% and 90% of the output signal in response to an input step function. When the All spectrum storage option is selected, then spectra are acquired continuously depending on the setting of the peak width. The time specified by the peak width is used as a factor in the acquisition of spectra. The acquisition time for one spectrum is slightly less than the peak width divided by 8, that is the acquisition time is between 0.0125 seconds (80 Hz) and 3.2 seconds.

**Limits**: When you set the peak width (in minutes), the corresponding response time is set automatically and the appropriate data rate for signal and spectra acquisition is selected as shown in the table below.

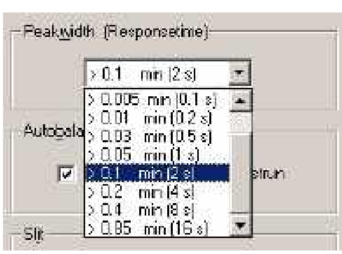



**Figure 29** Peakwidth Setting

**Table 14** Peak Width — Response Time — Data Rate

| Peak Width (min) | Response Time (sec) | Data Rate (Hz) | Detector |
|---|---|---|---|
| <0.0025 | 0.025 | 80 | G1315C/G1365C only |
| >0.0025 | 0.05 | 80 | G1315C/G1365C only |
| >0.005 | 0.1 | 40 | G1315C/G1365C only |
| >0.01 | 0.2 | 20 | G1315C/D and G1365C/D |
| >0.03 | 0.5 | 10 | G1315C/D and G1365C/D |
| >0.05 | 1.0 | 5 | G1315C/D and G1365C/D |
| >0.10 | 2.0 | 2.5 | G1315C/D and G1365C/D |
| >0.20 | 4.0 | 1.25 | G1315C/D and G1365C/D |
| >0.40 | 8.0 | 0.62 | G1315C/D and G1365C/D |
| >0.85 | 16.0 | 0.31 | G1315C/D and G1365C/D |

## Slit Settings

1 To change the Slit settings select **Setup Detector Signals**.

2 In the section Slit click on the drop-down list.

3 Change the Slit width according to your needs.


The Slit group allows you to select the optical bandwidth of the detector; the narrower the slit, the smaller the optical bandwidth of the instrument, but the lower its sensitivity. The smaller the optical bandwidth the higher the spectral resolution.
To set the slit width, display the drop-down list and select an appropriate slit width from the list.

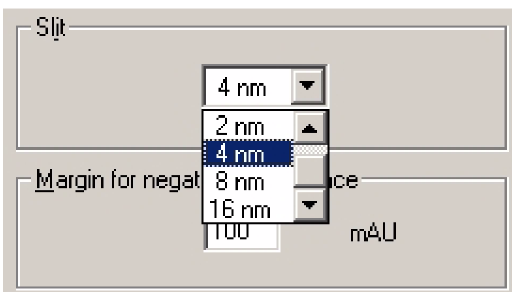



**Figure 30** Slit Settings

## Margin for Negative Absorbance Settings

1 To change the settings select **Setup Detector Signals**.

2 In the section Margin for Negative Absorbance change the value according to your needs.


Use this field to modify the detector's signal handling to increase the margin for negative absorbance. Use this option if, for example, your solvent gradient produces a decreasing baseline absorbance, and for GPC analyses.
*Limits*: 100 to 4000 mAU.


**Figure 31** Margin for Negative Absorbance

**NOTE** The higher the value the greater the baseline noise. Set this value only if you expect negative absorbance greater than -100 mAU.

## Optimizing the Detector

Additional theoretical information can be found in chapter "How to optimize the Detector" on page 99.

# Special Setups with Multiple DAD-MWDs

**NOTE**

The G1315C/D and G1365C/D detectors are based on the same new hardware/electronic platform.

The G1315A/B and G1365A/B detectors are based on the old hardware/electronic platform.

## Two detectors of same type (e.g. G1315C/D and G1315C/D)

If you have two G1315C/D DAD or G1365C/D MWD in the same system then you can rearrange the order in the menu **Instrument - Configure 1200 Access** to assign a specific detector as detector 1 and 2.

**NOTE**

The diagnostics, tests and OQ/PV should be done with only one detector configured.

## Two detectors of similar type (e.g. G1315C/D and G1315A/B)

If you have similar detectors in the same system, the G1315C/D will be automatically always detector 2 while the G1315A/B is detector 1 independent from its location in the stack. This cannot be changed.

# Solvent Information

Observe the following recommendations on the use of solvents.

- Follow recommendations for avoiding the growth of algae, see pump manuals.
- Small particles can permanently block capillaries and valves. Therefore, always filter solvents through 0.4 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.

## 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 conditions, 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 aequous halogene solutions, phenol and derivatives (cresols, salicylic acid etc.).

### 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:

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

  This reaction, in which stainless steel probably acts as a catalyst, occurs quickly with dried chloroform if the drying process removes the stabilizing alcohol.
- Chromatographic grade ethers, which can contain peroxides (for example, THF, dioxane, 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.

### Diamond-Like Carbon (DLC)

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

### Fused silica and Quartz ($SiO_2$)

Fused silica is used in 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 ($ZrO_2$)

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

### Platinum/Iridium

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

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

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

TFE/PDD copolymer tubings, which are used in all Agilent degassers except G1322A, 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 $Al_2O_3$-based ceramics

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

# 5
# How to optimize the Detector



This chapter provides information on how to optimize the detector.

# Introduction

The detector has a variety of parameters that can be used to optimize performance. Depending on whether signal or spectral data need to be optimized, different settings are recommended. The following sections describe optimization for:

- signal sensitivity, selectivity and linearity,
- spectral sensitivity and resolution (DAD only), and
- disk space required for storing data.

**NOTE** The information in this chapter should be seen as a basic introduction to diode array detector techniques. Some of these techniques may not be available in the instrument software controlling the detector.

## How to Get the Best Detector Performance

The information below will guide you on how to get the best detector performance. Follow these rules as a start for new applications. It gives rules-of-thumb for optimizing detector parameters.

# Optimization Overview

**Table 15** Optimization Overview

| Parameter | Impact |
| --- | --- |
| **1** Selection of flow cell | • peak resolution versus sensitivity |
| • Choose flow cell according to used column, see Figure 32 on page 102. | |
| **2** Connection of flow cell | • chromatographic resolution |
| • For flow rates from 0.5 mL/min connect column using the zero-dead-volume fittings of the detector.<br>• For small column i.d. (e.g 1 mm) the inlet capillary of the micro flow cell can be connected directly to the column. | |
| **3** Setting the peak width (response time) | • peak resolution versus sensitivity versus disk space |
| • Use peak width according Figure 32 on page 102 as starting point.<br>• Set the peak-width close to the width of a narrow peak of interest in your chromatogram. | |
| **4** Setting wavelength and bandwidth | |
| • Sample wavelength:<br>◦ Never miss a peak by the use of a browser wavelength like 250 nm with 100 nm bandwidth.<br>◦ Select specific wavelength with reduced bandwidth if you need selectivity, e.g. 250,10 nm and 360,100 nm as reference wavelength.<br>◦ Set the sample wavelength to a peak or valley in the spectrum to get best linearity for high concentrations. | • sensitivity versus selectivity<br>• sensitivity versus linearity |
| • Reference wavelength:<br>◦ Select the reference wavelength with broad bandwidth (30...100 nm) wavelength range where your analytes have little or no absorbance (e.g. sample at 254 nm, reference at 320 nm). | • baseline drift due to RI effects. |

**Table 15** Optimization Overview

| Parameter | Impact |
| --- | --- |
| **5** Setting the slit width | |
| • Use 4 nm slit for normal applications.<br>• Use narrow slit (e.g 1 nm) if your analytes have narrow absorbance bands and for high concentrations.<br>• Use a wide slit (e.g. 16 nm) to detect very low concentrations.<br>• Optimizing spectral acquisition (DAD only)<br>• Select spectra acquisition mode according to your needs (see Table 13 on page 87).<br>• Set the spectral wavelength range (for colorless samples 190...400 nm is sufficient).<br>• Set step to 4 nm for normal use; set small step (and slit width) if high resolution of spectra with fine structure is wanted. | • spectral resolution, sensitivity and linearity. |

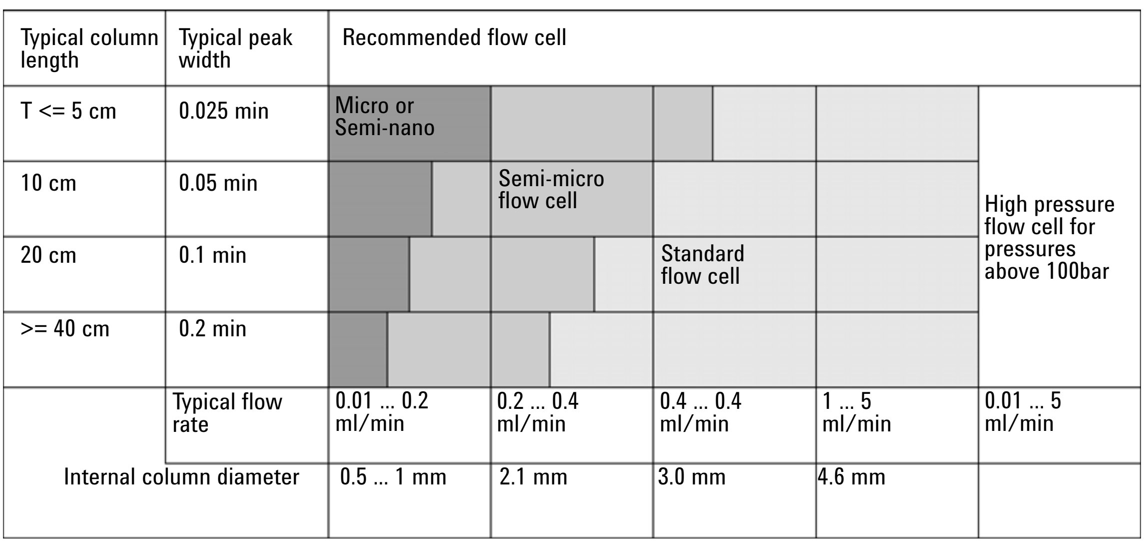



**Figure 32** Choosing a Flow Cell in HPLC

# Optimizing for Sensitivity, Selectivity, Linearity and Dispersion

## Flow Cell Path Length

Lambert-Beer's law shows a linear relationship between the flow cell path length and absorbance.

$$\text{Absorbance} = -\log T = \log \frac{I_0}{I} = \varepsilon \times C \times d$$

where

T is the transmission, defined as the quotient of the intensity of the transmitted light I divided by the intensity of the incident light, $I_0$,

ε is the extinction coefficient, which is a characteristic of a given substance under a precisely-defined set of conditions of wavelength, solvent, temperature and other parameters,

C [mol/L] is the concentration of the absorbing species, and

d [m] is the path length of the cell used for the measurement.

Therefore, flow cells with longer path lengths yield higher signals. Although noise usually increases little with increasing path length, there is a gain in signal-to-noise ratio. For example, in Figure 33 on page 104 the noise increased by less than 10 % but a 70 % increase in signal intensity was achieved by increasing the path length from 6 – 10 mm.

When increasing the path length, the cell volume usually increases — in our example from 5 – 13 µL. Typically, this causes more peak dispersion. As Figure 33 on page 104 demonstrates, this did not affect the resolution in the gradient separation in our example.

As a rule-of-thumb the flow cell volume should be about 1/3 of the peak volume at half height. To determine the volume of your peaks, take the peak width as reported in the integration results multiply it by the flow rate and divide it by 3).

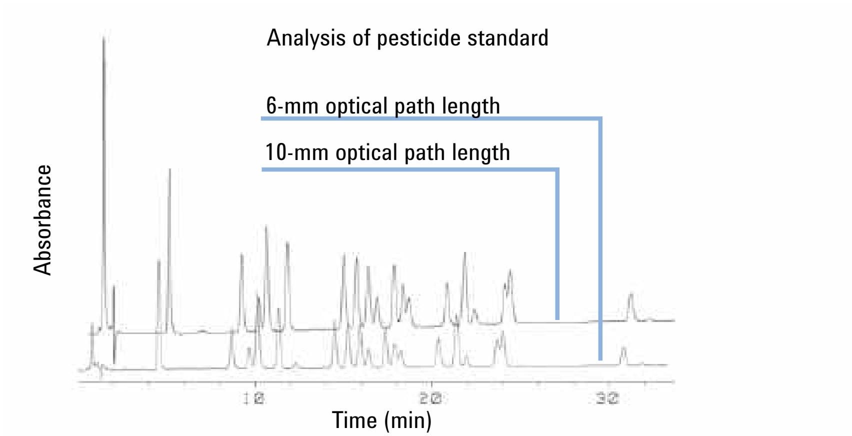



**Figure 33** Influence of Cell Path Length on Signal Height

Traditionally LC analysis with UV detectors is based on comparing measurements with internal or external standards. To check photometric accuracy of the detector it is necessary to have more precise information on path lengths of the flow cells.

The correct response is:

```
expected response * correction factor
```

Please find below the details of the flow cells:

**Table 16** Correction factors for flow cells

| Flow cell | Path length (actual) | Correction factor |
|---|---|---|
| Standard flow cell, 10 mm, 13 µL, 120 bar ( 12 MPa) (G1315-60022) | 9.80±0.07 mm | 10/9.8 |
| Semi-micro flow cell, 6 mm, 5 µL, 120 bar ( 12 MPa) (G1315-60025) | 5.80±0.07 mm | 6/5.8 |
| Micro flow cell, 3 mm, 2 µL, 120 bar ( 12 MPa) (G1315-60024) | 3.00+0.05 mm/-0.07 mm | 3/3 |
| Semi-nano flow cell kit, 10 mm, 500 nL, 5 MPa (G1315-68724) | 10.00±0.02 mm | 10/10 |
| Nano flow cell kit, 6 mm, 80 nL, 5 MPa ( G1315-68716) | 6.00±0.02 mm | 6/6 |
| Standard flow cell bio-inert, 10 mm, 13 µL, 120 bar ( 12 MPa) for MWD/DAD, includes Capillary Kit Flow Cells BIO (p/n G5615-68755) (G5615-60022) | 9.80±0.07 mm | 10/9.8 |

# Peak width (response time)

Response time describes how fast the detector signal follows a sudden change of absorbance in the flow cell. The detector uses digital filters to adapt response time to the width of the peaks in your chromatogram. These filters do not affect peak area nor peak symmetry. When set correctly, such filters reduce baseline noise significantly (Figure 34 on page 105), but reduce peak height only slightly. In addition, these filters reduce the data rate to allow optimum integration and display of your peaks and to minimize disk space required to store chromatograms and spectra.

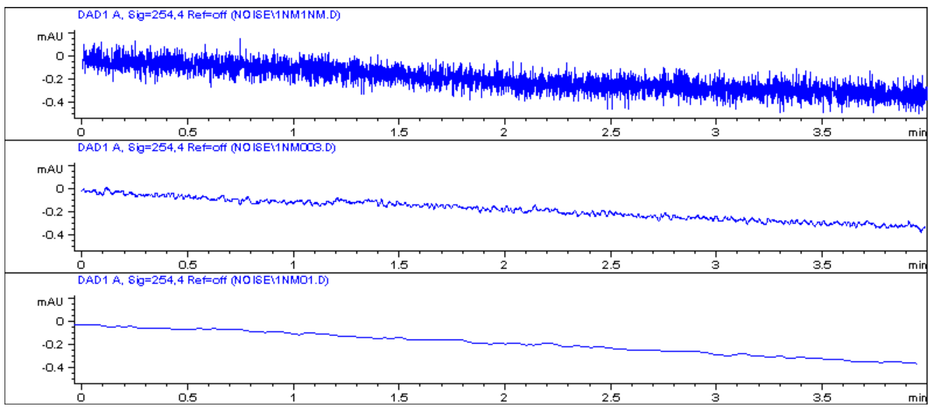



**Figure 34** Influence of Response Time on Signal and Noise

Table 17 on page 106 lists the filter choices of the detector. To get optimum results, set peak width as close as possible to a narrow peak of interest in your chromatogram. Response time will the be approximately 1/3 of the peak width, resulting in less than 5 % peak-height reduction and less than 5 % additional peak dispersion. Decreasing the peak width setting in the detector will result in less than 5 % gain in peak height but baseline noise will increase by a factor of 1.4 for a factor of 2 response-time reduction. Increasing peak width (response time) by factor of two from the recommended setting (over-filtering) will reduce peak height by about 20 % and reduce baseline noise by a factor of 1.4. This gives you the best possible signal-to-noise ratio, but may affect peak resolution.

**Table 17** Peak Width — Response Time — Data Rate

| Peak Width [minutes] | Response Time [seconds] | Data Rate [Hz] | Detector |
|---|---|---|---|
| <0.0025 | 0.025 | 80 | G1315C/G1365C only |
| >0.0025 | 0.05 | 80 | G1315C/G1365C only |
| >0.005 | 0.1 | 40 | G1315C/G1365C only |
| >0.01 | 0.2 | 20 | G1315C/D and G1365C/D |
| >0.03 | 0.5 | 10 | G1315C/D and G1365C/D |
| >0.05 | 1.0 | 5 | G1315C/D and G1365C/D |
| >0.10 | 2.0 | 2.5 | G1315C/D and G1365C/D |
| >0.20 | 4.0 | 1.25 | G1315C/D and G1365C/D |
| >0.40 | 8.0 | 0.62 | G1315C/D and G1365C/D |
| >0.85 | 16.0 | 0.31 | G1315C/D and G1365C/D |

## Sample and Reference Wavelength and Bandwidth

The detector measures absorbance simultaneously at wavelengths from 190 to 950 nm. Two lamps provide good sensitivity over the whole wavelength range. The deuterium discharge lamp provides the energy for the UV range (190 to 400 nm) and the tungsten lamp emits light from 400 to 950 nm for the visible and short wave near infrared.

If you know little about the analytes in your sample, use both lamps and store all spectra over the full wavelength range. This provides full information but fills up your disk space rather quickly. Spectra can be used to check a peak's purity and identity. Spectral information is also useful to optimize wavelength settings for your chromatographic signal.

The detector can compute and store at run time up to 8 signals with these properties:

- sample wavelength, the center of a wavelength band with the width of sample bandwidth (BW), and optionally
- reference wavelength, the center of a wavelength band with the width of reference bandwidth.

The signals comprises a series of data points over time, with the average absorbance in the sample wavelength band minus the average absorbance of the reference wavelength band.

Signal A in the detector default method is set to sample 250,100, reference 360,100, that is, the average absorbance from 200 – 300 nm minus the average absorbance from 300 – 400 nm. As all analytes show higher absorbance at 200 – 300 nm than at 300 – 400 nm, this signal will show you virtually every compound which can be detected by UV absorbance.

Many compounds show absorbance bands in the spectrum. Figure 35 on page 108 shows the spectrum of anisic acid as an example.

To optimize for lowest possible detectable concentrations of anisic acid, set the sample wavelength to the peak of the absorbance band (that is, 252 nm) and the sample bandwidth to the width of the absorbance band (that is, 30 nm). A reference of 360,100 is adequate. Anisic acid does not absorb in this range.

If you work with high concentrations, you may get better linearity above 1.5 AU by setting the sample wavelength to a valley in the spectrum, like 225 nm for anisic acid.

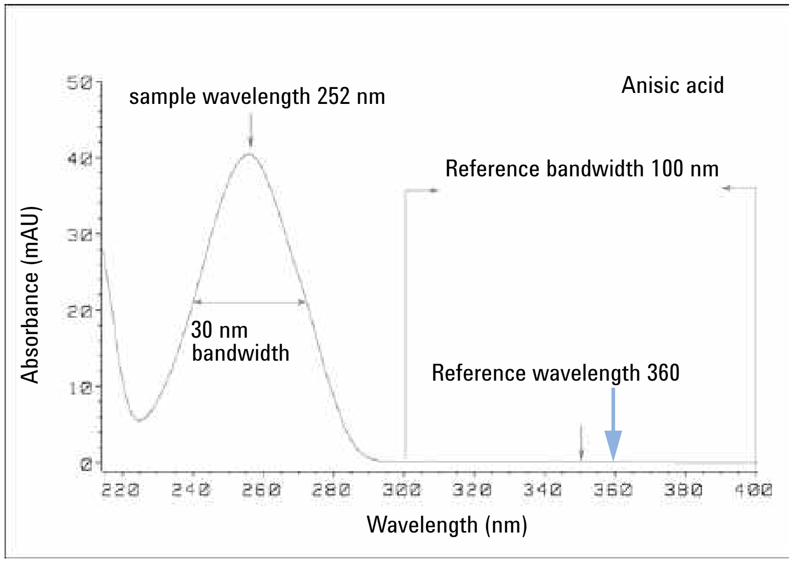



**Figure 35** Optimization of Wavelength Setting

A wide bandwidth has the advantage of reducing noise by averaging over a wavelength range – compared to a 4 nm bandwidth, the baseline noise is reduced by a factor of approximately 2.5, whereas the signal is about 75 % of a 4 nm wide band. The signal-to-noise ratio for a 30 nm bandwidth is twice that for a 4 nm bandwidth in our example.

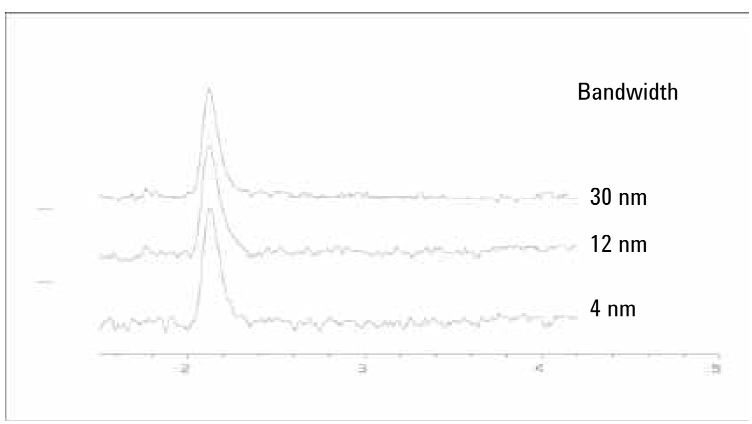
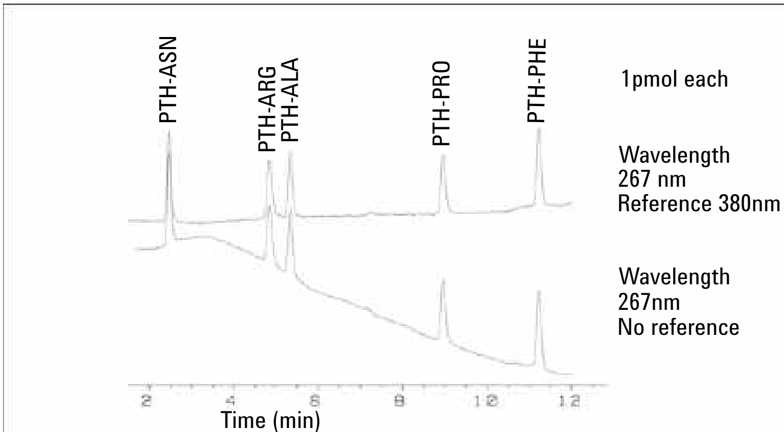



**Figure 36** Influence of Bandwidth on Signal and Noise

Because the detector averages absorbance values that are calculated for each wavelength, using a wide bandwidth does not negatively impact linearity.

The use of a reference wavelength is highly recommended to further reduce baseline drift and wander induced by room temperature fluctuations or refractive index changes during a gradient.

An example of the reduction of baseline drifts is shown in Figure 37 on page 109 for PTH-amino acids. Without a reference wavelength, the chromatogram drifts downwards due to refractive index changes induced by the gradient. This is almost completely eliminated by using a reference wavelength. With this technique, PTH-amino acids can be quantified in the low picomole range even in a gradient analysis.




Grad.: 0.02 m $KH_2PO_4$/ACN from 12% ACN to 45% ACN in 12 min

**Figure 37** Gradient Analysis of PTH-Amino Acids (1 pmol each), with and without Reference

# Slit Width

The detector has a variable slit at the entrance of the spectrograph. This is an effective tool to adapt the detector to changing demand of different analytical problems.

A narrow slit provides spectral resolution for analytes with very fine structures in the absorbance spectrum. An example of such a spectrum is benzene. The five main absorbance bands (fingers) are only 2.5 nm wide and just 6 nm apart from each other.

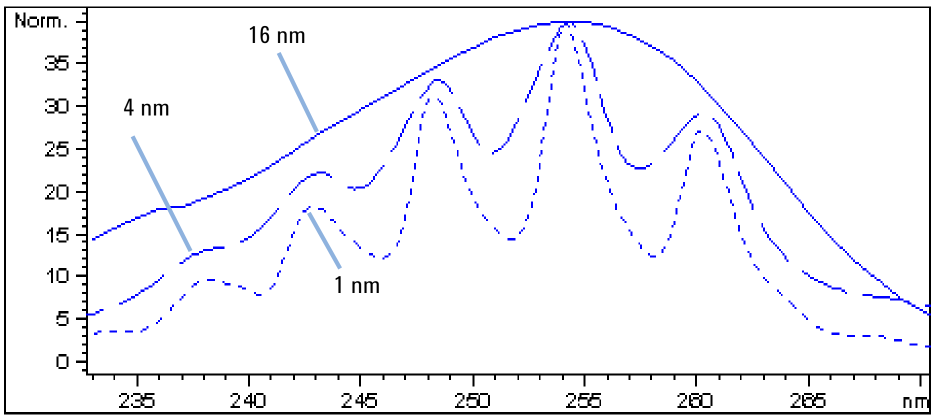



**Figure 38** Benzene at 1, 4 and 16 nm slit width (principle)

A wide slit uses more of the light shining through the flow cell. This gives lower baseline noise as shown in Figure 39 on page 111.

Slit width 1 nm

Slit width 4 nm

Slit width 16 nm

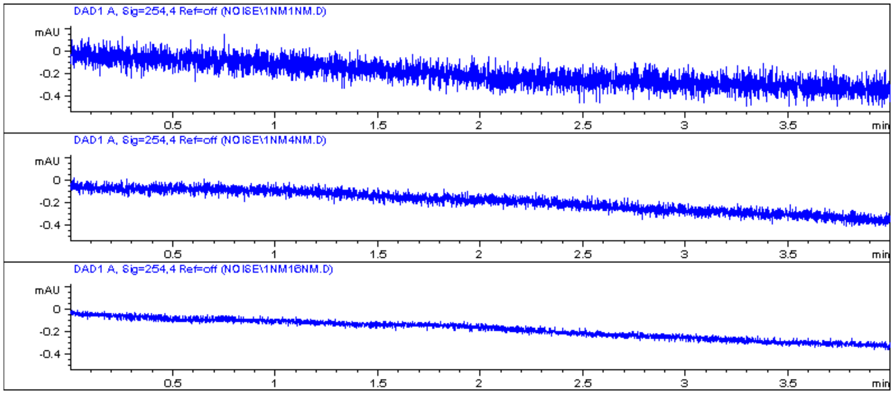



**Figure 39** Influence of the Slit Width on Baseline Noise

However, with a wider slit, the spectrograph's optical resolution (its ability to distinguish between different wavelengths) diminishes. Any photodiode receives light within a range of wavelength determined by the slit width. This explains why the fine spectral structure of benzene disappears when using a 16-nm wide slit.

Furthermore, the absorbance is no longer strictly linear with concentration for wavelengths at a steep slope of a compound's spectrum.

Substances with fine structures and steep slopes like benzene are very rare.

In most cases the width of absorbance bands in the spectrum is more like 30 nm as with anisic acid (Figure 35 on page 108).

In most situations, a slit width of 4 nm will give the best results.

Use a narrow slit (1 or 2 nm) if you want to identify compounds with fine spectral structures or if you need to quantify at high concentrations (> 1000 mAU) with a wavelength at the slope of the spectrum. Signals with a wide bandwidth can be used to reduce baseline noise. Because (digital) bandwidth is computed as average of absorbance, there is no impact on linearity.

Use a wide (8 or 16 nm) slit when your sample contains very small concentrations. Always use signals with bandwidth at least as wide as the slit width.

## Optimizing Spectral Acquisition (DAD only)

Storage of all spectra consumes a lot of disk space. It is very useful to have all spectra available during optimization of a method or when analyzing unique samples. However when running many samples of the same type, the large size of data files with all spectra may become a burden. The detector provides functions to reduce the amount of data, yet retaining the relevant spectral information.

For spectra options see Table 13 on page 87.

### Range

Only the wavelength range where the compounds in your sample absorb contains information that is useful for purity checks and library searches. Reducing the spectrum storage range saves disk space.

### Step

Most substances have broad absorbance bands. Display of spectra, peak purity and library search works best if a spectrum contains 5 to 10 data points per width of the absorbance bands. For anisic acid (the example used before) a step of 4 nm would be sufficient. However a step of 2 nm gives a more optimal display of the spectrum.

### Threshold

Sets the peak detector. Only spectra from peaks higher than threshold will be stored when a peak-controlled storage mode is selected.

## Margin for Negative Absorbance

The detector adjusts its gain during *balance* such that the baseline may drift slightly negative (about -100 mAU). In some special case, for example, when gradient with absorbing solvents are used, the baseline may drift to more negative values.

Only for such cases, increase the margin for negative absorbance to avoid overflow of the analog-to-digital converter.

# Optimizing Selectivity

## Quantifying Coeluting Peaks by Peak Suppression

In chromatography, two compounds may often elute together. A conventional dual-signal detector can only detect and quantify both compounds independently from each other if their spectra do not overlap. However, in most cases this is highly unlikely.

With a dual-channel detector based on diode-array technology, quantifying two compounds is possible even when both compounds absorb over the whole wavelength range. The procedure is called peak suppression or signal subtraction. As an example, the analysis of hydrochlorothiazide in the presence of caffeine is described. If hydrochlorothiazide is analyzed in biological samples, there is always a risk that caffeine is present which might interfere chromatographically with hydrochlorothiazide. As the spectra in Figure 40 on page 113 shows, hydrochlorothiazide is best detected at 222 nm, where caffeine also shows significant absorbance. It would therefore be impossible, with a conventional variable wavelength detector, to detect hydrochlorothiazide quantitatively when caffeine is present.

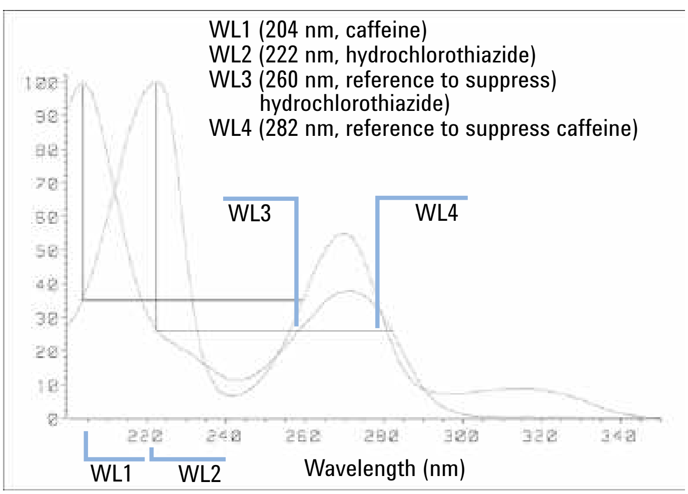



**Figure 40** Wavelength Selection for Peak Suppression

With a UV-visible detector based on a diode array and the correct choice of a reference wavelength setting, quantitative detection is possible. To suppress caffeine, the reference wavelength must be set to 282 nm. At this wavelength, caffeine shows exactly the same absorbance as at 222 nm. When the absorbance values are subtracted from each another, any indication of the presence of caffeine is eliminated. In the same way, hydrochlorothiazide can be suppressed if caffeine is to be quantified. In this case the wavelength is set to 204 nm and the reference wavelength to 260 nm. Figure 41 on page 114 shows the chromatographic results of the peak suppression technique.

The trade-off for this procedure is a loss in sensitivity. The sample signal decreases by the absorbance at the reference wavelength relative to the signal wavelength. Sensitivity may be decreased by as much as 10–30 %.

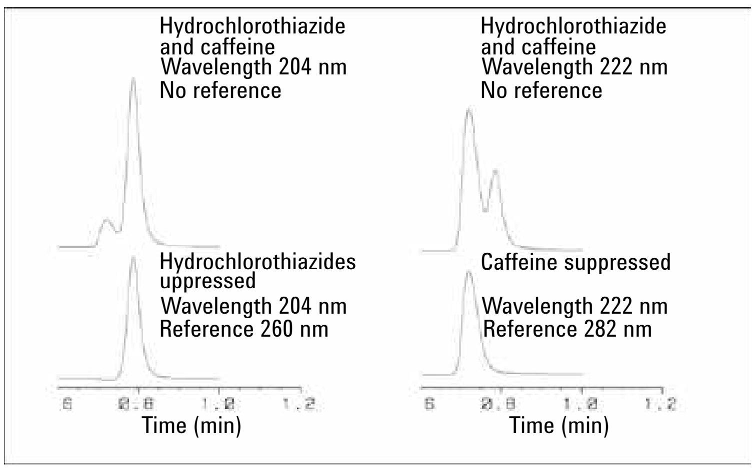



**Figure 41** Peak Suppression Using Reference Wavelength

# Ratio Qualifiers for Selective Detection of Compound Classes

Ratio qualifiers can be used where, in a complex sample, only one particular class needs to be analyzed — a parent drug and its metabolites in a biological sample, for example. Another example is the selective analysis of derivatives after pre- or post-column derivatization. Specifying a signal ratio that is typical for the sample class is one way of selectively plotting only those peaks that are of interest. The signal output remains at zero so long as the ratio is out of the user-specified ratio range. When the ratio falls within the range, the signal output corresponds to the normal absorbance, giving single, clear peaks on a flat baseline. An example is shown in Figure 42 on page 115 and Figure 43 on page 116.

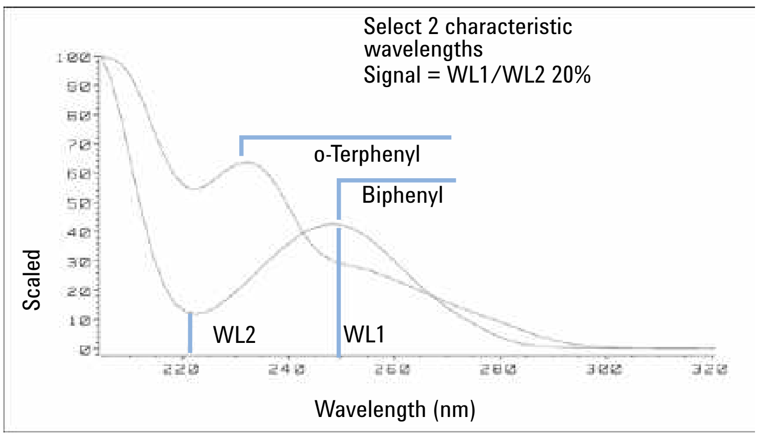



**Figure 42** Wavelength Selection for Ratio Qualifiers

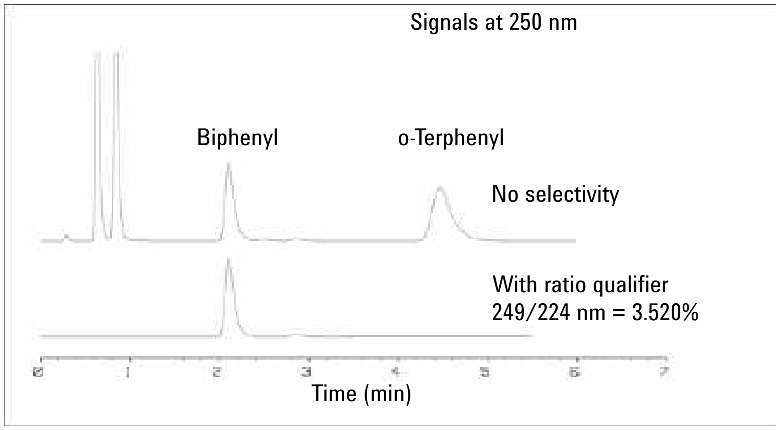



**Figure 43** Selectivity by Ratio Qualifiers

In a four-component mixture, only biphenyl was recorded. The other three peaks were suppressed because they did not meet the ratio-qualifier criterion and therefore the output was set to zero. The characteristic wavelengths 249 nm ($\lambda_1$) and 224 nm ($\lambda_2$) were found from the spectra shown in Figure 42 on page 115. The ratio range was set at 2 – 2.4 (2.2 ±10%). Only when the ratio between 249 and 224 nm was within this range, is the signal plotted. Of all four peaks, only the third fulfilled the criterion (Figure 43 on page 116). The others were not plotted.

# 6
# Troubleshooting and Diagnostics



This chapter gives an overview about the troubleshooting and diagnostic features and the different user interfaces.

# Overview of the Module’s Indicators and Test Functions

### Status Indicators

The module is provided with two status indicators which indicate the operational state (prerun, run, and error states) of the module. The status indicators provide a quick visual check of the operation of the module.

### Error Messages

In the event of an electronic, mechanical or hydraulic failure, the module generates an error message in the user interface. For each message, a short description of the failure, a list of probable causes of the problem, and a list of suggested actions to fix the problem are provided (see “Error Information” on page 123).

### Test Functions

A series of test functions are available for troubleshooting and operational verification after exchanging internal components (see “Test Functions” on page 143).

### Wavelength Verification / Recalibration

Wavelength recalibration is recommended after exchange of lamps and flow cells, maintenance of flow cells, repair of internal components, and on a regular basis to ensure correct operation of the module. The module uses the deuterium alpha and beta emission lines for wavelength calibration (see “Wavelength Verification and Calibration” on page 160).

# Status Indicators

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

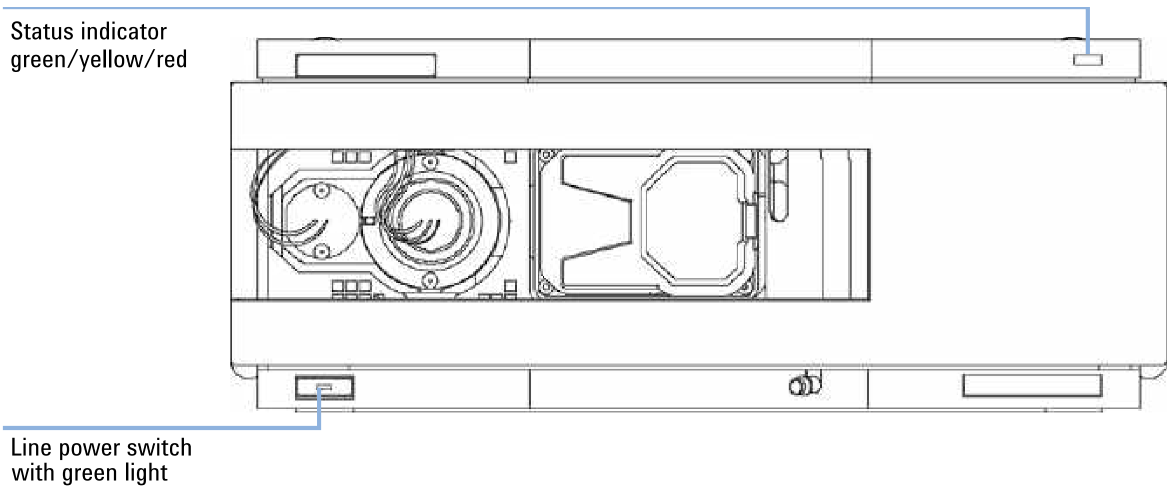



**Figure 44** Location of Status Indicators

## Power Supply Indicator

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

## Module Status Indicator

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

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

  If the error occurs during analysis, it is propagated within the LC system, i.e. a red LED may indicate a problem of a different module. Use the status display of your user interface for finding the root cause/module of the error.
- A *blinking* indicator indicates that the module is in resident mode (e.g. during update of main firmware).
- A *fast blinking* indicator indicates that the module is in a low-level error mode. In such a case try to re-boot the module or try a cold-start (see “Special Settings” on page 256). Then try a firmware update (see “Replacing the Module’s Firmware” on page 203). If this does not help, a main board replacement is required.

# User Interfaces

**NOTE**

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

Preferred tool should be the Agilent Diagnostic Software, see "Agilent Lab Advisor Software" on page 122.

Screenshots used within these procedures are based on the Agilent ChemStation.

In future, a user interface may not show the Diagnostics/Tests anymore. Then the Agilent Diagnostic Software must be used instead.

The Agilent ChemStation may not include any maintenance/test functions.

**Table 18** Test Functions avaible vs. User Interface

| Test | Diagnostic Software | ChemStation | Instant Pilot G4208A |
|---|---|---|---|
| Selftest | Yes | Yes | No |
| Filter | Yes | Yes | No |
| Slit | Yes | Yes | No |
| D/A Converter | Yes | Yes | No |
| Test Chromatogram | Yes | Yes (*) | No |
| Wavelength Calibration | Yes | Yes | Yes |
| Lamp Intensity | Yes | Yes | Yes |
| Holmium | Yes | Yes | Yes |
| Cell | Yes | Yes | Yes |
| Dark Current | Yes | Yes | Yes |

* requires a command via command line

# Agilent Lab Advisor Software

The Agilent Lab Advisor software is a standalone product that can be used with or without data system. Agilent Lab Advisor software helps to manage the lab for high quality chromatographic results and can monitor in real time a single Agilent LC or all the Agilent GCs and LCs configured on the lab intranet.

Agilent Lab Advisor software provides diagnostic capabilities for all Agilent 1200 Infinity Series modules. This includes diagnostic capabilities, calibration procedures and maintenance routines for all the maintenance routines.

The Agilent Lab Advisor software also allows users to monitor the status of their LC instruments. The Early Maintenance Feedback (EMF) feature helps to carry out preventive maintenance. In addition, users can generate a status report for each individual LC instrument. The tests and diagnostic features as provided by the Agilent Lab Advisor software may differ from the descriptions in this manual. For details refer to the Agilent Lab Advisor software help files.

The Instrument Utilities is a basic version of the Lab Advisor with limited functionality required for installation, use and maintenance. No advanced repair, troubleshooting and monitoring functionality is included.

# 7
# Error Information

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

# What Are Error Messages

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

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

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

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

# General Error Messages

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

## Timeout

**Error ID: 0062**

The timeout threshold was exceeded.

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

# Shutdown

**Error ID: 0063**

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

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

| Probable cause | Suggested actions |
|---|---|
| **1** Leak detected in another module with a CAN connection to the system. | Fix the leak in the external instrument before restarting the module. |
| **2** Leak detected in an external instrument with a remote connection to the system. | Fix the leak in the external instrument before restarting the module. |
| **3** Shut-down in an external instrument with a remote connection to the system. | Check external instruments for a shut-down condition. |

# Remote Timeout

**Error ID: 0070**

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

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

## Lost CAN Partner

**Error ID: 0071**

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

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

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

## Leak Sensor Short

**Error ID: 0082**

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

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

| Probable cause | Suggested actions |
|---|---|
| 1 Defective leak sensor. | Please contact your Agilent service representative. |
| 2 Leak sensor incorrectly routed, being pinched by a metal component. | • Please contact your Agilent service representative.<br>• Correct the routing of the cable.<br>• If cable defective, exchange the leak sensor. |

# Leak Sensor Open

**Error ID: 0083**

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

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

| Probable cause | Suggested actions |
|---|---|
| **1** Leak sensor not connected to the main board. | Please contact your Agilent service representative. |
| **2** Defective leak sensor. | Please contact your Agilent service representative. |
| **3** Leak sensor incorrectly routed, being pinched by a metal component. | Please contact your Agilent service representative. |

# Compensation Sensor Open

**Error ID: 0081**

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

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

| Probable cause | Suggested actions |
|---|---|
| **1** Defective main board. | Please contact your Agilent service representative. |

## Compensation Sensor Short

**Error ID: 0080**

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

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

| Probable cause | Suggested actions |
|---|---|
| 1 Defective main board. | Please contact your Agilent service representative. |

## Fan Failed

**Error ID: 0068**

The cooling fan in the module has failed.

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

| Probable cause | Suggested actions |
|---|---|
| 1 Fan cable disconnected. | Please contact your Agilent service representative. |
| 2 Defective fan. | Please contact your Agilent service representative. |
| 3 Defective main board. | Please contact your Agilent service representative. |

# Leak

**Error ID: 0064**

A leak was detected in the module.

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

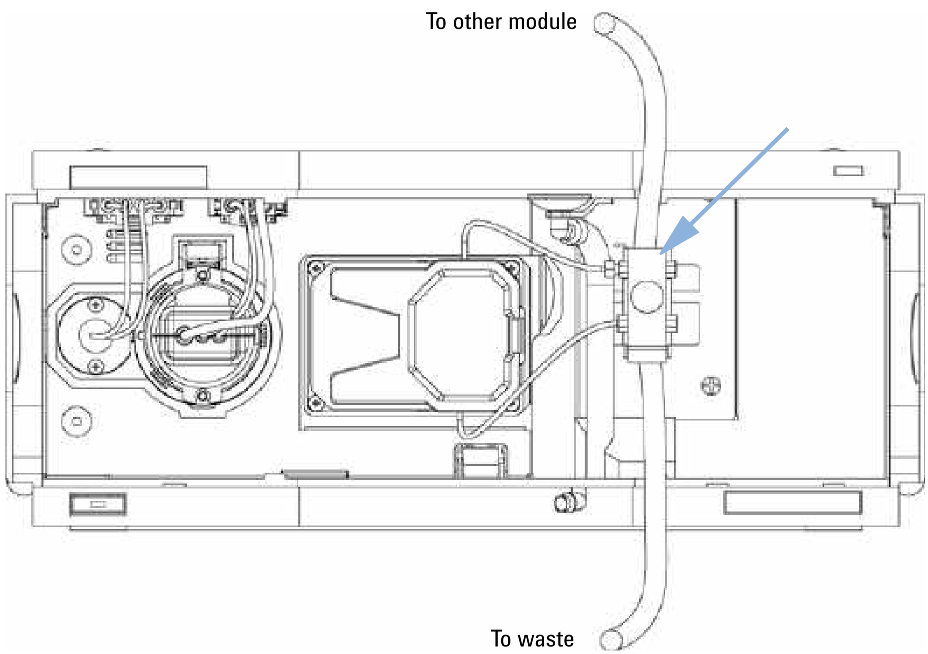
| Probable cause | Suggested actions |
|---|---|
| **1** Loose fittings. | Ensure all fittings are tight. |
| **2** Broken capillary. | Exchange defective capillaries. |
| **3** Leaking flow cell. | Exchange flow cell components. |

## Additional Information

A leak error may be caused by the Aligent 1200 sampler. In each sampler injection sequence, step# 2 ejects the mobile phase stored in the metering head during the previous injection. This mobile phase is ejected through the short plastic tube connected to port# 4 of the sampler switching valve. The output of port# 4 is integrated into the sampler's contingency leak drain system, which eventually terminates in the leak pan of the bottom module of the stack - the detector. With normal injection volumes and run times, the output of port# 4 is small, and evaporates right in the sampler leak pan. However, the output of port# 4 is significant, and a substantial volume of ejected mobile phase reaches the detector leak pan.

There are two possible fixes. Select the one which is most convenient.

1 The waste drain plumbing orientation as shown in the figure below, eliminates the possibility of any leak drainage from above reaching the detector leak pan. The leak drain for the detector can be connected to the detector's leak drain fitting, and taken to waste separately.



2 If it is desired that the system has only one leak drain tube, then it's possible in increase the length of the small plastic tube which is connected to port# 4 of the sampler switching valve. This tube can then be taken to waste separately. The tube which normally serves as the detector cell outlet tube can be used for this purpose.

# 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. |

# Cover Violation

**Error ID: 7461**

The top foam has been removed.

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

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

# Detector Error Messages

These errors are detector specific.

## Visible Lamp Current

The visible lamp current is missing.

The processor continually monitors the lamp current during operation. If the current falls below the lower current limit, the error message is generated.

| Probable cause | Suggested actions |
|---|---|
| 1 Lamp disconnected. | Ensure the visible lamp connector is seated firmly. |
| 2 Defective visible lamp. | Exchange the visible lamp. |
| 3 Defective connector or cable. | Please contact your Agilent service representative. |
| 4 Defective power supply. | Please contact your Agilent service representative. |

## Visible Lamp Voltage

The visible lamp voltage is missing.

The processor continually monitors the voltage across the lamp during operation. If the lamp voltage falls below the lower limit, the error message is generated.

| Probable cause | Suggested actions |
|---|---|
| 1 Defective connector or cable. | Please contact your Agilent service representative. |
| 2 Defective power supply. | Please contact your Agilent service representative. |

# Diode Current Leakage

**Error ID: 1041**

When the detector is switched on, the processor checks the leakage current of each of the optical diodes. If the leakage current exceeds the upper limit, the error message is generated.

| Probable cause | Suggested actions |
|---|---|
| **1** Defective PDA/optical unit. | Please contact your Agilent service representative. |
| **2** Defective connector or cable. | Please contact your Agilent service representative. |

# UV Lamp Current

**Error ID: 7450**

The UV lamp current is missing.

The processor continually monitors the anode current drawn by the lamp during operation. If the anode current falls below the lower current limit, the error message is generated.

| Probable cause | Suggested actions |
|---|---|
| **1** Lamp disconnected. | Ensure the UV lamp connector is seated firmly. |
| **2** Defective UV lamp or non-Agilent lamp. | Exchange the UV lamp. |
| **3** Defective detector main board. | Please contact your Agilent service representative. |
| **4** Defective power supply. | Please contact your Agilent service representative. |

## UV Lamp Voltage

**Error ID: 7451**

The UV lamp anode voltage is missing.

The processor continually monitors the anode voltage across the lamp during operation. If the anode voltage falls below the lower limit, the error message is generated.

| Probable cause | Suggested actions |
|---|---|
| **1** Defective UV lamp or non-Agilent lamp. | Exchange the UV lamp. |
| **2** Defective detector main board. | Please contact your Agilent service representative. |
| **3** Defective power supply. | Please contact your Agilent service representative. |

## UV Ignition Failed

**Error ID: 7452**

The UV lamp failed to ignite.

The processor monitors the UV lamp current during the ignition cycle. If the lamp current does not rise above the lower limit within 2 – 5 seconds, the error message is generated.

| Probable cause | Suggested actions |
|---|---|
| **1** Lamp too hot. Hot gas discharge lamps may not ignite as easily as cold lamps. | Switch off the lamp and allow it to cool down for at least 15 minutes. |
| **2** Lamp disconnected. | Ensure the lamp is connected. |
| **3** Defective UV lamp or non-Agilent lamp. | Exchange the UV lamp. |
| **4** Defective detector main board. | Please contact your Agilent service representative. |
| **5** Defective power supply. | Please contact your Agilent service representative. |

# UV Heater Current

**Error ID: 7453**

The UV lamp heater current is missing.

During UV lamp ignition, the processor monitors the heater current. If the current does not rise above the lower limit within one second, the error message is generated.

| Probable cause | Suggested actions |
| --- | --- |
| 1 Lamp disconnected. | Ensure the UV lamp is connected. |
| 2 Ignition started without the top foam in place. | Please contact your Agilent service representative. |
| 3 Defective UV lamp or non-Agilent lamp. | Exchange the UV lamp. |
| 4 Defective detector main board. | Please contact your Agilent service representative. |
| 5 Defective power supply. | Please contact your Agilent service representative. |

# Calibration Values Invalid

**Error ID: 1036**

The calibration values read from the spectrometer ROM are invalid.

After recalibration, the calibration values are stored in ROM. The processor periodically checks if the calibration data are valid. If the data are invalid or cannot be read from the spectrometer ROM, the error message is generated.

| Probable cause | Suggested actions |
| --- | --- |
| 1 Defective connector or cable. | Please contact your Agilent service representative. |
| 2 Defective PDA/optical unit. | Please contact your Agilent service representative. |

## Holmium Oxide Test Failed

| Probable cause | Suggested actions |
|---|---|
| **1** Lamps switched off. | Ensure the lamps are switched on. |
| **2** Defective or dirty flow cell. | Ensure the flow cell is inserted correctly, and is free from contamination (cell windows, buffers etc.). |
| **3** Defective filter assembly. | Please contact your Agilent service representative. |
| **4** Defective achromat assembly. | Please contact your Agilent service representative. |
| **5** Defective PDA/optical unit. | Please contact your Agilent service representative. |

## Illegal Temperature Value from Sensor on Main Board

**Error ID: 1071**

This temperature sensor (located on the detector main board) delivered a value outside the allowed range. The parameter of this event equals the measured temperature in 1/100 centigrade. As a result the temperature control is switched off.

| Probable cause | Suggested actions |
|---|---|
| **1** Defective sensor or main board. | Please contact your Agilent service representative. |
| **2** Detector is exposed to illegal ambient conditions. | Verify that the ambient conditions are within the allowed range. |

## Illegal Temperature Value from Sensor at Air Inlet

**Error ID: 1072**

This temperature sensor delivered a value outside the allowed range. The parameter of this event equals the measured temperature in 1/100 centigrade. As a result the temperature control is switched off.

| Probable cause | Suggested actions |
|---|---|
| **1** The temperature sensor is defect. | • Replace the cable to the main board.<br>• Please contact your Agilent service representative. |
| **2** Detector is exposed to illegal ambient conditions. | Verify that the ambient conditions are within the allowed range. |

## Wavelength Recalibration Lost

**Error ID: 1037**

The calibration information needed for your detector to operate correctly has been lost.

During calibration of the detector the calibration values are stored in ROM. If no data is available in the spectrometer ROM, the error message is generated.

| Probable cause | Suggested actions |
|---|---|
| **1** The detector is new. | Recalibrate the detector. |
| **2** The detector has been repaired. | Please contact your Agilent service representative. |

## Heater at fan assembly failed

**Error ID: 1073**

Every time the deuterium lamp or the tungsten lamp (DAD only) is switched on or off a heater self-test is performed. If the test fails an error event is created. As a result the temperature control is switched off.

| Probable cause | Suggested actions |
| --- | --- |
| **1** Defective connector or cable. | Please contact your Agilent service representative. |
| **2** Defective heater. | Please contact your Agilent service representative. |

## Heater Power At Limit

**Error ID: 1074**

The available power of the heater reached either the upper or lower limit. This event is sent only once per run. The parameter determines which limit has been hit:

0 means upper power limit hit (excessive ambient temperature drop).

1 means lower power limit hit (excessive ambient temperature increase).

| Probable cause | Suggested actions |
| --- | --- |
| **1** Excessive ambient temperature change. | Wait until temperature control equilibrates. |

## DSP Not Running

This error message comes up when the communication between the optical unit and the main board has a problem.

| Probable cause | Suggested actions |
|---|---|
| 1 Random communication error. | • Switch the detector off and on again at the power switch. If the error reoccurs:<br>• Please contact your Agilent service representative. |
| 2 Defective detector main board. | Please contact your Agilent service representative. |
| 3 Defective PDA/optical unit. | Please contact your Agilent service representative. |

## No Run Data Available In Device

In a very rare case the capacity of the CompactFlash Card is not sufficient. This could happen for example when the interrupt of LAN communication takes longer and the detector uses special settings (e.g full data rate at 80 Hz plus full spectra plus all signals) during data buffering.

| Probable cause | Suggested actions |
|---|---|
| 1 CompactFlash Card is full. | • Correct communication problem.<br>• Reduce data rate. |

## Instrument Logbook

| | | | |
|---|---|---|---|
| Method | | Instrument run started | 09:44:46 11/20/05 |
| 1200 DAD | 1 | Power on | 10:07:24 11/20/05 |
| 1200 DAD | 1 | UV-lamp on | 10:07:24 11/20/05 |
| 1200 DAD | 1 | Vis-lamp on | 10:07:24 11/20/05 |
| 1200 DAD | 1 | No Run data available in device! | 10:07:24 11/20/05 |
| CP Macro | | Analyzing rawdata SHORT_02.D | 10:07:25 11/20/05 |
| Method | | Instrument Error - Method/Sequence stopped | 10:07:25 11/20/05 |
| Method | | Method aborted | 10:09:52 11/20/05 |

**Figure 45** Instrument Logbook

**NOTE** The logbook does not indicate a communication loss (power fail). It just shows the recovering (Power on, Lamps on).

# 8
# Test Functions



This chapter describes the detector’s built in test functions.

# Self-test

The DAD self-test (see Figure 46 on page 144) runs a series of individual tests, and evaluates the results automatically. The following tests are run:

- Filter Test
- Slit Test
- Dark Current Test
- Intensity Test
- Wavelength Calibration Test
- Holmium Test
- Spectral Flatness Test
- ASTM Noise Test (optional)

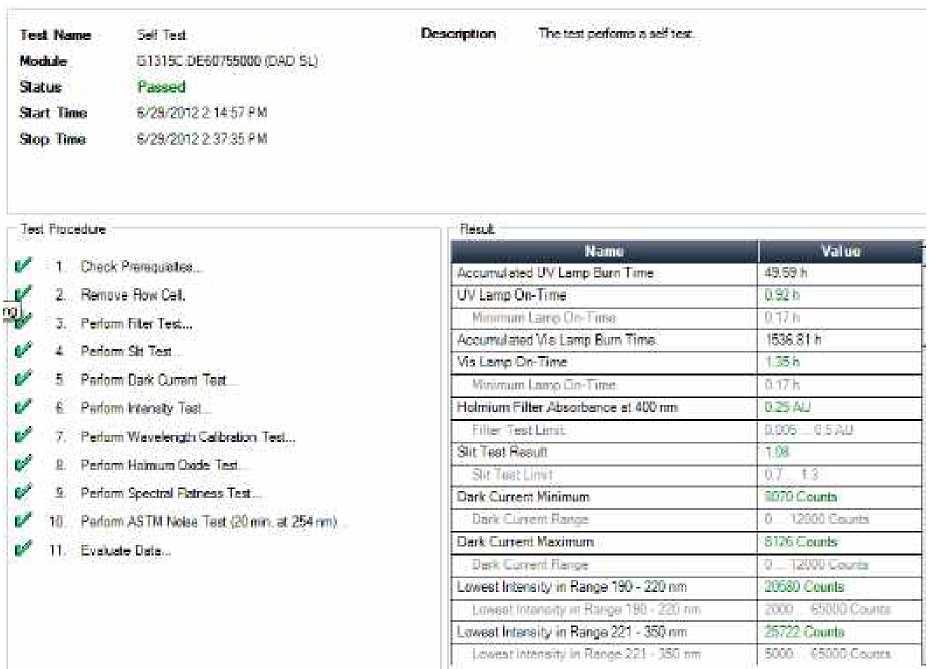



**Figure 46** Self-test

For details refer to the individual tests on the following pages.

# Filter Test

The filter test checks the correct operation of the filter assembly. When the test is started, the holmium oxide filter is moved into position. During filter movement, the absorbance signal is monitored. As the edge of the filter passes through the light path, an absorbance maximum is seen. Once the filter is in position, the absorbance maximum (of holmium oxide) is determined. Finally, the filter is moved out of the light path. During movement, an additional absorbance maximum is expected as the edge of the filter passes through the light path. The test passes successfully, if the two maxima resulting from the edge of the filter assembly (during filter movement) are seen, and the absorbance maximum of holmium oxide is within the limits.

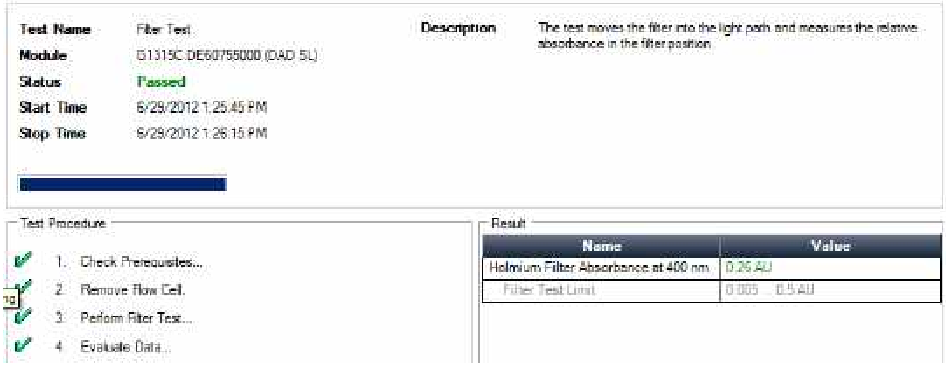



**Figure 47** Filter Test

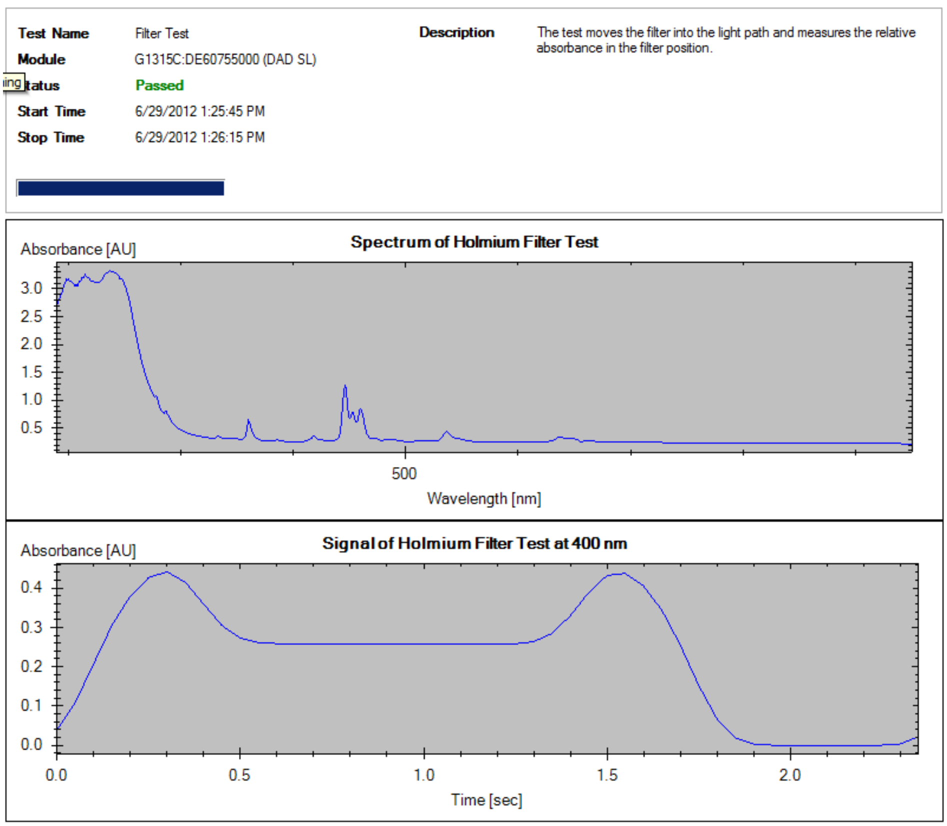



**Figure 48** Filter Test (Signals)

# Test Evaluation

## Filter Test Failed

### `Test Failed`

| Probable cause | Suggested actions |
|---|---|
| 1 Filter assembly (lever and filter) not installed. | Install the filter assembly. |
| 2 Defective filter motor. | Please contact your Agilent service representative. |

### `Holmium Oxide Maximum out of Limits`

| Probable cause | Suggested actions |
|---|---|
| 1 Holmium oxide filter not installed. | Install the holmium oxide filter. |
| 2 Dirty or contaminated filter. | Exchange the holmium oxide filter. |

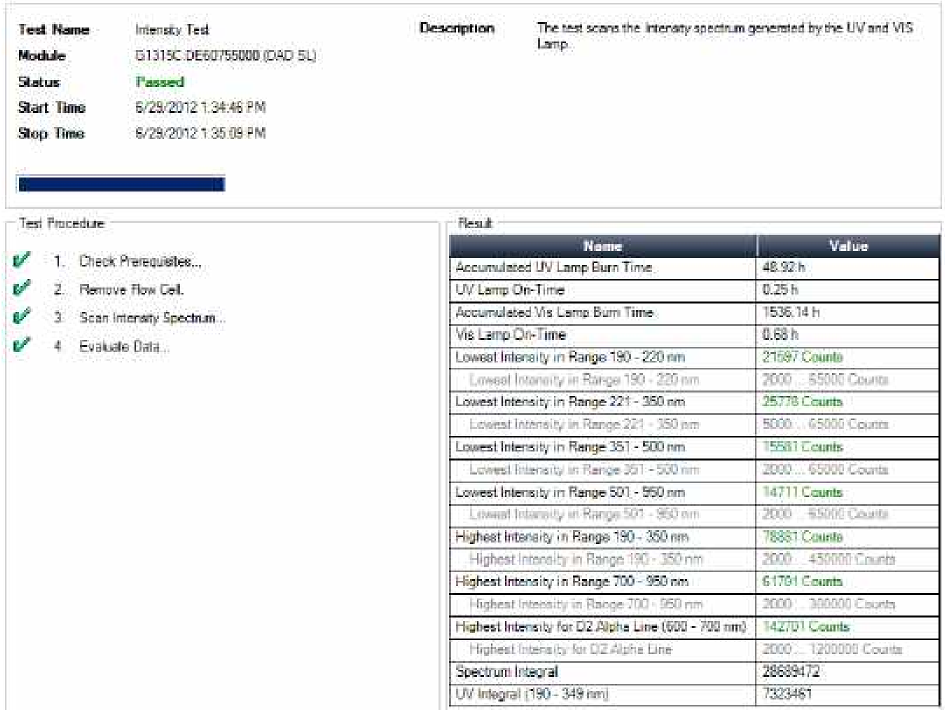
# Intensity Test

**NOTE** The test is for the standard flow cells (10 mm and 6 mm pathlength) only. The nano-flow cells (80 nL and 500 nL) cannot be run with this test due to its low volume.

The intensity test measures the intensity of the deuterium and tungsten lamps over the full wavelength range (190 – 950 nm). Four spectral ranges are used to evaluate the intensity spectrum. The test is used to determine the performance of the lamps and optics (see also "Cell Test" on page 156). When the test is started, the 1-nm slit is moved into the light path automatically, and the gain is set to zero. To eliminate effects due to absorbing solvents, the test should be done with water in the flow cell. The shape of the intensity spectrum is primarily dependent on the lamp, grating, and diode array characteristics. Therefore, intensity spectra will differ slightly between instruments. Figure 49 on page 149 shows a typical intensity test spectrum.

## Test Evaluation

The Agilent Lab Advisor, ChemStation and Instant Pilot evaluate four spectral ranges automatically, and display the limits for each range, the measured intensity counts, and *passed* or *failed* for each spectral range (see Figure 49 on page 149).



| | | | |
|---|---|---|---|
| **Test Name** | Intensity Test | **Description** | The test scans the intensity spectrum generated by the UV and VIS Lamp. |
| **Module** | G1315C:DE60755000 (DAD SL) | | |
| **Status** | Passed | | |
| **Start Time** | 6/29/2012 1:34:46 PM | | |
| **Stop Time** | 6/29/2012 1:35:09 PM | | |

Test Procedure

1. Check Prerequisites...
2. Remove Flow Cell.
3. Scan Intensity Spectrum...
4. Evaluate Data...

Result

| Name | Value |
|---|---|
| Accumulated UV Lamp Burn Time | 48.92 h |
| UV Lamp On-Time | 0.25 h |
| Accumulated Vis Lamp Burn Time | 1536.14 h |
| Vis Lamp On-Time | 0.68 h |
| Lowest Intensity in Range 190 - 220 nm | 21597 Counts |
| Lowest Intensity in Range 190 - 220 nm | 2000 ... 65000 Counts |
| Lowest Intensity in Range 221 - 350 nm | 25778 Counts |
| Lowest Intensity in Range 221 - 350 nm | 5000 ... 65000 Counts |
| Lowest Intensity in Range 351 - 500 nm | 15581 Counts |
| Lowest Intensity in Range 351 - 500 nm | 2000 ... 65000 Counts |
| Lowest Intensity in Range 501 - 950 nm | 14711 Counts |
| Lowest Intensity in Range 501 - 950 nm | 2000 ... 65000 Counts |
| Highest Intensity in Range 190 - 350 nm | 78851 Counts |
| Highest Intensity in Range 190 - 350 nm | 2000 ... 450000 Counts |
| Highest Intensity in Range 700 - 950 nm | 61781 Counts |
| Highest Intensity in Range 700 - 950 nm | 2000 ... 300000 Counts |
| Highest Intensity for D2 Alpha Line (600 - 700 nm) | 142701 Counts |
| Highest Intensity for D2 Alpha Line | 2000 ... 1200000 Counts |
| Spectrum Integral | 28689472 |
| UV Integral (190 - 349 nm) | 7323461 |

**Figure 49** Intensity Test

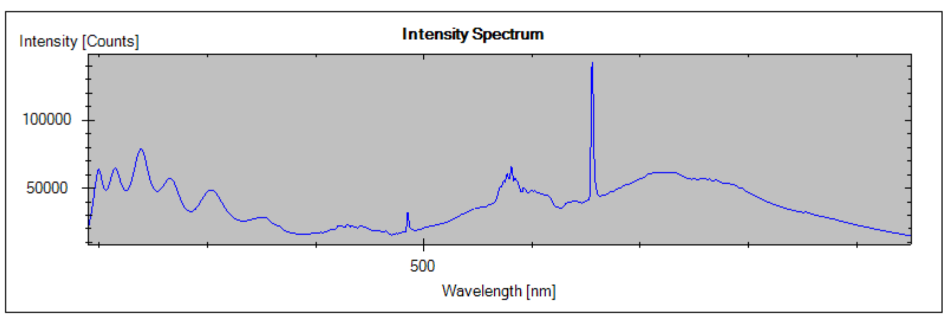



**Figure 50** Intensity Test (Signal)

In case of low counts in one or more ranges, start the testing with the comparison of values with flow cell vs. flow cell removed.

Contaminations of the cell windows and/or the lenses (there are 3 between vis-lamp and flow cell), will reduce the light throughput.

If the detector fails in the range 501 nm - 950 nm, check

- is the VIS-lamp ON? If not, turn it on.
- is VIS-lamp glass bulb blackended or broken? If yes, replace VIS-lamp.
- does the UV-lamp show a reflective coating towards the VIS-lamp? If yes, replace UV-lamp.

Example (measured without flow cell):

| | |
|---|---|
| VIS-LAMP OFF or defect: | 110 counts |
| VIS-LAMP ON and OK: | 13613 counts |

### Test Failed

| Probable cause | Suggested actions |
|---|---|
| **1** Absorbing solvent or air bubble in flow cell. | Ensure the flow cell is filled with water, and free from air bubbles. |
| **2** Dirty or contaminated flow cell. | Run the cell test (see “Cell Test” on page 156). If the test fails, exchange the flow cell windows. |
| **3** Dirty or contaminated optical components (achromat, windows). | Clean optical components with alcohol and lint-free cloth or replace the parts. |
| **4** Old or non-Agilent lamp. | Exchange the lamp. |

**NOTE**

If the lamp fails in a single range there might be no reason to change the lamp if the application is not run in that specific range.

Redo the test with removed flow cell. If the counts increase drastically (more than a factor of 2, then flow cell components are contaminated and may require maintenance/service.

If the intervals of lamp replacements are getting shorter, the Agilent service should check the optical unit for contaminated components in the light path (coupling lens, source lens, cell support assembly and flow cell windows).

# Holmium Oxide Test

The holmium oxide test uses characteristic absorbance maxima of the built-in holmium oxide filter to verify wavelength accuracy (see also "Wavelength Verification and Calibration" on page 160). When the test is started, the 1-nm slit is moved into the light path automatically. To eliminate effects due to absorbing solvents, the test should be done with water in the flow cell or with removed flow cell.

NOTE

See also "Declaration of Conformity for HOX2 Filter" on page 301.

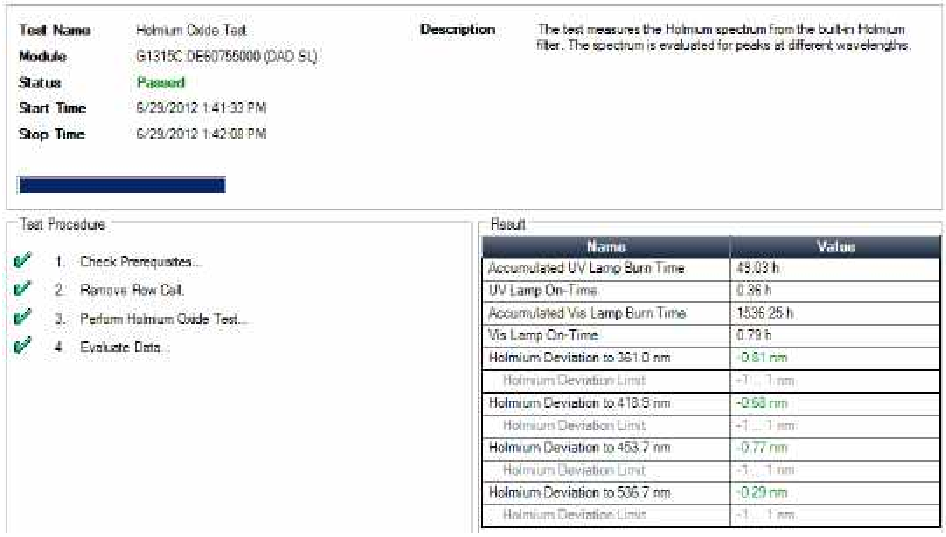
## Test Evaluation

### Holmium Oxide Test Evaluation

Limits:

| | |
|---|---|
| 361.0 nm | 360.0 - 362.0 nm (± 1nm) |
| 418.9 nm | 417.9 - 419.9 nm (± 1nm) (not with ChemStation) |
| 453.7 nm | 452.7 - 454.7 nm (± 1nm) |
| 536.7 nm | 535.7 - 537.7 nm (± 1nm) |

The test is evaluated by the instrument, and the measured maxima are displayed automatically. The test fails if one or more of the maxima lies outside of the limits (see Figure 51 on page 152).



| | |
|---|---|
| Test Name | Holmium Oxide Test |
| Module | G1315C DE60755000 (DAD SL) |
| Status | Passed |
| Start Time | 6/29/2012 1:41:33 PM |
| Stop Time | 6/29/2012 1:42:08 PM |

Description: The test measures the Holmium spectrum from the built-in Holmium filter. The spectrum is evaluated for peaks at different wavelengths.

Test Procedure

1. Check Prerequisites...
2. Remove Flow Cell.
3. Perform Holmium Oxide Test...
4. Evaluate Data...

Result

| Name | Value |
|---|---|
| Accumulated UV Lamp Burn Time | 49.03 h |
| UV Lamp On-Time | 0.36 h |
| Accumulated Vis Lamp Burn Time | 1536.25 h |
| Vis Lamp On-Time | 0.79 h |
| Holmium Deviation to 361.0 nm | -0.81 nm |
| Holmium Deviation Limit | -1 ... 1 nm |
| Holmium Deviation to 418.9 nm | -0.68 nm |
| Holmium Deviation Limit | -1 ... 1 nm |
| Holmium Deviation to 453.7 nm | -0.77 nm |
| Holmium Deviation Limit | -1 ... 1 nm |
| Holmium Deviation to 536.7 nm | -0.29 nm |
| Holmium Deviation Limit | -1 ... 1 nm |

**Figure 51** Holmium Oxide Test

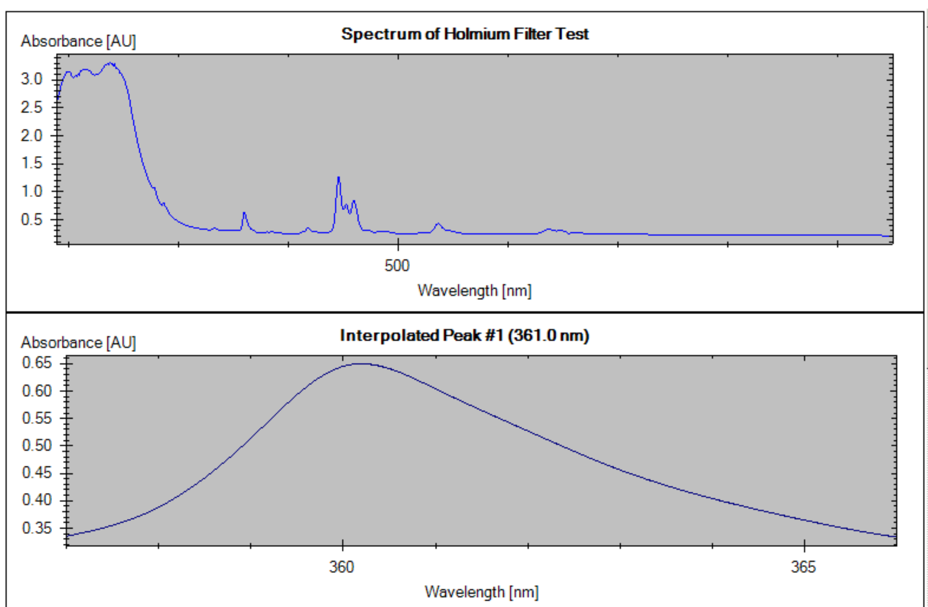



**Figure 52** Holmium Oxide Test (Signal)

### Test Failed

| Probable cause | Suggested actions |
|---|---|
| **1** Absorbing solvent or air bubble in flow cell. | Ensure the flow cell is filled with water. |
| **2** Incorrect calibration | Recalibrate (see “Wavelength Verification and Calibration” on page 160) and repeat the test. |
| **3** Dirty or contaminated flow cell. | Run the cell test (see “Cell Test” on page 156). If the test fails, exchange the flow cell windows. |
| **4** Dirty or contaminated optical components (achromat, windows). | Clean optical components with alcohol and lint-free cloth or replace the parts (see “Intensity Test” on page 148). |
| **5** Old or non-Agilent lamp. | Exchange the UV lamp. |

# ASTM Drift and Noise Test

The ASTM noise test determines the detector noise over a period of 20 minutes. The test is done with the flowcell removed, so the test results are not influenced by solvent or pump effects. On completion of the test, the noise result is displayed automatically.

## Test Evaluation

Limit is ± 0.02 mAU

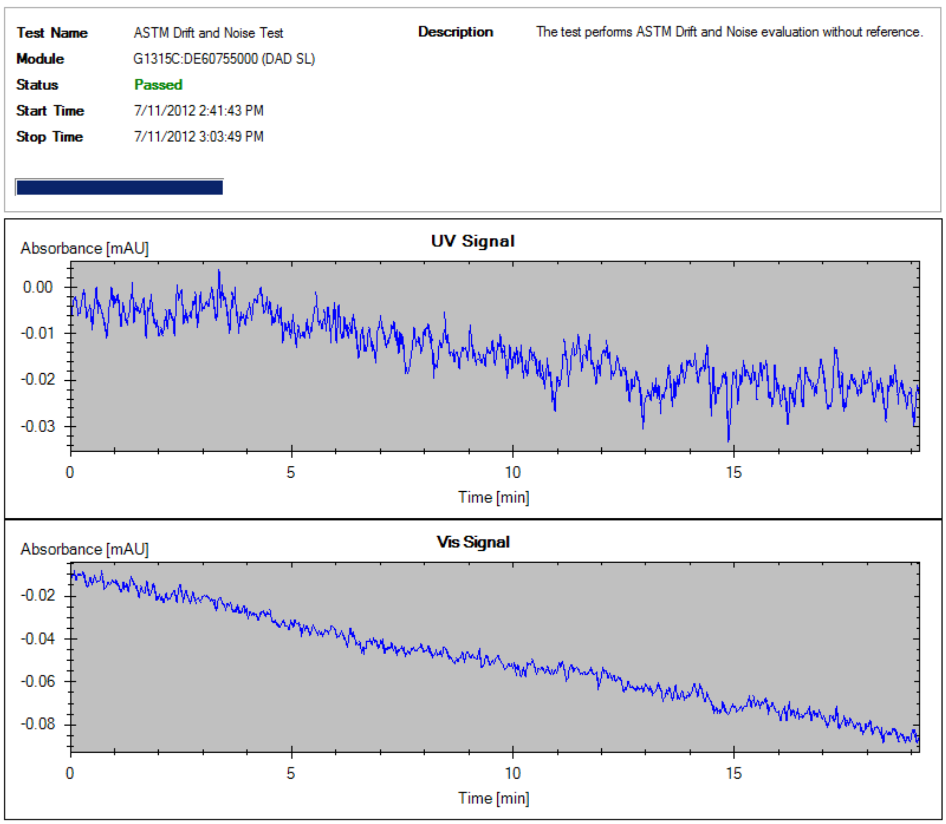



**Figure 53** ASTM Drift and Noise Test

`Test Failed`

| Probable cause | Suggested actions |
| --- | --- |
| **1** Insufficient lamp warm-up time | Allow lamp to warm-up for at least 1 hour. |
| **2** Old or non-Agilent lamp. | Exchange the lamp. |

# Cell Test

The cell test measures the intensity of the deuterium and tungsten lamps over the full wavelength range (190 – 950 nm), once with the flow cell installed, and once with the flow cell removed. The resulting intensity ratio is a measure of the amount of light absorbed by the flow cell. The test can be used to check for dirty or contaminated flow cell windows. When the test is started, the 1-nm slit is moved into the light path automatically, and the gain is set to zero. To eliminate effects due to absorbing solvents, the test should be done with water in the flow cell.

**NOTE** This test should be performed inititially with a new detector/flow cell. The values should be kept for later reference/comparison.

## Test Evaluation

### Cell Test Evaluation

The Agilent ChemStation calculates the intensity ratio automatically. The intensity ratio (typically between 0.5 and 0.7 for new standard flow cells and 0.1 to 0.3 for new mico- and high pressure cells) is dependent on the degree of contamination of the flow cell windows, and on the type of flow cell used.

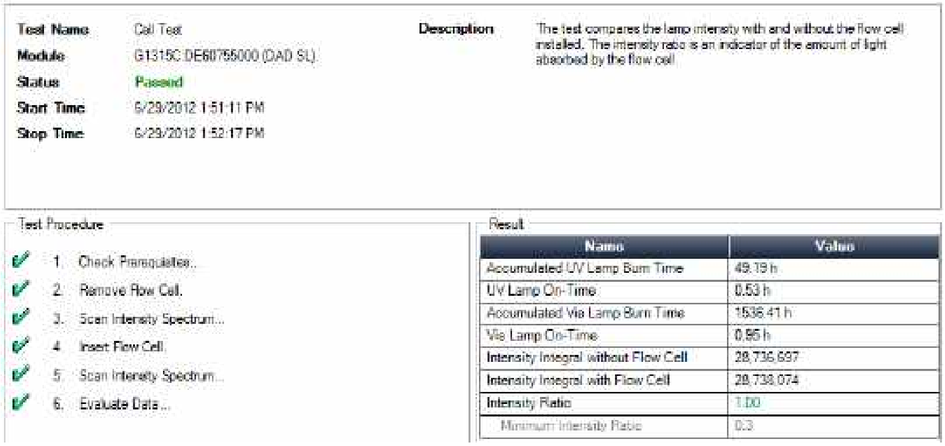



**Figure 54** Cell Test

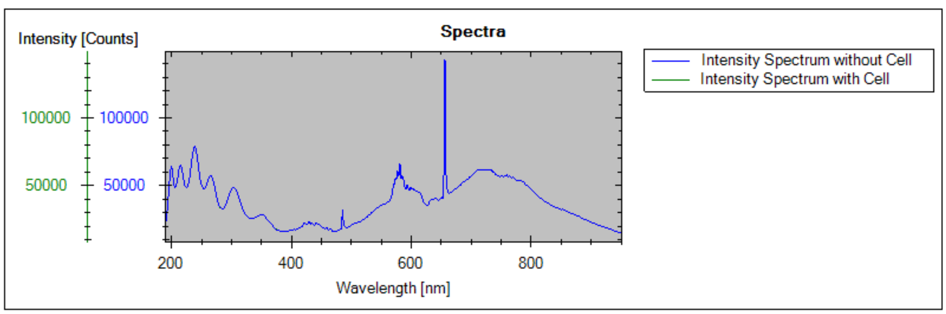



**Figure 55** Cell Test (Signals)

**NOTE** This test can be used for the standard flow cells only. The nano flow cells will give very low values due to their design.

### `Test Failed (low ratio value)`

| Probable cause | Suggested actions |
| --- | --- |
| **1** Absorbing solvent or air bubble in flow cell. | Ensure the flow cell is filled with water, and free from air bubbles. |
| **2** Dirty or contaminated flow cell. | Exchange the flow cell windows. |

# Using the Built-in Test Chromatogram

This function is available from the Agilent ChemStation, Lab Advisor and Instant Pilot.

The built-in Test Chromatogram can be used to check the signal path from the detector to the data system and the data analysis or via the analog output to the integrator or data system. The chromatogram is continuously repeated until a stop is executed either by means of a stop time or manually.

**NOTE** The peak height is always the same but the area and the retention time depend on the set peakwidth, see example below.

## Procedure Using the Agilent Lab Advisor

This procedure works for all Agilent 1200 Infinity detectors (DAD, MWD, VWD, FLD and RID). The example figure is from the RID detector.

1 Assure that the default LC method is loaded via the control software.
2 Start the Agilent Lab Advisor software (B.01.03 SP4 or later) and open the detector's **Tools** selection.
3 Open the test chromatogram screen


4 Turn the **Test Chromatogram** on.
5 Change to the detector's **Module Service Center** and add the detector signal to the Signal Plot window.

**6** To start a test chromatogram enter in the command line: STRT

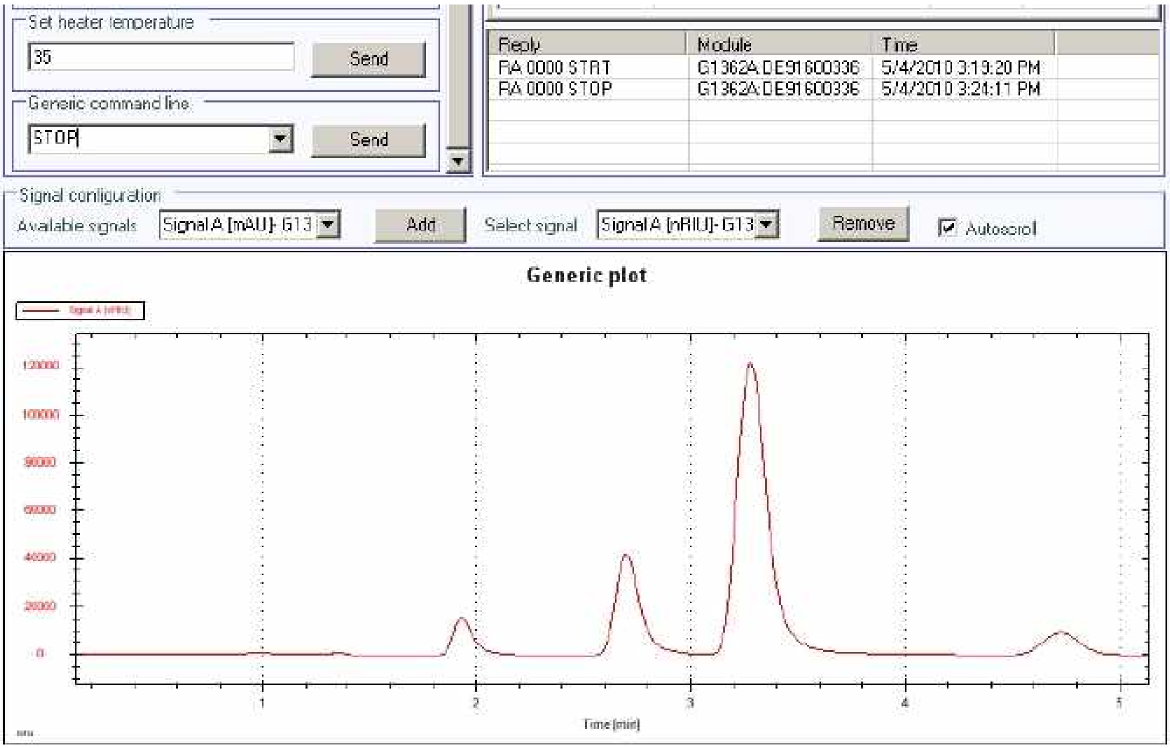



**Figure 56** Test Chromatogram with Agilent Lab Advisor

**7** To stop the test chromatogram enter in the command line: STOP

**NOTE** The test chromatogram is switched off automatically at the end of a run.

# Wavelength Verification and Calibration

The detector uses the alpha (656.1 nm) and beta (486 nm) emission lines of the deuterium lamp for wavelength calibration. The sharp emission lines enable more accurate calibration than is possible with holmium oxide. When verification is started, the 1-nm slit is moved into the light path automatically, and the gain is set to zero. To eliminate effects due to absorbing solvents, the test should be done with bubble free degassed HPLC water in the flow cell.

If a deviation is found and displayed, it can be recalibrated by pressing Adjust. The deviations are tracked in the Calibration History (diagnosis buffer in the detector).

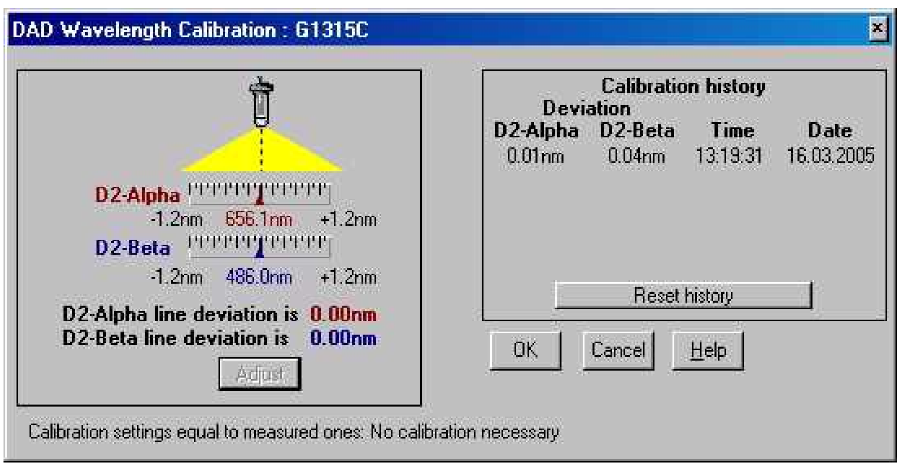



**Figure 57** Wavelength Verification and Calibration

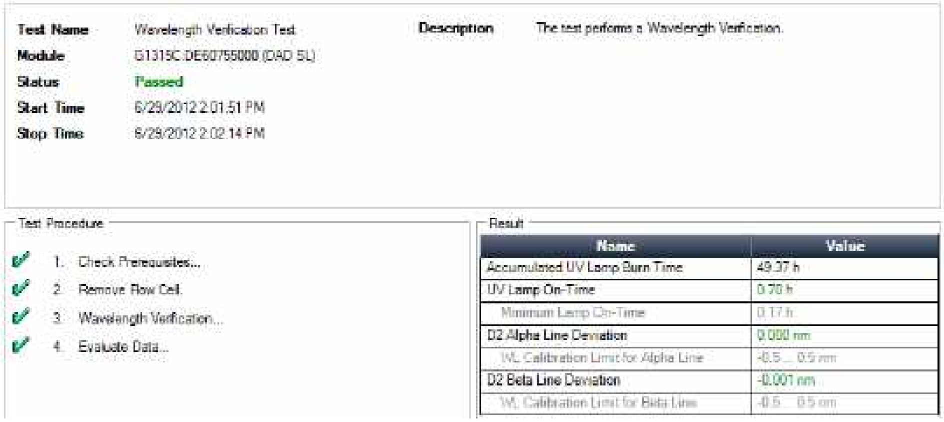



**Figure 58** Wavelength Verification

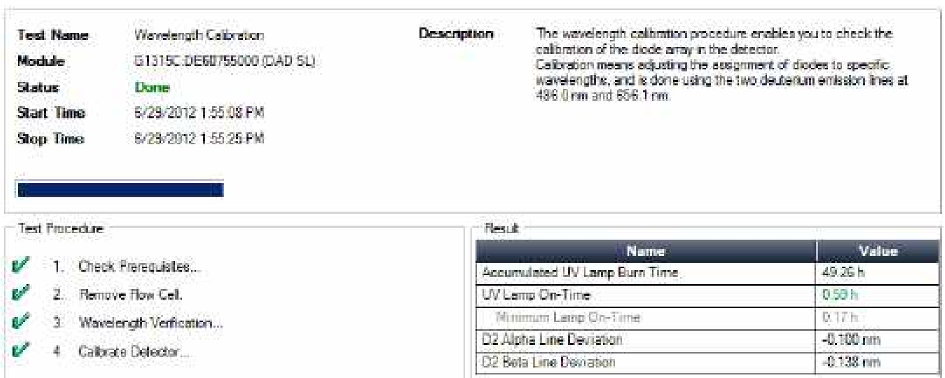



**Figure 59** Wavelength Calibration

Wavelength calibration should be done

- after maintenance of the flow cell,
- lamp exchange, or
- after a major repair, like processor board or optical unit exchange, see also "Replacing the Module's Firmware" on page 203.

After calibration, the holmium oxide test (see Figure 51 on page 152) provides verification of wavelength accuracy at three additional wavelengths.

# 9
# Maintenance



This chapter describes the maintenance of the detector.

# Introduction to Maintenance

The module is designed for easy maintenance. Maintenance can be done from the front with module in place in the system stack.

**NOTE**

There are no serviceable parts inside.

Do not open the module.

# Cautions and Warnings

**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** **Eye damage by detector light**

**Eye damage may result from directly viewing the UV-light produced by the lamp of the optical system used in this product.**

- → Always turn the lamp of the optical system off before removing it.

**WARNING** **Electrical shock**

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

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

**WARNING**

**Personal injury or damage to the product**

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

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

**CAUTION**

Safety standards for external equipment

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

# Overview of Maintenance

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

**Table 19** Overview of Maintenance

| Procedure | Typical Frequency | Notes |
|---|---|---|
| Cleaning of module | If required. | |
| Deuterium lamp or tungsten lamp exchange | If noise and/or drift exceeds your application limits or lamp does not ignite. | An intensity test should be performed after replacement. |
| Flow cell exchange | If application requires a different flow cell type. | A holmium or wavelength calibration test should be performed after replacement. |
| Flow cell parts Cleaning or exchange | If leaking or if intensity drops due to contaminated flow cell windows. | A pressure tightness test should be done after repair. |
| Holmium oxide filter Cleaning or exchange | If contaminated. | A holmium or wavelength calibration test should be performed after replacement. |
| Leak sensor drying | If leak has occurred. | Check for leaks. |
| Leak handling System replacement | If broken or corroded. | Check for leaks. |

# Cleaning the Module

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

**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.

# Exchanging a Lamp

**When** If noise or drift exceeds application limits or lamp does not ignite

**Tools required**

| Description |
| --- |
| Screwdriver, Pozidriv #1 PT3 |

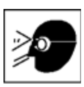
**Parts required**

| # | p/n | Description |
| --- | --- | --- |
| 1 | 2140-0820 | Longlife Deuterium lamp “C“ (with black cover and RFID tag) |
| 1 | G1103-60001 | Tungsten lamp |

**Preparations** Turn the lamp(s) off.

**WARNING**

**Eye damage by detector light**



**Eye damage may result from directly viewing the light produced by the deuterium lamp used in this product.**

→ Always turn the deuterium lamp off before removing it.

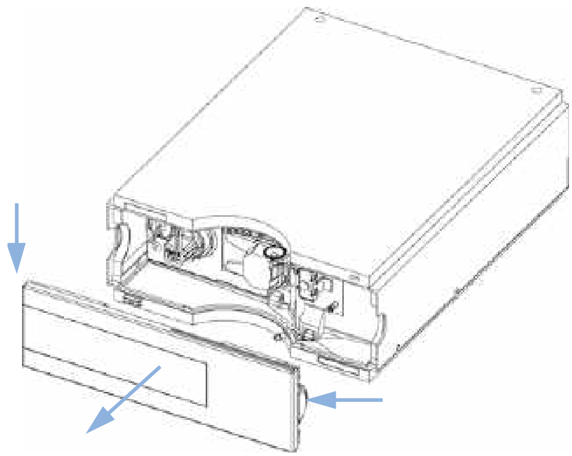
**WARNING**

**Injury by touching hot lamp**

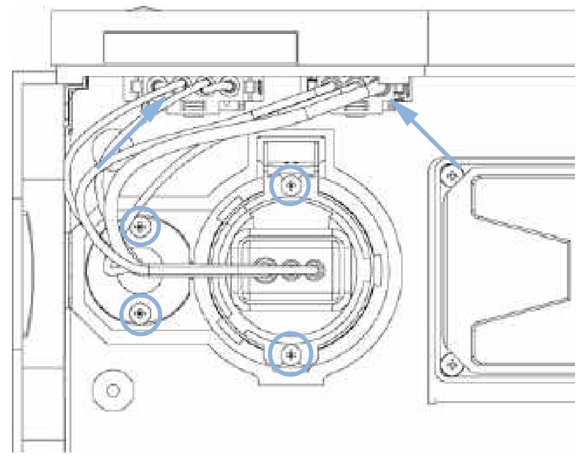
**If the detector has been in use, the lamp may be hot.**

→ If so, wait for lamp to cool down.

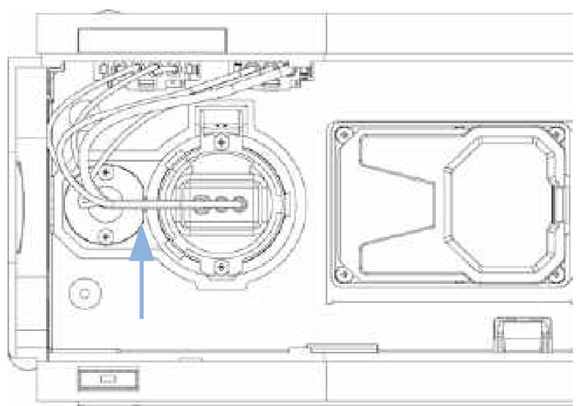
1 Press the release buttons and remove the front cover to gain access to the flow cell area.



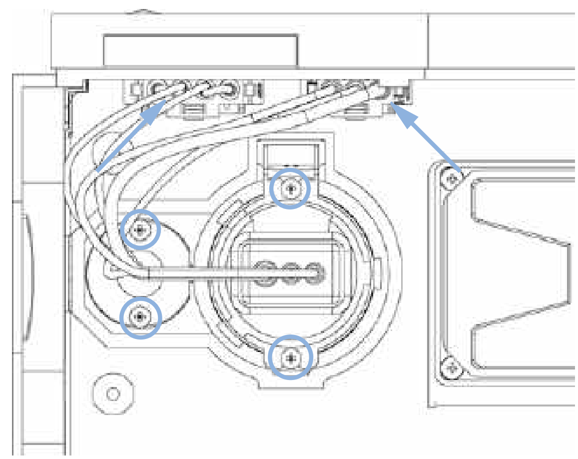
2 Disconnect lamp from the connector, unscrew the Vis-lamp (left) and/or UV-lamp (right) and remove the lamp. Do not touch the glass bulb with your fingers.

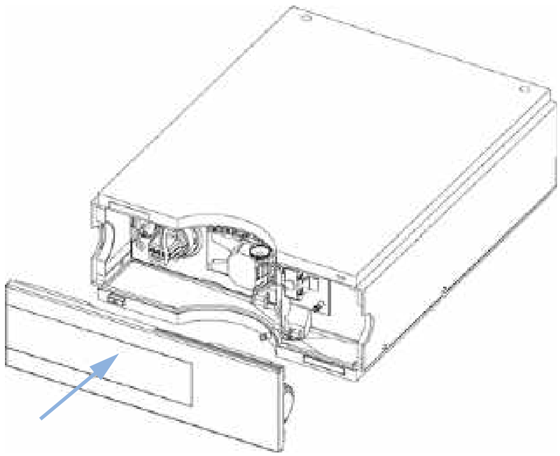


3 When replacing the Vis-lamp, assure that the Vis-lamp is inserted as shown (flat edge towards the deuterium lamp).



4 Insert the lamp. Fix the screws and reconnect the lamp to connector.



| | |
|---|---|
| **5** Replace the front cover.  | **Next Steps:**<br><br>**6** Reset the lamp counter as described in the user interface documentation (lamps with I.D. tag cannot be reset).<br><br>**7** Turn the lamp on and give the lamp 10 minutes to warm up.<br><br>**8** Perform a "Wavelength Verification and Calibration" on page 160 or a "Holmium Oxide Test" on page 151 to check the correct positioning of the UV-lamp.<br><br>**9** Perform an "Intensity Test" on page 148. |

# Exchanging a Flow Cell

BIO inert — For bio-inert modules use bio-inert parts only!

**When** If an application needs a different type of flow cell or the flow cell needs repair.

**Tools required**

| | p/n | Description |
|---|---|---|
| | | Wrench, 1/4 inch<br>for capillary connections |
| OR | 5043-0915 | Fitting mounting tool<br>for bio-inert capillaries |

**Parts required**

| # | p/n | Description |
|---|---|---|
| 1 | G1315-60022 | Standard flow cell, 10 mm, 13 µL, 120 bar (12 MPa) |
| 1 | G1315-60025 | Semi-micro flow cell, 6 mm, 5 µL, 120 bar (12 MPa) |
| 1 | G1315-60024 | Micro flow cell, 3 mm, 2 µL, 120 bar (12 MPa) |
| 1 | G1315-60015 | High pressure flow cell, 6 mm, 1.7 µL, 400 bar (40 MPa) |
| 1 | | Nano flow cell, refer to "Nano Flow Cell - Replacing or Cleaning" on page 192 |
| 1 | G5615-60022 | Standard flow cell bio-inert, 10 mm, 13 µL, 120 bar (12 MPa) for MWD/DAD, includes Capillary Kit Flow Cells BIO (p/n G5615-68755) |

**Preparations** Turn the lamp(s) off.

Remove the front cover.

**CAUTION**

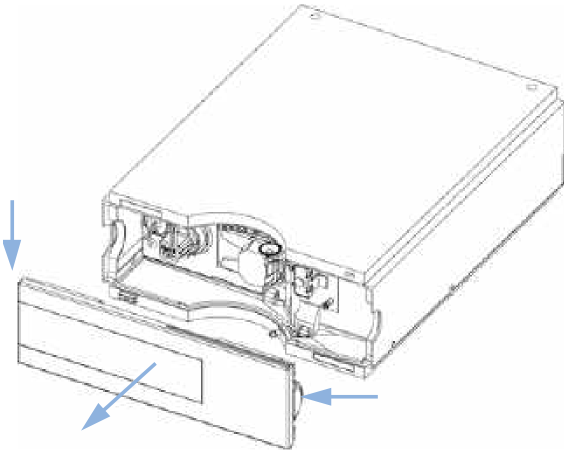
Sample degradation and contamination of the instrument

Metal parts in the flow path can interact with the bio-molecules in the sample leading to sample degradation and contamination.

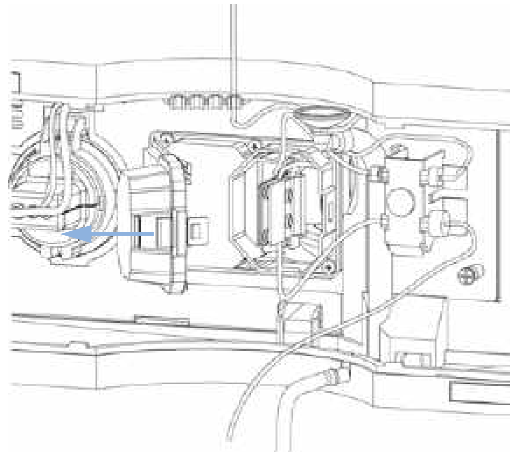
→ For bio-inert applications, always use dedicated bio-inert parts, which can be identified by the bio-inert symbol or other markers described in this manual.

→ Do not mix bio-inert and non-inert modules or parts in a bio-inert system.

**1** Press the release buttons and remove the front cover to gain access to the flow cell area.



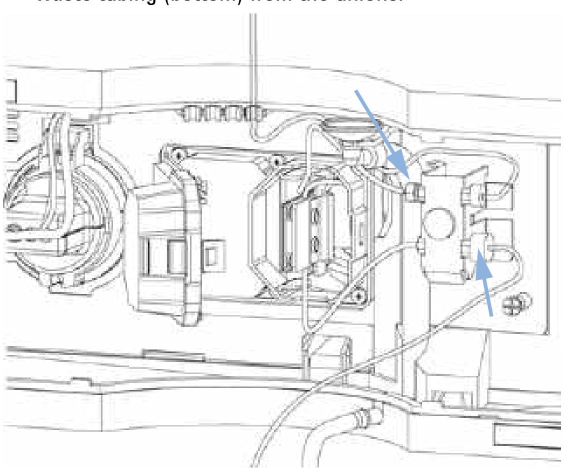
**2** Open the flow cell cover.



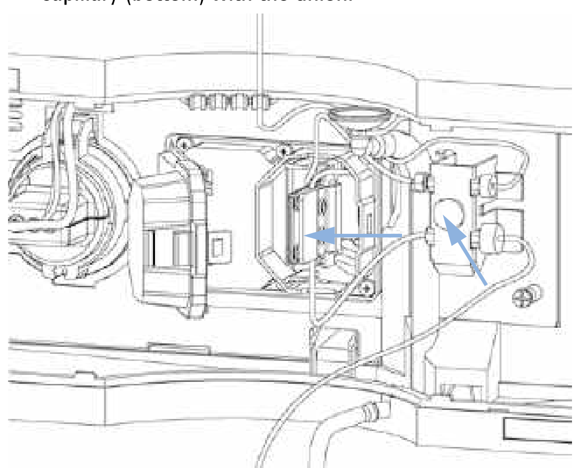
**NOTE**

Depending on the system setup, the inlet capillary might be routed directly from the module above or below to the cell and not to the capillary holder.

**3** Disconnect the flow cell inlet capillary (top) and the waste tubing (bottom) from the unions.

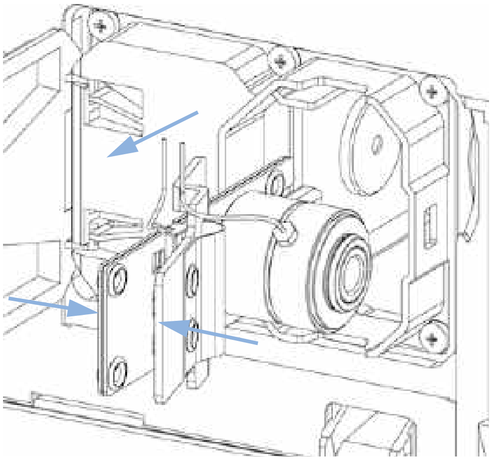


**4** Loosen the thumb screw and remove the flow cell outlet capillary (bottom) with the union.



<table>
<tr>
<td>

**5** Remove the flow cell while pressing the flow cell holder.



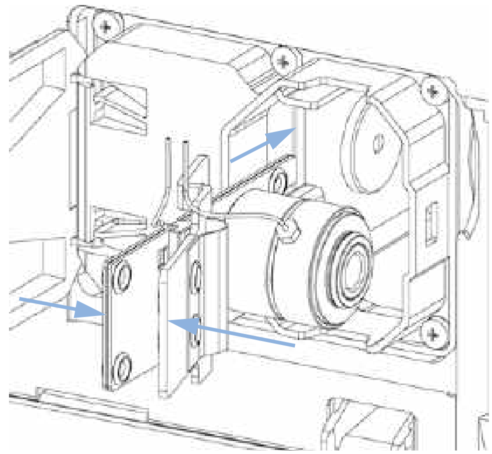
**NOTE**

The label attached to the flow cell provides information on part number, path length, volume and maximum pressure.

If you want to replace flow cell parts, "Maintenance of Standard, Semi-Micro or Micro Flow Cell" on page 176 or "Maintenance of High Pressure Flow Cell" on page 180.

</td>
<td>

**6** Insert the flow cell while pressing the flow cell holder.



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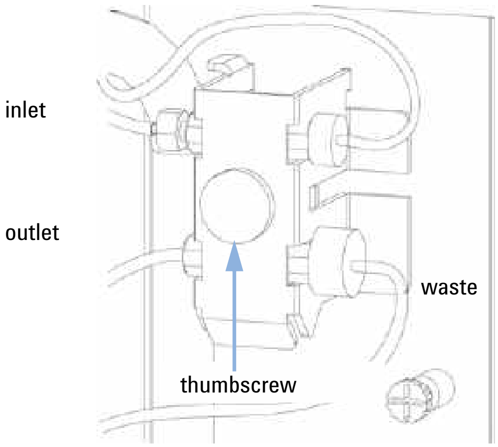
</table>

| | |
|---|---|
| **7** Insert the flow cell capillaries into the union holder (top is inlet, bottom is outlet). Tighten the thumb screw and Reconnect the waste tubing (bottom) to the union.   **NOTE** To check for leaks, establish a flow and observe the flow cell (outside of the cell compartment) and all capillary connections. | **Next Steps:** **8** Perform a "Wavelength Verification and Calibration" on page 160 or a "Holmium Oxide Test" on page 151 to check the correct positioning of the flow cell. **9** Replace the front cover. |

# Maintenance of Standard, Semi-Micro or Micro Flow Cell

BIO inert — For bio-inert modules use bio-inert parts only!

**When** If the flow cell needs repair due to leaks or contaminations (reduced light throughput)

| **Tools required** | **p/n** | **Description** |
|---|---|---|
| | | Wrench, 1/4 inch<br>for capillary connections |
| OR | 5043-0915 | Fitting mounting tool<br>for bio-inert capillaries |
| | | Hexagonal key, 4 mm (supplied in HPLC Tool-Kit) |
| | | Toothpick |

**Parts required** **Description**

For parts, see "Standard Flow Cell" on page 208, "Semi-Micro Flow Cell Parts" on page 212, "Micro Flow Cell" on page 214.

**Preparations**

Turn the flow off.

Remove the front cover.

Remove the flow cell, see "Exchanging a Flow Cell" on page 172.

**NOTE** The gaskets used in the standard and semi-micro/micro flow cell are different.

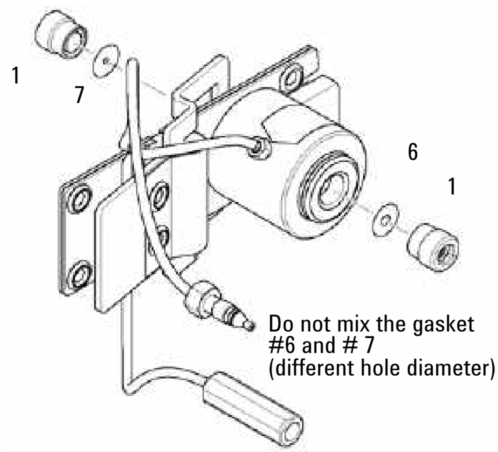
**CAUTION** Sample degradation and contamination of the instrument

Metal parts in the flow path can interact with the bio-molecules in the sample leading to sample degradation and contamination.

→ For bio-inert applications, always use dedicated bio-inert parts, which can be identified by the bio-inert symbol or other markers described in this manual.

→ Do not mix bio-inert and non-inert modules or parts in a bio-inert system.

**1** Use a 4 mm hex key to unscrew the window assembly [1] and remove the gasket [2] from the cell body.




**NOTE**

Carefully take one of the gaskets (#6 back or # 7 front) and insert it into the cell body.

Do not mix the gasket #6 and # 7.

Gasket # 7 has the smaller hole and must be on the light entrance side.

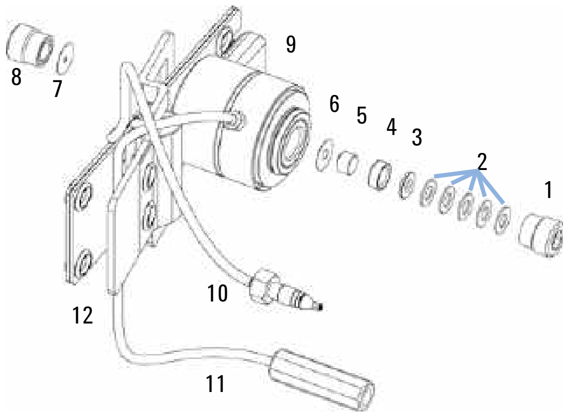
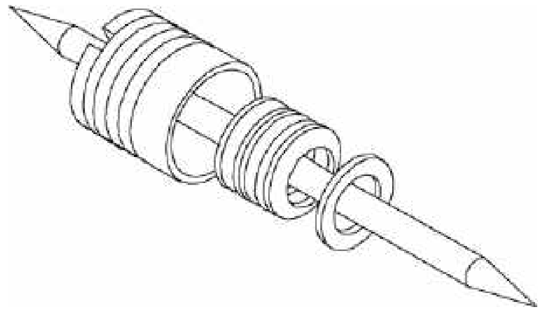
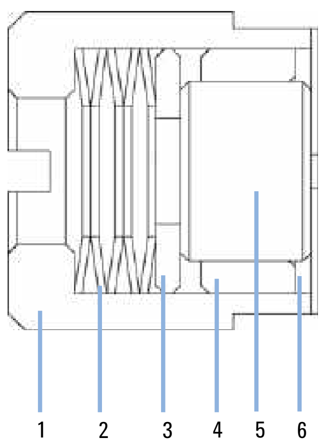
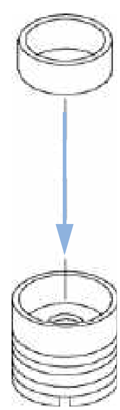
Verify that the gasket is positioned flat on the bottom and the light path is not blocked.

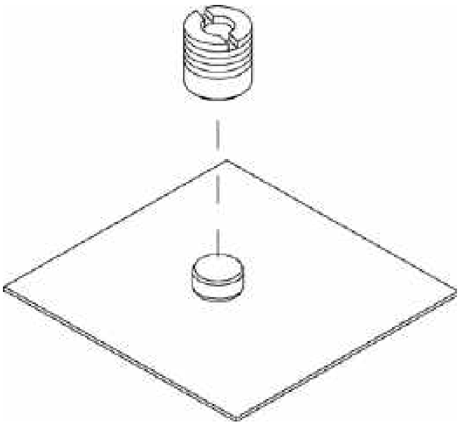
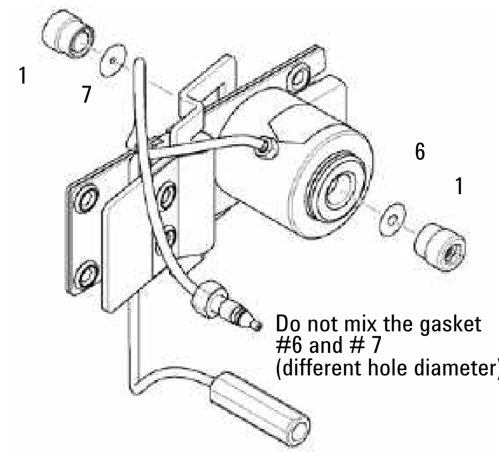
If you removed all individual parts from the window assembly refer to the figures in "Standard Flow Cell" on page 208 for the correct orientation of the parts.

**2** Use a tooth pick to remove the quartz window from the window assembly.

**NOTE**

If the washers fall out of the window assembly, they must be inserted in the correct order with the PTFE ring to prevent any leaks from the flow cell window.

| | |
|---|---|
| **3** Orientation of Flow Cell Parts ("Standard Flow Cell" on page 208)   **NOTE** Gaskets # 6 and #7 have different hole diameters. | **4** Assemble the washers and the window assembly in correct order.  |
| **5** Correct orientation of spring washers [2] is required.   | **6** Press the PTFE ring into the window assembly.  |

| | |
|---|---|
| **7** Press the window assembly onto the new or cleaned quartz window.  | **8** Insert the window assembly [1] into the cell body.   |

**Next Steps:**

**9** Using a 4-mm hex key, tighten the window screw hand tight plus a quarter turn.

**10** Reconnect the capillaries, see “Exchanging a Flow Cell” on page 172.

**11** Perform a leak test.

**12** Insert the flow cell.

**13** Replace the front cover

**14** Perform a “Wavelength Verification and Calibration” on page 160 or a “Holmium Oxide Test” on page 151 to check the correct positioning of the flow cell.

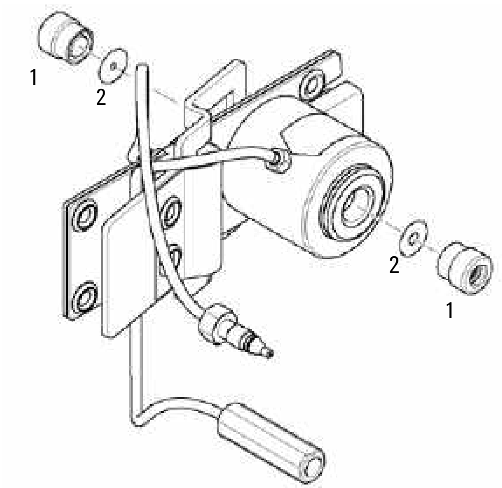
# Maintenance of High Pressure Flow Cell

| | |
|---|---|
| **When** | If the flow cell needs repair due to leaks or contaminations (reduced light throughput) |
| **Tools required** | **Description**<br>1/4 inch wrench for capillary connections<br>hexagonal key 4 mm<br>Tooth picks |
| **Parts required** | **Description**<br>For parts see “High Pressure Flow Cell” on page 224 |
| **Preparations** | • Turn the flow off.<br>• Remove the front cover.<br>• Remove the flow cell, see “Exchanging a Flow Cell” on page 172. |

**NOTE**

All descriptions in this procedure are based on the default orientation of the cell (as it is manufactured). The heat exchanger/capillary and the cell body can be fixed mirror symmetrically to have both capillaries routed to the bottom or to the top (depending on the routing of the capillaries to the column).

**1** Use a 4 mm hex key to unscrew the window assembly [1] and remove the gasket [2] from the cell body.

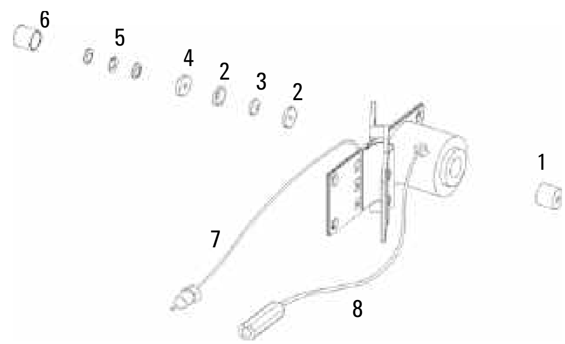



If you want to replace the gasket only, continue with step 8, “Maintenance of Standard, Semi-Micro or Micro Flow Cell” on page 176.

**2** Use a tooth pick to remove the quartz window from the window assembly.

**NOTE**

If the washers fall out of the window assembly, they must be inserted in the correct order with the PTFE ring to prevent any leaks from the flow cell window.




**3** Follow the procedure “Maintenance of Standard, Semi-Micro or Micro Flow Cell” on page 176 for reassembling.

# Replacing Capillaries on a Standard Flow Cell

BIO inert For bio-inert modules use bio-inert parts only!

| | | |
|---|---|---|
| **When** | If the capillary is blocked | |
| **Tools required** | **p/n** | **Description** |
| | | Wrench, 1/4 inch<br>for capillary connections |
| OR | 5043-0915 | Fitting mounting tool<br>for bio-inert capillaries |
| | | Wrench, 4 mm<br>(for capillary connections) |
| | | Screwdriver, Pozidriv #1 PT3 |
| **Parts required** | **Description** | |
| | For parts see “Standard Flow Cell” on page 208. | |
| **Preparations** | Turn the lamp(s) off. | |
| | Remove the front cover. | |
| | Remove the flow cell, see “Exchanging a Flow Cell” on page 172. | |

**NOTE** All descriptions in this procedure are based on the default orientation of the cell (as it is manufactured). The heat exchanger/capillary and the cell body can be fixed mirror symmetrically to have both capillaries routed to the bottom or to the top (depending on the routing of the capillaries to the column).

**NOTE** The fittings at the flow cell body are special types for low dead volumes and not compatible with other fittings.

When retightening the fittings, make sure that they are carefully tightened (handtight plus 1/4 turn with a wrench). Otherwise damage of the flow cell body or blockage may result.

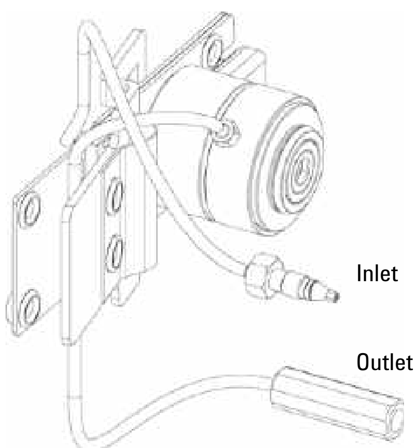
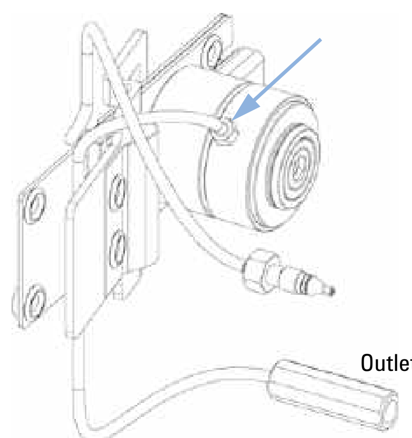
**CAUTION**

Sample degradation and contamination of the instrument

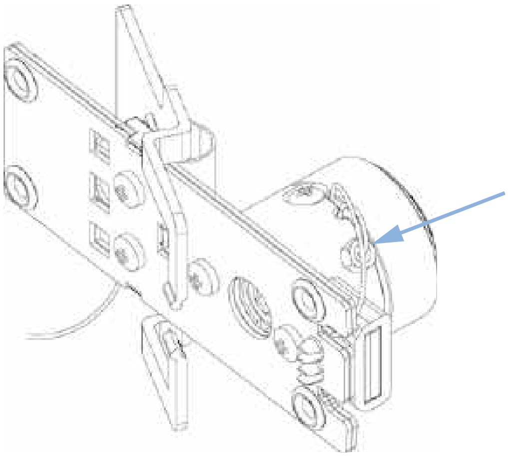
Metal parts in the flow path can interact with the bio-molecules in the sample leading to sample degradation and contamination.

→ For bio-inert applications, always use dedicated bio-inert parts, which can be identified by the bio-inert symbol or other markers described in this manual.

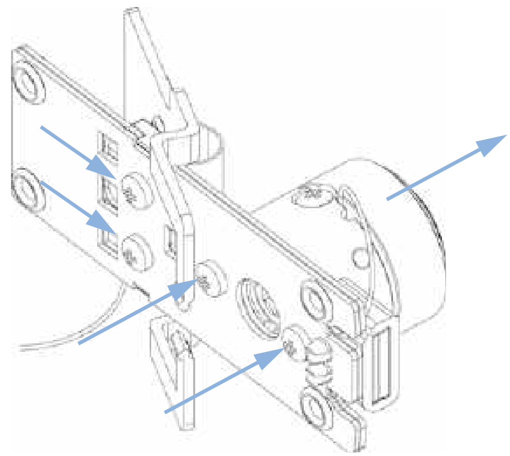
→ Do not mix bio-inert and non-inert modules or parts in a bio-inert system.

| | |
|---|---|
| **1** Identify the inlet and outlet capillaries. To replace the inlet capillary, continue with step *"To replace the inlet capillary, use a 4-mm wrench for the fitting."*   | **2** After replacing the outlet capillary, fix it handtight first. Then do a 1/4 turn with a 4-mm wrench.   |

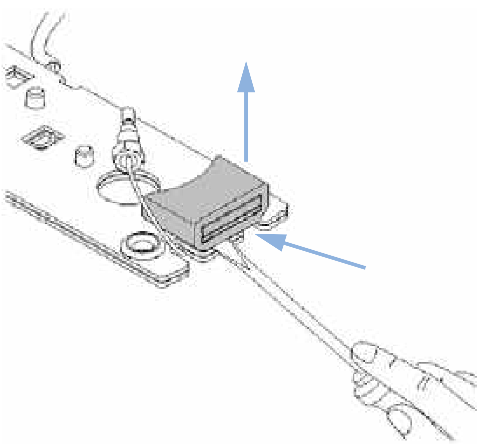
**3** To replace the inlet capillary, use a 4-mm wrench for the fitting.



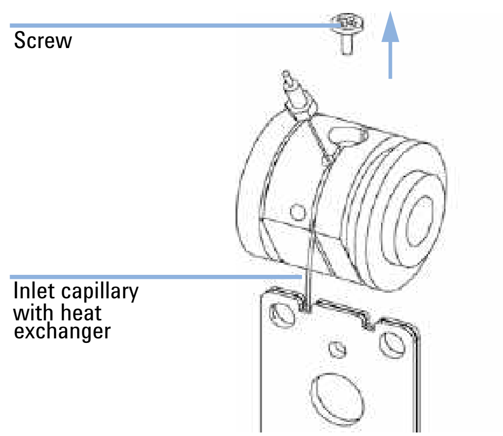
**4** Unscrew the cell body from the heat exchanger and the heat exchanger from the clamp unit.



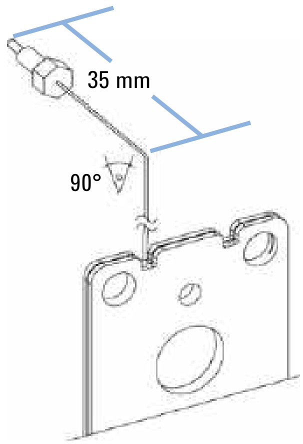
**5** Use a small flat screw driver to carefully lift off the I.D. tag. Shown is the default orientation. See Note at the beginning of this section.



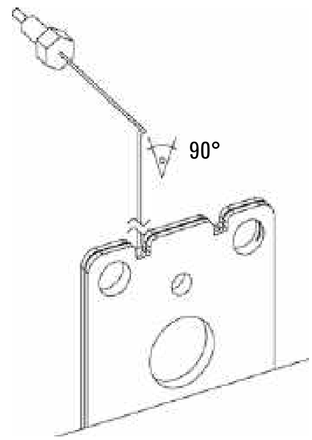
**6** Unscrew the fixing screw and unwrap the inlet capillary from the grove in the flow cell body.



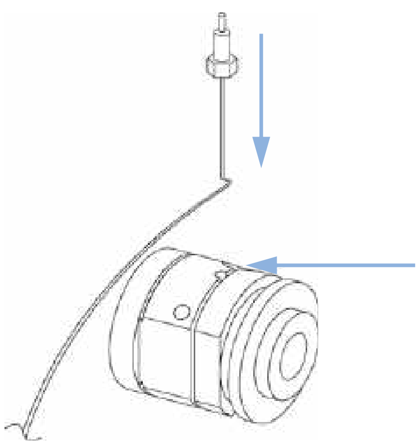
**7** Take the new inlet capillary and bend it 90° about 35 mm from its end.



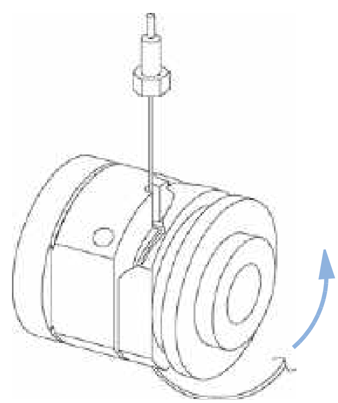

**8** Bend the capillary again by 90° as shown below.



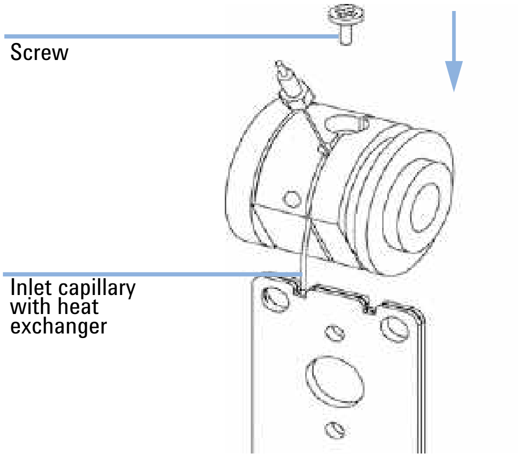

**9** Insert the capillary into the hole between fixing screw and the inlet fitting.



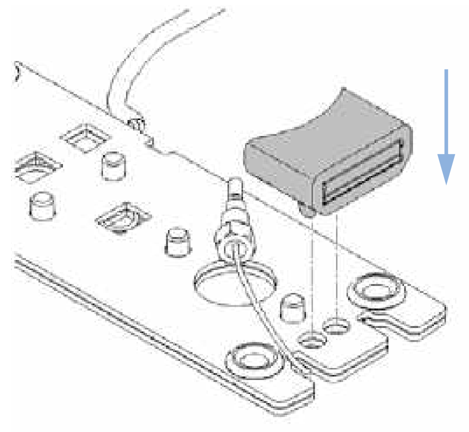
**10** The capillary lays in the grove and should be tied around the body (in the grove) 5 times.



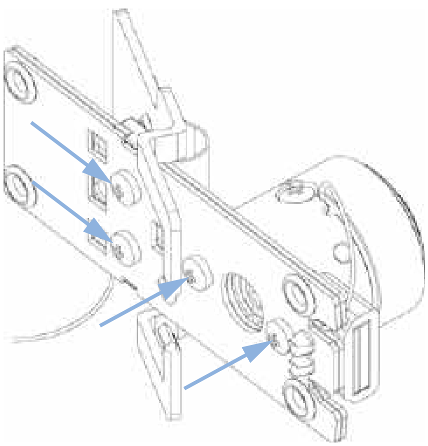
**11** Insert the fixing screw, so that the capillary cannot leave the grove.



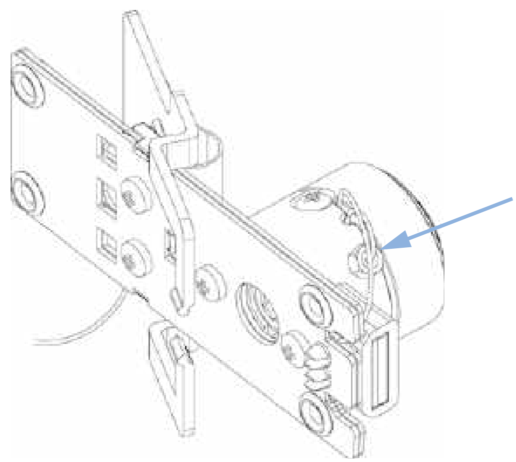

**12** Carefully insert the I.D. tag into the new heat exchanger. Shown is the default orientation. See Note at the beginning of this section.



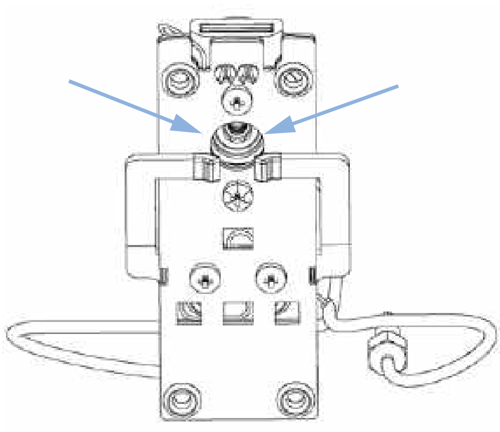
**13** Fix the heat exchanger to the clamp unit and the flow cell body to the heat exchanger.



**14** Fix the inlet capillary to the flow cell body handtight first. Then do a 1/4 turn with a 4-mm wrench.



**15** Check for a centered holder vs. hole. If required adjust with the holder screws.



**Next Steps:**

**16** Reconnect the capillaries, see "Exchanging a Flow Cell" on page 172.

**17** Perform a leak test.

**18** Insert the flow cell.

**19** Replace the front cover.

**20** Perform a "Wavelength Verification and Calibration" on page 160 or a "Holmium Oxide Test" on page 151 to check the correct positioning of the flow cell.

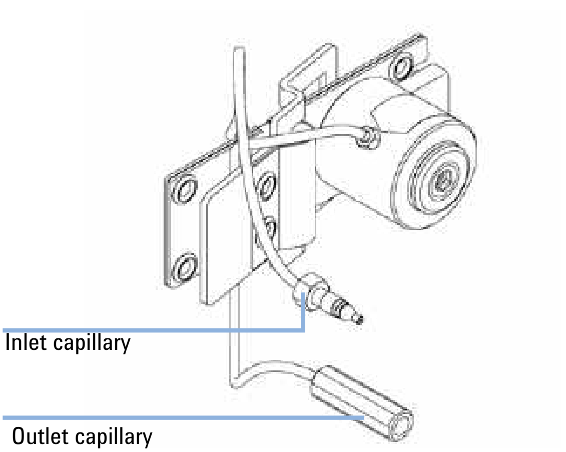
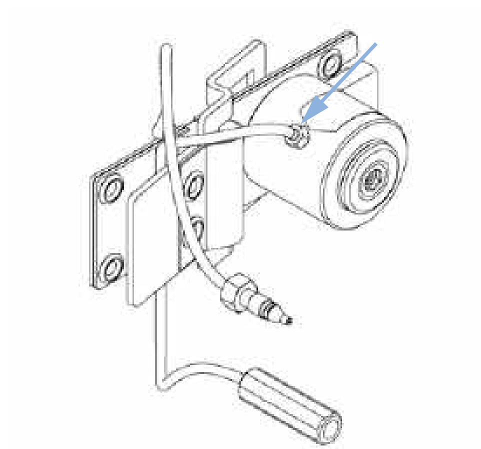
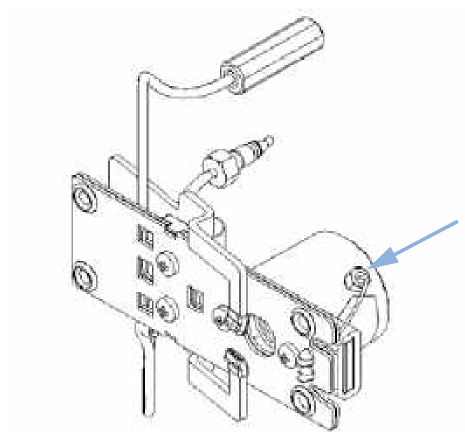
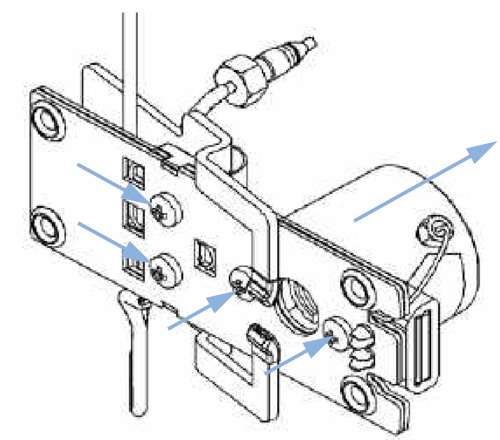
# Replacing Capillaries on a Semi-Micro and Micro Flow Cell

| | |
|---|---|
| **When** | If the capillary is blocked |
| **Tools required** | **Description**<br>Wrench, 1/4 inch<br>for capillary connections<br>Wrench, 4 mm<br>(for capillary connections)<br>Screwdriver, Pozidriv #1 PT3 |
| **Parts required** | **Description**<br>For parts see “Semi-Micro Flow Cell Parts” on page 212 or “Micro Flow Cell” on page 214. |
| **Preparations** | Turn the lamp(s) off.<br>Remove the front cover.<br>Remove the flow cell, “Exchanging a Flow Cell” on page 172. |

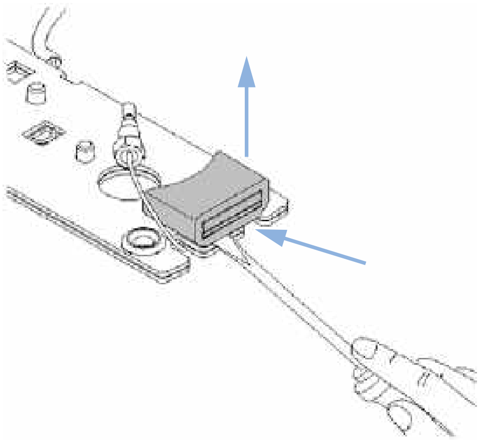
**NOTE** All descriptions in this procedure are based on the default orientation of the cell (as it is manufactured). The heat exchanger/capillary and the cell body can be fixed mirror symmetrically to have both capillaries routed to the bottom or to the top (depending on the routing of the capillaries to the column).

**NOTE** The fittings at the flow cell body are special types for low dead volumes and not compatible with other fittings.

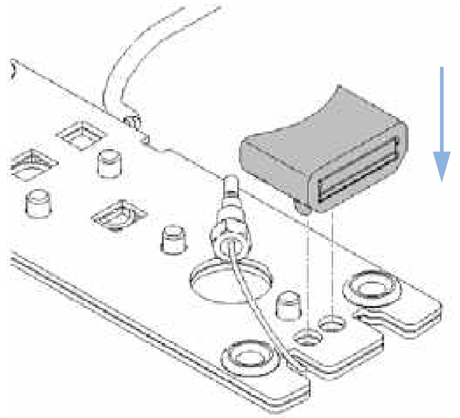
When retightening the fittings, make sure that they are carefully tightened (handtight plus 1/4 turn with a wrench). Otherwise damage of the flow cell body or blockage may result.

| | |
|---|---|
| **1** Identify the inlet and outlet capillaries.<br><br> | **2** After replacing the outlet capillary, fix it handtight first. Then do a 1/4 turn with a 4-mm wrench.<br> |
| **3** To replace the inlet capillary, use a 4-mm wrench for the fitting.<br> | **4** Unscrew the cell body from the heat exchanger and the heat exchanger from the clamp unit.<br> |

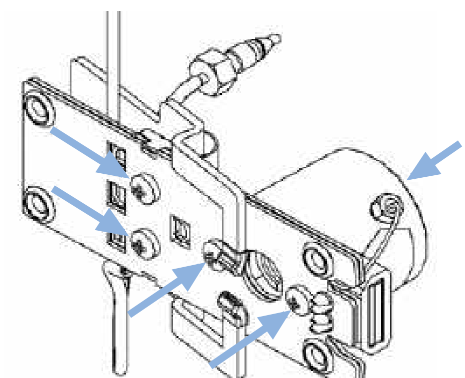
5 Use a small flat screw driver to carefully lift off the I.D. tag. Shown is the default orientation. See Note at the beginning of this section.



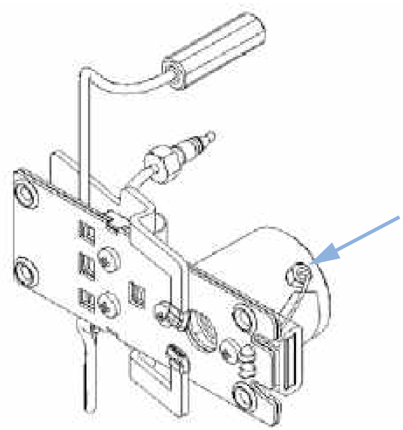
6 Carefully insert the I.D. tag into the new heat exchanger. Shown is the default orientation. See Note at the beginning of this section.

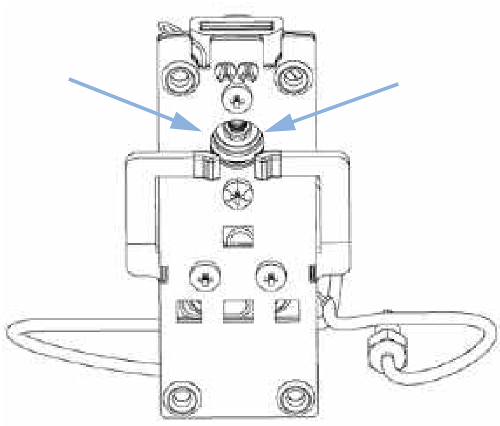


7 Fix the new heat exchanger to the clamp unit and the heat exchanger to the cell body.



8 Fix the inlet capillary to the flow cell body handtight first. Then do a 1/4 turn with a 4-mm wrench.



| | |
|---|---|
| **9** Check for a centered holder vs. hole. If required adjust with the holder screws.<br> | **Next Steps:**<br>**10** Reconnect the capillaries, see “Exchanging a Flow Cell” on page 172.<br>**11** Perform a leak test.<br>**12** Insert the flow cell.<br>**13** Replace the front cover.<br>**14** Perform a “Wavelength Verification and Calibration” on page 160 or a “Holmium Oxide Test” on page 151 to check the correct positioning of the flow cell. |

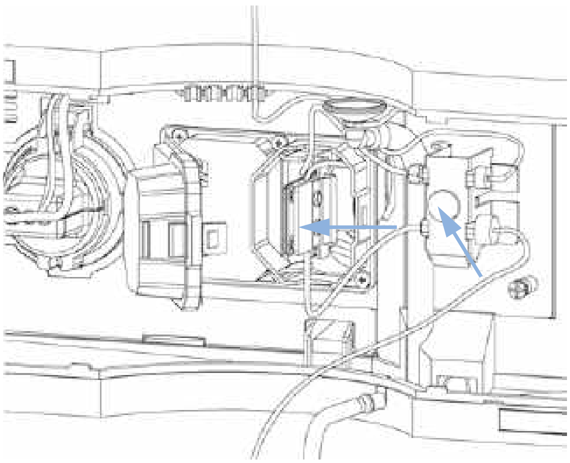
# Nano Flow Cell - Replacing or Cleaning

| | |
|---|---|
| **When** | If parts are contaminated or leaky. |
| **Tools required** | **Description** |
| | Screwdriver, Pozidriv #1 PT3 |
| | Wrench, 1/4 inch<br>for capillary connections |
| **Parts required** | **Description** |
| | For parts identification refer to "Nano Flow Cells" on page 220 (80 nL and 500 nL). |
| **Preparations** | Turn the lamp(s) off. |
| | Remove the front cover. |
| | Remove the flow cell, see "Exchanging a Flow Cell" on page 172. |

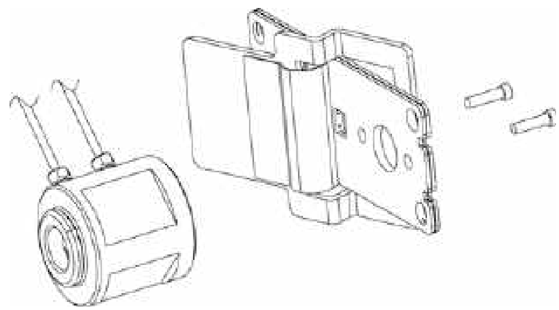
**NOTE** For details refer to the technical note that comes with the nano-flow cell kit.

**NOTE** The quartz block can be cleaned with alcohol. DO NOT touch the inlet and outlet windows at the quartz block.

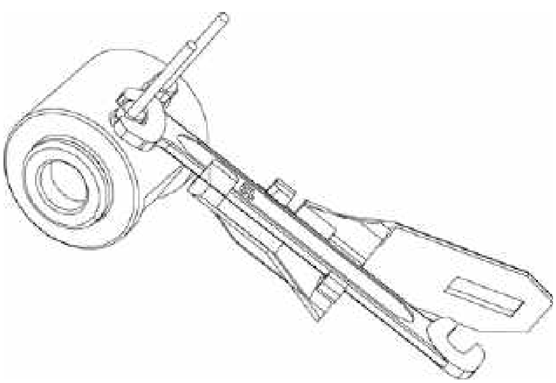
**1** Disconnect the capillaries from the capillary holder and remove the flow cell.



**2** Unscrew the cell body from the holder.

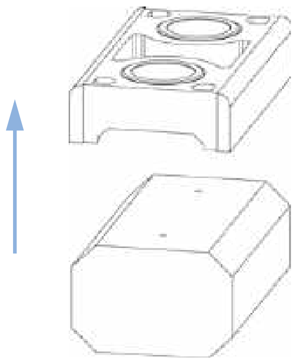


**3** Unscrew the capillaries from the flow cell. DO NOT use the adapter at this time!

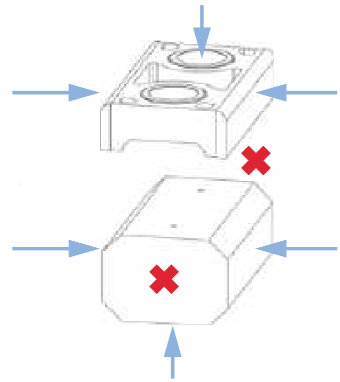


**4** Using for example a toothpick, press on the plastic part and slide the quartz body out of the cell housing.

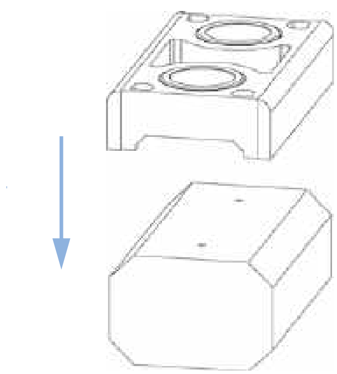
**5** The quartz body and the cell seal assembly can be separated for cleaning purpose.



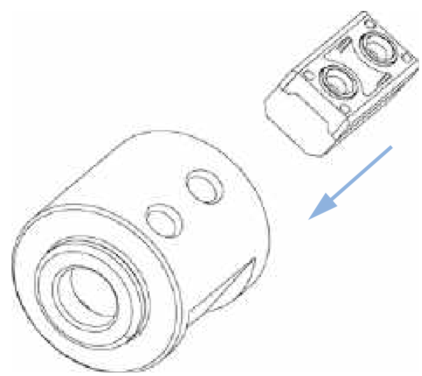
**6** This figure shows the correct holding of the quartz body and the cell seal assembly.



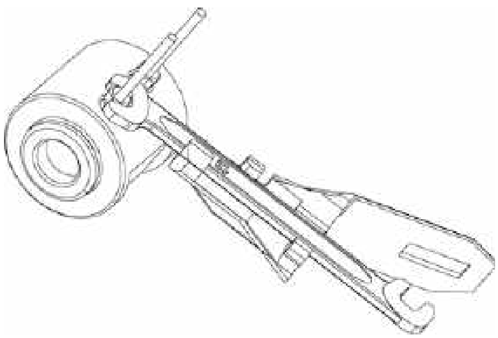
**7** Replace the cell seal assembly onto the quartz body. Always use a new seal assembly to exclude damage during disassembling.



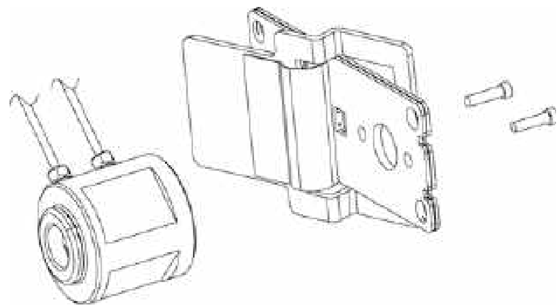
**8** Slide the quartz body completely into the cell body to the front stop (use for example a toothpick).



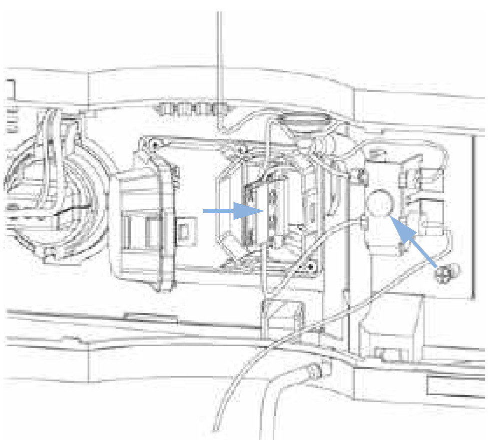
**9** Insert the flow cell capillaries and tighten them fingertight. Use the wrench and torque adapter as described on Figure 60 on page 196 and tighten the fittings alternately.



**10** Reassemble the flow cell body to the holder.



**11** Re-install the flow cell and connect the capillaries to the union holder.



**Next Steps:**

**12** Perform a leak test with the flow cell outside of the detector.

**13** If no leak is observed, install the flow cell and you are ready to work.

**14** Make sure that the flow cell assembly is inserted correctly and fits perfectly in the optical unit (especially when PEEK capillaries are used).

**NOTE** The cell body can be fitted in two positions to allow the capillaries routed upwards or downwards (depending on where the column is located). Route the capillaries directly column (inlet) and waste assembly (outlet).

**NOTE**

With the instrument accessory kit comes a 4-mm wrench and with the Sealing Kit a special adapter. Both together work as a torque wrench with pre-defined torque (maximum allowed torque for the cell fittings is 0.7 Nm). It can be used to tight the capillary fittings at the flow cell body. The wrench has to be plugged into the adapter as shown in Figure 60 on page 196.

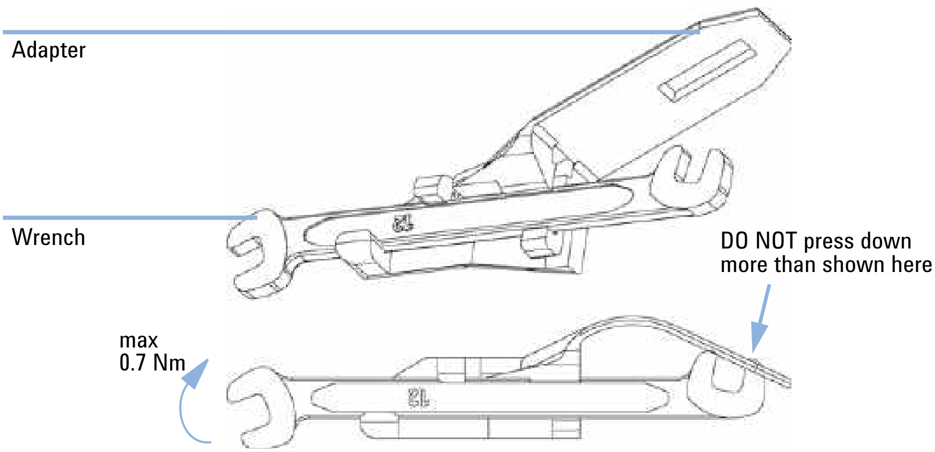



**Figure 60** Wrench plus Torque Adapter

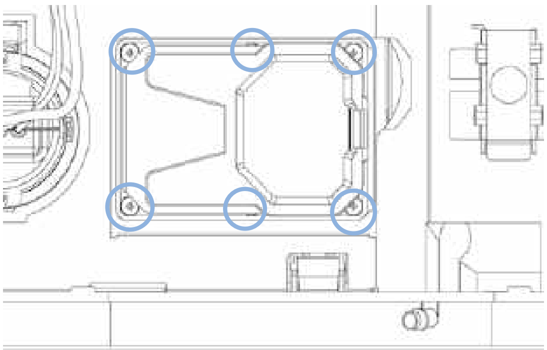
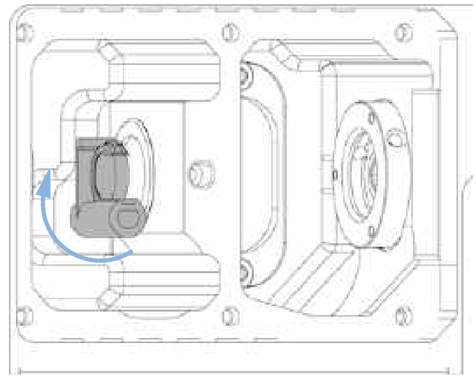
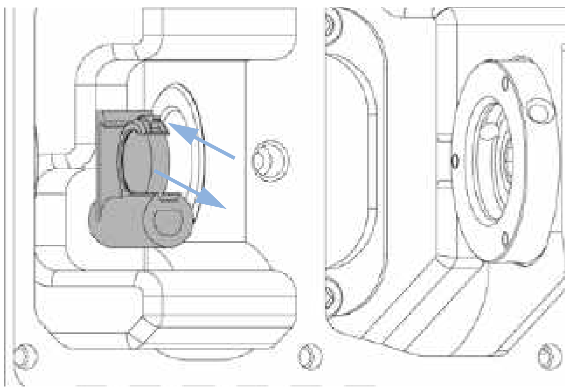
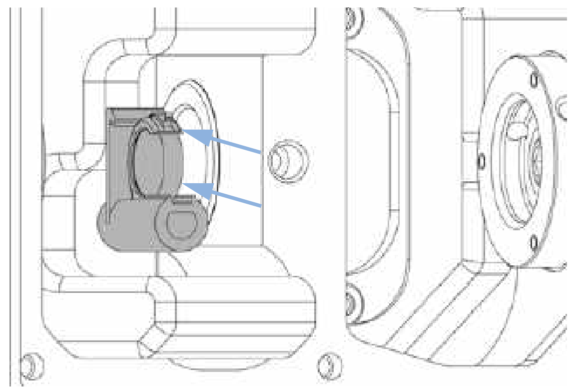
# Cleaning or Exchanging the Holmium Oxide Filter

| | | | |
|---|---|---|---|
| **When** | If holmium oxide filter is contaminated | | |
| **Tools required** | **Description** | | |
| | Screwdriver, Pozidriv #1 PT3 | | |
| | Screwdriver, flat blade | | |
| | Wrench, 1/4 inch<br>for capillary connections | | |
| | Pair of tweezers | | |
| **Parts required** | **#** | **p/n** | **Description** |
| | 1 | 79880-22711 | Holmium oxide filter |
| **Preparations** | Turn the lamp(s) off. | | |
| | Remove the front cover. | | |
| | Remove the flow cell, see "Exchanging a Flow Cell" on page 172. | | |

**NOTE**

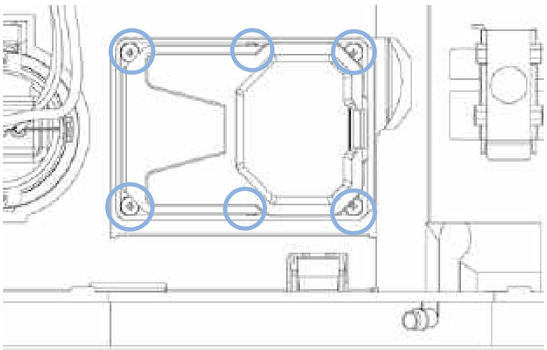
See also "Declaration of Conformity for HOX2 Filter" on page 301.

The glass tends to build a film on its surface even under normal environmental conditions. This is a phenomenon, which can be found also on the surface of several other glasses and has something to do with the composition of the glass. There is no indication, that the film has an influence on the measurement. Even in the case of a thick film, which scatters the light remarkably, no shift of the peak positions is to be expected. A slight change in the absorbance might be possible. Other components within the light path (lenses, windows, ...) are also changing their behavior over the time.

| | |
|---|---|
| **1** Unscrew the six screws and remove the flow cell cover.<br> | **2** If not already in this position, move the filter up.<br> |
| **3** While releasing the holder with a screw driver (at the top), carefully remove the holmium oxide filter.<br><br>**NOTE**<br>Do not scratch the holmium oxide filter.<br>The holmium oxide filter can be cleaned with alcohol and a lint-free cloth. | **4** While releasing the holder with a screw driver, carefully insert the holmium oxide filter.<br> |

<table>
<tr>
<td>

**5** Replace the flow cell cover and fix the six screws.



</td>
<td>

**Next Steps:**

**6** Perform a holmium oxide test, see “Holmium Oxide Test” on page 151 to check the proper function of the holmium oxide filter.

**7** Insert the flow cell, see “Exchanging a Flow Cell” on page 172.

**8** Replace the front cover.

**9** Turn on the flow.

</td>
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</table>

# Correcting Leaks

**When** If a leakage has occurred in the flow cell area or at the heat exchanger or at the capillary connections

| **Tools required** | **p/n** | **Description** |
|---|---|---|
| | | Tissue |
| | | Wrench, 1/4 inch<br>for capillary connections |
| | 5043-0915 | Fitting mounting tool<br>for bio-inert capillaries |

**Preparations** Remove the front cover.

1 Use tissue to dry the leak sensor area and the leak pan.

2 Observe the capillary connections and the flow cell area for leaks and correct, if required.

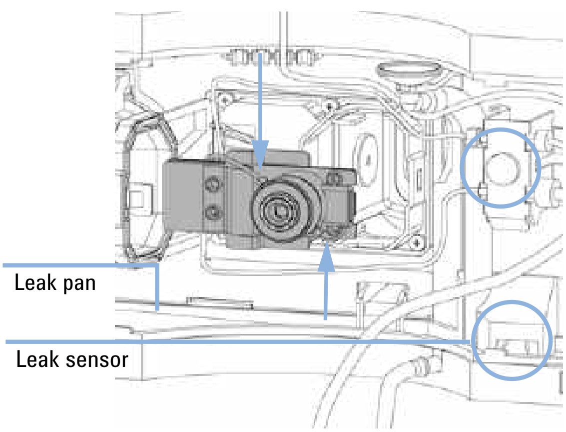



**Figure 61** Observing for Leaks

3 Replace the front cover.

# Replacing Leak Handling System Parts

| | | | |
|---|---|---|---|
| **When** | If the parts are corroded or broken | | |
| **Tools required** | None | | |
| **Parts required** | **#** | **p/n** | **Description** |
| | 1 | 5041-8388 | Leak funnel |
| | 1 | 5041-8389 | Leak funnel holder |
| | 1 | 5062-2463 | Corrugated tubing, PP, 6.5 mm id, 5 m |
| **Preparations** | Remove the front cover. | | |

1 Pull the leak funnel out of the leak funnel holder.

2 Pull out the leak funnel with the tubing.

3 Insert the leak funnel with the tubing in its position.

4 Insert the leak funnel into the leak funnel holder.

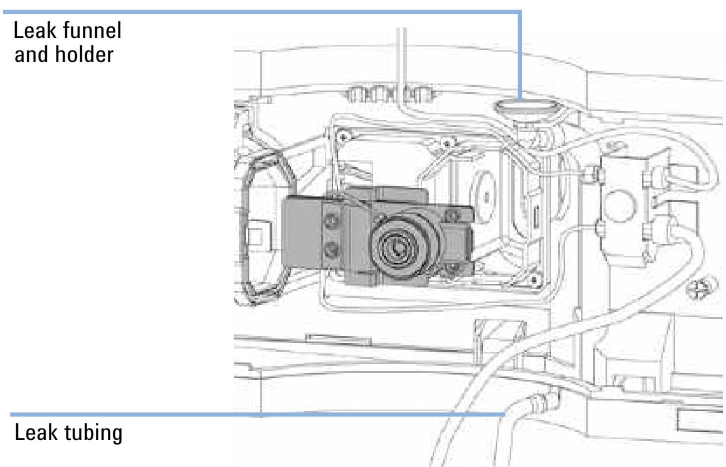



**Figure 62** Replacing Leak Handling System Parts

5 Replace the front cover.

# Replacing the CompactFlash Card (G1315C/G1365C only)

| | | | |
|---|---|---|---|
| **When** | If defective | | |
| **Tools required** | None | | |
| **Parts required** | **#** | **p/n** | **Description** |
| | 1 | 01100-68700 | CompactFlash Card Kit |
| **Preparations** | Turn the detector OFF and have access to the rear of the detector. | | |

**NOTE** The G1315C and G1365C is equipped with a CompactFlash card. This CompactFlash card is required for the operation of the detector (data buffering). DO NOT use other types of CompactFlash cards. Only CompactFlash cards supplied with the detector or as replacement with above part number are tested with the detector.

1 Remove the CompactFlash card by pulling it out of its slot in the rear of the detector.
2 Install the new CompactFlash card into the slot.
3 Turn the detector ON.

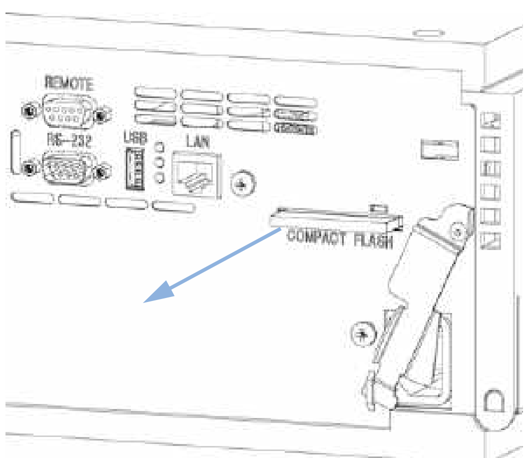



**Figure 63** Replacing CompactFlash card

# Replacing the Module's Firmware

**When**

The installation of newer firmware might be necessary

- if a newer version solves problems of older versions or
- to keep all systems on the same (validated) revision.

The installation of older firmware might be necessary

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

| **Tools required** | **Description** |
| --- | --- |
| | LAN/RS-232 Firmware Update Tool |
| OR | Agilent Lab Advisor software |
| OR | Instant Pilot G4208A<br>(only if supported by module) |

| **Parts required** | **#** | **Description** |
| --- | --- | --- |
| | 1 | Firmware, tools and documentation from Agilent web site |

**Preparations**

Read update documentation provided with the Firmware Update Tool.

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

1 Download the required module firmware, the latest LAN/RS-232 FW Update Tool and the documentation from the Agilent web.

- http://www.chem.agilent.com/_layouts/agilent/downloadFirmware.aspx?whid=69761

2 For loading the firmware into the module follow the instructions in the documentation.

*Module Specific Information*

**Table 20** Module Specific Information (G1315C/D and G1365C/D)

| | G1315C DAD VL+ / G1365C MWD | G1315D DAD / G1365D MWD |
|---|---|---|
| Initial firmware (main and resident) | B.01.02 | B.01.04 |
| Compatibility with 1260/1290 Infinity modules | When using the G1315C/D and G1365C/D in a system, all other modules must have firmware revision A.06.xx or B.06.xx or above (main and resident) from the same revision set (e.g. A.06.30/B.06.30). | |
| Compatibility with 1100/1200 series modules | When using the G1315C/D and G1365C/D in a system, all other modules must have firmware revision A.06.xx or B.01.02 or above (main and resident). Otherwise the communication will not work. | |
| Compatibility with VSA Optical | Introduced 08/2012. Firmware B.06.51, B.06.43 or B.06.26 or later (depends on the used firmware set). Earlier revisions are not compatible with the VSA Optical. These revisions are the required versions for the new VSA Optical Unit and Main Boards. | |
| Conversion to / emulation of G1315B or G1365B | Not possible due to different hardware and electronic platform. | |

# 10
# Parts for Maintenance



This chapter provides information on parts for maintenance.

# Overview of Maintenance Parts

| Item | p/n | Description |
|---|---|---|
| 1 | 5065-9982 | Plastics kit (includes base, top, left and right sides) |
| 2 | G4208-67001 | Instant Pilot G4208A (requires firmware B.02.08 or above) |
| 3 | | Flow cells with ID tag |
| 4 | G1315-87311 | Capillary ST 0.17 mm x 380 mm S/S |
| 5 | 5022-6515 | Union ZDV |
| 6 | G1315-68707 | Flow cell door (seal included) |
| | 5022-2112 | Screw cover |
| 7 | 79880-22711 | Holmium oxide filter |
| 8 | 2140-0820 | Longlife Deuterium lamp “C“ (with black cover and RFID tag) |
| 9 | G1103-60001 | Tungsten lamp |
| 10 | 5041-8388 | Leak funnel |
| 11 | 5041-8389 | Leak funnel |
| 12 | 5041-8387 | Tube clip |
| 13 | 5062-2463 | Corrugated tubing, PP, 6.5 mm id, 5 m |
| 14 | 5062-2462 | Tube PTFE 0.8 mm x 2 m, re-order 5 m |
| | 5181-1516 | CAN cable, Agilent module to module, 0.5 m |
| | 5181-1519 | CAN cable, Agilent module to module, 1 m |
| | G1369C or G1369-60012 | Interface board (LAN) |
| | 5023-0203 | Cross-over network cable, shielded, 3 m (for point to point connection) |
| | 5023-0202 | Twisted pair network cable, shielded, 7 m (for point to point connection) |
| | 01046-60105 | Analog cable (BNC to general purpose, spade lugs) |
| | G1351-68701 | Interface board (BCD) with external contacts and BCD outputs |
| | 01100-68700 | CompactFlash Card Kit |

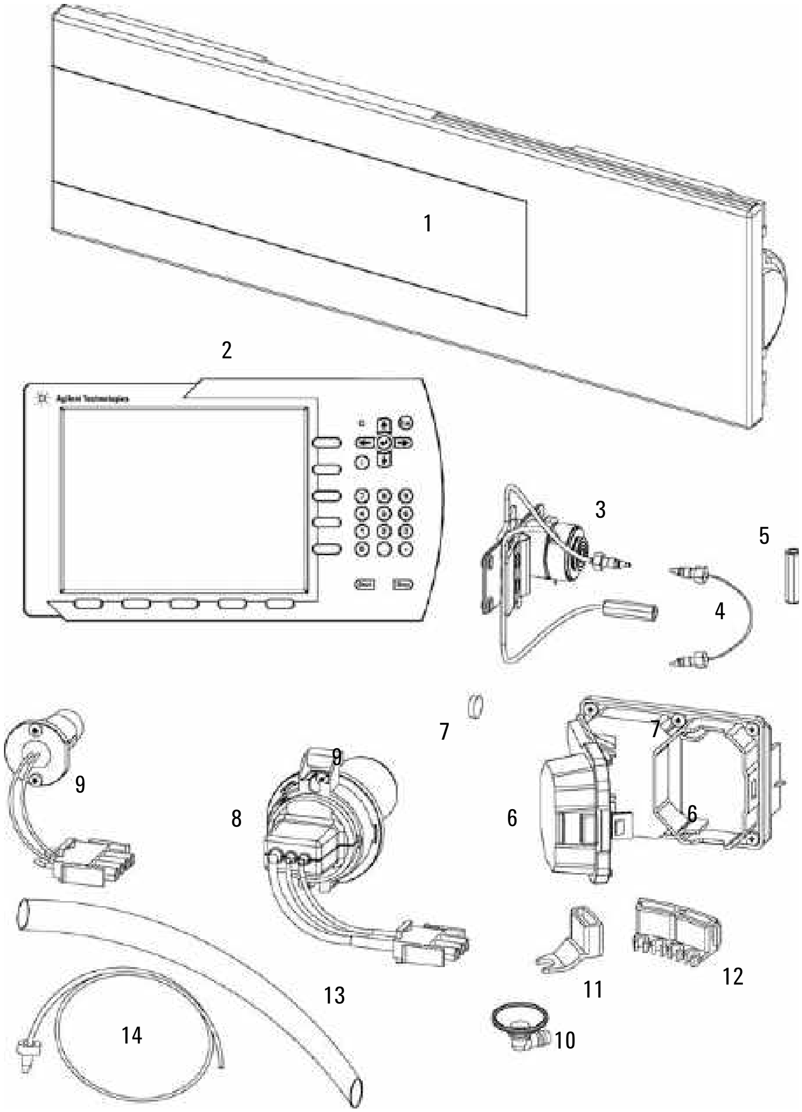



**Figure 64** Maintenance Parts

# Standard Flow Cell

| Item | p/n | Description |
|---|---|---|
| | G1315-60022 | Standard flow cell, 10 mm, 13 µL, 120 bar (12 MPa) |
| 1 | 79883-22402 | Window screw |
| 2 | 5062-8553 | Washer kit (10/pk) |
| 3 | 79883-28801 | Compression washer |
| 4 | 79883-22301 | Window holder |
| 5 | 1000-0488 | Quartz window |
| 6 | G1315-68711 | Gasket BACK (PTFE), 2.3 mm hole, outlet side (12/pk) |
| 7 | G1315-68710 | Gasket FRONT (PTFE), 1.3 mm hole, inlet side (12/pk) |
| 8 | | Window assembly (comprises window screw, spring washers, compression washer, window holder and quartz window) |
| | G1315-87321 | Capillary IN (0.17 mm, 590 mm lg) including heat exchanger |
| 10 | G1315-87302 | Capillary OUT (0.17 mm, 200 mm lg) |
| 11 | G1315-84910 | Clamp unit |
| | 0515-1056 | Screw M 2.5, 4 mm lg<br>for cell body/clamp |
| | 5022-2184 | Union ZDV |
| | G1315-68712 | Cell repair kit STD<br>includes window screw kit, 4 mm hexagonal wrench and seal kit |
| | 79883-68703 | Window screw kit, includes 2 quartz windows, 2 compression washers, 2 window holders, 2 window screws and 10 washers |

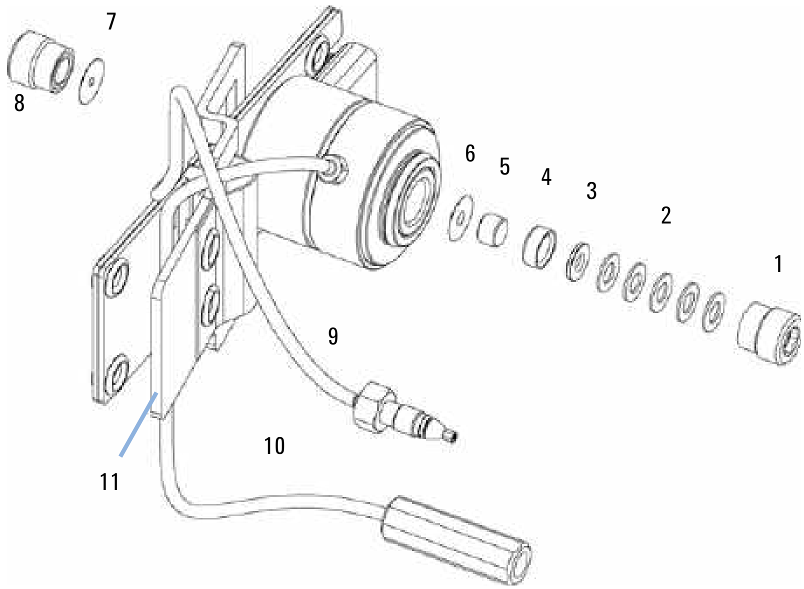



**Figure 65** Standard Flow Cell Parts

**NOTE** Gaskets # 6 and #7 have different hole diameters.

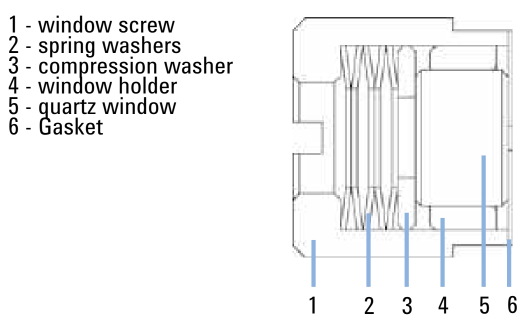



**Figure 66** Orientation of Spring Washers

# Standard Flow Cell Bio-inert

| Item | p/n | Description |
|---|---|---|
| | G5615-60022 | Standard flow cell bio-inert, 10 mm, 13 µL, 120 bar (12 MPa) for MWD/DAD, includes Capillary Kit Flow Cells BIO (p/n G5615-68755) |
| | G5615-68755 | Capillary Kit Flow Cells BIO includes Capillary PK 0.18 mm x 1.5 m and PEEK Fittings 10/PK (p/n 5063-6591) |
| 1 | 79883-22402 | Window screw |
| 2 | 5062-8553 | Washer kit (10/pk) |
| 3 | 79883-28801 | Compression washer |
| 4 | 79883-22301 | Window holder |
| 5 | 5190-0921 | Sapphire window |
| 6 | G1315-68711 | Gasket BACK (PTFE), 2.3 mm hole, outlet side (12/pk) |
| 7 | G1315-68710 | Gasket FRONT (PTFE), 1.3 mm hole, inlet side (12/pk) |
| 8 | | Window assembly (comprises window screw, spring washers, compression washer, window holder and quartz window) |
| 9 | G5615-87331 | Capillary In (0.17 mm, 590 mm lg), including heat exchanger) |
| 10 | G5615-87302 | Capillary Out (0.17 mm, 200 mm lg) |
| 11 | G1315-84910 | Clamp unit |
| | 0515-1056 | Screw M 2.5, 4 mm lg<br>for cell body/clamp |
| | 5022-2184 | Union ZDV |
| | G1315-68712 | Cell repair kit STD<br>includes window screw kit, 4 mm hexagonal wrench and seal kit |
| | G5615-68703 | Window screw kit bio-inert, includes 2 sapphire windows, 2 compression washers, 2 window holders, 2 window screws and 10 spring washers |
| | 5067-5695 | UHP-FF Fitting |

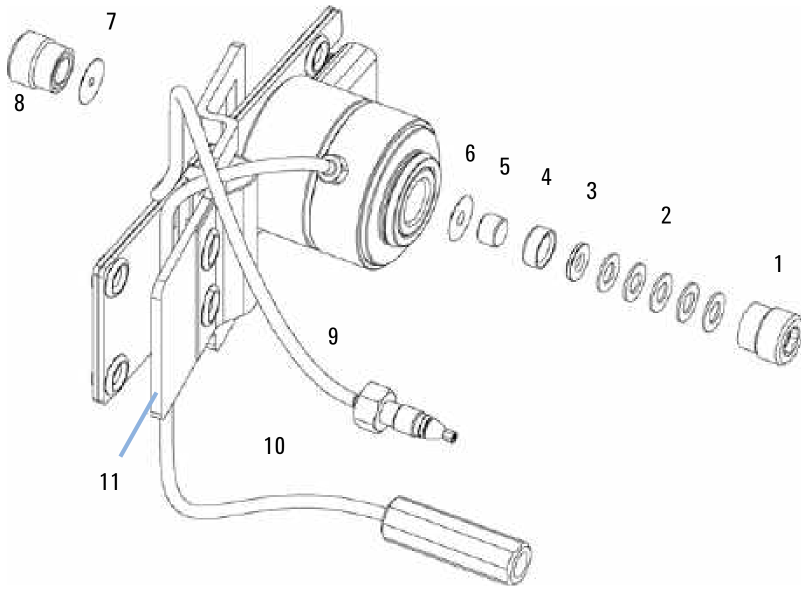



**Figure 67** Standard Flow Cell Bio-inert

1 - window screw
2 - spring washers
3 - compression washer
4 - window holder
5 - quartz window
6 - Gasket

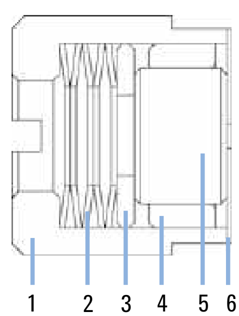



**Figure 68** Orientation of Spring Washers

# Semi-Micro Flow Cell Parts

| Item | p/n | Description |
|---|---|---|
| | G1315-60025 | Semi-micro flow cell, 6 mm, 5 µL, 120 bar (12 MPa) |
| 1 | 79883-22402 | Window screw |
| 2 | 5062-8553 | Washer kit (10/pk) |
| 3 | 79883-28801 | Compression washer |
| 4 | 79883-22301 | Window holder |
| 5 | 1000-0488 | Quartz window |
| 6 | 79883-68702 | Gasket BACK (PTFE), 1.8 mm hole, outlet side (12/pk) |
| 7 | G1315-68710 | Gasket FRONT (PTFE), 1.3 mm hole, inlet side (12/pk) |
| 8 | | Window assembly (comprises window screw, spring washers, compression washer, window holder and quartz window) |
| 9 | G1315-87319 | Capillary IN (0.17 mm, 310 mm lg) including heat exchanger |
| 10 | G1315-87306 | Capillary OUT (0.12 mm, 200 mm lg) |
| 10 | G1315-87302 | Capillary OUT (0.17 mm, 200 mm lg) |
| 11 | G1315-84910 | Clamp unit |
| | 0515-1056 | Screw M 2.5, 4 mm lg for cell body/clamp |
| | 5022-2184 | Union ZDV |
| | G1315-68713 | Cell repair kit semi-micro, includes window screw kit, Gasket Kit BACK, Gasket Kit FRONT and 4 mm hexagonal wrench |
| | 79883-68703 | Window screw kit, includes 2 quartz windows, 2 compression washers, 2 window holders, 2 window screws and 10 washers |

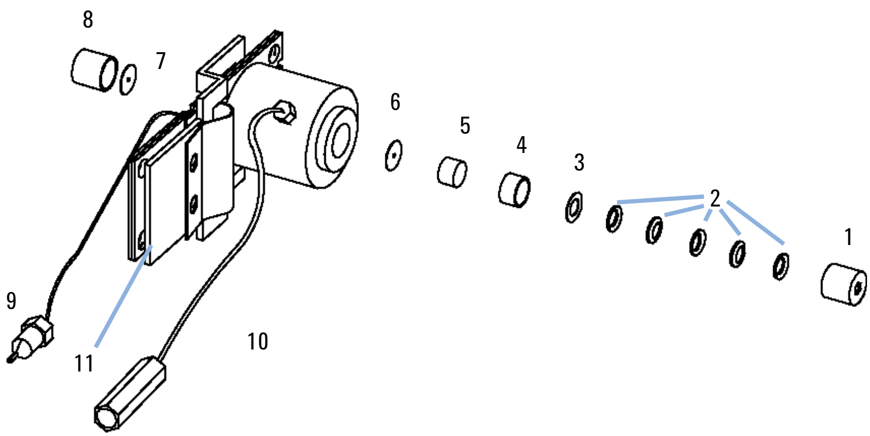



**Figure 69** Semi-Micro Flow Cell Parts

**NOTE** Gaskets # 6 and #7 have different hole diameters.

1 - window screw
2 - spring washers
3 - compression washer
4 - window holder
5 - quartz window
6 - Gasket

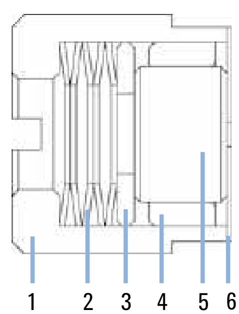



**Figure 70** Orientation of Spring Washers

# Micro Flow Cell

| Item | p/n | Description |
|---|---|---|
| | G1315-60024 | Micro flow cell, 3 mm, 2 µL, 120 bar (12 MPa) |
| 1 | 79883-22402 | Window screw |
| 2 | 5062-8553 | Washer kit (10/pk) |
| 3 | 79883-28801 | Compression washer |
| 4 | 79883-22301 | Window holder |
| 5 | 1000-0488 | Quartz window |
| 6 | 79883-68702 | Gasket BACK (PTFE), 1.8 mm hole, outlet side (12/pk) |
| 7 | G1315-68710 | Gasket FRONT (PTFE), 1.3 mm hole, inlet side (12/pk) |
| 8 | | Window assembly (comprises window screw, spring washers, compression washer, window holder and quartz window) |
| 9 | G1315-87339 | DAD Heat Exchanger Capillary 310 mm, 0.12 mm i.d. |
| 10 | G1315-87306 | Capillary OUT (0.12 mm, 200 mm lg) |
| 10 | G1315-87302 | Capillary OUT (0.17 mm, 200 mm lg) |
| 11 | G1315-84910 | Clamp unit |
| | 0515-1056 | Screw M 2.5, 4 mm lg<br>for cell body/clamp |
| | 5022-2184 | Union ZDV |
| | G1315-68713 | Cell repair kit semi-micro, includes window screw kit, Gasket Kit BACK, Gasket Kit FRONT and 4 mm hexagonal wrench |
| | 79883-68703 | Window screw kit, includes 2 quartz windows, 2 compression washers, 2 window holders, 2 window screws and 10 washers |

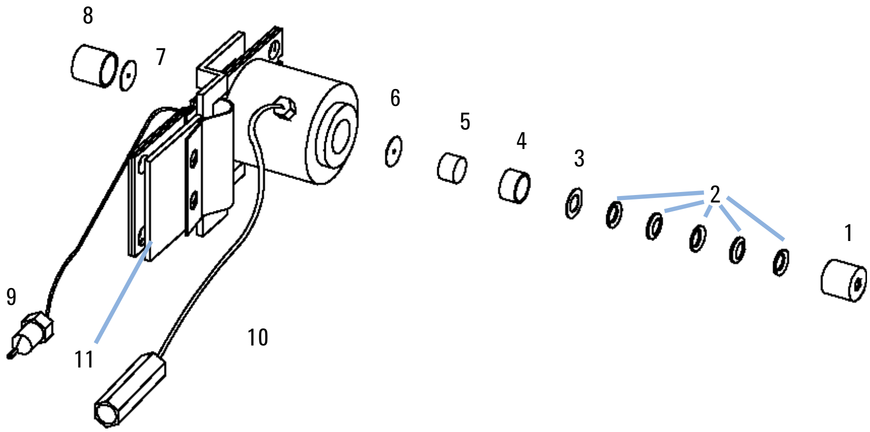



**Figure 71** Micro Flow Cell Parts

**NOTE** Gaskets # 6 and #7 have different hole diameters.

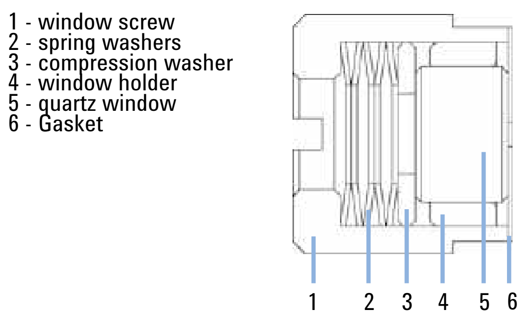



**Figure 72** Orientation of Spring Washers

# Prep Flow Cell - SST

**NOTE** For more details on the Preparative Flow Cells refer to the technical note that comes with the flow cells.

| Item | p/n | Description |
|---|---|---|
| | G1315-60016 | Prep flow cell SST - 3 mm, 120 bar (12 MPa) |
| 1 | 79883-22402 | Window screw |
| 2 | 5062-8553 | Washer kit (10/pk) |
| 3 | 79883-28801 | Compression washer |
| 4 | 79883-22301 | Window holder |
| 5 | 1000-0488 | Quartz window |
| 6 | G1315-68711 | Gasket BACK (PTFE), 2.3 mm hole, outlet side (12/pk) |
| 7 | G1315-68710 | Gasket FRONT (PTFE), 1.3 mm hole, inlet side (12/pk) |
| 8 | | Window assembly (comprises window screw, spring washers, compression washer, window holder and quartz window) |
| | 79883-68703 | Window screw kit, includes 2 quartz windows, 2 compression washers, 2 window holders, 2 window screws and 10 washers |
| | G1315-68712 | Cell repair kit STD<br>includes window screw kit, 4 mm hexagonal wrench and seal kit |
| 9 | G1315-87305 | Capillary SST, 250 mm length, 0.5 mm i.d., o.D. 0.9 mm<br>with fittings for flow cell assembled |
| 9a | 5062-2418 | 1/16” fittings and ferrules<br>10/pk |
| 10 | G1315-27706 | Cell body |
| 11 | G1315-84901 | Clamp unit |
| 12 | G1315-84902 | Handle for Clamp unit |
| 13 | 0515-1056 | Screw M 2.5, 4 mm lg<br>for cell body/clamp |

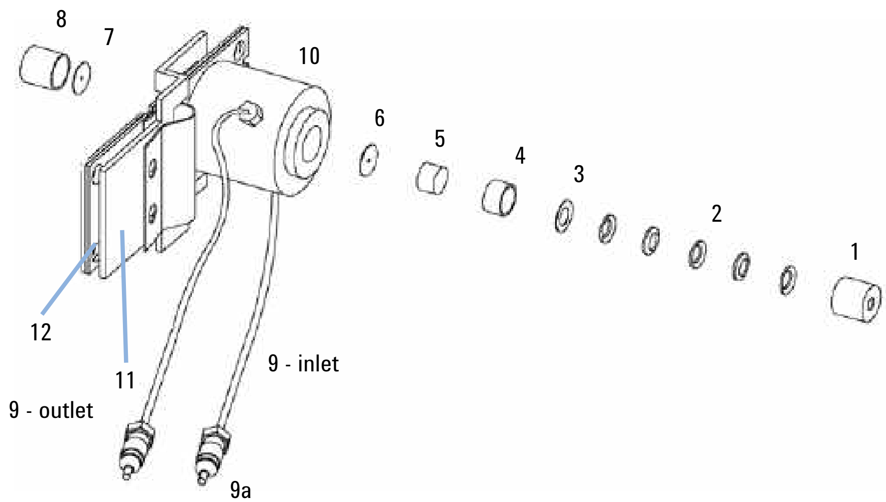



**Figure 73** Prep Flow Cell - SST Parts

**NOTE** Gaskets # 6 and #7 have different hole diameters.

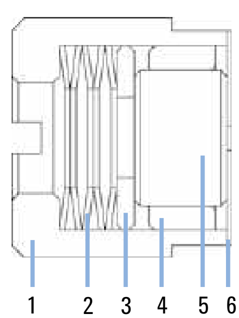



**Figure 74** Orientation of Spring Washers

# Prep Flow Cell - Quartz

**NOTE** For more details on the Preparative Flow Cells refer to the technical note that comes with the flow cells.

| Item | p/n | Description |
|---|---|---|
| | G1315-60017 | Prep flow cell quartz, 0.3 mm, 20 bar (2 MPa) |
| | G1315-60018 | Prep flow cell quartz, 0.06 mm (2 MPa) |
| 1 | G1315-67301 | PTFE tubing 2 m length, 0.8 mm i.d., o.D. 1.6 mm |
| | G1315-67302 | PTFE tubing 80 cm length, 0.5 mm i.d., o.D. 1.6 mm |
| 2 | 0100-1516 | Fitting male PEEK, 2/pk |
| 3 | G1315-27705 | Cell housing |
| 4 | G1315-84901 | Clamp unit |
| 5 | G1315-84902 | Handle for Clamp unit |
| 6 | 0515-1056 | Screw M 2.5, 4 mm lg<br>for cell body/clamp |
| 7 | G1315-80004 | Quartz body - Prep Cell 0.3 mm |
| 7 | G1315-80003 | Quartz body - Prep Cell 0.06 mm |

**NOTE** The flow cell comes with two tubings 0.8 mm i.d. and one 0.5 mm i.d. so that the combination at the flow cell could be either 0.8/0.8 or 0.5/0.8 (inlet/outlet).

Standard is 0.8/0.8. Depending on the system pressure (<30 mL/min) or bandbroadening, the inlet tubing might be changed to 0.5 mm.

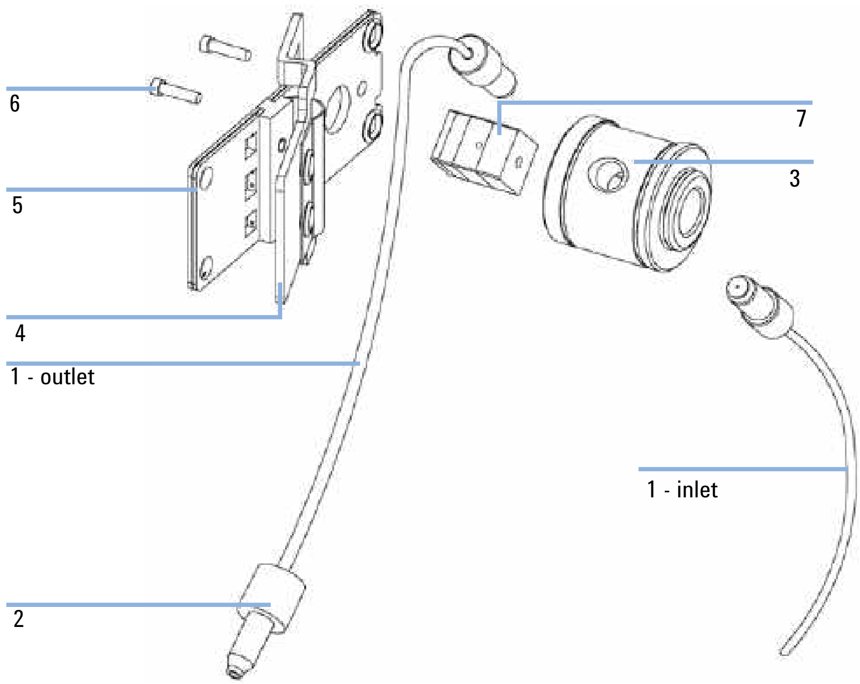



**Figure 75** Prep Flow Cell - Quartz Parts

# Nano Flow Cells

The following kits are available:

**Table 21** Nano-flow cell kits

| Part number | Comments |
| --- | --- |
| Semi-nano flow cell kit, 10 mm, 500 nL, 5 MPa (G1315-68724) | completely assembled (includes items 1, 2, 3, 4, 10, 11, 12, 13, 14, 15, and 16) |
| Nano flow cell kit, 6 mm, 80 nL, 5 MPa ( G1315-68716) | completely assembled (includes items 1, 2, 3, 4, 10, 11, 12, 13, 14, 15, and 16) |

Figure 76 on page 221 shows all parts delivered with the nano-flow cell kits.

**Generic parts for both nano-flow cells:**

| Item | p/n | Description |
| --- | --- | --- |
| 3 | 5063-6593 | Fitting Screw (for 4 mm wrench) |
| 4 | | Cell ferrules are factory installed |
| 5 | 5065-4422 | PEEK fitting 1/32" |
| 7 | 5063-6592 | Litetouch ferrules LT-100, (1/32" Ferrule and SS lock ring) |
| 8 | 5022-2146 | Union Adjustment Tool |
| 9 | 5022-2184 | Union ZDV |
| 10 | G1315-45003 | Torque adapter |
| 14 | G1315-84902 | Handle for Clamp unit |
| 15 | G1315-84910 | Clamp unit |
| 16 | 0515-1056 | Screw M 2.5, 4 mm lg for cell body/clamp |
| 17 | 8710-1534 | Wrench, 4 mm both ends, open end |

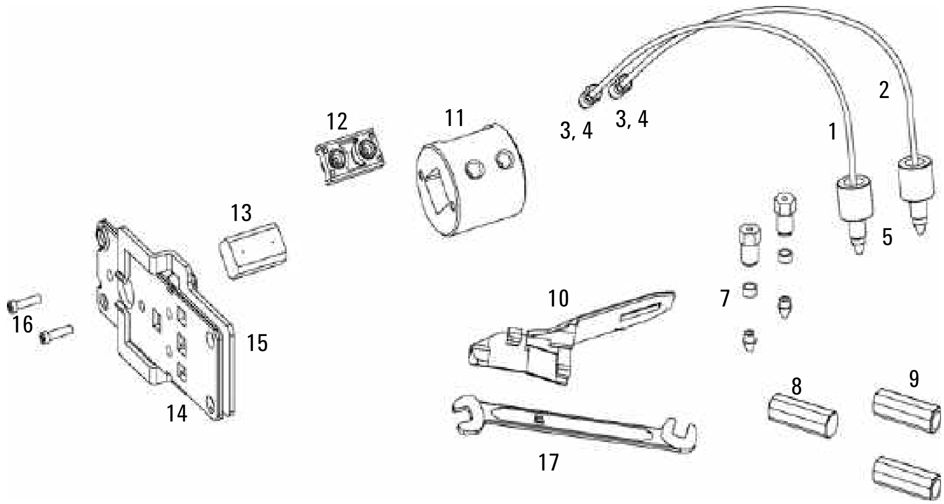



**Figure 76** Content of kits

### Specific parts for the semi-nano flow cell

| Item | p/n | Description |
|---|---|---|
| | G1315-68724 | Semi-nano flow cell kit, 10 mm, 500 nL, 5 MPa |
| 1 | G1315-87333 | PEEK coated fused silica capillary Inlet (100 µm) pre-mounted to cell, includes Inlet capillary, 300 mm long, 100 µm i.d. with pre-fixed ferrules (#4) and fittings (#3), plus one PEEK Fitting FT (#5) |
| 2 | G1315-87338 | PEEK coated fused silica capillary Outlet (100 µm) pre-mounted to cell, includes Outlet capillary, 120 mm long, 100 µm i.d. with pre-fixed ferrules (#4) and fitting (#3), plus one PEEK Fitting FT (#5) |
| 1 | G1315-87323 | PEEK coated fused silica capillary Inlet (50 µm) alternative, includes Inlet capillary, 400 mm long, 50 µm i.d. with pre-fixed ferrules (#4) and fittings (#3), plus one PEEK Fitting FT (#5) |
| 2 | G1315-87328 | PEEK coated fused silica capillary Outlet (50 µm), alternative, includes Outlet capillary, 120 mm long, 50 µm i.d. with pre-fixed ferrules (#4) and fitting (#3), plus one PEEK Fitting FT (#5) |
| 11 | G1315-27703 | Cell Housing (500 nL) |
| 12 | G1315-87101 | Cell Seal Assembly (500 nL) |
| 13 | G1315-80001 | Quartz Body (500 nL) |
| | G1315-68715 | Sealing Kit |

### Specific parts for the nano flow cell

| Item | p/n | Description |
|---|---|---|
| | G1315-68716 | Nano flow cell kit, 6 mm, 80 nL, 5 MPa |
| 1 | G1315-87323 | PEEK coated fused silica capillary Inlet (50 µm) alternative, includes Inlet capillary, 400 mm long, 50 µm i.d. with pre-fixed ferrules (#4) and fittings (#3), plus one PEEK Fitting FT (#5) |
| 2 | G1315-87328 | PEEK coated fused silica capillary Outlet (50 µm), alternative, includes Outlet capillary, 120 mm long, 50 µm i.d. with pre-fixed ferrules (#4) and fitting (#3), plus one PEEK Fitting FT (#5) |
| 1 | G1315-87313 | PEEK coated fused silica capillary Inlet (25 µm) alternative, includes Inlet capillary, 200 mm long, 25 µm i.d. with pre-fixed ferrules (#4) and fittings (#3), plus one PEEK Fitting FT (#5) |
| 2 | G1315-87318 | PEEK coated fused silica capillary Outlet (25 µm) alternative, includes Outlet capillary, 600 mm long, 25 µm i.d. with pre-fixed ferrules (#4) and fitting (#3), plus one PEEK Fitting FT (#5) |
| | G1315-27704 | Cell Housing (80 nL) |
| | G1315-87102 | Cell Seal Assembly (80 nL) |
| | G1315-80002 | Quartz Body (80 nL) |
| | G1315-68725 | Sealing Kit 80 nL cell |

# High Pressure Flow Cell

| Item | p/n | Description |
|---|---|---|
| | G1315-60015 | High pressure flow cell, 6 mm, 1.7 µL, 400 bar (40 MPa) |
| 1 | | Window assembly, comprises items 2, 3, 4, 5 and 6 |
| 2 | 79883-27101 | Seal ring |
| 3 | 1000-0953 | Quartz window |
| 4 | 79883-28802 | Compression washer |
| 5 | 5062-8553 | Washer kit (10/pk) |
| 6 | 79883-22404 | Window screw |
| 7 | G1315-87325 | Capillary IN (0.12 mm, 290 mm lg) including heat exchanger |
| 8 | G1315-87306 | Capillary OUT (0.12 mm, 200 mm lg) |
| 9 | G1315-84901 | Clamp unit |
| | 0515-1056 | Screw M 2.5, 4 mm lg for cell body/clamp |
| | G1315-87312 | Capillary ST 0.12 mm x 150 mm S/S |
| | G1315-87311 | Capillary ST 0.17 mm x 380 mm S/S |
| | 79883-68700 | High pressure cell repair kit (includes 1 quartz window, 1 compression washer, 5 spring washers, 2 seal rings) |

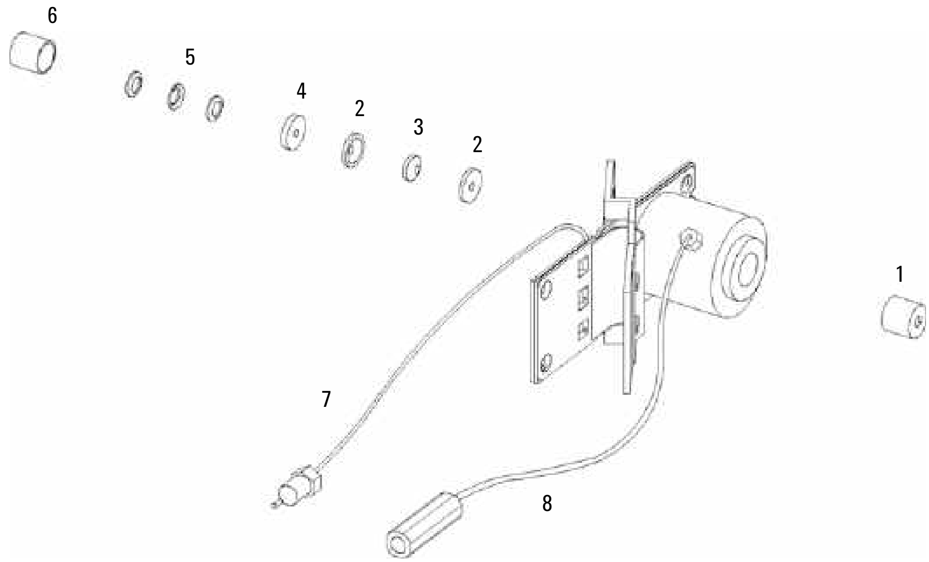



**Figure 77** High pressure flow cell - parts

# Accessory Kits

Accessory kit (G1315-68755) contains some accessories and tools needed for installation and repair of the module.

| Item | p/n | Description |
|---|---|---|
| | 5063-6527 | Tubing assembly, i.d. 6 mm, o.d. 9 mm, 1.2 m (to waste) |
| 1 | 5062-2462 | Tube PTFE 0.8 mm x 2 m, re-order 5 m |
| 2 | 0100-1516 | Fitting male PEEK, 2/pk |
| 3 | G1315-87311 | Capillary ST 0.17 mm x 380 mm S/S |
| 4 | 5180-4108 | Ferrule front 1/16" SST, qty=2, re-order pack of 10 |
| 5 | 5180-4114 | Ferrule back 1/16" SST, qty=2, re-order pack of 10 |
| 6 | 5061-3303 | Fitting 1/16" SST, qty=2, re-order pack of 10 |
| | G1315-87303 | Capillary SST column — detector 150 mm lg, 0.17 mm i.d. |
| | 5181-1516 | CAN cable, Agilent module to module, 0.5 m |

Items 4, 5 and 6 are included in kit 5062-2418 1/16" Fittings and Ferrules (front/back) 10/PK.

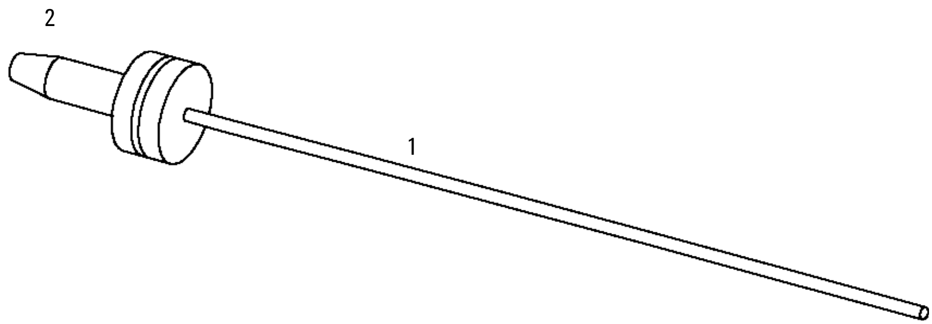



**Figure 78** Waste Tubing Parts

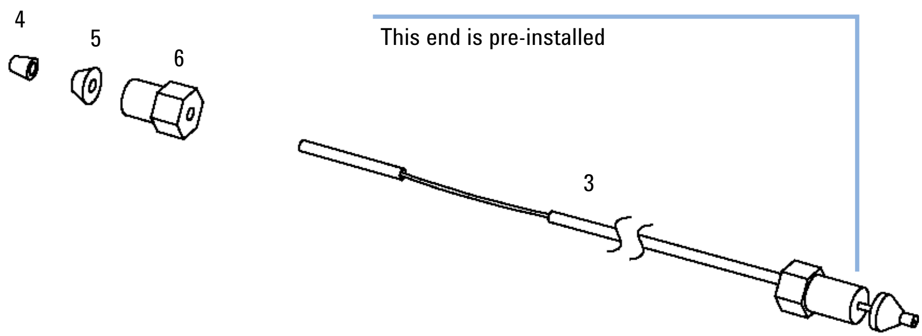



**Figure 79** Inlet Capillary (Column-Detector) Parts

# 11
# Identifying Cables



This chapter provides information on cables used with the Agilent 1200 Infinity Series modules.

# Cable Overview

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

### Analog cables

| p/n | Description |
|---|---|
| 35900-60750 | Agilent module to 3394/6 integrators |
| 35900-60750 | Agilent 35900A A/D converter |
| 01046-60105 | Analog cable (BNC to general purpose, spade lugs) |

### Remote cables

| p/n | Description |
|---|---|
| 03394-60600 | Agilent module to 3396A Series I integrators |
| | 3396 Series II / 3395A integrator, see details in section “Remote Cables” on page 234 |
| 03396-61010 | Agilent module to 3396 Series III / 3395B integrators |
| 5061-3378 | Remote Cable |
| 01046-60201 | Agilent module to general purpose |

### BCD cables

| p/n | Description |
|---|---|
| 03396-60560 | Agilent module to 3396 integrators |
| G1351-81600 | Agilent module to general purpose |

### CAN cables

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

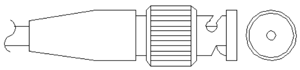
### LAN cables

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

### RS-232 cables

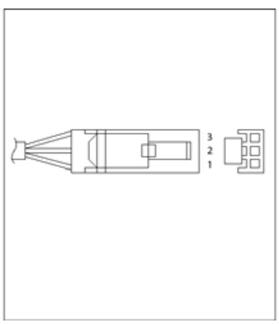
| p/n | Description |
|---|---|
| G1530-60600 | RS-232 cable, 2 m |
| RS232-61601 | RS-232 cable, 2.5 m<br>Instrument to PC, 9-to-9 pin (female). This cable has special pin-out, and is not compatible with connecting printers and plotters. It's also called "Null Modem Cable" with full handshaking where the wiring is made between pins 1-1, 2-3, 3-2, 4-6, 5-5, 6-4, 7-8, 8-7, 9-9. |
| 5181-1561 | RS-232 cable, 8 m |

# Analog Cables

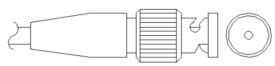


One end of these cables provides a BNC connector to be connected to Agilent modules. The other end depends on the instrument to which connection is being made.

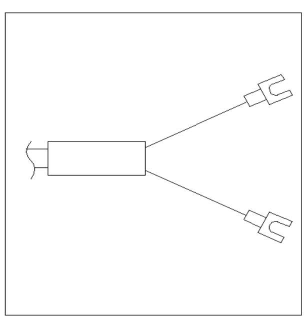
## Agilent Module to 3394/6 Integrators

| p/n 35900-60750 | Pin 3394/6 | Pin Agilent module | Signal Name |
|---|---|---|---|
|  | 1 | | Not connected |
| | 2 | Shield | Analog - |
| | 3 | Center | Analog + |

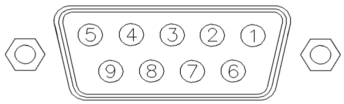
## Agilent Module to BNC Connector

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

## Agilent Module to General Purpose

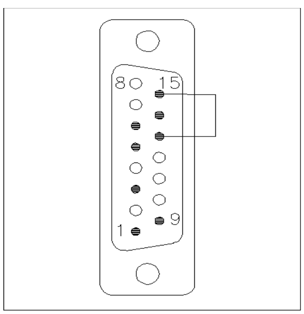
| p/n 01046-60105 | Pin | Pin Agilent module | Signal Name |
|---|---|---|---|
|  | 1 | | Not connected |
| | 2 | Black | Analog - |
| | 3 | Red | Analog + |

# Remote Cables




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.

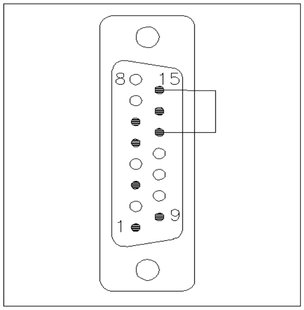
## Agilent Module to 3396A Integrators

| p/n 03394-60600 | Pin 3396A | Pin Agilent module | Signal Name | Active (TTL) |
|---|---|---|---|---|
|   | 9 | 1 - White | Digital ground | |
| | NC | 2 - Brown | Prepare run | Low |
| | 3 | 3 - Gray | Start | Low |
| | NC | 4 - Blue | Shut down | Low |
| | NC | 5 - Pink | Not connected | |
| | NC | 6 - Yellow | Power on | High |
| | 5,14 | 7 - Red | Ready | High |
| | 1 | 8 - Green | Stop | Low |
| | NC | 9 - Black | Start request | Low |
| | 13, 15 | | Not connected | |

## Agilent Module to 3396 Series II / 3395A Integrators

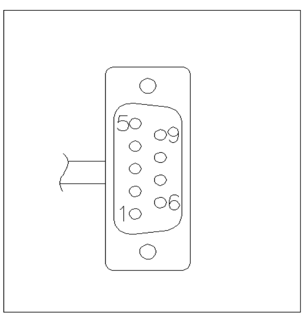
Use the cable Agilent module to 3396A Series I integrators (03394-60600) and cut pin #5 on the integrator side. Otherwise the integrator prints START; not ready.

## Agilent Module to 3396 Series III / 3395B Integrators



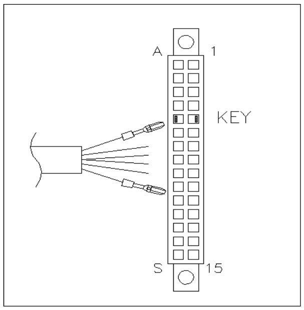

| p/n 03396-61010 | Pin 33XX | Pin Agilent module | Signal Name | Active (TTL) |
|---|---|---|---|---|
| | 9 | 1 - White | Digital ground | |
| | NC | 2 - Brown | Prepare run | Low |
| | 3 | 3 - Gray | Start | Low |
| | NC | 4 - Blue | Shut down | Low |
| | NC | 5 - Pink | Not connected | |
| | NC | 6 - Yellow | Power on | High |
| | 14 | 7 - Red | Ready | High |
| | 4 | 8 - Green | Stop | Low |
| | NC | 9 - Black | Start request | Low |
| | 13, 15 | | Not connected | |

## Agilent Module to Agilent 35900 A/D Converters

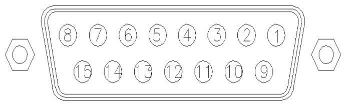



| p/n 5061-3378 | Pin 35900 A/D | Pin Agilent module | Signal Name | Active (TTL) |
|---|---|---|---|---|
| | 1 - White | 1 - White | Digital ground | |
| | 2 - Brown | 2 - Brown | Prepare run | Low |
| | 3 - Gray | 3 - Gray | Start | Low |
| | 4 - Blue | 4 - Blue | Shut down | Low |
| | 5 - Pink | 5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

## Agilent Module to General Purpose

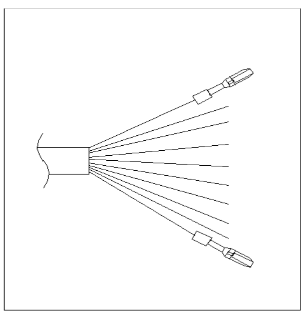
| p/n 01046-60201 | Wire Color | Pin Agilent module | Signal Name | Active (TTL) |
|---|---|---|---|---|
|   | White | 1 | Digital ground | |
| | Brown | 2 | Prepare run | Low |
| | Gray | 3 | Start | Low |
| | Blue | 4 | Shut down | Low |
| | Pink | 5 | Not connected | |
| | Yellow | 6 | Power on |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

# BCD Cables

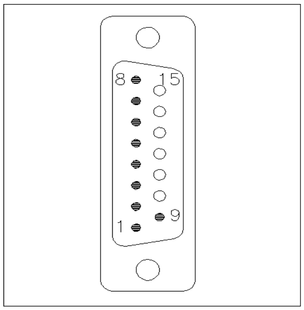



One end of these cables provides a 15-pin BCD connector to be connected to the Agilent modules. The other end depends on the instrument to be connected to

## Agilent Module to General Purpose

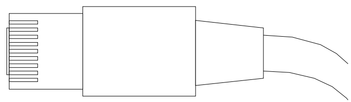
| p/n G1351-81600 | Wire Color | Pin Agilent module | Signal Name | BCD Digit |
|---|---|---|---|---|
|  | Green | 1 | BCD 5 | 20 |
| | Violet | 2 | BCD 7 | 80 |
| | Blue | 3 | BCD 6 | 40 |
| | Yellow | 4 | BCD 4 | 10 |
| | Black | 5 | BCD 0 | 1 |
| | Orange | 6 | BCD 3 | 8 |
| | Red | 7 | BCD 2 | 4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

## Agilent Module to 3396 Integrators




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

# CAN/LAN Cables



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

### CAN Cables

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

### LAN Cables

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

# Agilent 1200 module to PC

| p/n | Description |
|---|---|
| G1530-60600 | RS-232 cable, 2 m |
| RS232-61601 | RS-232 cable, 2.5 m<br>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 "Null Modem Cable" with full handshaking where the wiring is made between pins 1-1, 2-3, 3-2, 4-6, 5-5, 6-4, 7-8, 8-7, 9-9. |
| 5181-1561 | RS-232 cable, 8 m |

# 12 Hardware Information



This chapter describes the detector 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 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 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 your user interface:

- PC and Firmware Update Tool with local files on the hard disk
- Instant Pilot (G4208A) with files from a USB Flash Disk
- Agilent Lab Advisor software B.01.03 and above

The file naming conventions are:

PPPP_RVVV_XXX.dlb, where

PPPP is the product number, for example, 1315AB for the G1315A/B DAD,

R the firmware revision, for example, A for G1315B or B for the G1315C DAD,

VVV is the revision number, for example 102 is revision 1.02,

XXX is the build number of the firmware.

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

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

Main and resident firmware must be from the same set.

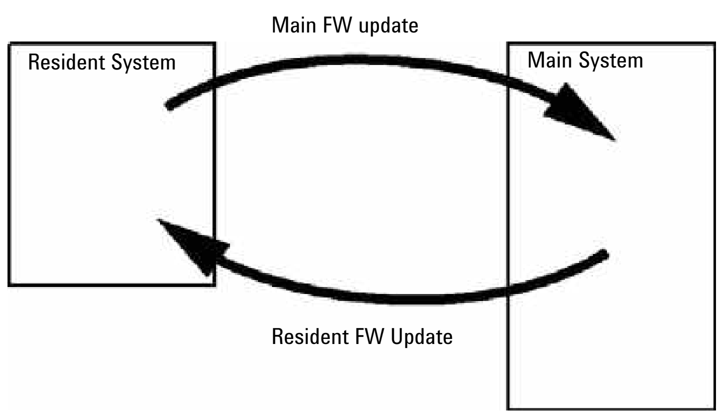



**Figure 80** Firmware Update Mechanism

**NOTE**

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.

- http://www.chem.agilent.com/_layouts/agilent/downloadFirmware.aspx?whid=69761

# Electrical Connections

- The CAN bus is a serial bus with high speed data transfer. The two connectors for the CAN bus are used for internal module data transfer and synchronization.
- Two independent analog outputs provide signals for integrators or data handling.
- 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 (ALL)

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

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

## Rear view of the module

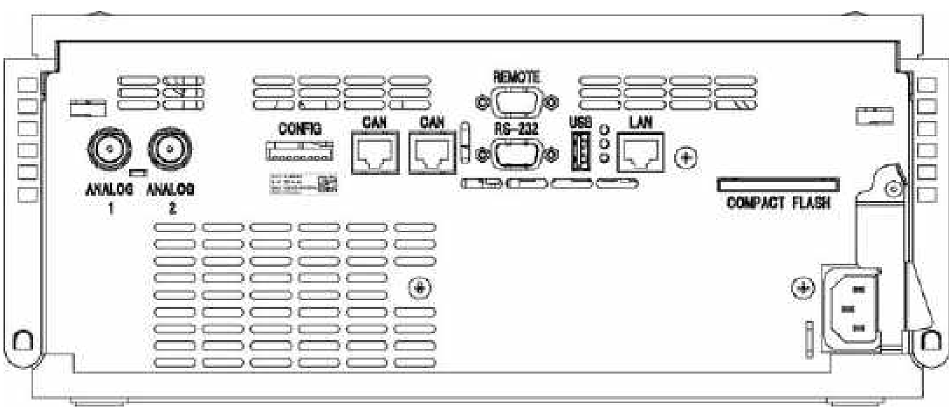



**Figure 81** Rear View of Detector

# Interfaces

The Agilent 1200 Infinity Series modules provide the following interfaces:

**Table 22** Agilent 1200 Infinity Series Interfaces

| Module | CAN | LAN/BCD (optional) | LAN (on-board) | RS-232 | Analog | APG Remote | Special |
|---|---|---|---|---|---|---|---|
| **Pumps** | | | | | | | |
| G1310B Iso Pump<br>G1311B Quat Pump<br>G1311C Quat Pump VL<br>G1312B Bin Pump<br>K1312B Bin Pump Clinical Ed.<br>G1312C Bin Pump VL<br>1376A Cap Pump<br>G2226A Nano Pump<br>G5611A Bio-inert Quat Pump | 2 | Yes | No | Yes | 1 | Yes | |
| G4220A/B Bin Pump<br>G4204A Quat Pump | 2 | No | Yes | Yes | No | Yes | CAN-DC- OUT for CAN slaves |
| G1361A Prep Pump | 2 | Yes | No | Yes | No | Yes | CAN-DC- OUT for CAN slaves |
| **Samplers** | | | | | | | |
| G1329B ALS<br>G2260A Prep ALS | 2 | Yes | No | Yes | No | Yes | THERMOSTAT for G1330B/K1330B |
| G1364B FC-PS<br>G1364C FC-AS<br>G1364D FC-µS<br>G1367E HiP ALS<br>K1367E HiP ALS Clinical Ed.<br>G1377A HiP micro ALS<br>G2258A DL ALS<br>G5664A Bio-inert FC-AS<br>G5667A Bio-inert Autosampler | 2 | Yes | No | Yes | No | Yes | THERMOSTAT for G1330B/K1330B<br>CAN-DC- OUT for CAN slaves |
| G4226A ALS | 2 | Yes | No | Yes | No | Yes | |

**Table 22** Agilent 1200 Infinity Series Interfaces

| Module | CAN | LAN/BCD (optional) | LAN (on-board) | RS-232 | Analog | APG Remote | Special |
|---|---|---|---|---|---|---|---|
| **Detectors** | | | | | | | |
| G1314B VWD VL<br>G1314C VWD VL+ | 2 | Yes | No | Yes | 1 | Yes | |
| G1314E/F VWD<br>K1314F Clinical Ed. | 2 | No | Yes | Yes | 1 | Yes | |
| G4212A/B DAD<br>K4212B DAD Clinical Ed. | 2 | No | Yes | Yes | 1 | Yes | |
| G1315C DAD VL+<br>G1365C MWD<br>G1315D DAD VL<br>G1365D MWD VL | 2 | No | Yes | Yes | 2 | Yes | |
| G1321B FLD<br>K1321B FLD Clinical Ed.<br>G1321C FLD | 2 | Yes | No | Yes | 2 | Yes | |
| G1362A RID | 2 | Yes | No | Yes | 1 | Yes | |
| G4280A ELSD | No | No | No | Yes | Yes | Yes | EXT Contact<br>AUTOZERO |
| **Others** | | | | | | | |
| G1170A Valve Drive | 2 | No | No | No | No | No | 1 |
| G1316A/C TCC<br>K1316C TCC Clinical Ed. | 2 | No | No | Yes | No | Yes | |
| G1322A DEG<br>K1322A DEG Clinical Ed. | No | No | No | No | No | Yes | AUX |
| G1379B DEG | No | No | No | Yes | No | Yes | |
| G4225A DEG<br>K4225A DEG Clinical Ed. | No | No | No | Yes | No | Yes | |

**Table 22** Agilent 1200 Infinity Series Interfaces

| Module | CAN | LAN/BCD (optional) | LAN (on-board) | RS-232 | Analog | APG Remote | Special |
|---|---|---|---|---|---|---|---|
| G4227A Flex Cube | 2 | No | No | No | No | No | CAN-DC- OUT for CAN slaves [1] |
| G4240A CHIP CUBE | 2 | Yes | No | Yes | No | Yes | CAN-DC- OUT for CAN slaves<br>THERMOSTAT for G1330A/B (NOT USED), K1330B |

1 Requires a HOST module with on-board LAN (e.g. G4212A or G4220A with minimum firmware B.06.40 or C.06.40) or with additional G1369C LAN Card

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

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

# Interfaces Overview

## 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 23** RS-232C Connection Table

| Pin | Direction | Function |
|---|---|---|
| 1 | In | DCD |
| 2 | In | RxD |
| 3 | Out | TxD |
| 4 | Out | DTR |
| 5 | | Ground |
| 6 | In | DSR |
| 7 | Out | RTS |
| 8 | In | CTS |
| 9 | In | RI |

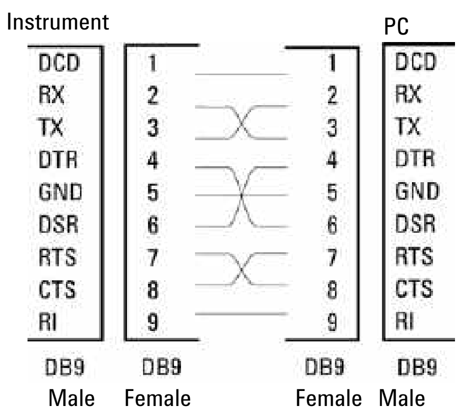



**Figure 82** RS-232 Cable

## 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).

**Table 24** Remote Signal Distribution

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

## Special Interfaces

There is no special interface for this module.

# 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).
  - Bootp mode for LAN and
  - 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.

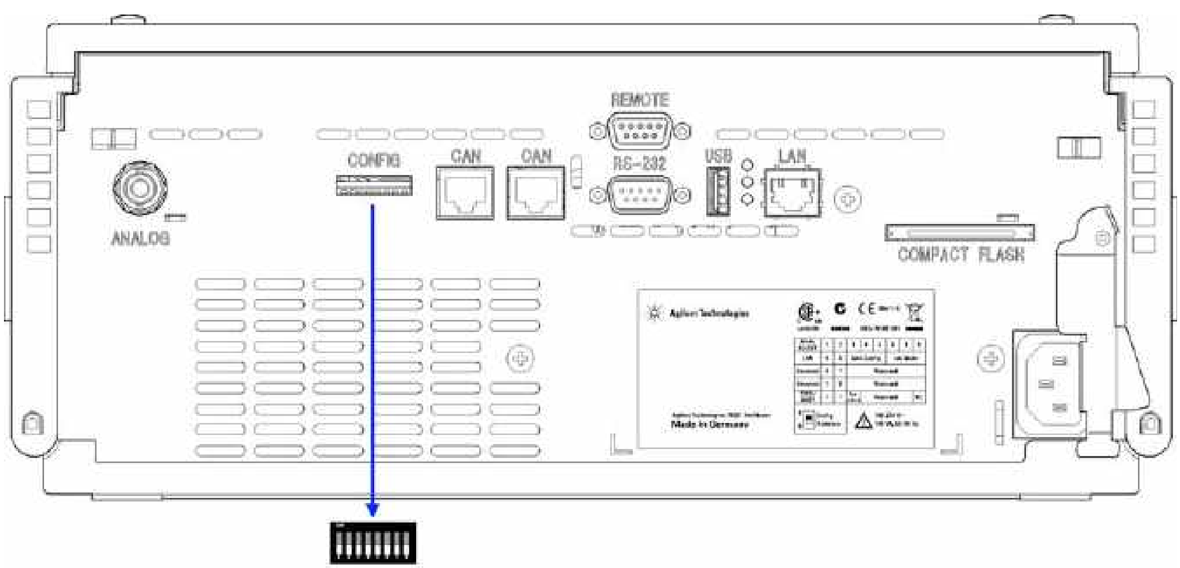



**Figure 83** Location of Configuration Switch (example shows a G4212A DAD)

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

**Table 25** 8-bit Configuration Switch (with on-board LAN)

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

## Legend:

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

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

**NOTE** For explanation of "Boot Resident System" and "Revert to Default Data (Coldstart)" refer to "Special Settings" on page 256.

## 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 26** Boot Resident Settings (On-board LAN)

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

### Forced Cold Start

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

**CAUTION**

Loss of data

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

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

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

**Table 27** Forced Cold Start Settings (On-board LAN)

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

# 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.

# Early Maintenance Feedback (EMF)

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.

# 13
# LAN Configuration

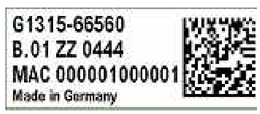


This chapter provides information on connecting the detector to the Agilent ChemStation PC.

# 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 underneath the configuration switch (see Figure 85 on page 262).




Part number of the detector main board
Revision Code, Vendor, Year and Week of assembly
MAC address
Country of Origin

**Figure 84** MAC-Label

2. Connect the instrument's LAN interface (see Figure 85 on page 262) to
   - the PC network card using a crossover network cable (point-to-point) or
   - a hub or switch using a standard LAN cable.

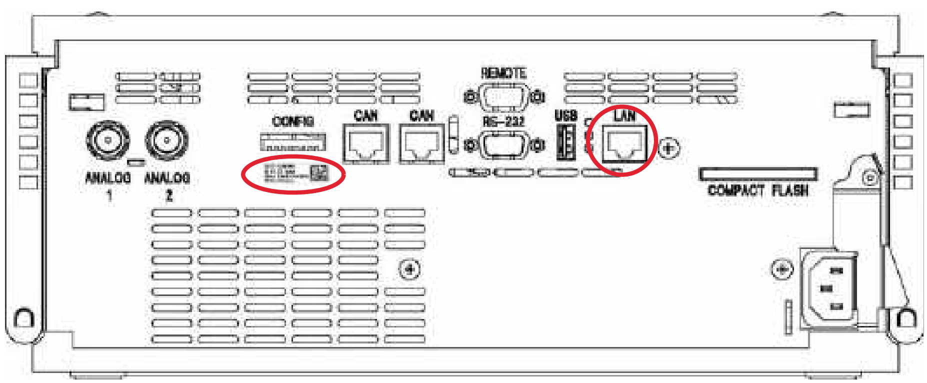



**Figure 85** Location of LAN interface and MAC label

# TCP/IP parameter configuration

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

- IP address
- Subnet Mask
- Default Gateway

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

- by automatically requesting the parameters from a network-based BOOTP Server (using the so-called Bootstrap Protocol)
- 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 270
- 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 a Bootp cycle, non-volatile memory or initialized with known default values. The initialization mode is selected by the configuration switch, see Table 29 on page 265.

# Configuration Switch

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

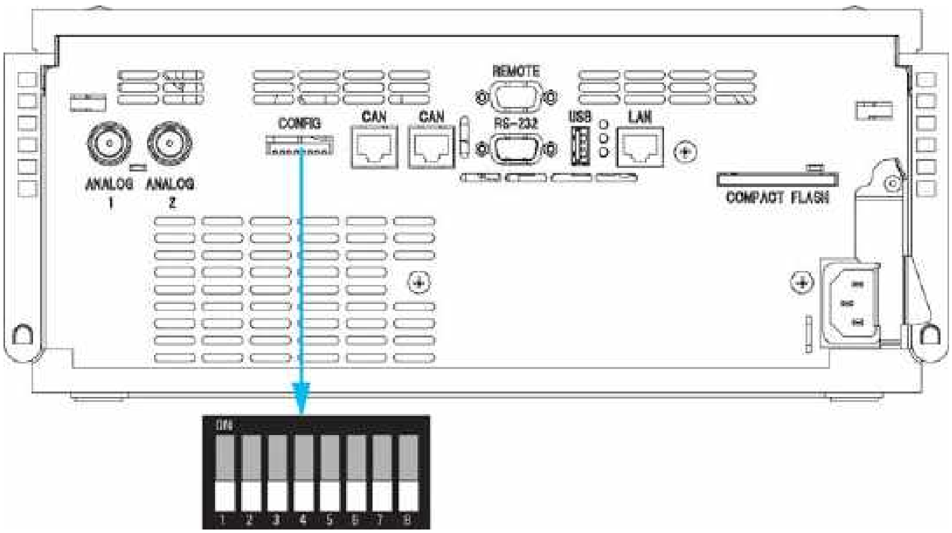



**Figure 86** Location of Configuration Switch

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.

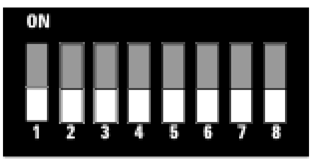
**Table 28** Factory Default Settings

| | |
|---|---|
| Initialization ('Init') Mode | Bootp, all switches down. For details see "Initialization mode selection" on page 265 |
| Link Configuration | speed and duplex mode determined by auto-negotiation, for details see "Link configuration selection" on page 272 |

# Initialization mode selection

The following initialization (init) modes are selectable:

**Table 29** Initialization Mode Switches




| SW 6 | SW 7 | SW 8 | Init Mode |
|---|---|---|---|
| OFF | OFF | OFF | Bootp |
| OFF | OFF | ON | Bootp & Store |
| OFF | ON | OFF | Using Stored |
| OFF | ON | ON | Using Default |
| ON | OFF | OFF | DHCP [1] |

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

## Bootp

When the initialization mode **Bootp** is selected, the module tries to download the parameters from a **Bootp** Server. The parameters obtained become the active parameters immediately. They are not stored to the non-volatile memory of the module. Therefore, the parameters are lost with the next power cycle of the module.

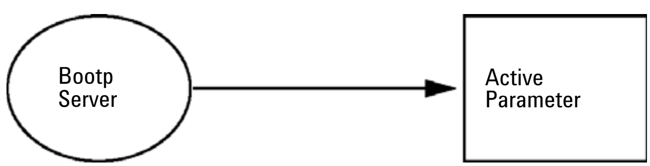



**Figure 87** **Bootp** (Principle)

## Bootp & Store

When **Bootp & Store** is selected, the parameters obtained from a **Bootp** Server become the active parameters immediately. In addition, they are stored to the non-volatile memory of the module. Thus, after a power cycle they are still available. This enables a kind of bootp once configuration of the module.

*Example:* The user may not want to have a **Bootp** Server be active in his network all the time. But on the other side, he may not have any other configuration method than **Bootp**. In this case he starts the **Bootp** Server temporarily, powers on the module using the initialization mode **Bootp & Store**, waits for the **Bootp** cycle to be completed, closes the **Bootp** Server and powers off the module. Then he selects the initialization mode Using Stored and powers on the module again. From now on, he is able to establish the TCP/IP connection to the module with the parameters obtained in that single **Bootp** cycle.

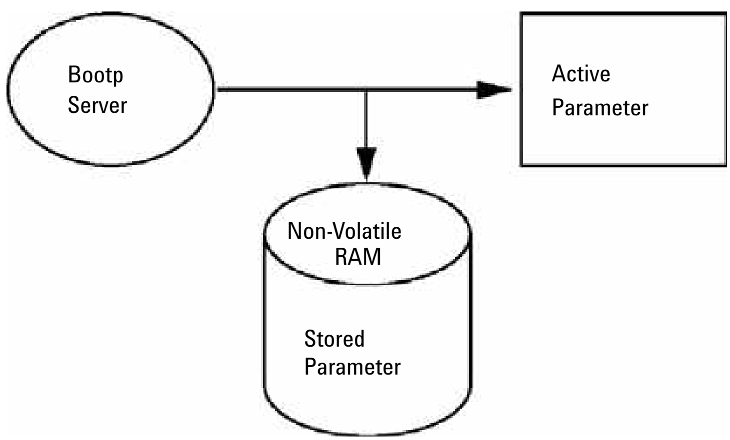



**Figure 88** Bootp & Store (Principle)

**NOTE** Use the initialization mode **Bootp & Store** carefully, because writing to the non-volatile memory takes time. Therefore, when the module shall obtain its parameters from a **Bootp** Server every time it is powered on, the recommended initialization mode is **Bootp**!

### 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.

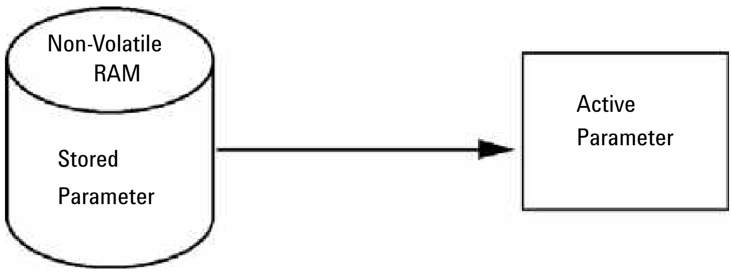



**Figure 89** Using Stored (Principle)

### Using Default

When **Using Default** is selected, the factory default parameters are taken instead. These parameters enable a TCP/IP connection to the LAN interface without further configuration, see Table 30 on page 267.

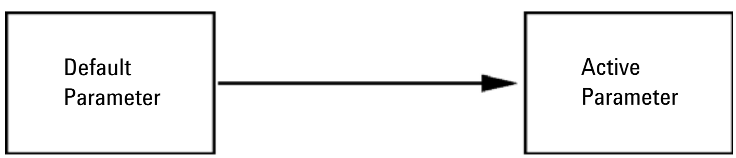



**Figure 90** Using Default (Principle)

**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 30** Using Default Parameters

| | |
|---|---|
| IP address: | 192.168.254.11 |
| Subnet Mask: | 255.255.255.0 |
| Default Gateway | not specified |

Since the default IP address is a so-called local address, it will not be routed by any network device. Thus, the PC and the module must reside in the same subnet.

The user may open a Telnet session using the default IP address and change the parameters stored in the non-volatile memory of the module. He may then close the session, select the initialization mode Using Stored, power-on again and establish the TCP/IP connection using the new parameters.

When the module is wired to the PC directly (e.g. using a cross-over cable or a local hub), separated from the local area network, the user may simply keep the default parameters to establish the TCP/IP connection.

**NOTE** In the **Using Default** mode, the parameters stored in the memory of the module are not cleared automatically. If not changed by the user, they are still available, when switching back to the mode Using Stored.

# Dynamic Host Configuration Protocol (DHCP)

## General Information (DHCP)

The Dynamic Host Configuration Protocol (DHCP) is an auto configuration protocol used on IP networks. The DHCP functionality is available on all Agilent HPLC modules with on-board LAN Interface or LAN Interface Card, and “B”-firmware (B.06.40 or above).

When the initialization mode “DHCP” is selected, the card tries to download the parameters from a DHCP Server. The parameters obtained become the active parameters immediately. They are not stored to the non-volatile memory of the card.

Besides requesting the network parameters, the card also submits its hostname to the DHCP Server. The hostname equals the MAC address of the card, e.g. *0030d3177321*. It is the DHCP server's responsibility to forward the hostname/address information to the Domain Name Server. The card does not offer any services for hostname resolution (e.g. NetBIOS).


**Figure 91** DHCP (Principle)

**NOTE**

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

# Setup (DHCP)

**Software required** The modules in the stack must have at least firmware from set A.06.34 and the above mentioned modules B.06.40 or above (must from the same firmware 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.

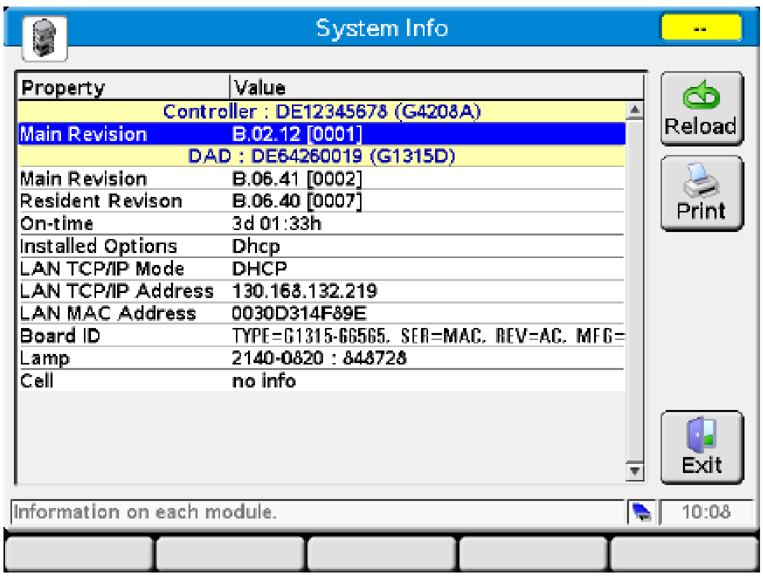



**Figure 92** LAN Setting on Instant Pilot

2 Set the Configuration Switch to DHCP either on the G1369C LAN Interface Card or the main board of above mentioned modules.

**Table 31** G1369C LAN Interface Card (configuration switch on the card)

| SW 4 | SW 5 | SW 6 | SW 7 | SW 8 | Initialization Mode |
|---|---|---|---|---|---|
| ON | OFF | OFF | OFF | OFF | DHCP |

**Table 32** LC Modules inclusive 1120/1220 (configuration switch at rear of the instrument)

| SW 6 | SW 7 | SW 8 | Initialization Mode |
| --- | --- | --- | --- |
| ON | OFF | OFF | DHCP |

**3** Turn on the module that hosts the LAN interface.

**4** Configure your Control Software (e.g. Agilent ChemStation, 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 269).

# Link configuration selection

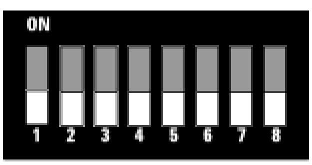
The LAN interface supports 10 or 100 Mbps operation in full- or half-duplex modes. In most cases, full-duplex is supported when the connecting network device - such as a network switch or hub - supports IEEE 802.3u auto-negotiation specifications.

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 33** Link Configuration Switches

| | SW 3 | SW 4 | SW 5 | Link Configuration |
|---|---|---|---|---|
|   | OFF | - | - | speed and duplex mode determined by auto-negotiation |
| | ON | OFF | OFF | manually set to 10 Mbps, half-duplex |
| | ON | OFF | ON | manually set to 10 Mbps, full-duplex |
| | ON | ON | OFF | manually set to 100 Mbps, half-duplex |
| | ON | ON | ON | manually set to 100 Mbps, full-duplex |

# Automatic Configuration with BootP

**NOTE** All examples shown in this chapter will not work in your environment. You need your own IP-, Subnet-Mask- and Gateway addresses.

**NOTE** Assure that the detector configuration switch is set properly. The setting should be either **BootP** or **BootP & Store**, see Table 29 on page 265.

**NOTE** Assure that the detector connected to the network is powered off.

**NOTE** If the Agilent BootP Service program is not already installed on your PC, then install it from your Agilent ChemStation DVD, located in folder **BootP**.

## About Agilent BootP Service

The Agilent BootP Service is used to assign the LAN Interface with an IP address.

The Agilent BootP Service is provided on the ChemStation DVD. The Agilent BootP Service is installed on a server or PC on the LAN to provide central administration of IP addresses for Agilent instruments on a LAN. The BootP service must be running TCP/IP network protocol and cannot run a DHCP server.

## How BootP Service Works

When an instrument is powered on, an LAN Interface in the instrument broadcasts a request for an IP address or host name and provides its hardware MAC address as an identifier. The Agilent BootP Service answers this request and passes a previously defined IP address and host name associated with the hardware MAC address to the requesting instrument.

The instrument receives its IP address and host name and maintains the IP address as long as it is powered on. Powering down the instrument causes it to lose its IP address, so the Agilent BootP Service must be running every time the instrument powers up. If the Agilent BootP Service runs in the background, the instrument will receive its IP address on power-up.

The Agilent LAN Interface can be set to store the IP address and will not lose the IP address if power cycled.

## Situation: Cannot Establish LAN Communication

If a LAN communication with BootP service cannot be established, check the following on the PC:

- Is the BootP service started? During installation of BootP, the service is not started automatically.
- Does the Firewall block the BootP service? Add the BootP service as an exception.
- Is the LAN Interface using the BootP-mode instead of "Using Stored" or "Using Default" modes?

## Installation of BootP Service

Before installing and configuring the Agilent BootP Service, be sure to have the IP addresses of the computer and instruments on hand.

1 Log on as Administrator or other user with Administrator privileges.
2 Close all Windows programs.
3 Insert the Agilent ChemStation software DVD into the drive. If the setup program starts automatically, click **Cancel** to stop it.
4 Open Windows Explorer.
5 Go to the BootP directory on the Agilent ChemStation DVD and double-click **BootPPackage.msi**.
6 If necessary, click the **Agilent BootP Service...** icon in the task bar.
7 The **Welcome** screen of the **Agilent BootP Service Setup Wizard** appears. Click **Next**.
8 The **End-User License Agreement** screen appears. Read the terms, indicate acceptance, then click **Next**.
9 The **Destination Folder** selection screen appears. Install BootP to the default folder or click **Browse** to choose another location. Click **Next**.

   The default location for installation is:

   C:\Program Files\Agilent\BootPService\
10 Click **Install** to begin installation.

**11** Files load; when finished, the **BootP Settings** screen appears.

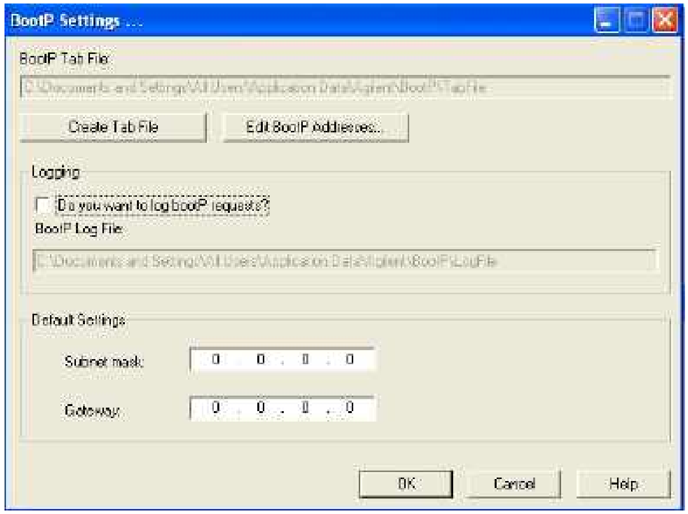



**Figure 93** BootP Settings screen

**12** In the **Default Settings** part of the screen, if known, you can enter the subnet mask and gateway.

Defaults can be used:

- The default subnet mask is 255.255.255.0
- The default gateway is 192.168.254.11

**13** On the **BootP Settings** screen, click **OK**. The **Agilent BootP Service Setup** screen indicates completion.

**14** Click **Finish** to exit the **Agilent BootP Service Setup** screen.

**15** Remove the DVD from the drive.

This completes installation.

**16** Start BootP Service in the Windows® services: On the Windows® desktop click right on **Computer** icon, select **Manage > Services and Applications > Services**. Select the **Agilent BootP Service** and click **Start**.

# Two Methods to Determine the MAC Address

## Enabling logging to discover the MAC address using BootP

If you want to see the MAC address, select the **Do you want to log BootP requests?** check box.

1 Open BootP Settings from **Start > All Programs > Agilent BootP Service > EditBootPSettings**.

2 In **BootP Settings...** check **Do you want to log BootP requests?** to enable logging.


**Figure 94** Enable BootP logging

The log file is located in

C:\Documents and Settings\All Users\Application Data\Agilent\BootP\LogFile

It contains a MAC address entry for each device that requests configuration information from BootP.

3 Click **OK** to save the values or **Cancel** to discard them. The editing ends.

4 After each modification of the BootP settings (i.e. **EditBootPSettings**) a stop or start of the BootP service is required for the BootP service to accept changes. See "Stopping the Agilent BootP Service" on page 281 or "Restarting the Agilent BootP Service" on page 282.

5 Uncheck the **Do you want to log BootP requests?** box after configuring instruments; otherwise, the log file will quickly fill up disk space.

## Determining the MAC address directly from the LAN Interface card label

1 Turn off the instrument.

2 Read the MAC address from the label and record it.

The MAC address is printed on a label on the rear of the module. It is the number below the barcode and after the colon (:) and usually begins with the letters AD, see Figure 84 on page 262 and Figure 85 on page 262.

3 Turn on the instrument.

## Assigning IP Addresses Using the Agilent BootP Service

The Agilent BootP Service assigns the Hardware MAC address of the instrument to an IP address.

### Determining the MAC address of the instrument using BootP Service

1 Power cycle the Instrument.

2 After the instrument completes self-test, open the log file of the BootP Service using Notepad.

   - The default location for the logfile is C:\Documents and Settings\All Users\Application Data\Agilent\BootP\LogFile.
   - The logfile will not be updated if it is open.

   The contents will be similar to the following:

```
02/25/10 15:30:49 PM

Status: BootP Request received at outermost layer

Status: BootP Request received from hardware address: 0010835675AC

Error: Hardware address not found in BootPTAB: 0010835675AC

Status: BootP Request finished processing at outermost layer
```

3 Record the hardware (MAC) address (for example, 0010835675AC).

4 The Error means the MAC address has not been assigned an IP address and the Tab File does not have this entry. The MAC address is saved to the Tab File when an IP address is assigned.

5 Close the log file before turning on another instrument.

6 Uncheck the **Do you want to log BootP requests?** box after configuring instruments to avoid having the logfile use up excessive disk space.

### Adding each instrument to the network using BootP

1 Follow **Start > All Programs > Agilent BootP Service** and select **Edit BootP Settings**. The BootP Settings screen appears.

2 Uncheck the **Do you want to log BootP requests?** once all instruments have been added.

The **Do you want to log BootP requests?** box must be unchecked when you have finished configuring instruments; otherwise, the log file will quickly fill up disk space.

3 Click **Edit BootP Addresses...** The **Edit BootP Addresses** screen appears.

4 Click **Add...** The **Add BootP Entry** screen appears.

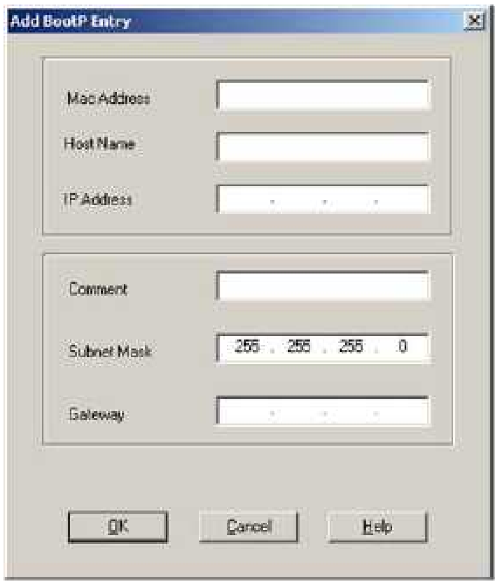



**Figure 95** Enable BootP logging

5 Make these entries for the instrument:
   - MAC address
   - Host name, Enter a Hostname of your choice.

     The Host Name must begin with "alpha" characters (i.e. LC1260)
   - IP address
   - Comment (optional)
   - Subnet mask
   - Gateway address (optional)

   The configuration information entered is saved in the Tab File.

6 Click **OK**.

7 Leave **Edit BootP Addresses** by pressing **Close**.

8 Exit **BootP Settings** by pressing **OK**.

9 After each modification of the BootP settings (i.e. EditBootPSettings) a stop or start of the BootP service is required for the BootP service to accept changes. See "Stopping the Agilent BootP Service" on page 281 or "Restarting the Agilent BootP Service" on page 282.

10 Power cycle the Instrument.

   OR

   If you changed the IP address, power cycle the instrument for the changes to take effect.

11 Use the PING utility to verify connectivity by opening a command window and typing:

   Ping 192.168.254.11 for example.

   The Tab File is located at

   C:\Documents and Settings\All Users\Application Data\Agilent\BootP\TabFile

# Changing the IP Address of an Instrument Using the Agilent BootP Service

Agilent BootP Service starts automatically when your PC reboots. To change Agilent BootP Service settings, you must stop the service, make the changes, and then restart the service.

## Stopping the Agilent BootP Service

1 From the Windows control panel, select **Administrative Tools > Services**. The **Services** screen appears.

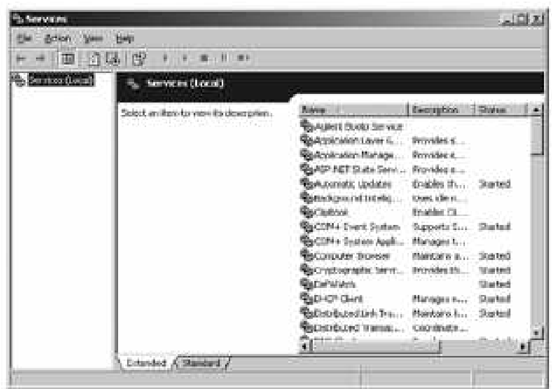


**Figure 96** Windows Services screen

2 Right-click **Agilent BootP Service**.

3 Select **Stop**.

4 Close the **Services and Administrative Tools** screen.

### Editing the IP address and other parameters in EditBootPSettings

1 Select **Start > All Programs > Agilent BootP Service** and select **Edit BootP Settings**. The **BootP Settings** screen appears.

2 When the **BootP Settings** screen is first opened, it shows the default settings from installation.

3 Press **Edit BootP Addresses...** to edit the Tab File.

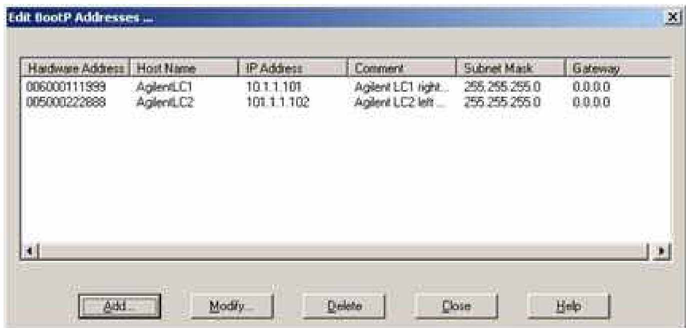



**Figure 97** Edit BootP Adresses screen

4 In the **Edit BootP Addresses...** screen press **Add...** to create a new entry or select an existing line from the table and press **Modify...** or **Delete** to change the IP address, comment, subnet mask, for example, in the Tab File.

If you change the IP address, it will be necessary to power cycle the instrument for the changes to take effect.

5 Leave **Edit BootP Addresses...** by pressing **Close**.

6 Exit BootP Settings by pressing OK.

### Restarting the Agilent BootP Service

1 In the Windows control panel, select **Administrative Tools > Services**. The **Services** screen appears, see Figure 96 on page 281.

2 Right-click **Agilent BootP Service** and select **Start**.

3 Close the **Services and Administrative Tools** screens.

# Storing the settings permanently with Bootp

If you want to change parameters of the module using the Bootp follow the instructions below.

1 Turn off the module.
2 Change the module's settings of the Configuration Switch to *"Bootp & Store"* mode, see Table 29 on page 265.
3 Start the Agilent Bootp Service and open its window.
4 If required, modify the parameters for the module according to your needs using the existing configuration.
5 Press **OK** to exit the Bootp Manager.
6 Now turn on the module and view the Bootp Server window. After some time the Agilent Bootp Service will display the request from the LAN interface. The parameters are now stored permanently in the non-volatile memory of the module.
7 Close the Agilent Bootp Service and turn off the module.
8 Change the settings of the module's Configuration Switch to *"Using Stored"* mode, see Table 29 on page 265.
9 Power cycle the module. The module can be accessed now via LAN without the Agilent Bootp Service.

# 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.

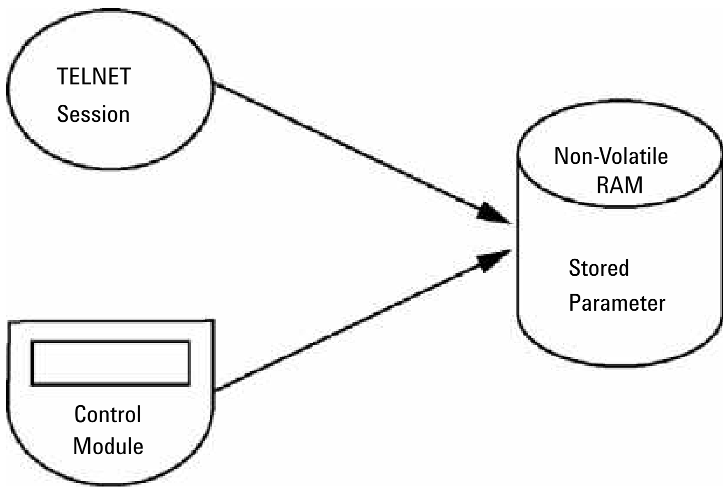



**Figure 98** Manual Configuration (Principle)

## 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 99** Telnet - Starting a session

where <IP address> may be the assigned address from a Bootp cycle, a configuration session with the Handheld Controller, or the default IP address (see "Configuration Switch" on page 264).

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


**Figure 100** A connection to the module is made

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


**Figure 101** Telnet Commands

**Table 34** Telnet Commands

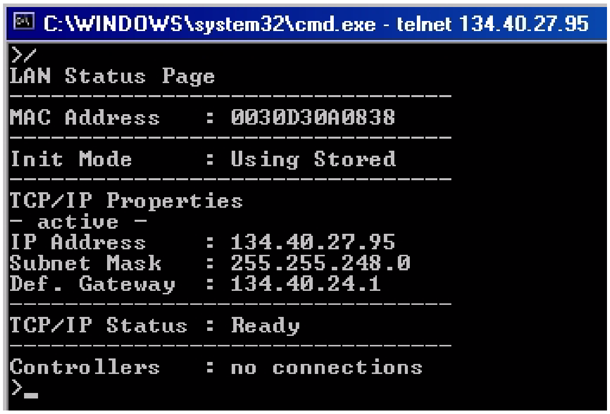
| Value | Description |
|---|---|
| ? | displays syntax and descriptions of commands |
| / | displays current LAN settings |
| ip <x.x.x.x> | sets new ip address |
| sm <x.x.x.x> | sets new subnet mask |
| gw <x.x.x.x> | sets new default gateway |
| exit | exits shell and saves all changes |

**4** To change a parameter follows the style:

- parameter value, for example:
  `ip 134.40.27.230`

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

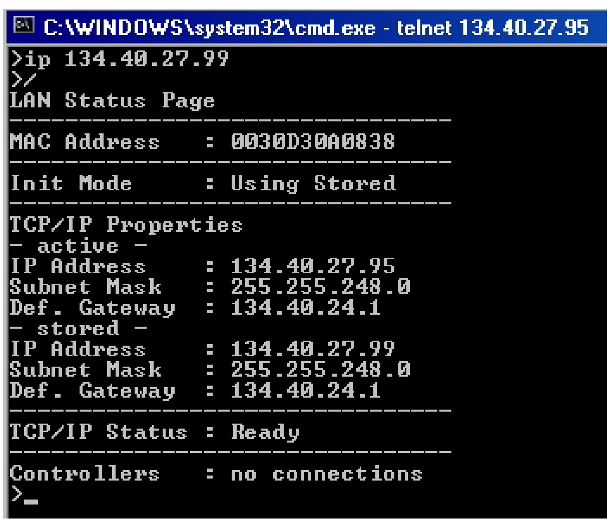
5 Use the “/” and press Enter to list the current settings.




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

**Figure 102** Telnet - Current settings in "Using Stored" mode

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




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

connected to PC with controller software (e.g. Agilent ChemStation), here not connected

**Figure 103** Telnet - Change IP settings

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

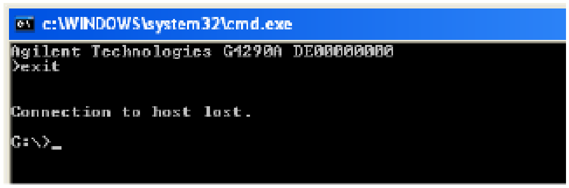



**Figure 104** Closing the Telnet Session

**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.

# With the Instant Pilot (G4208A)

To configure the TCP/IP parameters before connecting the module to the network, the Instant Pilot (G4208A) can be used.

1 From the Welcome screen press the **More** button.

2 Select **Configure.**

3 Press the **DAD** button.

4 Scroll down to the LAN settings.

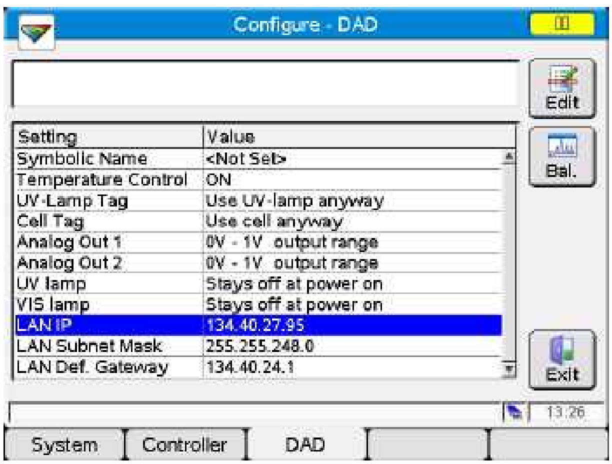



**Figure 105** Instant Pilot - LAN Configuration

5 Press the **Edit** button (only visible if not in Edit mode), perform the required changes and press the **Done** button.

6 Leave the screen by clicking **Exit**.

# 14
# Appendix



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

# Safety Information

## General Safety Information

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

**WARNING**

**Ensure the proper usage of the equipment.**

**The protection provided by the equipment may be impaired.**

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

## Safety Standards

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

## Operation

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

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

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

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

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

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

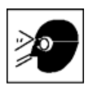
Do not install substitute parts or make any unauthorized modification to the instrument.

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

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

# Safety Symbols

**Table 35** Safety Symbols

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

**WARNING**

**A WARNING**

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

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

**CAUTION**

A CAUTION

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

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

# The Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC)

## Abstract

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

**NOTE**

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

Product Category: With reference to the equipment types in the WEEE Directive Annex I, this product is classed as a “Monitoring and Control instrumentation” product.

*Do not dispose off in domestic household waste*

To return unwanted products, contact your local Agilent office, or see www.agilent.com for more information.

# Radio Interference

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

## Test and Measurement

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

# Sound Emission

## Manufacturer’s Declaration

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

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

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

# UV-Radiation

**NOTE** This information is only valid for UV-lamps without cover (e.g. 2140-0590 and 2140-0813).

Emissions of ultraviolet radiation (200-315 nm) from this product is limited such that radiant exposure incident upon the unprotected skin or eye of operator or service personnel is limited to the following TLVs (Threshold Limit Values) according to the American Conference of Governmental Industrial Hygienists:

**Table 36** UV-Radiation Limits

| Exposure/day | Effective Irradiance |
| --- | --- |
| 8 hours | 0.1 µW/cm2 |
| 10 minutes | 5.0 µW/cm2 |

Typically the radiation values are much smaller than these limits:

**Table 37** UV-Radiation Typical Values

| Position | Effective Irradiance |
| --- | --- |
| Lamp installed, 50 cm distance | Average 0.016 µW/cm2 |
| Lamp installed, 50 cm distance | Maximum 0.14 µW/cm2 |

# Solvent Information

## Flow Cell

To protect optimal functionality of your flow-cell:

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

## Use of Solvents

Observe the following recommendations on the use of solvents.

- Brown glass ware can avoid growth of algae.
- Small particles can permanently block capillaries and valves. Therefore always filter solvents through 0.4 µm filters.
- Avoid the use of the following steel-corrosive solvents:
  - Solutions of alkali halides and their respective acids (for example, lithium iodide, potassium chloride, and so on),
  - High concentrations of inorganic acids like sulfuric acid and nitric acid, especially at higher temperatures (if your chromatography method allows, replace by phosphoric acid or phosphate buffer which are less corrosive against stainless steel),
  - Halogenated solvents or mixtures which form radicals and/or acids, for example:

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

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

- Chromatographic grade ethers, which can contain peroxides (for example, THF, dioxane, di-isopropylether) such ethers should be filtered through dry aluminium oxide which adsorbs the peroxides,
- Solvents containing strong complexing agents (e.g. EDTA),
- Mixtures of carbon tetrachloride with 2-propanol or THF.

# Declaration of Conformity for HOX2 Filter

## Declaration of Conformity

We herewith inform you that the

**Holmium Oxide Glass Filter**

used in Agilents absorbance detectors listed in the table below meets the requirements of National Institute of Standards and Technology (NIST) to be applied as certified wavelength standard.

According to the publication of NIST in J. Res. Natl. Inst. Stand. Technol. 112, 303-306 (2007) the holmium oxide glass filters are inherently stable with respect to the wavelength scale and need no recertification. The expanded uncertainty of the certified wavelength values is 0.2 nm.

Agilent Technologies guarantees, as required by NIST, that the material of the filters is holmium oxide glass representing the inherently existent holmium oxide absorption bands.

Test wavelengths:

Where "x" can be any alphanumeric character

| Product Number | Series | Measured Wavelength * | Wavelength Accuracy | Optical Bandwidth |
|---|---|---|---|---|
| G1315x, G1365x | 1100, 1200, 1260 | 361.0 nm<br>418.9 nm<br>453.7 nm<br>536.7 nm | +/- 1 nm | 2 nm |
| G7115x, G7165x | 1260 | | | |
| G1600x, G7100x | CE | | | |
| G1314x | 1100, 1200, 1260, 1290 | 360.8nm<br>418.5nm<br>536.4nm | +/- 1 nm | 6 nm |
| G7114x | 1260, 1290 | | | |
| G4286x,..., 94x | 1120, 1220 | | | |

*) The variation in Measured Wavelength depends on the different Optical Bandwidth.

28-Oct-2014
(Date)

Thomas Jöris
(R&D Manager)

Stephan Bergenbach
(Quality Manager)

P/N 89550-90501

Revision: G
Effective by: 28-Oct-2014

# Installation of Stainless Steel Cladded PEEK Capillaries

**NOTE**

This installation procedure applies for capillaries and corresponding fittings used in modules delivered before January 2013. For current capillaries and fittings, see "Installing UHP-FF Fittings" on page 55.

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

**CAUTION**

Handling of stainless-steel-cladded PEEK capillaries

Be careful when installing stainless-steel-cladded PEEK capillaries. The correct torque must be applied to avoid leaks potentially causing measurement problems or damage to the capillary.

→ Follow the procedure below for a correct installation

## Installation procedure

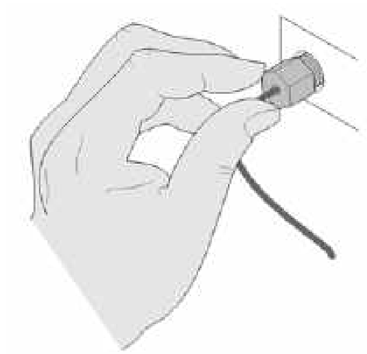
The amount of force/torque needing to be applied to install the capillary depends on

- the female connector to which the capillary is installed, and whether the material of that connector is soft or hard. Compared with hard connectors, a greater tightening angle is required for soft connectors to achieve same torque.
- whether the capillary is installed for the first time or subsequent times. For the first time, a greater tightening angle needs to be applied.

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

## First Step: Finger-tight Fitting

**1** Tighten the fitting using your fingers.



## Second Step: Installation to Connector

In the second step (“Second Step: Installation to Hard Connectors” on page 303 or “Second Step: Installation to Soft Connectors” on page 304), a wrench is used to rotate the fitting relative to the finger-tight position by a defined angle. For each of the cases mentioned above, there is a recommended range in which the fitting is tight.

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

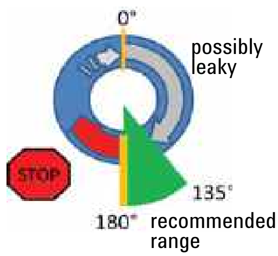
Alternatively, a torque wrench may be used. The target torque for all connections is about 0.7 Nm. When using a torque wrench, read instructions for that tool carefully, as wrong handling may easily miss the correct torque.

### Second Step: Installation to Hard Connectors

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

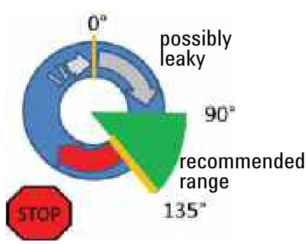
**First installation of a capillary to a hard connector**

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




**Second and subsequent installations of a capillary to a hard connector**

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




## Second Step: Installation to Soft Connectors

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

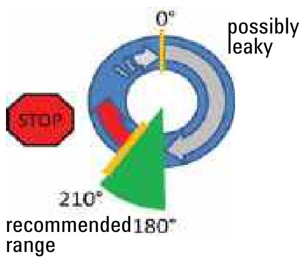
- to and from all bio-inert valves (injection valve in the autosampler and valves in the thermostatted column compartment and 1290 Infinity Valve Drive),
- bio-inert ZDV unions (detector flow cells, multi-draw upgrade kit, capillary to capillary connections, for example, for heat exchangers),

- to the autosampler needle and
- to PEEK columns (like many bio-inert columns).

For the installation of bio-inert ZDV unions, see "Installation of the Bio-inert Zero Dead Volume (ZDV) Union" on page 59.

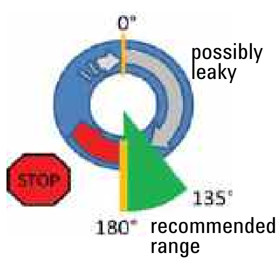
**First installation of a capillary to a soft connector**

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



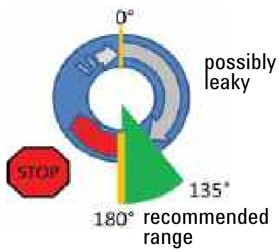
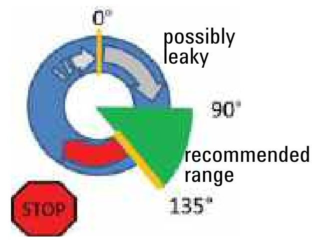
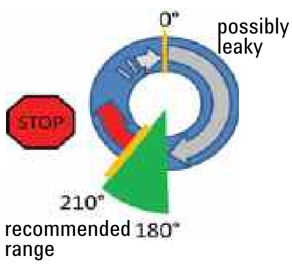
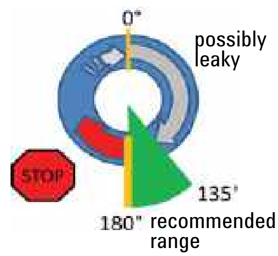

**Second and subsequent installations of a capillary to a soft connector**

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



## Summary for Second Step

**Table 38** Summary for second step

<table>
<tr><th>2nd Step</th><th>First installation</th><th>Subsequent installations</th></tr>
<tr><td>Hard connectors</td><td>
</td><td>
</td></tr>
<tr><td>Soft connectors</td><td>
</td><td>
</td></tr>
</table>

## Removing Capillaries

**CAUTION** Potential damage of capillaries

→ Do not remove fittings from used capillaries.

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

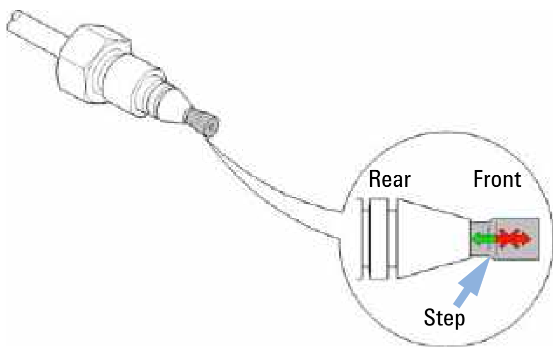



**Figure 106** Capillary fitting

# Agilent Technologies on Internet

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http://www.agilent.com

# Index

www.agilent.com

# In This Book

This manual contains technical reference information about the Agilent 1260 Infinity diode array and multiple wavlength detectors G1315C/D and G1365C/D.

The manual describes the following:

- introcduction and specifications,
- installation,
- using and optimizing,
- troubleshooting and diagnose,
- maintenance,
- parts identification,
- safety and related information.



Printed in Germany
07/2018

G1315-90015
Rev. C

Agilent Technologies