Notices

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**CAUTION**

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In This Guide...

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

- G7115A - 1260 Infinity II DAD WR
- G7165A - 1260 Infinity II MWD

1 Introduction
This chapter gives an introduction to the module.

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

3 Using the Module
This chapter explains the essential operational parameters of the module.

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

5 Optimizing 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.

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.
In This Guide...

8 Test Functions and Calibration
This chapter describes the tests for the module.

9 Maintenance
This chapter describes the maintenance of the detector.

10 Parts for Maintenance
This chapter provides information on parts for maintenance and repair.

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

12 Hardware Information
This chapter describes the detector in more detail on hardware and electronics.

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

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

1 **Introduction**  9
   - Introduction to the Detector  10
   - G7115A Diode Array Detector WR  11
   - G7165A Multiple Wavelength Detector  13
   - Optical System  15
   - Leak and Waste Handling  18
   - Bio-inert Materials  23

2 **Site Requirements and Specifications**  25
   - Site Requirements  26
   - Physical Specifications  29
   - Performance Specifications  30

3 **Using the Module**  37
   - Magnets  38
   - Turn on/off  39
   - Status Indicators  40
   - Instrument Configuration  41
   - Set up the Detector with Agilent Open Lab ChemStation  42
   - The Detector User Interface  43
   - Detector Control Settings  45
   - Method Parameter Settings  46

4 **Preparing the Detector**  51
   - Leak and Waste Handling  52
   - Setting up an Analysis  54
   - Solvent Information  61
## Contents

### 5 Optimizing the Detector 67
- Optimizing the Detector Performance 68
- Optimization Overview 69
- Optimizing for Sensitivity, Selectivity, Linearity and Dispersion 71
- Optimizing Selectivity 81
- Optimizing the Detector Regarding to the System 85
- Warm up of the Detector 91

### 6 Troubleshooting and Diagnostics 93
- Available Tests vs User Interfaces 94
- Agilent Lab Advisor Software 95
- Available Diagnostic Functions vs. Product Level 96

### 7 Error Information 99
- What Are Error Messages 101
- General Error Messages 102
- Detector Error Messages 109

### 8 Test Functions and Calibration 117
- Introduction 118
- Conditions of Detector 122
- Failing a Test 123
- Self-Test 124
- Intensity Test 126
- Cell Test 129
- Filter Test 132
- Holmium Oxide Test 134
- ASTM Drift and Noise Test 137
- Slit Test 141
- Wavelength Verification Test 144
- Wavelength Calibration 146
- D/A Converter (DAC) Test 149
- Dark-Current Test 151
- Spectral Scan 154
- Other Lab Advisor Functions 155
9 Maintenance 157
Introduction to Maintenance 158
Cautions and Warnings 159
Overview of Maintenance 161
Cleaning the Module 162
Remove and Install Doors 163
Replace a Lamp 164
Remove and Install a Flow Cell 168
Maintenance of Standard, Semi-Micro or Micro Flow Cell 172
Maintenance of High Pressure Flow Cell 176
Replacing Capillaries on a Standard Flow Cell 178
Replacing Capillaries on a Semi-Micro and Micro Flow Cell 183
Nano Flow Cell - Replacing or Cleaning 187
Cleaning or Exchanging the Holmium Oxide Filter 192
Correcting Leaks 195
Replacing Leak Handling System Parts 198
Replacing the Module’s Firmware 200
Information from Module’s Assemblies 202

10 Parts for Maintenance 203
Overview of Maintenance Parts 204
Standard Flow Cell 206
Standard Flow Cell Bio-inert 208
Semi-Micro Flow Cell 210
Micro Flow Cell 212
High Pressure Flow Cell 214
Prep Flow Cell - SST 216
Prep Flow Cell - Quartz 218
Nano Flow Cells 220
Accessory Kits 223
Holmium Oxide Filter 224
Leak Handling Parts 225
1 Introduction

Introduction to the Detector 10
G7115A Diode Array Detector WR 11
    Product Description 11
    Features 12
G7165A Multiple Wavelength Detector 13
    Product Description 13
    Features 14
Optical System 15
Leak and Waste Handling 18
    Waste Concept 22
    Bio-inert Materials 23

This chapter gives an introduction to the module.
Introduction to the Detector

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

- 120 Hz data acquisition rate for (ultra-) fast LC applications,
- 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 mm 13 μL, semi-micro 6 mm 5 μL, micro 3 mm 2 μL, 80 nL, 500 nL, 10 mm, high pressure 10 mm 1.7 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 “Specifications” on page 30.
G7115A Diode Array Detector WR

Product Description

The 1260 Infinity II DAD WR detector is designed for highest optical performance, GLP compliance, and easy maintenance. With its 120 Hz data acquisition rate the detector is perfectly suited for fast LC applications. The long –life deuterium lamps allow highest intensity and lowest detection limits over a wavelength range of 190 – 950 nm. The use of RFID tags for all flow cells and UV-lamps provides traceable information about these assemblies.

The built-in holmium oxide filter features the fast wavelength accuracy verification, while the built-in temperature controls improves the baseline stability. Additional diagnostic signals for temperature and lamp voltage monitoring are available.

Figure 1: Overview of the detector
Features

- **Higher sensitivity and selectivity** - simultaneous detection of up to eight compound-specific wavelengths.
- **Low detection limits** - low noise front-end electronics and the patented flow cell design delivers very low detection limits thanks to the minimization of short-term noise (\(< ± 7 \, \mu\text{AU}\)).
- **Up to 100 % resolution gain in fast LC** - using an 120 Hz data acquisition rate.
- **Maximum baseline stability** - electronic temperature control (ETC) reduces baseline drift under fluctuating ambient temperature and humidity conditions.
- **Wide linear range** - for reliable, simultaneous quantification of primary compounds, by-products, and impurities.
- **Programmable slit** (1 – 16 nm) for rapid optimization of sensitivity and linearity.
- **Excellent data traceability** - radio frequency identification (RFID) tags on cells and source lamps improve traceability of data.
- **Automatic wavelength verification** by built-in holmium oxide filter.
- **Nine analytical and preparative flow cells** provide you with maximum application flexibility and choice.
- **Extensive diagnostics**, error detection and display with Instant Pilot controller and Lab Advisor software.
G7165A Multiple Wavelength Detector

**Product Description**

The 1260 Infinity II Multiple Wavelength Detector is designed for highest optical performance, GLP compliance, and easy maintenance. With its 120 Hz data acquisition rate, the detector is perfectly suited for fast LC applications. The long-life deuterium lamps allows highest intensity and lowest detection limits over a wavelength range of 190 – 950 nm. The use of RFID tags for all flow cells and UV-lamps provides traceable information about these assemblies.

The built-in holmium oxide filter features the fast wavelength accuracy verification, while the built-in temperature controls improves the baseline stability. Additional diagnostic signals for temperature and lamp voltage monitoring are available.

![Overview of the detector](image)

**Figure 2** Overview of the detector
Introduction
G7165A Multiple Wavelength Detector

Features

- **Higher sensitivity and selectivity** - simultaneous detection of up to eight compound-specific wavelengths.
- **Low detection limits** - low noise front-end electronics and the patented flow cell design delivers very low detection limits thanks to the minimization of short-term noise (< ± 7 μAU).
- **Up to 100 % resolution gain in fast LC** - using a 120 Hz data acquisition rate.
- **Maximum baseline stability** - electronic temperature control (ETC) reduces baseline drift under fluctuating ambient temperature and humidity conditions.
- **Wide linear range** - for reliable, simultaneous quantification of primary compounds, by-products and impurities.
- **Programmable slit** (1 – 16 nm) for rapid optimization of sensitivity and linearity.
- **Excellent data traceability** - radio frequency identification (RFID) tags on cells and source lamps improve traceability of data.
- **Automatic wavelength verification** by built-in holmium oxide filter.
- **Nine analytical and preparative flow cells** provide you with maximum application flexibility and choice.
- **Extensive diagnostics**, error detection and display with Instant Pilot controller and Lab Advisor software.
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 3  Optical System of the Detector
## 1 Introduction

### Optical System

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lamps</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Achromat (Source Lens)</strong></td>
<td>The achromat receives the light from both lamps and focuses it so that the beam passes through the flow cell.</td>
</tr>
<tr>
<td><strong>Holmium Oxide Filter</strong></td>
<td>The holmium oxide filter is electromechanically actuated. During the holmium filter test it moves into the light path.</td>
</tr>
<tr>
<td><strong>Cell Support Window</strong></td>
<td>The cell support window assembly separates the holmium filter area from the flow cell area.</td>
</tr>
<tr>
<td><strong>Flow Cell Compartment</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Spectrograph</strong></td>
<td>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 &lt; 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.</td>
</tr>
<tr>
<td><strong>Variable Entrance Slit System</strong></td>
<td>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.</td>
</tr>
</tbody>
</table>
Optical System

**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.
Leak and Waste Handling

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

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

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

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

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

- from the detector's flow cell outlet
- from the Multisampler needle wash port
- from the Sample Cooler (condensate)
- from the Seal Wash Sensor
- from the pump's Purge Valve or Multipurpose Valve
Figure 4  Infinity II Leak Waste Concept (flexible rack installation)
Introduction

Leak and Waste Handling

Figure 5  Infinity II Single Stack Leak Waste Concept (bench installation)
Figure 6  Infinity II Two Stack Leak Waste Concept (bench installation)

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

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

For the 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 science 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.
# Introduction

## Bio-inert Materials

### Table 1  Used Bio-inert materials

<table>
<thead>
<tr>
<th>Module</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agilent 1260 Infinity II Bio-inert Pump (G5654A)</td>
<td>Titanium, gold, platinum-iridium, ceramic, ruby, PTFE, PEEK</td>
</tr>
<tr>
<td>Agilent 1260 Infinity II Bio-inert Multisampler (G5668A)</td>
<td>Upstream of sample introduction: • Titanium, gold, PTFE, PEEK, ceramic</td>
</tr>
<tr>
<td></td>
<td>Downstream of sample introduction: • PEEK, ceramic</td>
</tr>
<tr>
<td>Agilent 1260 Infinity II Bio-inert Manual Injector (G5628A)</td>
<td>PEEK, ceramic</td>
</tr>
</tbody>
</table>

**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 II Diode Array Detectors DAD G7115A)*
  - PEEK, ceramic, sapphire, PTFE

- 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 G7121A/B)*
  - PEEK, fused silica, PTFE

- Quick-Connect Heat Exchanger Bio-inert (G7116-60041) *(for Agilent 1260 Infinity II Multicolumn Thermostat G7116A)*
  - PEEK (steel-cladded)

- Bio-inert Valve heads (G4235A, G5631A, G5632A, G5639A)
  - PEEK, ceramic (Al₂O₃ based)

- Bio-inert Connection capillaries
  - Upstream of sample introduction:
    - Titanium
  - Downstream of sample introduction:
    - 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 II 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 61.
2 Site Requirements and Specifications

Site Requirements 26
Physical Specifications 29
Performance Specifications 30
  Specifications 30
  Specification Conditions 36

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 29. Consequently there is no voltage selector in the rear of the module. There are also no externally accessible fuses, because automatic electronic fuses are implemented in the power supply.

**WARNING**

Hazard of electrical shock or damage of your instrumentation can result, if the devices are connected to a line voltage higher than specified.

➔ Connect your instrument to the specified line voltage only.

**WARNING**

Electrical shock hazard

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

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

➔ Do not open the cover.

➔ Do not operate the instrument and disconnect the power cable in case the cover has any signs of damage.

➔ Contact Agilent for support and request an instrument repair service.

**WARNING**

Inaccessible power plug.

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

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

➔ Provide sufficient space behind the power socket of the instrument to unplug the cable.
Power Cords

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

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

**WARNING**

Absence of ground connection

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

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

**WARNING**

Unintended use of supplied power cords

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

➔ Never use a power cord other than the one that Agilent shipped with this instrument.

➔ Never use the power cords that Agilent Technologies supplies with this instrument for any other equipment.

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

**WARNING**

Power cords

Solvents may damage electrical cables.

➔ Prevent electrical cables from getting in contact with solvents.

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

Site Requirements

Bench Space

The module dimensions and weight (see Table 2 on page 29) allow you to place the module on almost any desk or laboratory bench. It needs an additional 2.5 cm (1.0 inches) of space on either side and approximately 8 cm (3.1 inches) in the rear for air circulation and electric connections.

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

The module should be operated in a horizontal position.

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

Environment

Your detector will work within the specifications at ambient temperatures and relative humidity described in Table 2 on page 29.

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 Table 3 on page 30 and Table 4 on page 33) 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

<table>
<thead>
<tr>
<th>Type</th>
<th>Specification</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>12 kg (26.5 lbs)</td>
<td></td>
</tr>
<tr>
<td>Dimensions (height × width × depth)</td>
<td>140 x 396 x 436 mm (5.5 x 15.6 x 17 inches)</td>
<td></td>
</tr>
<tr>
<td>Line voltage</td>
<td>100 – 240 V~, ± 10 %</td>
<td>Wide-ranging capability</td>
</tr>
<tr>
<td>Line frequency</td>
<td>50 or 60 Hz, ± 5 %</td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>110 VA / 100 W</td>
<td></td>
</tr>
<tr>
<td>Ambient operating temperature</td>
<td>4–55 °C (39–131 °F)</td>
<td></td>
</tr>
<tr>
<td>Ambient non-operating temperature</td>
<td>-40 – 70 °C (-40 – 158 °F)</td>
<td></td>
</tr>
<tr>
<td>Humidity</td>
<td>&lt; 95 % r.h. at 40 °C (104 °F)</td>
<td>Non-condensing</td>
</tr>
<tr>
<td>Operating altitude</td>
<td>Up to 3000 m (9842 ft)</td>
<td></td>
</tr>
<tr>
<td>Non-operating altitude</td>
<td>Up to 4600 m (15092 ft)</td>
<td>For storing the module</td>
</tr>
<tr>
<td>Safety standards: IEC, EN, CSA, UL</td>
<td>Installation category II, Pollution degree 2</td>
<td>For indoor use only.</td>
</tr>
<tr>
<td>ISM Classification</td>
<td>ISM Group 1 Class B</td>
<td>According to CISPR 11</td>
</tr>
</tbody>
</table>
## Site Requirements and Specifications

### Performance Specifications

### Specifications

#### Performance Specifications G7115A

<table>
<thead>
<tr>
<th>Type</th>
<th>Specification</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detection type</td>
<td>1024-element photodiode array</td>
<td></td>
</tr>
<tr>
<td>Light source</td>
<td>Deuterium and tungsten lamps</td>
<td>The UV-lamp is equipped with RFID tag that holds lamp typical information.</td>
</tr>
<tr>
<td>Data rate</td>
<td>up to 120 Hz</td>
<td></td>
</tr>
<tr>
<td>Wavelength range</td>
<td>190 – 950 nm</td>
<td></td>
</tr>
<tr>
<td>Short term noise (ASTM)</td>
<td>&lt; ± 0.7·10⁻⁵ AU at 254 and 750 nm</td>
<td>see &quot;Specification Conditions&quot; below</td>
</tr>
<tr>
<td>Drift</td>
<td>&lt; 0.9·10⁻³ AU/h at 254 nm</td>
<td>see &quot;Specification Conditions&quot; below</td>
</tr>
<tr>
<td>Linear absorbance range</td>
<td>&gt; 2 AU (5 %) at 265 nm</td>
<td>see &quot;Specification Conditions&quot; below</td>
</tr>
<tr>
<td>Wavelength accuracy</td>
<td>± 1 nm</td>
<td>Self-calibration with deuterium lines, verification with holmium oxide filter</td>
</tr>
<tr>
<td>Wavelength bunching</td>
<td>1 – 400 nm</td>
<td>Programmable in steps of 1 nm</td>
</tr>
<tr>
<td>Slit width</td>
<td>1, 2, 4 , 8, 16 nm</td>
<td>Programmable slit</td>
</tr>
<tr>
<td>Diode width</td>
<td>&lt; 1 nm</td>
<td></td>
</tr>
</tbody>
</table>
### Site Requirements and Specifications

#### Performance Specifications

**Flow cells**
- Standard: 13 µL volume, 10 mm cell path length and 120 bar (1740 psi) pressure maximum
- Standard bio-inert: 13 µL volume, 10 mm cell path length and 120 bar (1740 psi) pressure maximum
- Semi-micro: 5 µL volume, 6 mm cell path length and 120 bar (1740 psi) pressure maximum
- Micro: 2 µL volume, 3 mm cell path length, 120 bar (1740 psi) pressure maximum
- Semi-nano: 500 nL volume, 10 mm cell path length and 50 bar (725 psi) pressure maximum
- Nano: 80 nL volume, 6 mm cell path length and 50 bar (725 psi) pressure maximum
- High pressure: 1.7 µL volume, 6 mm cell path length and 400 bar (5800 psi) pressure maximum
- Prep SST: 3 mm cell path length and 120 bar (1740 psi) pressure maximum
- Prep Quartz: 0.3 mm cell path length and 20 bar (290 psi) pressure maximum
- 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. 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 OpenLab CDS
- OpenLab CS C.01.07
- Driver A.02.14

---

### Table 3

**Performance specifications G7115A**

<table>
<thead>
<tr>
<th>Type</th>
<th>Specification</th>
<th>Comments</th>
</tr>
</thead>
</table>
| Flow cells         | Standard: 13 µL volume, 10 mm cell path length and 120 bar (1740 psi) pressure maximum  
|                    | Standard bio-inert: 13 µL volume, 10 mm cell path length and 120 bar (1740 psi) pressure maximum  
|                    | Semi-micro: 5 µL volume, 6 mm cell path length and 120 bar (1740 psi) pressure maximum  
|                    | Micro: 2 µL volume, 3 mm cell path length, 120 bar (1740 psi) pressure maximum  
|                    | Semi-nano: 500 nL volume, 10 mm cell path length and 50 bar (725 psi) pressure maximum  
|                    | Nano: 80 nL volume, 6 mm cell path length and 50 bar (725 psi) pressure maximum  
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|                    | Prep SST: 3 mm cell path length and 120 bar (1740 psi) pressure maximum  
|                    | Prep Quartz: 0.3 mm cell path length and 20 bar (290 psi) pressure maximum  
|                    | 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. 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   | Agilent OpenLab CDS  
| evaluation         | OpenLab CS C.01.07  
|                    | Driver A.02.14  

---

**Agilent InfinityLab LC Series DAD WR and MWD User Manual**

31
## Site Requirements and Specifications

### Performance Specifications

<table>
<thead>
<tr>
<th>Type</th>
<th>Specification</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Control</td>
<td>Agilent Instant Pilot (G4208A)</td>
<td>B.02.20 or above</td>
</tr>
<tr>
<td>Analog outputs</td>
<td>Recorder/integrator: 100 mV or 1 V, output range 0.001 – 2 AU, two outputs</td>
<td></td>
</tr>
<tr>
<td>Communications</td>
<td>LAN, Controller-area network (CAN), USB, Extended Remote Interface (ERI): ready, start, stop and shut-down signals</td>
<td></td>
</tr>
<tr>
<td>Safety and maintenance</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>GLP features</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>Housing</td>
<td>All materials recyclable.</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>Second generation of Electronic temperature control (ETC) for the complete optical unit</td>
<td></td>
</tr>
</tbody>
</table>
### Performance Specifications G7165A

#### Table 4  Performance specifications G7165A

<table>
<thead>
<tr>
<th>Type</th>
<th>Specification</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detection type</td>
<td>1024-element photodiode array</td>
<td></td>
</tr>
<tr>
<td>Light source</td>
<td>Deuterium and tungsten lamps</td>
<td>The UV-lamp is equipped with RFID tag that holds lamp typical information.</td>
</tr>
<tr>
<td>Data rate</td>
<td>up to 120 Hz</td>
<td></td>
</tr>
<tr>
<td>Wavelength range</td>
<td>190 – 950 nm</td>
<td></td>
</tr>
<tr>
<td>Short term noise (ASTM) Single and Multi-Wavelength</td>
<td>&lt; ± 0.7·10^{-5} AU at 254 and 750 nm</td>
<td>see &quot;Specification Conditions&quot; below</td>
</tr>
<tr>
<td>Drift</td>
<td>&lt; 0.9·10^{-3} AU/h at 254 nm</td>
<td>see &quot;Specification Conditions&quot; below</td>
</tr>
<tr>
<td>Linear absorbance range</td>
<td>&gt; 2 AU (5 %) at 265 nm</td>
<td>see &quot;Specification Conditions&quot; below</td>
</tr>
<tr>
<td>Wavelength accuracy</td>
<td>± 1 nm</td>
<td>Self-calibration with deuterium lines, verification with holmium oxide filter</td>
</tr>
<tr>
<td>Wavelength bunching</td>
<td>1 – 400 nm</td>
<td>Programmable in steps of 1 nm</td>
</tr>
<tr>
<td>Slit width</td>
<td>1, 2, 4, 8, 16 nm</td>
<td>Programmable slit</td>
</tr>
<tr>
<td>Diode width</td>
<td>&lt; 1 nm</td>
<td></td>
</tr>
</tbody>
</table>
### Site Requirements and Specifications

#### Performance Specifications

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                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.  
                                                                                     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 |                                                                 |
| Control and data evaluation | Agilent ChemStation for LC (32-bit)  
                                • OpenLab CS C.01.07  
                                • Driver A.02.14 | B.02.20 or above |
| Local Control  | Agilent Instant Pilot (G4208A)                                                                 |                                                                         |
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<tr>
<td>Others</td>
<td>Second generation of Electronic temperature control (ETC) for the complete optical unit</td>
<td></td>
</tr>
</tbody>
</table>
Site Requirements and Specifications
Performance Specifications

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 instrument 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.
This chapter explains the essential operational parameters of the module.
3 Using the Module
Magnets

Magnets

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

1

2

Power switch
(1) On
(2) Off

3
The module status indicator indicates one of six possible module conditions:

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

1. Set the switches of the Configuration switch at the rear of the module:
   a. All switches DOWN: module uses the default IP address 192.168.254.11.
   b. Switch 4 UP and others DOWN: module uses DHCP.

2. Enter the setup information (MAC / IP address and/or Instrument Name).
   a. Agilent OpenLab ChemStation (Configure Instrument):
   b. Lab Advisor (Instrument Overview - Add Instrument):
Set up the Detector with Agilent Open Lab ChemStation

The setup of the detector is shown with the Agilent OpenLab ChemStation C.01.07 and Driver A.02.14.

NOTE This section describes the detector settings only. For information on the Agilent OpenLab ChemStation or other 1200 Infinity modules refer to the corresponding documentation.

Figure 7 ChemStation Method and Run Control (just detector is shown)

After successful load of the OpenLab ChemStation, you should see the module as an active item in the graphical user interface (GUI).
The Detector User Interface

Within the detector GUI, there are active areas. If you move the mouse cursor across the icons the cursor will change.

- **1** Lamp: turn on and off of UV-lamp
- **2** EMF status
- **3** Detector status
- **4** Detector balance status
- **5** Lamp status (on/off)
- **6** Lamp information (RFID tag)
- **7** Flow Cell information (RFID tag)

RFID tag information is displayed when moving with the mouse cursor on to the tag attached to the flow cell or lamp. The information provides flow cell and lamp related information like:
- Part number
- Production date
- Serial number
and other details.
Using the Module

The Detector User Interface

EMF Status shows Run / Ready / Error state and “Not Ready text” or “Error text”
- Offline (gray)
- Ok. No Maintenance required (green)
- EMF warning. Maintenance might be required (yellow)
- EMF warning. Maintenance required (red)

Important: The EMF settings can be accessed via Agilent Lab Advisor. The limit(s) can be changed. Based on the limit, the User Interface displays the above status.

Module Status shows Run / Ready / Error state and “Not Ready text” or “Error text”
- Error (red)
- Not ready (yellow)
- Ready (green)
- Pre run, Post run (purple)
- Run (blue)
- Idle (green)
- Offline (dark gray)
- Standby (light gray)

A right-click into the Active Area will open a menu to
- Show the Control Interface (special module settings)
- Show the Method interface (similar as via menu Instrument > Setup Instrument Method)
- Set Error Method
- Identify Module (Status LED will blink)
- Perform a Balance
- Switch the UV-lamp on/off (same as click on button “Make Device Ready/Turn device off (standby)"
- Switch the Vis-lamp on/off
Detector Control Settings

The figure shows the default settings.

- **Lamps**: can be turned ON/OFF.
- **At Power On**: automatic lamp-on at power on.
- **Analog Output Range**: can be set to either 100 mV or 1 V full scale, for additional settings see **Analog Output** (under “Method Parameter Settings” on page 46).
- **Temperature Control**: can be turned ON/OFF. The optical unit is kept on constant temperature and improves the baseline stability in unstable environments. See also note below. ON it will keep the optical unit stabilized.
- **UV Lamp Tag**: Use lamp only if lamp tag is available detects a lamp with RFID tag. If no RFID tag lamp is used, “UV lamp not ready” is displayed and it cannot be ignited. A compatible mode has to be selected based on the used lamp; see Non-RFID-tag lamp information below.
  - **Always use lamp**: In case a non-RFID-tag lamp is used, the user interface will show this when selecting a compatible mode. You may operate the detector outside of the guaranteed specification. The correct selection is important for optimal performance and lifetime.
- **Cell Tag**: Use cell only if cell tag is available detects a cell with RFID tag. If no RFID tag cell is used, “cell tag not ready” is displayed and it cannot be ignited and analysis is disabled.
  - **Always use cell**: In case a non-RFID-tag cell is used, the user interface will show this when selecting a compatible mode.
- **Automatic Turn On**: automatic detector power on.

**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.
3 Using the Module

Method Parameter Settings

These settings are available via **Menu > Instrument > Set up Instrument Method** or via right click into the module’s active area (does not show the Instrument Curves tab).

![Figure 8 Method parameter settings](image)

**NOTE** For additional help and support: Highlight the desired cell and press F1. A help screen will open with additional information and documentation about the topic.
### Table 5  Method Parameter Settings

<table>
<thead>
<tr>
<th>Signals</th>
<th>Acquire</th>
<th>Wavelength</th>
<th>Bandwidth</th>
<th>Reference Wavelength</th>
<th>Reference Bandwidth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal A</td>
<td>✓</td>
<td>250</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal B</td>
<td></td>
<td>254</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal C</td>
<td></td>
<td>210</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal D</td>
<td></td>
<td>280</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal E</td>
<td></td>
<td>260</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal F</td>
<td></td>
<td>240</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal G</td>
<td></td>
<td>270</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal H</td>
<td></td>
<td>290</td>
<td>4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Signals

Up to 8 individual signals can be set. For each of the signals, the wavelength and bandwidth can be set for sample and reference.

**Limits:**
- Wavelength: 190.0 to 950.0 nm in steps of 0.1 nm
- Bandwidth: 1.0 to 400.0 nm in steps of 0.1 nm

Setting an appropriate reference wavelength could improve the baseline behavior.

### Peakwidth (Response time, Data Rate)

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, which is the acquisition time.

**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.

Do not use peak width shorter than necessary.

For details see “Peak width (response time)” on page 73.

### Stoptime/Posttime

The stoptime is the time where either the complete system stops (As Pump/Injector) or the module (if different from system stop time). The data collection is stopped at this time. A posttime period can be used to allow module’s items to equilibrate (e.g. after gradient change or temperature change).
### Using the Module

#### Method Parameter Settings

<table>
<thead>
<tr>
<th>Table 5</th>
<th>Method Parameter Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spectrum Settings</strong> (DAD only)</td>
<td></td>
</tr>
<tr>
<td>- Store: None / All</td>
<td></td>
</tr>
<tr>
<td>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 0.01 s and less than or equal to 2.55 s.</td>
<td></td>
</tr>
<tr>
<td>- Range defines the wavelength range for spectral storage.</td>
<td></td>
</tr>
<tr>
<td>Limits: 190 – 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.</td>
<td></td>
</tr>
<tr>
<td>- Step defines the wavelength resolution for spectral storage.</td>
<td></td>
</tr>
<tr>
<td>Limits: 0.10 – 100.00 nm in steps of 0.1 nm.</td>
<td></td>
</tr>
<tr>
<td><strong>Analog Output</strong></td>
<td></td>
</tr>
<tr>
<td>The range can be set to either 100 mV or 1 V full scale, see “Detector Control Settings” on page 45.</td>
<td></td>
</tr>
<tr>
<td>- Zero Offset: 1 – 99 % in steps of 1 % (5 % equal to 50 mV).</td>
<td></td>
</tr>
<tr>
<td>- Attenuation: 0.98 – 2000 mAU at discrete values for either 100 mV or 1 V full scale.</td>
<td></td>
</tr>
<tr>
<td><strong>Margin for negative Absorbance</strong></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>Limits: 100 to 4000 mAU.</td>
<td></td>
</tr>
<tr>
<td>The higher the value the greater the baseline noise. Set this value only if you expect negative absorbance greater than -100 mAU.</td>
<td></td>
</tr>
<tr>
<td><strong>Slitwidth</strong>: You can select the optical bandwidth (1, 2, 4, 8 or 16 nm) 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.</td>
<td></td>
</tr>
</tbody>
</table>

---

48 Agilent InfinityLab LC Series DAD WR and MWD User Manual
### Table 5  
**Method Parameter Settings**

<table>
<thead>
<tr>
<th>Autobalance</th>
<th>Lamps on required for acquisition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-run</td>
<td>UV Lamp</td>
</tr>
<tr>
<td>Post-run</td>
<td>Vis Lamp</td>
</tr>
</tbody>
</table>

#### Autobalance
Defines, whether a balance is performed prior to a run and/or after a run has finished.

#### Lamp on required for acquisition:
If unchecked, the lamp will be turned off after the analysis has finished. Note that the lamp on requires at least one hour warm-up time, see “Warm up of the Detector” on page 91.

### Timetable
You may set up time events to change functions with their parameters over the run time. Add lines as required.

**Time Limits:** 0.00 to 99999.00 min in steps of 0.01 min.

Via the buttons in the bottom area, time table lines can be added, removed, cut, copied, pasted or completely cleared. Based on the chosen function, a certain parameter can be selected.

### Instrument Curves
The detector has several signals (internal temperatures, voltages of lamps) that can be used for diagnosing problems. These can be baseline problems deriving from deuterium lamps wander / drift problems due to temperature changes.

These signals can be used in addition to the normal baseline signal to determine whether correlation to temperature or voltage/current of the lamp.

These signals are available via the Agilent ChemStation Online Plot/Data Signal and/or Agilent Lab Advisor Software.
3 Using the Module
Method Parameter Settings
4 Preparing the Detector

Leak and Waste Handling 52
Waste Concept 53

Setting up an Analysis 54
Before Using the System 54
Requirements and Conditions 56
Preparing the Detector 58
Preparing the HPLC System 58
Running the Sample and Verifying the Results 60

Solvent Information 61

This chapter provides information on how to set up the module 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.

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

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

➔ Do not operate the instrument in an explosive atmosphere.

➔ Reduce the volume of substances to the minimum required for the analysis.

➔ Never exceed the maximum permissible volume of solvents (8 L) in the solvent cabinet. Do not use bottles that exceed the maximum permissible volume as specified in the usage guideline for solvent cabinet.

➔ Ground the waste container.

➔ Regularly check the filling level of the waste container. The residual free volume in the waste container must be large enough to collect the waste liquid.

➔ To achieve maximal safety, regularly check the tubing for correct installation.

**NOTE**

For details, see the usage guideline for the solvent cabinet. A printed copy of the guideline has been shipped with the solvent cabinet, electronic copies are available in the Agilent Information Center or via the Internet.

For details on correct installation, see separate installation documentation.
**Waste Concept**

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

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. Solvents containing volatile ingredients will slightly lose these. Therefore priming of the pumping system is required before starting an application.
Preparing the Detector

Setting up an Analysis

Open the purge valve of your pump (by turning it counterclockwise) and set flow rate to 3 – 5 mL/min.

Flush all tubes with at least 30 mL of solvent.

Set flow to required value of your application and close the purge valve.

Pump for approximately 10 minutes before starting your application.

Table 6  Choice of Priming Solvents for Different Purposes

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

**NOTE**

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

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

**NOTE**

Pump for approximately 10 minutes before starting your application.
Requirements and Conditions

What You Will Need

The table below lists the items you need to have for the set up of the analysis. Some of these are optional (not required for the basic system).

Table 7  What you will need

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agilent 1200 Infinity Series system Pump</td>
<td>(plus degassing)</td>
</tr>
<tr>
<td>Autosampler</td>
<td></td>
</tr>
<tr>
<td>Detector, standard flow cell installed</td>
<td></td>
</tr>
<tr>
<td>Degasser (optional)</td>
<td></td>
</tr>
<tr>
<td>Column Compartment (optional)</td>
<td></td>
</tr>
<tr>
<td>Agilent CDS</td>
<td></td>
</tr>
<tr>
<td>System should be correctly set up for LAN</td>
<td>communication with the Agilent ChemStation</td>
</tr>
<tr>
<td>Column: Zorbax Eclipse XDB-C18, 4.6 x 150 mm, 5 μm</td>
<td>(993967-902) or an equivalent column</td>
</tr>
<tr>
<td>Standard: Agilent isocratic checkout sample</td>
<td>(01080-68704)</td>
</tr>
</tbody>
</table>

Conditions

A single injection of the isocratic test standard is made under the conditions given in Table 8 on page 56:

Table 8  Conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow</td>
<td>1.5 mL/min</td>
</tr>
<tr>
<td>Stoptime</td>
<td>8 min</td>
</tr>
<tr>
<td>Solvent</td>
<td>100% (30% water/70% Acetonitrile)</td>
</tr>
<tr>
<td>Temperature</td>
<td>Ambient</td>
</tr>
<tr>
<td>Wavelength</td>
<td>sample 254 nm</td>
</tr>
<tr>
<td>Injection Volume</td>
<td>1 μL</td>
</tr>
<tr>
<td>Column Temperature</td>
<td>25 °C or ambient</td>
</tr>
</tbody>
</table>
Typical Chromatogram

A typical chromatogram for this analysis is shown in Figure 9 on page 57. 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 9  Typical Chromatogram with UV-detector
Preparing the Detector

For best performance of the detector

- Let the lamp warm-up and stabilize for at least one hour (initial turn on of the module requires a longer time depending on the environment and the application needs); refer to “Specification Conditions” on page 36.

- For high sensitivity measurements, a stable environment is required; refer to “Environment” on page 28. Prevent drafts from air condition systems.

- Setting an appropriate reference wavelength could improve the baseline behavior.

- Do not work with removed/open front panels/doors. When the system includes a G1316 TCC (typically located below the detector) and its front panel is removed while the TCC is set to high temperatures, the up-streaming air could influence the stability of the detector baseline.

Preparing the HPLC System

1. Turn on the control software and the monitor.
2. Turn on the modules.
3. Start the control software. The screen should show all modules and the system status is Not Ready.
4. Turn on the modules that require conditioning:
   a. Detector lamp (warm-up for at least 60 min to get a stable baseline).
   b. Column compartment (set temperature as required).
   c. Pump (purge).
   d. Sampler (prepare the standard isocratic sample into a vial).
   e. Solvents (fill water and Acetonitrile into the solvent bottles).
5. Load the default method.
6. Pump the water/acetonitrile (30/70 %) mobile phase through the column for 10 min for equilibration.
7 Select the menu item **Run Control > Sample Info** and enter information about this application. Click **OK** to leave this screen.

![Sample Info](image)

**Figure 10** Sample Info
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.

![Chromatogram](image)

**Figure 11** 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.
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 0.22 μm filters.
- Avoid or minimize the use of solvents that may corrode parts in the flow path. Consider specifications for the pH range given for different materials like flow cells, valve materials etc. and recommendations in subsequent sections.

Material Information

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

Disclaimer

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

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

It is stable in the specified pH range (for the Bio-inert LC system: pH 1 – 13, see bio-inert module manuals for details), and inert to many common solvents. There is still a number of known incompatibilities with chemicals such as chloroform, methylene chloride, THF, DMSO, strong acids (nitric acid > 10 %, sulphuric acid > 10 %, sulfonic acids, trichloroacetic acid), halogenes or aqueous halogene solutions, phenol and derivatives (cresols, salicylic acid etc.).

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

Polyimide

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

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

Polyethylene (PE)

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

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

**Tantalum (Ta)**

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

**Stainless Steel (ST)**

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

- Solutions of alkali halides, their respective acids (for example, lithium iodide, potassium chloride, and so on) and aqueous solutions of halogens.
- High concentrations of inorganic acids like nitric acid, sulfuric acid and organic solvents especially at higher temperatures (replace, if your chromatography method allows, by phosphoric acid or phosphate buffer which are less corrosive against stainless steel).
- Halogenated solvents or mixtures which form radicals and/or acids, for example:
  \[ 2 \text{CHCl}_3 + \text{O}_2 \rightarrow 2 \text{COCl}_2 + 2 \text{HCl} \]
  This reaction, in which stainless steel probably acts as a catalyst, occurs quickly with dried chloroform if the drying process removes the stabilizing alcohol.
- Chromatographic grade ethers, which can contain peroxides (for example, THF, dioxane, di-isopropylether). Such ethers should be filtered through dry aluminium oxide which adsorbs the peroxides.
- Solutions of organic acids (acetic acid, formic acid, and so on) in organic solvents. For example, a 1 % solution of acetic acid in methanol will attack steel.
- Solutions containing strong complexing agents (for example, EDTA, ethylene diamine tetra-acetic acid).
- Mixtures of carbon tetrachloride with 2-propanol or THF.
Preparation of the Detector

Solvent Information

**Titanium (Ti)**

Titanium is highly resistant to oxidizing acids (for example, nitric, perchloric and hypochlorous acid) over a wide range of concentrations and temperatures. This is due to a thin oxide layer on the surface, which is stabilized by oxidizing compounds. Non-oxidizing acids (for example, hydrochloric, sulfuric and phosphoric acid) can cause slight corrosion, which increases with acid concentration and temperature. For example, the corrosion rate with 3% HCl (about pH 0.1) at room temperature is about 13 μm/year. At room temperature, titanium is resistant to concentrations of about 5% sulfuric acid (about pH 0.3). Addition of nitric acid to hydrochloric or sulfuric acids significantly reduces corrosion rates. Titanium is sensitive to acidic metal chlorides like FeCl₃ or CuCl₂. Titanium is subject to corrosion in anhydrous methanol, which can be avoided by adding a small amount of water (about 3%). Slight corrosion is possible with ammonia > 10%.

**Diamond-Like Carbon (DLC)**

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

**Fused silica and Quartz (SiO₂)**

Fused silica is used in 1290 Infinity Flow Cells and capillaries. Quartz is used for classical flow cell windows. It is inert against all common solvents and acids except hydrofluoric acid and acidic solvents containing fluorides. It is corroded by strong bases and should not be used above pH 12 at room temperature. The corrosion of flow cell windows can negatively affect measurement results. For a pH greater than 12, the use of flow cells with sapphire windows is recommended.

**Gold**

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

**Zirconium Oxide (ZrO₂)**

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

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

Fluorinated polymers (PTFE, PFA, FEP, FFKM)

Fluorinated polymers like PTFE (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 Al₂O₃-based ceramics

Sapphire, ruby and ceramics based on aluminum oxide Al₂O₃ are inert to almost all common acids, bases and solvents. There are no documented incompatibilities for HPLC applications.
Preparing the Detector
Solvent Information
5

Optimizing the Detector

Optimizing the Detector Performance 68
Optimization Overview 69
Optimizing for Sensitivity, Selectivity, Linearity and Dispersion 71
  Flow Cell Path Length 71
  Peak width (response time) 73
  Sample and Reference Wavelength and Bandwidth 75
  Slit Width 78
  Optimizing Spectral Acquisition (DAD only) 80
  Margin for Negative Absorbance 80
Optimizing Selectivity 81
  Quantifying Coeluting Peaks by Peak Suppression 81
  Ratio Qualifiers for Selective Detection of Compound Classes 83
Optimizing the Detector Regarding to the System 85
  Delay Volume and Extra-Column Volume 85
  How to Configure the Optimum Delay Volume 85
  How to Achieve Higher Sensitivity 86
Warm up of the Detector 91

This chapter provides information on how to optimize the detector.
Optimizing the Detector Performance

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 9  Optimization Overview**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 Selection of flow cell</strong></td>
<td>• peak resolution versus sensitivity</td>
</tr>
<tr>
<td>• Choose flow cell according to used column, see Figure 12 on page 70.</td>
<td></td>
</tr>
<tr>
<td><strong>2 Connection of flow cell</strong></td>
<td>• chromatographic resolution</td>
</tr>
<tr>
<td>• For flow rates from 0.5 mL/min connect column using the zero-dead-volume fittings of the detector.</td>
<td></td>
</tr>
<tr>
<td>• For small column i.d. (e.g 1 mm) the inlet capillary of the micro flow cell can be connected directly to the column.</td>
<td></td>
</tr>
<tr>
<td><strong>3 Setting the peak width (response time)</strong></td>
<td>• peak resolution versus sensitivity versus disk space</td>
</tr>
<tr>
<td>• Use peak width according Figure 12 on page 70 as starting point.</td>
<td></td>
</tr>
<tr>
<td>• Set the peak-width close to the width of a narrow peak of interest in your chromatogram.</td>
<td></td>
</tr>
<tr>
<td><strong>4 Setting wavelength and bandwidth</strong></td>
<td>• sensitivity versus selectivity</td>
</tr>
<tr>
<td>• Sample wavelength:</td>
<td>• sensitivity versus linearity</td>
</tr>
<tr>
<td>• Never miss a peak by the use of a browser wavelength like 250 nm with 100 nm bandwidth.</td>
<td></td>
</tr>
<tr>
<td>• Select specific wavelength with reduced bandwidth if you need selectivity, e.g. 250,10 nm and 360,100 nm as reference wavelength.</td>
<td></td>
</tr>
<tr>
<td>• Set the sample wavelength to a peak or valley in the spectrum to get best linearity for high concentrations.</td>
<td></td>
</tr>
<tr>
<td>• Reference wavelength:</td>
<td>• baseline drift due to RI effects.</td>
</tr>
<tr>
<td>• 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).</td>
<td></td>
</tr>
<tr>
<td><strong>5 Setting the slit width</strong></td>
<td>• spectral resolution, sensitivity and linearity</td>
</tr>
<tr>
<td>• Use 4 nm slit for normal applications.</td>
<td></td>
</tr>
<tr>
<td>• Use narrow slit (e.g 1 nm) if your analytes have narrow absorbance bands and for high concentrations.</td>
<td></td>
</tr>
<tr>
<td>• Use a wide slit (e.g. 16 nm) to detect very low concentrations.</td>
<td></td>
</tr>
<tr>
<td>• Optimizing spectral acquisition (DAD only)</td>
<td></td>
</tr>
<tr>
<td>• Select spectra acquisition mode according to your needs.</td>
<td></td>
</tr>
<tr>
<td>• Set the spectral wavelength range (for colorless samples 190...400 nm is sufficient).</td>
<td></td>
</tr>
<tr>
<td>• Set step to 4 nm for normal use; set small step (and slit width) if high resolution of spectra with fine structure is wanted.</td>
<td></td>
</tr>
</tbody>
</table>
## Optimizing the Detector

### Optimization Overview

<table>
<thead>
<tr>
<th>Typical column length</th>
<th>Typical peak width</th>
<th>Recommended flow cell</th>
</tr>
</thead>
<tbody>
<tr>
<td>T &lt;= 5 cm</td>
<td>0.025 min</td>
<td>Micro or Semi-nano</td>
</tr>
<tr>
<td>10 cm</td>
<td>0.05 min</td>
<td>Semi-micro flow cell</td>
</tr>
<tr>
<td>20 cm</td>
<td>0.1 min</td>
<td>Standard flow cell</td>
</tr>
<tr>
<td>&gt;= 40 cm</td>
<td>0.2 min</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Typical flow rate</th>
<th>Internal column diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01 ... 0.2 ml/min</td>
<td>0.5 ... 1 mm</td>
</tr>
<tr>
<td>0.2 ... 0.4 ml/min</td>
<td>2.1 mm</td>
</tr>
<tr>
<td>0.4 ... 0.4 ml/min</td>
<td>3.0 mm</td>
</tr>
<tr>
<td>1 ... 5 ml/min</td>
<td>4.6 mm</td>
</tr>
</tbody>
</table>

Figure 12  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, \( I_0 \),
- \( \varepsilon \) 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 13 on page 72 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 \( \mu \)L. Typically, this causes more peak dispersion. As Figure 13 on page 72 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).
Optimizing the Detector
Optimizing for Sensitivity, Selectivity, Linearity and Dispersion

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:

\[ \text{expected response} \times \text{correction factor} \]

Please find below the details of the flow cells:

**Table 10**  Correction factors for flow cells

<table>
<thead>
<tr>
<th>Flow cell</th>
<th>Path length (actual)</th>
<th>Correction factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard flow cell, 10 mm, 13 µL, 120 bar (12 MPa) (G1315-60022)</td>
<td>9.80±0.07 mm</td>
<td>10/9.8</td>
</tr>
<tr>
<td>Semi-micro flow cell, 6 mm, 5 µL, 120 bar (12 MPa) (G1315-60025)</td>
<td>5.80±0.07 mm</td>
<td>6/5.8</td>
</tr>
<tr>
<td>Micro flow cell, 3 mm, 2 µL, 120 bar (12 MPa) (G1315-60024)</td>
<td>3.00±0.05 mm/-0.07 mm</td>
<td>3/3</td>
</tr>
<tr>
<td>Semi-nano flow cell kit, 10 mm, 500 nL, 5 MPa (G1315-68724)</td>
<td>10.00±0.02 mm</td>
<td>10/10</td>
</tr>
<tr>
<td>Nano flow cell kit, 6 mm, 80 nL, 5 MPa (G1315-68716)</td>
<td>6.00±0.02 mm</td>
<td>6/6</td>
</tr>
<tr>
<td>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)</td>
<td>9.80±0.07 mm</td>
<td>10/9.8</td>
</tr>
</tbody>
</table>
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 14 on page 73), 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 14 Influence of Response Time on Signal and Noise](image)

Table 11 on page 74 list 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.
5 Optimizing the Detector
Optimizing for Sensitivity, Selectivity, Linearity and Dispersion

Table 11  Peak Width — Response Time — Data Rate (G7115A/G7165A)

<table>
<thead>
<tr>
<th>Peak width at half height [min]$^1$</th>
<th>Response [s]</th>
<th>Scan data rate[Hz] ≤ 251 pts/scan</th>
<th>Scan data rate[Hz] ≤ 501 pts/scan</th>
<th>Scan data rate[Hz] &gt; 501 pts/scan</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0.0015625</td>
<td>0.015625</td>
<td>120</td>
<td>120</td>
<td>40</td>
</tr>
<tr>
<td>&gt; 0.0015625</td>
<td>0.03125</td>
<td>120</td>
<td>120</td>
<td>40</td>
</tr>
<tr>
<td>&gt; 0.003125</td>
<td>0.0625</td>
<td>80</td>
<td>80</td>
<td>40</td>
</tr>
<tr>
<td>&gt; 0.00625</td>
<td>0.125</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>&gt; 0.0125</td>
<td>0.25</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>&gt; 0.025</td>
<td>0.5</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>&gt; 0.05</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>&gt; 0.1</td>
<td>2</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>&gt; 0.2</td>
<td>4</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
</tr>
<tr>
<td>&gt; 0.4</td>
<td>8</td>
<td>0.625</td>
<td>0.625</td>
<td>0.625</td>
</tr>
<tr>
<td>&gt; 0.85</td>
<td>16</td>
<td>0.3125</td>
<td>0.3125</td>
<td>0.3125</td>
</tr>
</tbody>
</table>

$^1$ Values in the User Interface may be rounded.
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 15 on page 76 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.
Optimizing the Detector
Optimizing for Sensitivity, Selectivity, Linearity and Dispersion

Figure 15  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 16  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 17 on page 77 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.

Figure 17  Gradient Analysis of PTH-Amino Acids (1 pmol each), with and without Reference

Grad.: 0.02 m KH₂PO₄/ACN from 12% ACN to 45% ACN in 12 min
**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.

![Benzene at 1, 4 and 16 nm slit width (principle)](image)

**Figure 18**  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 19** on page 79.
Optimizing for Sensitivity, Selectivity, Linearity and Dispersion

### Optimizing the Detector

#### Figure 19 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 15 on page 76).

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.

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.
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 20 on page 81 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 20**  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 21 on page 82 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 \%.

<table>
<thead>
<tr>
<th>Hydrochlorothiazide and caffeine</th>
<th>Hydrochlorothiazide and caffeine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wavelength 204 nm</td>
<td>Wavelength 222 nm</td>
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<tr>
<td>No reference</td>
<td>No reference</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hydrochlorothiazides suppressed</th>
<th>Caffeine suppressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wavelength 204 nm</td>
<td>Wavelength 222 nm</td>
</tr>
<tr>
<td>Reference 260 nm</td>
<td>Reference 282 nm</td>
</tr>
</tbody>
</table>

Figure 21  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 22 on page 83 and Figure 23 on page 84.

**Figure 22**  Wavelength Selection for 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 22 on page 83. 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 23 on page 84). The others were not plotted.
Optimizing the Detector Regarding to the System

Delay Volume and Extra-Column Volume

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

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

Extra-Column Volume

Extra-column volume is a source of peak dispersion that will reduce the resolution of the separation and so should be minimized. Smaller diameter columns require proportionally smaller extra-column volumes to keep peak dispersion at a minimum.

In a liquid chromatograph the extra-column volume will depend on the connection tubing between the autosampler, column and detector; and on the volume of the flow cell in the detector. The extra-column volume is minimized with the Agilent InfinityLab LC Series system due to the narrow-bore (0.12 mm i.d.) tubing, the low-volume heat exchangers in the column compartment and the flow cell in the detector.

How to Configure the Optimum Delay Volume

To maintain resolution in the Agilent 1290 Infinity II DAD/Agilent 1290 Infinity DAD FS the 10 mm Max-Light cartridge cell has a low dispersion volume ($\sigma$ volume 1.0 μL) and no further volume optimization is required. In situations where the alternative 60 mm Max-Light high sensitivity cell is used to get higher sensitivity the cell volume is optimized for the use with 3 mm and 4.6 mm inner diameter columns.
Optimizing the Detector Regarding to the System

How to Achieve Higher Sensitivity

The detector has a number of parameters that are used to optimize performance. The following sections describe how the detector parameters affect performance characteristics:

- Flow cell affects sensitivity,
- Wavelength and bandwidth affect sensitivity, selectivity and linearity,
- Slit width affects sensitivity, spectral resolution and linearity,
- Peak width affects sensitivity and resolution.

Flow Cell

The Max-Light cartridge flow cell has a standard 10 mm path length and is optimized for minimal volume and dispersion (σ volume 1.0 μL). It has high light transmission minimizing noise to reduce noise due to the optofluidic waveguide. It is suitable for use with a wide range of analytical columns from short narrow-bore columns to long standard diameter (4.6 mm) columns. Generally the peak dispersion volume (calculated from peak width x flow rate) should be greater than about 2 μL for this cell (for example 0.02 min x 200 μL/min = 4 μL).

The Max-Light high sensitivity cell has a path length of 60 mm and this will give between three and five times increase in signal-to-noise values depending on the application conditions. The dispersion volume is fractionally increased compared to the standard cell.

Wavelength and Bandwidth

The detector measures absorbance simultaneously at wavelengths from 190 nm to 640 nm using diode-array detection. A UV-lamp provides good sensitivity over the whole wavelength range. The diode-array detector (DAD) can simultaneously compute and send to the data system up to eight chromatographic signals and the full-range spectra at every time point.

A UV chromatogram or signal is a plot of absorbance data versus time and is defined by its wavelength and bandwidth.

- The wavelength indicates the center of the detection band.
- The bandwidth defines the wavelength range over which the absorbance values are averaged to give the result at each time point.
For example, a signal at wavelength 250 nm with a bandwidth of 16 nm will be an average of the absorbance data from 242 nm to 258 nm. Additionally, a reference wavelength and reference bandwidth can be defined for each signal. The average absorbance from the reference bandwidth centered on the reference wavelength will be subtracted from its equivalent value at the signal wavelength to produce the output chromatogram.

The signal wavelength and bandwidth can be chosen so that they are optimized for:

- Broad band universal detection
- Narrow band selective detection
- Sensitivity for a specific analyte.

Broad band or universal detection works by having a wide bandwidth to detect any species with absorbance in that range. For example, to detect all absorbing molecules between 200 nm and 300 nm set a signal at 250 nm with a bandwidth of 100 nm. The disadvantage is that sensitivity will not be optimal for any one of those molecules. Narrow band or selective detection is used most often. The UV spectrum for a particular molecule is examined and an appropriate absorbance maximum is selected. If possible, the range where solvents absorb strongly should be avoided (below 220 nm for methanol, below 210 nm for acetonitrile). For example, in Figure 24 on page 88, anisic acid has a suitable absorbance maximum at 252 nm. A narrow bandwidth of 4 nm to 12 nm generally gives good sensitivity and is specific for absorbance in a narrow range.

The narrow band can be optimized for sensitivity for a specific molecule. As the bandwidth is increased the signal is reduced but so is the noise and there will be an optimum for best S/N. As an approximate guide, this optimum is often close to the natural bandwidth at half-height of the absorption band in the UV spectrum. In the anisic acid example this is 30 nm.

The analytical wavelength is usually set at a wavelength maximum to increase sensitivity to that molecule. The detector is linear up to 2 AU and beyond for many applications. This offers a wide linear range for concentration. For high concentration analysis the concentration linear range can be extended by setting the wavelength to one with a lower absorbance such as a wavelength minimum or by taking a wider bandwidth which usually includes lower absorbance values. The use of wavelength maxima and minima for quantitation dates back to conventional UV detectors which because of mechanical tolerances in moving gratings needed to avoid steeply sloping parts of the spectrum. Diode-array based detectors do not have this limitation.
but for reasons of convention maxima and minima are chosen in preference to other parts of the spectrum.

The reference bandwidth is normally set on a region of the UV spectrum in which the analyte has no absorbance. This is shown in the spectrum for anisic acid in Figure 24 on page 88. This spectrum is typical of many small molecules containing a UV chromophore. For best results the reference has been set so that it is a wide band as close to the signal wavelength as possible but on a zero absorbance region. Reference bandwidths of 60 nm to 100 nm are commonly used. The default reference is 360 nm with a bandwidth of 100 nm. A wide bandwidth is used because this reduces the noise in the reference signal (from statistical theory, the error, i.e. noise in this case, is reduced by the square root of the number of determinations). It is important that the reference bandwidth does not extend to a part of the spectrum that has some absorbance as this would then reduce the resulting signal and sensitivity would be reduced. The use of a reference wavelength can help to reduce drift or wander in the chromatogram caused by refractive index changes due to room temperature fluctuation or gradient operation. The effect of a reference signal can be easily tested by setting two otherwise identical signals, one with and one without a reference signal. If there is no part of the spectrum with zero absorbance then it will be better to have the reference signal turned off.

Figure 24  Spectrum of Anisic Acid
Peak Width, Response Time and Data Collection Rate

The peak width setting, response time and data rate in the detector are all linked. The available settings are shown in Table 12 on page 90. It is important to set this correctly for optimum sensitivity and to preserve the resolution achieved in the separation.

The detector internally acquires data points faster than is needed for a chromatogram and processes them to produce the signal seen by the data system. Part of the processing reduces the data to an appropriate data rate which allows the chromatographic peaks to be accurately drawn. As with most analytical determinations groups of readings are effectively averaged to reduce error in the result. The detector bunches raw data points and produces the output signal data at the required data collection rate by an electronic filtering process. If the resulting data rate is too slow (over filtering) the peak heights will be reduced and the resolution between them reduced; too fast and the data is noisier than it need be to accurately profile narrow peaks.

The peak width setting in the detector allows the user to correctly set these parameters without needing any knowledge other than sight of the chromatogram integration results to see how wide the peaks are. The peak width setting should be set for the narrowest peak width observed in the chromatogram. If it is set too wide it will make the peaks appear lower in height and wider (and potentially less resolved) and if it is set too narrow it will increase the baseline noise unnecessarily. Essentially the software uses this value to set the data collection rate such that it collects enough data points over the narrowest peaks and it is aiming for 15 to 25 points across a peak. The DAD can collect at a maximum up to 120 Hz if required which would allow enough data points to be collected over a peak that is only 0.1 s wide. The response time setting is another way of indicating how this filtering is set. It is measured in seconds and is about one-third of the peak width value (which is measured in minutes). It effectively shows how quickly the plotted signal responds to a step change in the input signal.

NOTE

The full spectra is not available under all conditions.

Based on the data points, the scan data rate is reduced, see Table 12 on page 90.
## 5 Optimizing the Detector

### Optimizing the Detector Regarding to the System

**Table 12**  Peak Width — Response Time — Data Rate (G7115A/G7165A)

<table>
<thead>
<tr>
<th>Peak width at half height [min]</th>
<th>Response [s]</th>
<th>Scan data rate [Hz] ≤ 251 pts/scan</th>
<th>Scan data rate [Hz] ≤ 501 pts/scan</th>
<th>Scan data rate [Hz] &gt; 501 pts/scan</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0.0015625</td>
<td>0.015625</td>
<td>120</td>
<td>120</td>
<td>40</td>
</tr>
<tr>
<td>&gt; 0.0015625</td>
<td>0.03125</td>
<td>120</td>
<td>120</td>
<td>40</td>
</tr>
<tr>
<td>&gt; 0.003125</td>
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<td>80</td>
<td>80</td>
<td>40</td>
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<tr>
<td>&gt; 0.00625</td>
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<td>&gt; 0.025</td>
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<td>10</td>
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<tr>
<td>&gt; 0.05</td>
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<td>2.5</td>
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<tr>
<td>&gt; 0.2</td>
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<tr>
<td>&gt; 0.4</td>
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<tr>
<td>&gt; 0.85</td>
<td>16</td>
<td>0.3125</td>
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<td>0.3125</td>
</tr>
</tbody>
</table>

1 Values in the User Interface may be rounded.

**NOTE**  The maximum spectra scan rate depends on the data points per scan, see Table 12 on page 90.
Warm up of the Detector

Give the optical unit enough time to warm-up and stabilize (> 60 minutes). The detector is temperature controlled. After turn-on of the detector, it goes through a cycle of different states:

- 0 to 0.5 minutes the heater control is OFF and the heater element runs at 0 % duty cycle.
- 0.5 to 1 minutes the heater control is OFF and the heater element runs at 66% duty cycle. This first minute is used as self-test of the heater functionality.
- 1 to 30 minutes the heater control is OFF and the heater element runs at 40% duty cycle.
- After 30 minutes the heater control is ON and is working with optimized parameters to get the optical unit into the optimal temperature window stabilized.

This cycle starts

- when the detector is turned off/on
- when the lamp is turned off/on

to ensure that the temperature control operates in a defined control range.

**NOTE**

The times to stabilize the baseline may vary from instrument to instrument and depends on the environment. The example below was done under stable environmental conditions.

The figures below show the first two hours of a detector warm-up phase. The lamp was turned on immediately after turn on of the detector.
5 Optimizing the Detector

Warm up of the Detector

Figure 25  Detector Warm-up – 1<sup>st</sup> hour

Figure 26  Detector Warm-up – 2<sup>nd</sup> hour
6 Troubleshooting and Diagnostics

Available Tests vs User Interfaces  94
Agilent Lab Advisor Software  95
Available Diagnostic Functions vs. Product Level  96

This chapter gives an overview about the troubleshooting and diagnostic features.
Available Tests vs User Interfaces

NOTE

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

Preferred tool should be the Agilent Lab Advisor, see “Agilent Lab Advisor Software” on page 95.

Agilent Lab Advisor B.02.08 or later is required.

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

Figure 27  Tests in the Agilent Lab Advisor
Agilent Lab Advisor Software

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

The Agilent Lab Advisor software is available in two versions:

- Lab Advisor Basic
- Lab Advisor Advanced

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

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

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

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

**Table 13  Available Diagnostic Functions vs. Product Level**

<table>
<thead>
<tr>
<th>Product Level</th>
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<tbody>
<tr>
<td><strong>Tests</strong></td>
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<tr>
<td>- ASTM Drift and Noise Test</td>
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<tr>
<td>- Cell Test</td>
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<tr>
<td>- D/A Converter Test</td>
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<tr>
<td>- Dark Current Test</td>
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<tr>
<td>- Filter Test</td>
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<tr>
<td>- Holmium Oxide Test</td>
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<tr>
<td>- Intensity Test</td>
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<tr>
<td>- Quick Noise Test</td>
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<tr>
<td>- Self Test</td>
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<td>- Slit Test</td>
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<td>- Wavelength Verification Test</td>
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<td>- Test Chromatogram</td>
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<td>- Spectral Scan</td>
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### Table 13  Available Diagnostic Functions vs. Product Level

<table>
<thead>
<tr>
<th></th>
<th>Product Level</th>
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<tbody>
<tr>
<td><strong>Controls</strong></td>
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<td>- Advanced Method</td>
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<tr>
<td>Parameters</td>
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<td>- Vis lamp required</td>
<td>Advanced</td>
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<td>- Analog Output 1 Offset [% Full Scale]</td>
<td>Advanced</td>
</tr>
<tr>
<td>- D2 lamp required</td>
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<td>- Analog Output 1 Attenuation</td>
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<td><strong>Configuration</strong></td>
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<td>- Analog Output 1 Range</td>
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<td>- Remote Pulse Duration [s]*</td>
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<tr>
<td>- Basic</td>
<td>Advanced</td>
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<tr>
<td><strong>Control</strong></td>
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<td>- Vis lamp</td>
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<td>- Balance Detector</td>
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<td>- UV Lamp</td>
<td>Basic Advanced</td>
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<td><strong>Method Parameters</strong></td>
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<tr>
<td>- Set Signal A</td>
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<td>- Set Signal C</td>
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<td>- Set Data Rate [HZ]</td>
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<tr>
<td>- Set Signal B</td>
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<td><strong>Module Information</strong></td>
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<td><strong>Special Commands</strong></td>
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### Available Diagnostic Functions vs. Product Level

**Table 13**  Available Diagnostic Functions vs. Product Level

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<th>Function</th>
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<td>-Cell tag required</td>
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<td>-Detector Reset</td>
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<td>-Clear Error</td>
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<td>-UV Lamp</td>
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<td>-Vis Lamp</td>
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<td>-Lamp Voltage [V]</td>
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<td>-Board Temperature [°C]</td>
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</tr>
<tr>
<td><strong>EMF Counters</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-Accumulated UV Lamp On-Time</td>
<td>Basic</td>
<td>Advanced</td>
</tr>
<tr>
<td>-Number of UV Lamp Ignitions</td>
<td>Basic</td>
<td>Advanced</td>
</tr>
<tr>
<td>-Accumulated Tungsten Lamp On-Time</td>
<td>Basic</td>
<td>Advanced</td>
</tr>
<tr>
<td>-Number of Tungsten Lamp Ignitions</td>
<td>Basic</td>
<td>Advanced</td>
</tr>
</tbody>
</table>
7 Error Information

What Are Error Messages 101

General Error Messages 102
  Timeout 102
  Shutdown 102
  Remote Timeout 103
  Lost CAN Partner 103
  Leak Sensor Short 104
  Leak Sensor Open 104
  Compensation Sensor Open 105
  Compensation Sensor Short 105
  Fan Failed 106
  Leak 106
  Open Cover 107
  Cover Violation 107
  ERI Messages 108

Detector Error Messages 109
  Visible Lamp Current 109
  Visible Lamp Voltage 109
  Diode Current Leakage 110
  UV Lamp Current 110
  UV Lamp Voltage 111
  UV Ignition Failed 111
  UV Heater Current 112
  Calibration Values Invalid 112
  Holmium Oxide Test Failed 113
  Illegal Temperature Value from Sensor on Main Board 113
  Illegal Temperature Value from Sensor at Air Inlet 114
  Wavelength Recalibration Lost 114
7 Error Information
Available Diagnostic Functions vs. Product Level

Heater at fan assembly failed 115
Heater Power At Limit 115
DSP Not Running 116

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

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

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

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

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

General Error Messages

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

Timeout

Error ID: 0062
The timeout threshold was exceeded.

Probable cause

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

Suggested actions

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

Shutdown

Error ID: 0063
An external instrument has generated a shutdown signal on the remote line.

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

Probable cause

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

Suggested actions

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

Error ID: 0070

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

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

Lost CAN Partner

Error ID: 0071

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

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

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

### Leak Sensor Short

**Error ID: 0082**

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

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

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1    Defective leak sensor.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>2    Leak sensor incorrectly routed, being pinched by a metal component.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>3    Power switch assembly defective</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>

### 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.

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1    Leak sensor not connected to the Power Switch board.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>2    Defective leak sensor.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>3    Leak sensor incorrectly routed, being pinched by a metal component.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>4    Power switch assembly defective</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>
Compensation Sensor Open

Error ID: 0081

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

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

Probable cause  
1. Loose connection between the power switch board and the main board  
2. Defective power switch assembly

Suggested actions  
Please contact your Agilent service representative.

Compensation Sensor Short

Error ID: 0080

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

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

Probable cause  
1. Defective power switch assembly  
2. Loose connection between the power switch board and the main board

Suggested actions  
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.

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

**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.

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Loose fittings.</td>
<td>Ensure all fittings are tight.</td>
</tr>
<tr>
<td>2 Broken capillary.</td>
<td>Exchange defective capillaries.</td>
</tr>
<tr>
<td>3 Leaking flow cell.</td>
<td>Exchange flow cell components.</td>
</tr>
</tbody>
</table>
### 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.


Error Information
General Error Messages

ERI Messages

Error ID: 11120 (+5 V), 11121 (+25 V)

The ERI (Enhanced Remote Interface) provides two error events related to over current situations on the +5 V and +24 V lines.

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  The load on the ERI is too high.</td>
<td>Reduce the load.</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Lamp disconnected.</td>
<td>Ensure the visible lamp connector is seated firmly.</td>
</tr>
<tr>
<td>2 Defective visible lamp.</td>
<td>Exchange the visible lamp.</td>
</tr>
<tr>
<td>3 Defective connector or cable.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>4 Defective power supply.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Defective connector or cable.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>2 Defective power supply.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Defective UV lamp or non-Agilent lamp.</td>
<td>Exchange the UV lamp.</td>
</tr>
<tr>
<td>2 Defective detector main board.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>3 Defective power supply.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Lamp too hot. Hot gas discharge lamps may not ignite as easily as cold lamps.</td>
<td>Switch off the lamp and allow it to cool down for at least 15 minutes.</td>
</tr>
<tr>
<td>2 Lamp disconnected.</td>
<td>Ensure the lamp is connected.</td>
</tr>
<tr>
<td>3 Defective UV lamp or non-Agilent lamp.</td>
<td>Exchange the UV lamp.</td>
</tr>
<tr>
<td>4 Defective detector main board.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>5 Defective power supply.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>
Error Information
Detector Error Messages

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.

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

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.

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Defective connector or cable.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>2 Defective PDA/optical unit.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>
Holmium Oxide Test Failed

Probable cause
1 Lamps switched off.
2 Defective or dirty flow cell.
3 Defective filter assembly.
4 Defective achromat assembly.
5 Defective PDA/optical unit.

Suggested actions
1 Ensure the lamps are switched on.
2 Ensure the flow cell is inserted correctly, and is free from contamination (cell windows, buffers etc.).
3 Please contact your Agilent service representative.
4 Please contact your Agilent service representative.
5 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
1 Defective sensor or main board.
2 Detector is exposed to illegal ambient conditions.

Suggested actions
1 Please contact your Agilent service representative.
2 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.
| | • 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.

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Defective connector or cable.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>2 Defective heater.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>

**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).

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Excessive ambient temperature change.</td>
<td>Wait until temperature control equilibrates.</td>
</tr>
</tbody>
</table>
DSP Not Running

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

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Random communication error.</td>
<td>• Switch the detector off and on again at the power switch. If the error reoccurs:</td>
</tr>
<tr>
<td></td>
<td>• Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>2 Defective detector main board.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>3 Defective PDA/optical unit.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>
8
Test Functions and Calibration

Introduction 118
Conditions of Detector 122
Failing a Test 123
Self-Test 124
Intensity Test 126
   Test Failed 128
Cell Test 129
   Test Failed (low ratio value) 131
Filter Test 132
   Test Evaluation 133
Holmium Oxide Test 134
   Test Evaluation 135
ASTM Drift and Noise Test 137
   Test Failed 140
Slit Test 141
   Test Failed 143
Wavelength Verification Test 144
Wavelength Calibration 146
   Wavelength Recalibration Fails 148
D/A Converter (DAC) Test 149
   Test Evaluation 150
Dark-Current Test 151
   Test Failed 153
Spectral Scan 154
Other Lab Advisor Functions 155
   EMFs - Early Maintenance Feature 155

This chapter describes the tests for the module.
Introduction

All tests are described based on the Agilent Lab Advisor Software B.02.08. Other user interfaces may not provide any test or just a few.

For details on the use of the interface refer to the interface documentation.

The Lab Advisor shows the available test under Service & Diagnostics.

| Table 14  Available Diagnostic Functions vs. Product Level |
| --- | --- |
| **Tests** |  |
| -ASTM Drift and Noise Test | Basic | Advanced |
| -Cell Test | Basic | Advanced |
| -D/A Converter Test | Basic | Advanced |
| -Dark Current Test | Basic | Advanced |
| -Filter Test | Basic | Advanced |
| -Holmium Oxide Test | Basic | Advanced |
| -Intensity Test | Basic | Advanced |
| -Quick Noise Test | Basic | Advanced |
| -Self Test | Basic | Advanced |
| -Slit Test | Basic | Advanced |
| -Wavelength Verification Test | Basic | Advanced |
| **Calibrations** |  |
| -Wavelength Calibration | Basic | Advanced |
| **Tools** |  |
| -Diagnostic Buffers | Basic | Advanced |
| -Module Info | Basic | Advanced |
| -Test Chromatogram | Basic | Advanced |
### Table 14  Available Diagnostic Functions vs. Product Level

<table>
<thead>
<tr>
<th></th>
<th>Product Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spectral Scan</td>
<td>Basic Advanced</td>
</tr>
<tr>
<td><strong>Controls</strong></td>
<td></td>
</tr>
<tr>
<td>Advanced Method</td>
<td></td>
</tr>
<tr>
<td>Parameters</td>
<td></td>
</tr>
<tr>
<td>Vis lamp required</td>
<td>Advanced</td>
</tr>
<tr>
<td>Analog Output 1  Offset [% Full Scale]</td>
<td>Advanced</td>
</tr>
<tr>
<td>D2 lamp required</td>
<td>Advanced</td>
</tr>
<tr>
<td>Analog Output 1 Attenuation</td>
<td>Advanced</td>
</tr>
<tr>
<td><strong>Configuration</strong></td>
<td></td>
</tr>
<tr>
<td>Analog Output 1 Range</td>
<td>Advanced</td>
</tr>
<tr>
<td>Remote Pulse Duration [s]*</td>
<td>Basic Advanced</td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td></td>
</tr>
<tr>
<td>Vis lamp</td>
<td>Basic Advanced</td>
</tr>
<tr>
<td>Balance Detector</td>
<td>Advanced</td>
</tr>
<tr>
<td>UV Lamp</td>
<td>Basic Advanced</td>
</tr>
<tr>
<td><strong>Method Parameters</strong></td>
<td></td>
</tr>
<tr>
<td>Set Signal A</td>
<td>Advanced</td>
</tr>
<tr>
<td>Set Signal C</td>
<td>Advanced</td>
</tr>
<tr>
<td>Set Data Rate [HZ]</td>
<td>Advanced</td>
</tr>
<tr>
<td>Set Signal B</td>
<td>Advanced</td>
</tr>
<tr>
<td><strong>Module Information</strong></td>
<td></td>
</tr>
<tr>
<td>Identify Module</td>
<td>Basic Advanced</td>
</tr>
<tr>
<td><strong>Special Commands</strong></td>
<td></td>
</tr>
<tr>
<td>Lamp tag required</td>
<td>Basic Advanced</td>
</tr>
<tr>
<td>Cell tag required</td>
<td>Basic Advanced</td>
</tr>
</tbody>
</table>
### Table 14  Available Diagnostic Functions vs. Product Level

<table>
<thead>
<tr>
<th>Function</th>
<th>Basic</th>
<th>Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Detector Reset</td>
<td>Basic</td>
<td>Advanced</td>
</tr>
<tr>
<td>-Clear Error</td>
<td>Basic</td>
<td>Advanced</td>
</tr>
<tr>
<td><strong>Statemachines</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-UV Lamp</td>
<td>Basic</td>
<td>Advanced</td>
</tr>
<tr>
<td>-Vis Lamp</td>
<td></td>
<td>Advanced</td>
</tr>
<tr>
<td><strong>Signals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-Signal A [mAU]</td>
<td></td>
<td>Advanced</td>
</tr>
<tr>
<td>-Lamp Voltage [V]</td>
<td></td>
<td>Advanced</td>
</tr>
<tr>
<td>-Board Temperature [°C]</td>
<td></td>
<td>Advanced</td>
</tr>
<tr>
<td>-Optical Temperature [°C]</td>
<td></td>
<td>Advanced</td>
</tr>
<tr>
<td><strong>EMF Counters</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-Accumulated UV Lamp On-Time</td>
<td>Basic</td>
<td>Advanced</td>
</tr>
<tr>
<td>-Number of UV Lamp Ignitions</td>
<td>Basic</td>
<td>Advanced</td>
</tr>
<tr>
<td>-Accumulated Tungsten Lamp On-Time</td>
<td>Basic</td>
<td>Advanced</td>
</tr>
<tr>
<td>-Number of Tungsten Lamp Ignitions</td>
<td>Basic</td>
<td>Advanced</td>
</tr>
</tbody>
</table>
Figure 28  The Lab Advisor shows the available tests
Conditions of Detector

The test usually should be performed with a detector turned on for at least one hour, so that the temperature regulation of the optical unit is working (not active during the first 30 minutes after turn on). If the detector is on, tests can be performed usually 10 minutes after the UV-lamp has been turned on.
Failing a Test

If a test fails with the flow cell installed, repeat the test with removed flow cell and compare. If the test fails also, then start with proposed actions mentioned in the details of the tests.
Self-Test

The self-test runs a series of individual tests (described on the next pages), and evaluates the results automatically. The following tests are run:

- Filter Test
- Slit Test
- Dark Current Test
- Intensity Test
- Wavelength Verification Test
- Holmium Oxide Test
- Spectral Flatness Test
- ASTM Noise Test (without testing the Drift)

When

For complete detector check.

Parts required

Description
Removed Flow Cell or Flow Cell (filled with water)

Preparations

- Lamp must be on for at least 10 min.
- For noise test a longer warm-up time may be required (> 2 h).
1 Run the **Self Test** with Agilent Lab Advisor (for further information see Online-Help of user interface).

![Self Test Results](image)

**Figure 29** Self Test – Results

Under the tab **Signals** you can find the detailed signals from the tests.
Intensity Test

The intensity test measures the intensity of the UV-lamp 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 lamp and optics (see also “Cell Test” on page 129). 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 the flow cell removed. 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.

When

In case of UV-lamp problem (drift, noise).

Parts required

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removed Flow Cell or Flow Cell (filled with water)</td>
</tr>
</tbody>
</table>

Preparations

- Lamp must be on for at least 10 min.
- When using a flow cell a flow rate of 1 mL/min with water is required.
1 Run the **Intensity Test** with Agilent Lab Advisor (for further information see Online-Help of user interface).

![Intensity Test](image)

**Figure 30** Intensity Test – Results (w/o flow cell)

![Intensity Spectrum](image)

**Figure 31** Intensity Test – Signals (w/o flow cell)
### Test Failed

**Intensity Test Evaluation**

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Absorbing solvent or air bubble in flow cell.</td>
<td>• Ensure the flow cell is filled with water, and free from air bubbles.</td>
</tr>
<tr>
<td></td>
<td>• Repeat test without flow cell and compare results.</td>
</tr>
<tr>
<td>2 Incorrect calibration</td>
<td>Recalibrate and repeat the test.</td>
</tr>
<tr>
<td>3 Dirty or contaminated flow cell.</td>
<td>Run the cell test. If the test fails, flush the flow cell. See also “Maintenance of Standard, Semi-Micro or Micro Flow Cell” on page 172.</td>
</tr>
<tr>
<td>4 Dirty or contaminated optical components.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>5 Old UV-lamp.</td>
<td>Exchange the UV-lamp.</td>
</tr>
<tr>
<td>6 Defect optical unit.</td>
<td>If the test fails with flow cell and new UV-lamp, please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>

**NOTE**

If only one range fails and the application does not require this range, the lamp may not be changed.
Cell Test

The cell test measures the intensity of the UV- 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.

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

When

In case of low intensity or noise and drift problem.

Parts required

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow Cell (filled with water)</td>
</tr>
</tbody>
</table>

Preparations

- Lamp must be on for at least 10 min.
- When using a flow cell a flow rate of 1 mL/min with water is required.
8 Test Functions and Calibration

Cell Test

1 Run the **Cell-Test** with Agilent Lab Advisor (for further information see Online-Help of user interface).

![Figure 32: Cell Test – Results](image)

![Figure 33: Cell Test – Signals (example shows low intensity for flow cell)](image)
**Test Failed (low ratio value)**

Cell Test Evaluation

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Absorbing solvent or air bubble in flow cell.</td>
<td>Ensure the flow cell is filled with water, and free from air bubbles.</td>
</tr>
<tr>
<td>2 Dirty or contaminated flow cell.</td>
<td>Clean the flow cell as described in &quot;Maintenance of Standard, Semi-Micro or Micro Flow Cell&quot; on page 172.</td>
</tr>
</tbody>
</table>
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 34  Filter Test
Test Evaluation

Filter Test Failed

Test Failed

Probable cause

1  Filter assembly (lever and filter) not installed.

2  Defective filter motor.

Suggested actions

Install the filter assembly.

Please contact your Agilent service representative.

Holmium Oxide Maximum out of Limits

Probable cause

1  Holmium oxide filter not installed.

2  Dirty or contaminated filter.

Suggested actions

Install the holmium oxide filter.

Exchange the holmium oxide filter.
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 Test” on page 144). 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 287.
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 35 on page 135).
Test Functions and Calibration
Holmium Oxide Test

Test Failed

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Absorbing solvent or air bubble in flow cell.</td>
<td>Ensure the flow cell is filled with water.</td>
</tr>
<tr>
<td>2 Incorrect calibration</td>
<td>Recalibrate (see “Wavelength Calibration” on page 146) and repeat the test.</td>
</tr>
<tr>
<td>3 Dirty or contaminated flow cell.</td>
<td>Run the cell test (see “Cell Test” on page 129). If the test fails, exchange the flow cell windows.</td>
</tr>
<tr>
<td>4 Dirty or contaminated optical components (achromat, windows).</td>
<td>Clean optical components with alcohol and lint-free cloth or replace the parts (see “Intensity Test” on page 126).</td>
</tr>
<tr>
<td>5 Old or non-Agilent lamp.</td>
<td>Exchange the UV lamp.</td>
</tr>
</tbody>
</table>

Figure 36  Holmium Oxide Test (Signal)
ASTM Drift and Noise Test

The ASTM noise test determines the detector noise over a period of 20 minutes. The test is done with installed flow cell or flow cell removed. This test also checks for the drift. It is also part of the Self Test (without checking for the drift).

If the test is performed with the flow cell removed, the test results are not influenced by solvent or pump effects.

When
In case of noise and drift problem.

Parts required
Description
Removed Flow Cell or Flow Cell (filled with water)

Preparations
• Detector and UV-lamp must be on for at least 2 hours.
• ASTM measurements based on specifications may require longer stabilization times.
• When using a flow cell a flow rate of 1 mL/min with water is required.
1. Run the **ASTM Drift and Noise Test** with Agilent Lab Advisor (for further information see Online-Help of user interface).

![Figure 37](image_url) **Figure 37**  
ASTM Drift and Noise Test – Results (with Flow Cell removed)
Figure 38  ASTM Drift and Noise Test – Signal (with Flow Cell removed)
# Test Failed

## ASTM Noise Test Evaluation

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Insufficient lamp warm-up time.</td>
<td>Allow detector and UV-lamp turned on for at least 2 hours.</td>
</tr>
<tr>
<td>2 Absorbing solvent or air bubble in flow cell.</td>
<td>Ensure the flow cell is filled with water, and free from air bubbles.</td>
</tr>
<tr>
<td>3 Dirty or contaminated flow cell.</td>
<td>• Flush flow cell.</td>
</tr>
<tr>
<td></td>
<td>• Clean the flow cell as described in “Maintenance of Standard, Semi-Micro or Micro Flow Cell” on page 172.</td>
</tr>
<tr>
<td>4 Old UV-lamp.</td>
<td>Exchange the UV-lamp.</td>
</tr>
<tr>
<td>5 Old Vis-lamp.</td>
<td>Exchange the Vis-lamp.</td>
</tr>
<tr>
<td>6 Environment not according to specifications.</td>
<td>Improve environment.</td>
</tr>
</tbody>
</table>
Slit Test

The slit test verifies correct operation of the micromechanical slit.

During the test, the slit is moved through all slit positions while the detector monitors the lamp intensity change. When the slit position is changed, the intensity drop (move to smaller slit) or intensity increase (move to larger slit) must be within a defined range.

If the test is performed with the flow cell removed, the test results are not influenced by solvent or pump effects.

If the intensity changes are outside the expected range, the test fails.

When

In case of problems.

Parts required

Description

Removed Flow Cell or Flow Cell (filled with water)

Preparations

- Lamp must be on for at least 10 min.
- When using a flow cell a flow rate of 1 mL/min with water is required.
8 Test Functions and Calibration

Slit Test

1 Run the Slit Test with the Agilent Lab Advisor (for further information see Online-Help of user interface).

![Slit Test Results](image1)

**Figure 39** Slit Test – Results

![Slit Test Signal at 300 nm](image2)

**Figure 40** Slit Test – Signal
## Test Failed

Slit Test Evaluation

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Air bubble in flow cell.</td>
<td>Flush the flow cell or remove the flow cell.</td>
</tr>
<tr>
<td>2  Old lamp.</td>
<td>Run the “Intensity Test”. Exchange the lamp if old or defective.</td>
</tr>
<tr>
<td>3  Defective slit assembly.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>4  Defective detector main board.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>5  Defective optical unit.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>
Wavelength Verification Test

The detector uses the alpha (656.1 nm) and beta (486 nm) emission lines of the UV-lamp for wavelength calibration. The sharp emission lines enable accurate calibration. When verification is started, the 1-nm slit is moved into the light path automatically. The test is run with Flow Cell removed or with Flow Cell installed.

If the test is performed with the Flow Cell removed, the test results are not influenced by solvent or pump effects.

When

The detector is calibrated at the factory, and under normal operating conditions should not require recalibration. However, it is advisable to recalibrate:

• after repair of components in the optical unit,
• after exchange of the optical unit or main board,
• after replacing the Flow Cell or UV-lamp,
• after significant environmental condition changes (temperature, humidity),
• at a regular interval, at least once per year (for example, prior to an Operational Qualification/Performance Verification procedure), and
• when chromatographic results indicate the detector may require recalibration.

Parts required

Description

Removed Flow Cell or Flow Cell (filled with water)

Preparations

• Lamp must be on for at least 10 min.
• When using a Flow Cell a flow rate of 0.5 mL/min with water is required.
1 Run the Wavelength Verification Test with the Agilent Lab Advisor (for further information see Online-Help of user interface).
Wavelength 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 recalibration is started, the 1 nm slit is moved into the light path automatically. The gain is set to zero.

On completion of the scan, the alpha- and beta-line deviations (in nm) are displayed. These values indicate how far the detector calibration deviates from the actual positions of the alpha and beta emission lines. After calibration, the deviation is zero.

To eliminate effects due to absorbing solvents, remove the flow cell before starting the test.

When

The detector is calibrated at the factory, and under normal operating conditions should not require recalibration. However, it is advisable to recalibrate:

- after maintenance (flow cell or UV-lamp),
- after repair of components in the optical unit,
- after exchange of the optical unit or main board,
- after significant environmental condition changes (temperature, humidity),
- at a regular interval, at least once per year (for example, prior to an Operational Qualification/Performance Verification procedure), and
- when chromatographic results indicate the detector may require recalibration.

Parts required

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removed Flow Cell or Flow Cell (filled with water)</td>
</tr>
</tbody>
</table>

Preparations

- Detector/lamp must be on for more than 1 h.
- When using a Flow Cell a flow rate of 0.5 mL/min with water is required.

NOTE

If the detector is operated in a lab environment that differs at average from the final test environment (25 °C) then the detector should be recalibrated for this temperature.

NOTE

If the detector was repaired (opened covers), the wavelength calibration can be done 10 minutes after lamp on. A final wavelength calibration should be repeated after complete warm-up of the detector.
1 Run the Wavelength Calibration with the Agilent Lab Advisor (for further information see Online-Help of user interface).

![Wavelength Calibration](image)

**Figure 42** Wavelength Calibration - Results

If you select **No**, the test is aborted.

If you select **Yes**, the re-calibration is performed (the offset is corrected).
Wavelength Recalibration Fails

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Absorbing solvent or air bubble in Flow Cell.</td>
<td>Repeat calibration with Flow Cell and compare results.</td>
</tr>
<tr>
<td>2 Dirty or contaminated Flow Cell.</td>
<td>• Ensure the Flow Cell is filled with water.</td>
</tr>
<tr>
<td></td>
<td>• Recalibrate.</td>
</tr>
<tr>
<td>3 Old UV-lamp.</td>
<td>Exchange the UV-lamp.</td>
</tr>
<tr>
<td>4 Dirty or contaminated optical components.</td>
<td>Run the Cell Test. If the test fails, flush the flow</td>
</tr>
<tr>
<td></td>
<td>cell.</td>
</tr>
</tbody>
</table>

**NOTE** If the test fails with Flow Cell and new UV-lamp, the optical unit must be checked/replaced.
D/A Converter (DAC) Test

The detector provides analog output of chromatographic signals for use with integrators, chart recorders or data systems. The analog signal is converted from the digital format by the digital-analog-converter (DAC).

The DAC test is used to verify correct operation of the digital-analog-converter by applying a digital test signal to the DAC.

The DAC outputs an analog signal of approximately 50 mV (if the zero offset of the analog output is set to the default value of 5 %) which can be plotted on an integrator. A continuous square wave with an amplitude of 10 μV and a frequency of approximately 1 cycle/24 seconds is applied to the signal.

The amplitude of the square wave and the peak-to-peak noise are used to evaluate the DAC test.

When

If the analog detector signal is noisy or missing.

Preparations

Lamp must be on for at least 10 minutes. Connect integrator, chart recorder or data system to the detector analog output.

1 Run the D/A Converter (DAC) Test with the Agilent Lab Advisor (for further information see Online-Help of user interface).

Figure 43  D/A Converter (DAC) Test – Results
## Test Evaluation

The noise on the step should be less than 3 μV.

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Bad cable or grounding problem between detector and external device.</td>
<td>Check or replace the cable.</td>
</tr>
<tr>
<td>2 Defective detector main board.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>
Dark-Current Test

The dark-current test measures the leakage current from each diode. The test is used to check for leaking diodes which may cause non-linearity at specific wavelengths. During the test, the slit assembly moves to the dark position, cutting off all light falling onto the diode array. Next, the leakage current from each diode is measured, and displayed graphically. The leakage current (represented in counts) for each diode should fall within the limits.

When

1. Run the **Dark Current Test** with the recommended user interface (for further information see Online-Help of user interface).

![Figure 44](Image)

**Figure 44** Dark Current Test – Results
8 Test Functions and Calibration

Dark-Current Test

Figure 45 Dark Current Test – Signals
## Test Failed

<table>
<thead>
<tr>
<th>Probable cause</th>
<th>Suggested actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Defective slit assembly (stray light).</td>
<td>Run the “Slit Test” on page 141 (part of the “Self-Test” on page 124).</td>
</tr>
<tr>
<td>2 Defective detector main board.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
<tr>
<td>3 Defective PDA/optical unit.</td>
<td>Please contact your Agilent service representative.</td>
</tr>
</tbody>
</table>
Spectral Scan

The Spectral Scan tool is available for diode-array and variable wavelength detectors (DAD/MWD and VWD). It allows you to scan a spectrum over a specified wavelength range and export the data to a csv (comma-separated values) file that can be used in other applications (for example, Microsoft Excel).

![Spectral Scan](image)

**Figure 46** Spectral Scan
Other Lab Advisor Functions

EMFs - Early Maintenance Feature

The EMFs screen allows you to view and manage the EMF counters for all modules in all systems.

![EMFs Screen](image)

**Figure 47** Early Maintenance Feature
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** Module is partially energized when switched off, as long as the power cord is plugged in.

Risk of stroke and other personal injury. Repair work at the module can lead to personal injuries, e.g. shock hazard, when the module cover is opened and the instrument is connected to power.

➔ Never perform any adjustment, maintenance or repair of the module with the top cover removed and with the power cord plugged in.

➔ The security lever at the power input socket prevents that the module cover is taken off when line power is still connected. Never plug the power line back in when cover is removed.

**WARNING** Sharp metal edges

Sharp-edged parts of the equipment may cause injuries.

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

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

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

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

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

➔ Do not operate the instrument in an explosive atmosphere.
CAUTION
Electronic boards and components are sensitive to electrostatic discharge (ESD).
ESD can damage electronic boards and components.
➔ Be sure to hold the board by the edges, and do not touch the electrical components. Always use ESD protection (for example, an ESD wrist strap) when handling electronic boards and components.

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.

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 15  Overview of Maintenance

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

<table>
<thead>
<tr>
<th>Parts required</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5067-5737</td>
<td>Door left</td>
</tr>
<tr>
<td></td>
<td>5067-5736</td>
<td>Door right</td>
</tr>
</tbody>
</table>

**NOTE**

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

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

2. For the Installation of the front door. Insert the hinges into their guides and move the door in until the release buttons click into their final position.
Replace a Lamp

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

Tools required
Screwdriver, Pozidriv #1 PT3

Parts required

<table>
<thead>
<tr>
<th>#</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2140-0820</td>
<td>Longlife Deuterium lamp “C” (with black cover and RFID tag)</td>
</tr>
<tr>
<td>1</td>
<td>G1103-60001</td>
<td>Tungsten lamp</td>
</tr>
</tbody>
</table>

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.

**NOTE**
The lamp house cover includes a magnet.
1. Open the doors.

2. Grab the lamp cover and pull it off (it is fixed by two magnets in the center of the cover).

3. Unplug the lamp connector as required.

4. Unscrew (do not remove) the two lamp screws (Pozidriv) as required.
9 Maintenance
Replace a Lamp

5 Remove the deuterium lamp and place it on a clean place.

6 Remove the Vis-lamp and place it on a clean place.

**NOTE**
Do not touch the glass bulb with your fingers. It may reduce the light output.

7 Insert the deuterium lamp (RFID tag on the top side).

8 Insert the Vis-lamp (flat side to the right).

9 Reconnect the lamp connector as required.

10 Place the lamp cables in the lamp cover.
11 Slide the lamp cover into the top position of the metal front and press the lamp cover completely in until it clicks.

12 Close the doors.

Next Steps:

13 Perform a “Wavelength Verification Test” on page 144 or a “Holmium Oxide Test” on page 134 to check the correct positioning of the flow cell.

14 Perform an Intensity Test.
## Remove and Install a Flow Cell

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

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wrench, 1/4 inch for capillary connections</td>
</tr>
<tr>
<td>5043-0915</td>
<td>Fitting mounting tool for bio-inert capillaries</td>
</tr>
</tbody>
</table>

### Parts required

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1315-60022</td>
<td>Standard flow cell, 10 mm, 13 µL, 120 bar (12 MPa)</td>
</tr>
<tr>
<td>G1315-60025</td>
<td>Semi-micro flow cell, 6 mm, 5 µL, 120 bar (12 MPa)</td>
</tr>
<tr>
<td>G1315-60024</td>
<td>Micro flow cell, 3 mm, 2 µL, 120 bar (12 MPa)</td>
</tr>
<tr>
<td>G1315-60015</td>
<td>High pressure flow cell, 6 mm, 1.7 µL, 400 bar (40 MPa)</td>
</tr>
<tr>
<td></td>
<td>Nano flow cell</td>
</tr>
<tr>
<td>G5615-60022</td>
<td>Standard flow cell bio-inert, 10 mm, 13 µL, 120 bar (12 MPa) for MWD/DAD,</td>
</tr>
<tr>
<td></td>
<td>includes Capillary Kit Flow Cells BIO (p/n G5615-68755)</td>
</tr>
</tbody>
</table>

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

### 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.

### NOTE
The lamp house cover includes a magnet.
1. Open the doors.

2. Grab the lamp cover and pull it off (it is fixed by two magnets in the center of the cover).

3. Open the flow cell door.

4. Disconnect the flow cell inlet capillary (top) from the union.

5. Disconnect the waste tubing (bottom) from the union.

6. Loosen the thumb screw (1.) and remove the flow cell outlet capillary (bottom) with the union (2.).
9 Maintenance

Remove and Install a Flow Cell

7 Remove the flow cell while pressing the flow cell holder.

8 Insert 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, see “Maintenance of Standard, Semi-Micro or Micro Flow Cell” on page 172 or “Maintenance of High Pressure Flow Cell” on page 176.

9 Insert the flow cell capillaries into the union holder (top is inlet, bottom is outlet).

10 Tighten the thumb screw.
11 Reconnect the waste tubing (bottom) to the union. Establish a flow and check for leaks.

12 Close the flow cell door.

**NOTE**
To check for leaks, establish a flow and observe the flow cell (outside of the cell compartment) and all capillary connections.

13 Slide the lamp cover into the top position of the metal front and press the lamp cover completely in until it clicks.

14 Close the doors.

15 Perform a **Wavelength Verification and Calibration** or a **Holmium Oxide Test** to check the correct positioning of the flow cell.
9 Maintenance

Maintenance of Standard, Semi-Micro or Micro Flow Cell

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

**When**

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

**Tools required**

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wrench, 1/4 inch for capillary connections</td>
</tr>
<tr>
<td>5043-0915</td>
<td>Fitting mounting tool for bio-inert capillaries</td>
</tr>
<tr>
<td></td>
<td>Hexagonal key, 4 mm (supplied in HPLC Tool-Kit)</td>
</tr>
<tr>
<td></td>
<td>Toothpick</td>
</tr>
</tbody>
</table>

**Parts required**


**Preparations**

- Turn the flow off.
- Open the doors of the module.
- Remove the flow cell, see “Remove and Install a Flow Cell” on page 168

**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 (6,7) 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 “Standard Flow Cell” on page 206 for the correct orientation of the parts.

2. Use a toothpick 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.
9 Maintenance

Maintenance of Standard, Semi-Micro or Micro Flow Cell

3 Orientation of Flow Cell Parts.

4 Assemble the washers and the window assembly in correct order.

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

5 Correct orientation of spring washers (2) is required.

1 - Window screw
2 - Spring washers
3 - Compression washer
4 - Window holder
5 - Quartz window
6 - Gasket

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.

**NOTE**
Do not mix the gasket #6 and #7 (different hole diameter).

**Next Steps:**

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

10 Reconnect the capillaries, see “Remove and Install a Flow Cell” on page 168.

11 Perform a leak test.

12 Insert the flow cell.

13 Replace the front cover

14 Perform a “Wavelength Verification Test” on page 144 or a “Holmium Oxide Test” on page 134 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
<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wrench, 1/4 inch for capillary connections</td>
</tr>
<tr>
<td>OR</td>
<td>5043-0915 Fitting mounting tool for bio-inert capillaries</td>
</tr>
<tr>
<td></td>
<td>Hexagonal key, 4 mm (supplied in HPLC Tool-Kit)</td>
</tr>
<tr>
<td></td>
<td>Toothpick</td>
</tr>
</tbody>
</table>

Parts required
For parts see “High Pressure Flow Cell” on page 214

Preparations
• Turn the flow off.
• Open the doors of the module.
• Remove the flow cell, see “Remove and Install a Flow Cell” on page 168

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).
### Maintenance of High Pressure Flow Cell

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

2. Use a toothpick 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.

Replacing Capillaries on a Standard Flow Cell

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

When

If the capillary is blocked

Tools required

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wrench, 1/4 inch</td>
</tr>
<tr>
<td></td>
<td>for capillary connections</td>
</tr>
<tr>
<td></td>
<td>Fitting mounting tool</td>
</tr>
<tr>
<td>5043-0915</td>
<td>for bio-inert capillaries</td>
</tr>
<tr>
<td></td>
<td>Wrench, 4 mm</td>
</tr>
<tr>
<td></td>
<td>(for capillary connections)</td>
</tr>
<tr>
<td></td>
<td>Screwdriver, Pozidriv #1 PT3</td>
</tr>
</tbody>
</table>

Parts required

For parts see “Standard Flow Cell” on page 206

Preparations

- Turn the lamp(s) off.
- Open the doors of the module.
- Remove the flow cell, see “Remove and Install a Flow Cell” on page 168.

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.

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

4 Unscrew the cell body from the heat exchanger and the heat exchanger from the clamp unit.
9 Maintenance
Replacing Capillaries on a Standard Flow Cell

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 groove 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 groove and should be tied around the body (in the groove) 5 times.

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

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.
# Maintenance

## Replacing Capillaries on a Standard Flow Cell

<table>
<thead>
<tr>
<th>Step</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Fix the heat exchanger to the clamp unit and the flow cell body to the heat exchanger.</td>
</tr>
<tr>
<td>14</td>
<td>Fix the inlet capillary to the flow cell body handtight first. Then do a 1/4 turn with a 4 mm wrench.</td>
</tr>
<tr>
<td>15</td>
<td>Check for a centered holder vs. hole. If required adjust with the holder screws.</td>
</tr>
<tr>
<td>Next Steps:</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Reconnect the capillaries, see “Remove and Install a Flow Cell” on page 168.</td>
</tr>
<tr>
<td>17</td>
<td>Perform a leak test.</td>
</tr>
<tr>
<td>18</td>
<td>Insert the flow cell.</td>
</tr>
<tr>
<td>19</td>
<td>Close the doors of the module.</td>
</tr>
<tr>
<td>20</td>
<td>Perform a “Wavelength Verification Test” on page 144 or a “Holmium Oxide Test” on page 134 to check the correct positioning of the flow cell.</td>
</tr>
</tbody>
</table>
# Replacing Capillaries on a Semi-Micro and Micro Flow Cell

## When
If the capillary is blocked

## Tools required

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrench, 1/4 inch for capillary connections</td>
</tr>
<tr>
<td>Wrench, 4 mm (for capillary connections)</td>
</tr>
<tr>
<td>Screwdriver, Pozidriv #1 PT3</td>
</tr>
</tbody>
</table>

## Parts required

For parts see “Semi-Micro Flow Cell” on page 210 or “Micro Flow Cell” on page 212.

## Preparations

- Turn the lamp(s) off.
- Open the doors of the module.
- Remove the flow cell, see “Remove and Install a Flow Cell” on page 168.

## 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.
9 Maintenance
Replacing Capillaries on a Semi-Micro and Micro Flow Cell

1 Identify the inlet and outlet capillaries.

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

Next Steps:

10 Reconnect the capillaries, see "Remove and Install a Flow Cell" on page 168.
11 Perform a leak test.
12 Insert the flow cell.
13 Close the doors.
14 Perform a "Wavelength Verification Test" on page 144 or a "Holmium Oxide Test" on page 134 to check the correct positioning of the flow cell.
## Nano Flow Cell - Replacing or Cleaning

**When**
If parts are contaminated or leaky.

**Tools required**

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screwdriver, Pozidriv #1 PT3</td>
</tr>
<tr>
<td>Wrench, 1/4 inch</td>
</tr>
<tr>
<td>for capillary connections</td>
</tr>
</tbody>
</table>

**Parts required**
For parts identification refer to “Nano Flow Cells” on page 220 (80 nL and 500 nL).

**Preparations**
- Turn the lamp(s) off.
- Open the doors of the module.
- Remove the flow cell, see “Remove and Install a Flow Cell” on page 168.

**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.
## Maintenance

### Nano Flow Cell - Replacing or Cleaning

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Disconnect the capillaries from the capillary holder and remove the flow cell, see “Remove and Install a Flow Cell” on page 168.</td>
</tr>
<tr>
<td>2</td>
<td>Unscrew the cell body from the holder.</td>
</tr>
<tr>
<td>3</td>
<td>Unscrew the capillaries from the flow cell. DO NOT use the adapter at this time!</td>
</tr>
<tr>
<td>4</td>
<td>Using for example a toothpick, press on the plastic part and slide the quartz body out of the cell housing.</td>
</tr>
</tbody>
</table>
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 48 on page 191 and tighten the fittings alternately.

10 Reassemble the flow cell body to the holder.

**Next Steps:**

11 Install the flow cell, see “Remove and Install a Flow Cell” on page 168.

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).
**Wrench plus Torque**

**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 tighten the capillary fittings at the flow cell body. The wrench has to be plugged into the adapter as shown in Figure 48 on page 191.

---

**Figure 48** Wrench plus Torque Adapter
Cleaning or Exchanging the Holmium Oxide Filter

When
If holmium oxide filter is contaminated

Tools required

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screwdriver, Pozidriv #1 PT3</td>
</tr>
<tr>
<td>Screwdriver, flat blade</td>
</tr>
<tr>
<td>Wrench, 1/4 inch for capillary connections</td>
</tr>
<tr>
<td>Pair of tweezers</td>
</tr>
</tbody>
</table>

Parts required

<table>
<thead>
<tr>
<th>#</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>79880-22711</td>
<td>Holmium oxide filter</td>
</tr>
</tbody>
</table>

Preparations

- Turn the lamp(s) off.
- Open the doors of the module.
- Remove the flow cell, see “Remove and Install a Flow Cell” on page 168.

NOTE
See also “Declaration of Conformity for HOX2 Filter” on page 287.

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.

2 If not already in this position, move the filter up.

3 Release the holder with a screw driver (at the top).

4 Remove the holmium oxide filter.

**NOTE**
Do not scratch the holmium oxide filter.

**NOTE**
The holmium oxide filter can be cleaned with alcohol and a lint-free cloth.

5 Insert the holmium oxide filter.

6 Replace the flow cell cover and fix the six screws.
9 Maintenance
Cleaning or Exchanging the Holmium Oxide Filter

7 Perform a holmium oxide test (see “Holmium Oxide Test” on page 134) to check the proper function of the holmium oxide filter.

8 Install the flow cell, see “Remove and Install a Flow Cell” on page 168.

9 Close the doors.

10 Turn on the flow.
CorrectingLeaks

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

Tools required

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tissue</td>
</tr>
<tr>
<td></td>
<td>Wrench, 1/4 inch</td>
</tr>
<tr>
<td>5043-0915</td>
<td>Fitting mounting tool</td>
</tr>
<tr>
<td></td>
<td>for bio-inert capillaries</td>
</tr>
</tbody>
</table>

**NOTE** Use tissue to dry the leak sensor area and the leak pan.

1 Open the doors.

2 Grab the lamp cover and pull it off (it is fixed by two magnets in the center of the cover).
3 Open the flow cell door.

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

**NOTE**

To check for leaks, establish a flow and observe the flow cell (outside of the cell compartment) and all capillary connections.

5 Check the Leak Sensor area for leaks and correct, if required.

6 Install the flow cell and close the flow cell door.
### Correcting Leaks

7. Slide the lamp cover into the top position of the metal front and press the lamp cover completely in until it clicks.

8. Close the doors.

9. Perform a **Wavelength Verification and Calibration** or a **Holmium Oxide Test** to check the correct positioning of the flow cell.
9 Maintenance
Replacing Leak Handling System Parts

Replacing Leak Handling System Parts

When If the parts are corroded or broken

<table>
<thead>
<tr>
<th>Parts required</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5043-0856</td>
<td>Leak Adapter</td>
</tr>
<tr>
<td></td>
<td>5063-6527</td>
<td>Tubing assembly, i.d. 6 mm, o.d. 9 mm, 1.2 m (to waste)</td>
</tr>
</tbody>
</table>

1. Open the doors.

2. Press the Leak Adapter down (1.) and remove it together with the tubing (2.).

3. Install the Leak Adapter by pressing it into the Main Cover.

4. Insert the Tubing (approximately 85 mm required for replacement) between Leak Adapter outlet and Leak Panel.
5 Close the doors.
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

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

Parts required

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

Preparations

Read update documentation provided with the Firmware Update Tool.

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

1. Download the required module firmware, the latest FW Update Tool and the documentation from the Agilent web.

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

Table 16  Module Specific Information (G7115A DAD/G7165A MWD)

<table>
<thead>
<tr>
<th></th>
<th>G7115A DAD</th>
<th>G7165A MWD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial firmware</td>
<td>D.07.01</td>
<td>D.07.01</td>
</tr>
<tr>
<td>(main and resident)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compatibility with</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1260/1290 Infinity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>modules</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compatibility with</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1100/1200 Series</td>
<td></td>
<td></td>
</tr>
<tr>
<td>modules</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conversion to /</td>
<td></td>
<td></td>
</tr>
<tr>
<td>emulation of G1315D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or G1365D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• G7115A allows</td>
<td></td>
<td></td>
</tr>
<tr>
<td>conversion to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G1315C/D DAD, G1365C/D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MWD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• G7165A allows</td>
<td></td>
<td></td>
</tr>
<tr>
<td>conversion to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G1365C/D MWD</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Information from Module’s Assemblies

Lamp and Flow Cell RFID Tag

The detector is equipped with a UV lamp and flow cell identification system using RFID (radio frequency identification) tags attached to the assemblies and RFID tag readers at the optical unit. The table below lists all parameters stored in the RFID tag.

**Table 17  RFID Tag Data**

<table>
<thead>
<tr>
<th>Lamp information</th>
<th>Flow cell information</th>
</tr>
</thead>
<tbody>
<tr>
<td>• product number</td>
<td>• product number</td>
</tr>
<tr>
<td>• serial number</td>
<td>• serial number</td>
</tr>
<tr>
<td>• production date</td>
<td>• production date</td>
</tr>
<tr>
<td>• accumulated UV on time (in hours)</td>
<td>• nominal path length of the cell (in mm)</td>
</tr>
<tr>
<td>• actual UV lamp on time (in hours)</td>
<td>• cell volume ($\sigma$) in $\mu$L</td>
</tr>
<tr>
<td>• number of ignitions</td>
<td>• maximum pressure (in bar)</td>
</tr>
<tr>
<td>• date of last intensity test</td>
<td>• date of last cell test</td>
</tr>
</tbody>
</table>

**NOTE**
The pressure value is always displayed in bar, even if the user interface uses other units, e.g. PSI.

Serial Number and Firmware Revision

The user interface provides module specific information that is stored in the main board. These are for example the serial number, firmware revision.
10 Parts for Maintenance

Overview of Maintenance Parts 204
Standard Flow Cell 206
Standard Flow Cell Bio-inert 208
Semi-Micro Flow Cell 210
Micro Flow Cell 212
High Pressure Flow Cell 214
Prep Flow Cell - SST 216
Prep Flow Cell - Quartz 218
Nano Flow Cells 220
Accessory Kits 223
Holmium Oxide Filter 224
Leak Handling Parts 225

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

Figure 49  Overview of maintenance parts
### Overview of Maintenance Parts

<table>
<thead>
<tr>
<th>Item</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5067-5737</td>
<td>Door left</td>
</tr>
<tr>
<td>2</td>
<td>5067-5736</td>
<td>Door right</td>
</tr>
<tr>
<td>3</td>
<td>G1103-60001</td>
<td>Tungsten lamp</td>
</tr>
<tr>
<td>4</td>
<td>2140-0820</td>
<td>Longlife Deuterium lamp “C” (with black cover and RFID tag)</td>
</tr>
<tr>
<td>5</td>
<td>5043-1013</td>
<td>Tubing Clip</td>
</tr>
<tr>
<td>6</td>
<td>5043-0856</td>
<td>Leak Adapter</td>
</tr>
<tr>
<td>7</td>
<td>5063-6527</td>
<td>Tubing assembly, i.d. 6 mm, o.d. 9 mm, 1.2 m (to waste) for Waste and Leak Adapter (ca. 85 mm required)</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Flow cell with RFID tag&lt;br&gt;for details refer to specific flow cell</td>
</tr>
<tr>
<td></td>
<td>G1315-60022</td>
<td>Standard flow cell, 10 mm, 13 µL, 120 bar (12 MPa)</td>
</tr>
<tr>
<td></td>
<td>G5615-60022</td>
<td>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)</td>
</tr>
<tr>
<td></td>
<td>G1315-60025</td>
<td>Semi-micro flow cell, 6 mm, 5 µL, 120 bar (12 MPa)</td>
</tr>
<tr>
<td></td>
<td>G1315-60024</td>
<td>Micro flow cell, 3 mm, 2 µL, 120 bar (12 MPa)</td>
</tr>
<tr>
<td></td>
<td>G1315-60015</td>
<td>High pressure flow cell, 6 mm, 1.7 µL, 400 bar (40 MPa)</td>
</tr>
<tr>
<td></td>
<td>G1315-60016</td>
<td>Prep flow cell SST - 3 mm, 120 bar (12 MPa)</td>
</tr>
<tr>
<td></td>
<td>G1315-60017</td>
<td>Prep flow cell quartz, 0.3 mm, 20 bar (2 MPa)</td>
</tr>
<tr>
<td></td>
<td>G1315-60018</td>
<td>Prep flow cell quartz, 0.06 mm (2 MPa)</td>
</tr>
<tr>
<td></td>
<td>G1315-68724</td>
<td>Semi-nano flow cell kit, 10 mm, 500 nL, 5 MPa</td>
</tr>
<tr>
<td></td>
<td>G1315-68716</td>
<td>Nano flow cell kit, 6 mm, 80 nL, 5 MPa</td>
</tr>
<tr>
<td>9</td>
<td>5022-6515</td>
<td>Union ZDV</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Tube PTFE 0.8 mm x 2 m, re-order 5 m</td>
</tr>
<tr>
<td>11</td>
<td>G1315-87311</td>
<td>Capillary ST 0.17 mm x 380 mm S/S</td>
</tr>
<tr>
<td></td>
<td>79880-22711</td>
<td>Holmium oxide filter&lt;br&gt;(not shown)</td>
</tr>
</tbody>
</table>
### Standard Flow Cell

<table>
<thead>
<tr>
<th>Item</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>79883-22402</td>
<td>Window screw</td>
</tr>
<tr>
<td>2</td>
<td>5062-8553</td>
<td>Washer kit (10/pk)</td>
</tr>
<tr>
<td>3</td>
<td>79883-28801</td>
<td>Compression washer</td>
</tr>
<tr>
<td>4</td>
<td>79883-22301</td>
<td>Window holder</td>
</tr>
<tr>
<td>5</td>
<td>1000-0488</td>
<td>Quartz window</td>
</tr>
<tr>
<td>6</td>
<td>G1315-68711</td>
<td>Gasket BACK (PTFE), 2.3 mm hole, outlet side (12/pk)</td>
</tr>
<tr>
<td>7</td>
<td>G1315-68710</td>
<td>Gasket FRONT (PTFE), 1.3 mm hole, inlet side (12/pk)</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Window assembly (comprises window screw, spring washers, compression washer, window holder and quartz window)</td>
</tr>
<tr>
<td>9</td>
<td>G1315-87321</td>
<td>Capillary IN (0.17 mm, 590 mm lg) including heat exchanger</td>
</tr>
<tr>
<td>10</td>
<td>G1315-87302</td>
<td>Capillary OUT (0.17 mm, 200 mm lg)</td>
</tr>
<tr>
<td>11</td>
<td>G1315-84910</td>
<td>Clamp unit</td>
</tr>
<tr>
<td>12</td>
<td>0515-1056</td>
<td>Screw M 2.5, 4 mm lg for cell body/clamp</td>
</tr>
<tr>
<td></td>
<td>5022-2184</td>
<td>Union ZDV</td>
</tr>
<tr>
<td></td>
<td>G1315-68712</td>
<td>Cell repair kit STD includes window screw kit, 4 mm hexagonal wrench and seal kit</td>
</tr>
<tr>
<td></td>
<td>79883-68703</td>
<td>Window screw kit, includes 2 quartz windows, 2 compression washers, 2 window holders, 2 window screws and 10 washers</td>
</tr>
</tbody>
</table>
### Figure 50  Standard Flow Cell Parts

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 51  Orientation of Spring Washers
## Standard Flow Cell Bio-inert

<table>
<thead>
<tr>
<th>Item</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>79883-22402</td>
<td>Window screw</td>
</tr>
<tr>
<td>2</td>
<td>5062-8553</td>
<td>Washer kit (10/pk)</td>
</tr>
<tr>
<td>3</td>
<td>79883-28801</td>
<td>Compression washer</td>
</tr>
<tr>
<td>4</td>
<td>79883-22301</td>
<td>Window holder</td>
</tr>
<tr>
<td>5</td>
<td>5190-0921</td>
<td>Sapphire window</td>
</tr>
<tr>
<td>6</td>
<td>G1315-68711</td>
<td>Gasket BACK (PTFE), 2.3 mm hole, outlet side (12/pk)</td>
</tr>
<tr>
<td>7</td>
<td>G1315-68710</td>
<td>Gasket FRONT (PTFE), 1.3 mm hole, inlet side (12/pk)</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Window assembly (comprises window screw, spring washers, compression washer, window holder and quartz window)</td>
</tr>
<tr>
<td>9</td>
<td>G5615-87331</td>
<td>Capillary In (0.17 mm, 590 mm lg), including heat exchanger</td>
</tr>
<tr>
<td>10</td>
<td>G5615-87302</td>
<td>Capillary Out (0.17 mm, 200 mm lg)</td>
</tr>
<tr>
<td>11</td>
<td>G1315-84910</td>
<td>Clamp unit</td>
</tr>
<tr>
<td></td>
<td>0515-1056</td>
<td>Screw M 2.5, 4 mm lg for cell body/clamp</td>
</tr>
<tr>
<td></td>
<td>5022-2184</td>
<td>Union ZDV</td>
</tr>
<tr>
<td></td>
<td>G1315-68712</td>
<td>Cell repair kit STD includes window screw kit, 4 mm hexagonal wrench and seal kit</td>
</tr>
<tr>
<td></td>
<td>G5615-68703</td>
<td>Window screw kit bio-inert, includes 2 sapphire windows, 2 compression washers, 2 window holders, 2 window screws and 10 spring washers</td>
</tr>
<tr>
<td></td>
<td>5067-5695</td>
<td>UHP-FF Fitting</td>
</tr>
</tbody>
</table>
Figure 52  Standard Flow Cell Bio-inert

1 - Window screw
2 - Spring washers
3 - Compression washer
4 - Window holder
5 - Quartz window
6 - Gasket

Figure 53  Orientation of Spring Washers
## Semi-Micro Flow Cell

<table>
<thead>
<tr>
<th>Item</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>79883-22402</td>
<td>Window screw</td>
</tr>
<tr>
<td>2</td>
<td>5062-8553</td>
<td>Washer kit (10/pk)</td>
</tr>
<tr>
<td>3</td>
<td>79883-28801</td>
<td>Compression washer</td>
</tr>
<tr>
<td>4</td>
<td>79883-22301</td>
<td>Window holder</td>
</tr>
<tr>
<td>5</td>
<td>1000-0488</td>
<td>Quartz window</td>
</tr>
<tr>
<td>6</td>
<td>79883-68702</td>
<td>Gasket BACK (PTFE), 1.8 mm hole, outlet side (12/pk)</td>
</tr>
<tr>
<td>7</td>
<td>G1315-68710</td>
<td>Gasket FRONT (PTFE), 1.3 mm hole, inlet side (12/pk)</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Window assembly (comprises window screw, spring washers, compression washer, window holder and quartz window)</td>
</tr>
<tr>
<td>9</td>
<td>G1315-87319</td>
<td>Capillary IN (0.17 mm, 310 mm lg) including heat exchanger</td>
</tr>
<tr>
<td>10</td>
<td>G1315-87306</td>
<td>Capillary OUT (0.12 mm, 200 mm lg)</td>
</tr>
<tr>
<td>10</td>
<td>G1315-87302</td>
<td>Capillary OUT (0.17 mm, 200 mm lg)</td>
</tr>
<tr>
<td>11</td>
<td>G1315-84910</td>
<td>Clamp unit</td>
</tr>
<tr>
<td>0515-1056</td>
<td>5022-2184</td>
<td>Screw M 2.5, 4 mm lg for cell body/clamp</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Union ZDV</td>
</tr>
<tr>
<td>G1315-68713</td>
<td></td>
<td>Cell repair kit semi-micro, includes window screw kit, Gasket Kit BACK, Gasket Kit FRONT and 4 mm hexagonal wrench</td>
</tr>
<tr>
<td>79883-68703</td>
<td></td>
<td>Window screw kit, includes 2 quartz windows, 2 compression washers, 2 window holders, 2 window screws and 10 washers</td>
</tr>
</tbody>
</table>
Figure 54  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 55  Orientation of Spring Washers
## Micro Flow Cell

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

**Figure 56** Micro Flow Cell Parts

**Figure 57** Orientation of Spring Washers
# High Pressure Flow Cell

<table>
<thead>
<tr>
<th>Item</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>G1315-60015</td>
<td>High pressure flow cell, 6 mm, 1.7 µL, 400 bar (40 MPa)</td>
</tr>
<tr>
<td>1</td>
<td>79883-27101</td>
<td>Window assembly, comprises items 2, 3, 4, 5 and 6</td>
</tr>
<tr>
<td>2</td>
<td>1000-0953</td>
<td>Quartz window</td>
</tr>
<tr>
<td>3</td>
<td>79883-28802</td>
<td>Compression washer</td>
</tr>
<tr>
<td>4</td>
<td>5062-8553</td>
<td>Washer kit (10/pk)</td>
</tr>
<tr>
<td>5</td>
<td>79883-22404</td>
<td>Window screw</td>
</tr>
<tr>
<td>6</td>
<td>G1315-87325</td>
<td>Capillary IN (0.12 mm, 290 mm lg) including heat exchanger</td>
</tr>
<tr>
<td>7</td>
<td>G1315-87306</td>
<td>Capillary OUT (0.12 mm, 200 mm lg)</td>
</tr>
<tr>
<td>8</td>
<td>G1315-84901</td>
<td>Clamp unit</td>
</tr>
<tr>
<td>9</td>
<td>0515-1056</td>
<td>Screw M 2.5, 4 mm lg for cell body/clamp</td>
</tr>
<tr>
<td></td>
<td>G1315-87312</td>
<td>Capillary ST 0.12 mm x 150 mm S/S</td>
</tr>
<tr>
<td></td>
<td>G1315-87311</td>
<td>Capillary ST 0.17 mm x 380 mm S/S</td>
</tr>
<tr>
<td></td>
<td>79883-68700</td>
<td>High pressure cell repair kit (includes 1 quartz window, 1 compression washer, 5 spring washers, 2 seal rings)</td>
</tr>
</tbody>
</table>
Figure 58  High pressure flow cell - parts
Prep Flow Cell - SST

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

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

Gaskets # 6 and #7 have different hole diameters.

---

**Figure 59**  Prep Flow Cell - SST Parts

**Figure 60**  Orientation of Spring Washers

1 - Window screw  
2 - Spring washers  
3 - Compression washer  
4 - Window holder  
5 - Quartz window  
6 - Gasket
Prep Flow Cell - Quartz

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

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

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 61  Prep Flow Cell - Quartz Parts
Nano Flow Cells

The following kits are available:

**Table 18  Nano-flow cell kits**

<table>
<thead>
<tr>
<th>Part number</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semi-nano flow cell kit, 10 mm, 500 nL, 5 MPa (G1315-68724)</td>
<td>completely assembled (includes items 1, 2, 3, 4, 10, 11, 12, 13, 14, 15, and 16)</td>
</tr>
<tr>
<td>Nano flow cell kit, 6 mm, 80 nL, 5 MPa (G1315-68716)</td>
<td>completely assembled (includes items 1, 2, 3, 4, 10, 11, 12, 13, 14, 15, and 16)</td>
</tr>
</tbody>
</table>

**Figure 62** on page 221 shows all parts delivered with the nano-flow cell kits.

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

<table>
<thead>
<tr>
<th>Item</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>5063-6593</td>
<td>Fitting Screw (for 4 mm wrench)</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Cell ferrules are factory installed</td>
</tr>
<tr>
<td>5</td>
<td>5065-4422</td>
<td>PEEK fitting 1/32&quot;</td>
</tr>
<tr>
<td>7</td>
<td>5063-6592</td>
<td>Litetouch ferrules LT-100, (1/32&quot; Ferrule and SS lock ring)</td>
</tr>
<tr>
<td>8</td>
<td>5022-2146</td>
<td>Union Adjustment Tool</td>
</tr>
<tr>
<td>9</td>
<td>5022-2184</td>
<td>Union ZDV</td>
</tr>
<tr>
<td>10</td>
<td>G1315-45003</td>
<td>Torque adapter</td>
</tr>
<tr>
<td>14</td>
<td>G1315-84902</td>
<td>Handle for Clamp unit</td>
</tr>
<tr>
<td>15</td>
<td>G1315-84910</td>
<td>Clamp unit</td>
</tr>
<tr>
<td>16</td>
<td>0515-1056</td>
<td>Screw M 2.5, 4 mm lg for cell body/clamp</td>
</tr>
<tr>
<td>17</td>
<td>8710-1534</td>
<td>Wrench, 4 mm both ends, open end</td>
</tr>
</tbody>
</table>
### Specific parts for the semi-nano flow cell

<table>
<thead>
<tr>
<th>Item</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>G1315-68724</td>
<td>Semi-nano flow cell kit, 10 mm, 500 nL, 5 MPa</td>
</tr>
<tr>
<td>1</td>
<td>G1315-87333</td>
<td>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)</td>
</tr>
<tr>
<td>2</td>
<td>G1315-87338</td>
<td>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)</td>
</tr>
<tr>
<td>1</td>
<td>G1315-87323</td>
<td>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)</td>
</tr>
<tr>
<td>2</td>
<td>G1315-87328</td>
<td>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)</td>
</tr>
<tr>
<td>11</td>
<td>G1315-27703</td>
<td>Cell Housing (500 nL)</td>
</tr>
<tr>
<td>12</td>
<td>G1315-87101</td>
<td>Cell Seal Assembly (500 nL)</td>
</tr>
<tr>
<td>13</td>
<td>G1315-80001</td>
<td>Quartz Body (500 nL)</td>
</tr>
<tr>
<td></td>
<td>G1315-68715</td>
<td>Sealing Kit</td>
</tr>
</tbody>
</table>
### Specific parts for the nano flow cell

<table>
<thead>
<tr>
<th>Item</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1315-68716</td>
<td>Nano flow cell kit, 6 mm, 80 nL, 5 MPa</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>G1315-87323</td>
<td>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)</td>
</tr>
<tr>
<td>2</td>
<td>G1315-87328</td>
<td>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)</td>
</tr>
<tr>
<td>1</td>
<td>G1315-87313</td>
<td>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)</td>
</tr>
<tr>
<td>2</td>
<td>G1315-87318</td>
<td>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)</td>
</tr>
<tr>
<td>G1315-27704</td>
<td>Cell Housing (80 nL)</td>
<td></td>
</tr>
<tr>
<td>G1315-87102</td>
<td>Cell Seal Assembly (80 nL)</td>
<td></td>
</tr>
<tr>
<td>G1315-80002</td>
<td>Quartz Body (80 nL)</td>
<td></td>
</tr>
<tr>
<td>G1315-68725</td>
<td>Sealing Kit 80 nL cell</td>
<td></td>
</tr>
</tbody>
</table>

Accessory Kits

Detector Accessory Kit (G7115-68755) contains the following items:

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5062-8535</td>
<td>Waste accessory kit</td>
</tr>
<tr>
<td>5500-1155</td>
<td>Tube Connector, 90 degree, ID 6.4</td>
</tr>
<tr>
<td>0100-1516</td>
<td>Fitting male PEEK, 2/pk</td>
</tr>
<tr>
<td>5181-1516</td>
<td>CAN cable, Agilent module to module, 0.5 m</td>
</tr>
<tr>
<td>5500-1191</td>
<td>Capillary ST 0.12 mm x 280 mm, long socket</td>
</tr>
</tbody>
</table>
## Holmium Oxide Filter

<table>
<thead>
<tr>
<th>Item</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>G7115-68700</td>
<td>Filter motor assembly (includes filter lever G1315-45001 and spring 1460-1510)</td>
</tr>
<tr>
<td>2</td>
<td>1460-1510</td>
<td>Spring</td>
</tr>
<tr>
<td>3</td>
<td>G1315-45001</td>
<td>Filter lever</td>
</tr>
<tr>
<td>4</td>
<td>79880-22711</td>
<td>Holmium oxide filter</td>
</tr>
</tbody>
</table>

**NOTE**

When the filter motor has been removed, the filter lever should not be reused. Use always a new filter lever to assure correct fit on the filter motor shaft.

![Holmium Oxide Filter Parts](image_url)

*Figure 63*  Holmium Oxide Filter Parts
## Leak Handling Parts

<table>
<thead>
<tr>
<th>Item</th>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5043-0856</td>
<td>Leak Adapter</td>
</tr>
<tr>
<td>2</td>
<td>5063-6527</td>
<td>Tubing assembly, i.d. 6 mm, o.d. 9 mm, 1.2 m (to waste)</td>
</tr>
<tr>
<td>3</td>
<td>5061-3356</td>
<td>Leak Sensor Assembly</td>
</tr>
<tr>
<td>4</td>
<td>G7115-45000</td>
<td>Leak Plane 1260 DAD Infinity II</td>
</tr>
<tr>
<td></td>
<td>0515-2529</td>
<td>Screw Tapping PAN-HD-TORX T10 3x8 ST-ZN (not shown)</td>
</tr>
<tr>
<td>5</td>
<td>5043-1013</td>
<td>Tubing Clip</td>
</tr>
</tbody>
</table>

![Leak Parts](image)

*Figure 64  Leak Parts*
10 Parts for Maintenance
Leak Handling Parts
11 Identifying Cables

Cable Overview 228
Analog Cables 230
Remote Cables 232
BCD Cables 235
CAN/LAN Cables 237
Agilent 1200 module to PC 238

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

### Cable Overview

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

### Analog cables

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>35900-60750</td>
<td>Agilent module to 3394/6 integrators</td>
</tr>
<tr>
<td>35900-60750</td>
<td>Agilent 35900A A/D converter</td>
</tr>
<tr>
<td>01046-60105</td>
<td>Analog cable (BNC to general purpose, spade lugs)</td>
</tr>
</tbody>
</table>

### Remote cables

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>03394-60600</td>
<td>Agilent module to 3396A Series I integrators</td>
</tr>
<tr>
<td>03396-61010</td>
<td>Agilent module to 3396 Series III / 3395B integrators</td>
</tr>
<tr>
<td>5061-3378</td>
<td>Remote Cable</td>
</tr>
<tr>
<td>01046-60201</td>
<td>Agilent module to general purpose</td>
</tr>
</tbody>
</table>

### BCD cables

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>03396-60560</td>
<td>Agilent module to 3396 integrators</td>
</tr>
<tr>
<td>G1351-81600</td>
<td>Agilent module to general purpose</td>
</tr>
</tbody>
</table>
## CAN cables

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

## LAN cables

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

## RS-232 cables

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1530-60600</td>
<td>RS-232 cable, 2 m</td>
</tr>
<tr>
<td>RS232-61601</td>
<td>RS-232 cable, 2.5 m Instrument to PC, 9-to-9 pin (female). This cable has special pin-out, and is not compatible with connecting printers and plotters. It’s also called ”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.</td>
</tr>
<tr>
<td>5181-1561</td>
<td>RS-232 cable, 8 m</td>
</tr>
</tbody>
</table>
Analog Cables

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

### Agilent Module to 3394/6 Integrators

<table>
<thead>
<tr>
<th>p/n 35900-60750</th>
<th>Pin 3394/6</th>
<th>Pin Agilent module</th>
<th>Signal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Not connected</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Shield</td>
<td>Analog -</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Center</td>
<td>Analog +</td>
<td></td>
</tr>
</tbody>
</table>
### Agilent Module to BNC Connector

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

### Agilent Module to General Purpose

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

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

### 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.
## Identifying Cables

### Remote Cables

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

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

Remote Cables

Agilent Module to Agilent 35900 A/D Converters

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

Agilent Module to General Purpose

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

<table>
<thead>
<tr>
<th>p/n G1351-81600</th>
<th>Wire Color</th>
<th>Pin Agilent module</th>
<th>Signal Name</th>
<th>BCD Digit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Green</td>
<td>1</td>
<td>BCD 5</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Violet</td>
<td>2</td>
<td>BCD 7</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Blue</td>
<td>3</td>
<td>BCD 6</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Yellow</td>
<td>4</td>
<td>BCD 4</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Black</td>
<td>5</td>
<td>BCD 0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Orange</td>
<td>6</td>
<td>BCD 3</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Red</td>
<td>7</td>
<td>BCD 2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Brown</td>
<td>8</td>
<td>BCD 1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Gray</td>
<td>9</td>
<td>Digital ground</td>
<td>Gray</td>
</tr>
<tr>
<td></td>
<td>Gray/pink</td>
<td>10</td>
<td>BCD 11</td>
<td>800</td>
</tr>
<tr>
<td></td>
<td>Red/blue</td>
<td>11</td>
<td>BCD 10</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>White/green</td>
<td>12</td>
<td>BCD 9</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>Brown/green</td>
<td>13</td>
<td>BCD 8</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>not connected</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>not connected</td>
<td>15</td>
<td>+ 5 V</td>
<td>Low</td>
</tr>
</tbody>
</table>
### Agilent Module to 3396 Integrators

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

![Diagram of BCD Cables](image)
CAN/LAN Cables

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

**CAN Cables**

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

**LAN Cables**

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

Agilent 1200 module to PC

<table>
<thead>
<tr>
<th>p/n</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1530-60600</td>
<td>RS-232 cable, 2 m</td>
</tr>
<tr>
<td>RS232-61601</td>
<td>RS-232 cable, 2.5 m</td>
</tr>
<tr>
<td></td>
<td>Instrument to PC, 9-to-9 pin (female). This cable has special pin-out, and</td>
</tr>
<tr>
<td></td>
<td>is not compatible with connecting printers and plotters. It’s also called</td>
</tr>
<tr>
<td></td>
<td>&quot;Null Modem Cable&quot; with full handshaking where the wiring is made between</td>
</tr>
<tr>
<td></td>
<td>pins 1-1, 2-3, 3-2, 4-6, 5-5, 6-4, 7-8, 8-7, 9-9.</td>
</tr>
<tr>
<td>5181-1561</td>
<td>RS-232 cable, 8 m</td>
</tr>
</tbody>
</table>
12 Hardware Information

Firmware Description 240
Electrical Connections 243
  Rear View of the Module 244
  Serial Number Information (ALL) 244
Interfaces 245
  Interfaces Overview 246
  ERI (Enhanced Remote Interface) 249
  USB (Universal Serial Bus) 251
Setting the 6-bit Configuration Switch 252
  Special Settings 253
Instrument Layout 255
  Early Maintenance Feedback (EMF) 256

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, USB and RS-232C)
- memory management
- ability to update the firmware of the 'main system'

**Main System**

Its properties are:

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

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

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

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

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

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

The file naming conventions are:

PPPP_RVVV_XXX.dlb, where

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

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

NOTE

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

Main and resident firmware must be from the same set.
Some modules are limited in downgrading due to their main board version or their initial firmware revision. For example, a G1315C DAD SL cannot be downgraded below firmware revision B.01.02 or to a A.xx.xx.

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

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

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

Electrical Connections

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

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

- The ERI/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 shutdown, prepare, and so on.

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

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

- 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.
Rear View of the Module

![Rear view of the detector](image)

**Figure 66**  Rear view of the detector

### Serial Number Information (ALL)

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

<table>
<thead>
<tr>
<th>CCXZZ00000</th>
<th>Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC</td>
<td>Country of manufacturing</td>
</tr>
<tr>
<td></td>
<td>• DE = Germany</td>
</tr>
<tr>
<td></td>
<td>• JP = Japan</td>
</tr>
<tr>
<td></td>
<td>• CN = China</td>
</tr>
<tr>
<td>X</td>
<td>Alphabetic character A-Z (used by manufacturing)</td>
</tr>
<tr>
<td>ZZ</td>
<td>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)</td>
</tr>
<tr>
<td>00000</td>
<td>Serial number</td>
</tr>
</tbody>
</table>
## Interfaces

The Agilent 1200 Infinity Series II modules provide the following interfaces:

**Table 19**  Agilent 1200 Infinity II Series Interfaces

<table>
<thead>
<tr>
<th>Module</th>
<th>CAN</th>
<th>USB</th>
<th>LAN (on-board)</th>
<th>RS-232</th>
<th>Analog</th>
<th>APG (A) / ERI (E)</th>
<th>Special</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pumps</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G7104A Flexible Pump</td>
<td>2</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>1</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>G7110B Isocratic Pump</td>
<td>2</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>E</td>
</tr>
<tr>
<td>G7111A/B Quaternary Pump</td>
<td>2</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>E</td>
</tr>
<tr>
<td>G7120A High Speed Pump</td>
<td>2</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>1</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td><strong>Samplers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G7129A/B Vialsampler</td>
<td>2</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>E</td>
</tr>
<tr>
<td>G7167A/B Multisampler</td>
<td>2</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>E</td>
</tr>
<tr>
<td><strong>Detectors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G7114A/B VWD</td>
<td>2</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>1</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>G7115A DAD</td>
<td>2</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>1</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>G7117A/B/C DAD</td>
<td>2</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>1</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>G7121A/B FLD</td>
<td>2</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>1</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>G7162A/B RID</td>
<td>2</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>1</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td>G7165A MWD</td>
<td>2</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>1</td>
<td>E</td>
<td></td>
</tr>
<tr>
<td><strong>Others</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G7116A/B MCT</td>
<td>2</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Requires a HOST module via CAN</td>
</tr>
</tbody>
</table>

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

Interfaces

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

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.

USB

The USB interface replaces the RS-232 Serial interface in new FUSION generation modules. For details on USB refer to “USB (Universal Serial Bus)” on page 251.
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.

Remote (ERI)

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

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

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

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

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

**NOTE**

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

Table 20  ERI signal distribution

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

Special Interfaces
There is no special interface for this module.
ERI (Enhanced Remote Interface)

ERI replaces the AGP Remote Interface that is used in the HP 1090/1040/1050/1100 HPLC systems and Agilent 1100/1200/1200 Infinity HPLC modules. All new 1200 Infinity II products using the FUSION core electronics use ERI. This interface is already used in the Agilent Universal Interface Box 2 (UIB2).

**ERI Description**

The ERI interface contains eight individual programmable input/output pins. In addition, it provides 24 V power and 5 V power and a serial data line to detect and recognize further add-ons that could be connected to this interface. This way the interface can support various additional devices like sensors, triggers (in and out) and small controllers, etc.

**Figure 67** Location of the ERI interface (example shows a G7114A/B VWD)
12 Hardware Information

Interfaces

**IO (Input/Output) Lines**

- Eight generic bi-directional channels (input or output).
- Same as the APG Remote.
- Devices like valves, relays, ADCs, DACs, controllers can be supported/controlled.

**1-Wire Data (Future Use)**

This serial line can be used to read out an EPROM or write into an EPROM of a connected ERI-device. The firmware can detect the connected type of device automatically and update information in the device (if required).
**5V Distribution (Future Use)**

- Available directly after turn on/off the hosting module (assures that certain base functionality of the device can be detected by firmware).
- For digital circuits or similar.
- Provided 500 mA maximum.
- Short-circuit proof with automatic switch off (by firmware).

**24V Distribution (Future Use)**

- Available by firmware command (defined turn on/off).
- For devices that need higher power
  - Class 0: 0.5 A maximum (12 W)
  - Class 1: 1.0 A maximum (24 W)
  - Class 2: 2.0 A maximum (48 W)
- Class depends on hosting module’s internal power overhead.
- If a connected device requires more power the firmware detects this (overcurrent detection) and provides the information to the user interface.
- Fuse used for safety protection (on board).
- Short circuit will be detected through hardware.

**USB (Universal Serial Bus)**

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

- a PC with control software (for example Agilent Lab Advisor)
- USB Flash Disk
The 6-bit configuration switch is located at the rear of the module with FUSION electronics. Switch settings provide configuration parameters for LAN and instrument specific initialization procedures.

All modules with FUSION electronics:

- Default is ALL switches DOWN (best settings).
  - Default IP address for LAN 192.168.254.11
- For specific LAN modes switches 4-5 must be set as required.
- For boot resident/cold start modes switches 1+2 or 6 must be UP.
Table 21 6-bit Configuration Switch

<table>
<thead>
<tr>
<th>Mode</th>
<th>Function/Setting</th>
<th>Switch 1</th>
<th>Switch 2</th>
<th>Switch 3</th>
<th>Switch 4</th>
<th>Switch 5</th>
<th>Switch 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>COM</td>
<td>n.a.</td>
<td>0</td>
<td>n.a.</td>
<td>n.a.</td>
<td>LAN Init Mode</td>
<td>n.a.</td>
<td></td>
</tr>
<tr>
<td>Use Default IP Address</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Use Stored IP Address</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Use DHCP to request IP Address</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Test</td>
<td>1</td>
<td>System</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>ColdStart</td>
<td></td>
</tr>
<tr>
<td>Boot Main System / Keep Data</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Boot Resident System / Keep Data</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Boot Main System / Revert to Default Data</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Boot Resident System / Revert to Default Data</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

1 When selecting mode COM, settings are stored to non-volatile memory. When selecting mode TEST, COM settings are taken from non-volatile memory.

2 not assigned - Always keep these switches on position ‘0’ (off)

3 Default IP Address is 192.168.254.11

4 Host Name will be the MAC address.

Special Settings

Boot-Resident/Main

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

If you use the following switch settings and power the instrument up again, the instrument firmware stays in the resident/main mode. In 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).
12 Hardware Information
Setting the 6-bit Configuration Switch

Forced Cold Start

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

- Boot Main System / Revert to Default Data
  The instrument will boot to main mode and changes to the module’s default parameter. May be also required to load resident firmware into the module.

- Boot Resident System / Revert to Default Data
  The instrument will boot to resident mode and changes to the module’s default parameter. May be also required to load main firmware into the module.

**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, it will start as described above.

**Table 22** Boot Resident / Forced Coldstart

<table>
<thead>
<tr>
<th>SW1</th>
<th>SW2</th>
<th>SW3</th>
<th>SW4</th>
<th>SW5</th>
<th>SW6</th>
<th>Init Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Boot Main System / Keep Data</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>Boot Main System / Revert to Default Data</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Boot Resident System / Keep Data</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>Boot Resident System / Revert to Default Data</td>
</tr>
</tbody>
</table>

Note: The setting '0' (down) is essential.
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.

<table>
<thead>
<tr>
<th>Lamp Type</th>
<th>Counter Reset</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>lamp with RFID tag</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>lamp without RFID tag</td>
<td>YES</td>
<td>via Lab Advisor or Instant Pilot</td>
</tr>
</tbody>
</table>

The detector provides the following EMF counters:
- Deuterium Lamp On-Time
- Number of UV lamp ignitions

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.

**NOTE**  
This function is only available via Agilent Lab Advisor or Instant Pilot.
12 Hardware Information
Early Maintenance Feedback (EMF)
13 \textbf{LAN Configuration}

What You Have to Do First \hspace{1em} 260
TCP/IP parameter configuration \hspace{1em} 261
Configuration Switches \hspace{1em} 262
Initialization Mode Selection \hspace{1em} 263
Dynamic Host Configuration Protocol (DHCP) \hspace{1em} 265
\hspace{1em} General Information (DHCP) \hspace{1em} 265
\hspace{1em} Setup (DHCP) \hspace{1em} 266
Manual Configuration \hspace{1em} 268
\hspace{1em} With Telnet \hspace{1em} 269
\hspace{1em} With the Instant Pilot (G4208A) \hspace{1em} 273

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

What You Have to Do First

The module has an on-board LAN communication interface.

**NOTE** This chapter is generic and may show figures that differ from your module. The functionality is the same.

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 70 on page 260).

![Figure 69 MAC-Label](image)

2. Connect the instrument's LAN interface (see Figure 70 on page 260) to:
   - the PC network card using a crossover network cable (point-to-point) or
   - a hub or switch using a standard LAN cable.

![Figure 70 Location of LAN interfaces and MAC label](image)
TCP/IP parameter configuration

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

- IP address
- Subnet Mask
- Default Gateway

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

- by automatically requesting the parameters from a network-based DHCP Server (using the so-called Dynamic Host Configuration Protocol). This mode requires a LAN-onboard Module or a G1369C LAN Interface card, see “Setup (DHCP)” on page 266
- 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 non-volatile memory or initialized with known default values. The initialization mode is selected by the configuration switch, see Table 23 on page 263.
Configuration Switches

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

![Configuration switch](image)

**Figure 71** Location of Configuration switch (example shows a G7114A/B VWD)

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.
Initialization Mode Selection

The following initialization (init) modes are selectable:

**Table 23 Initialization Mode Switches**

<table>
<thead>
<tr>
<th>SW1</th>
<th>SW2</th>
<th>SW3</th>
<th>SW4</th>
<th>SW5</th>
<th>SW6</th>
<th>Init Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Use Default IP Address</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Use Stored IP Address</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Use DHCP</td>
</tr>
</tbody>
</table>

Note: The setting ‘0’ (down) is essential.

Default IP address for LAN is 192.168.254.11.

DHCP address is the module’s LAN MAC address.

**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.
Using Default

When **Using Default** is selected, the factory default parameters are taken instead. These parameters enable a TCP/IP connection to the LAN interface without further configuration, see Table 24 on page 264.

![Diagram of Default Parameter](image)

**Figure 73** Using Default (Principle)

**NOTE**

Using the default address in your local area network may result in network problems. Take care and change it to a valid address immediately.

**Table 24** Using Default Parameters

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

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

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

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

**NOTE**

In the **Using Default** mode, the parameters stored in the memory of the module are not cleared automatically. If not changed by the user, they are still available, when switching back to the mode Using Stored.
Dynamic Host Configuration Protocol (DHCP)

General Information (DHCP)

The Dynamic Host Configuration Protocol (DHCP) is an auto configuration protocol used on IP networks. The DHCP functionality is available on all Agilent HPLC modules with on-board LAN Interface or LAN Interface Card G1369C, and “B”-firmware (B.06.40 or above) or modules with "D"-firmware. All modules should use latest firmware from the same set.

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

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

![Diagram](image)

**Figure 74** DHCP (Principle)

**NOTE**

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

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

3. The DHCP server may reject the hostname proposed by the card and assign a name following local naming conventions.
Setup (DHCP)

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

1 Note the MAC address of the LAN interface (provided with G1369C LAN Interface Card or Main Board). This MAC address is on a label on the card or at the rear of the main board, e.g. 0030d3177321.

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

![System Info](image)

**Figure 75**  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 25 G1369C LAN Interface Card (configuration switch on the card)

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

Table 26 LC Modules with 8-bit configuration switch (B-firmware) (configuration switch at rear of the instrument)

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

3 Turn on the module that hosts the LAN interface.

4 Configure your Control Software (e.g. OpenLAB CDS ChemStation Edition, Lab Advisor, Firmware Update Tool) and use MAC address as host name, e.g. 0030d3177321.

The LC system should become visible in the control software (see Note in section “General Information (DHCP)” on page 265).
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.

![Diagram of Manual Configuration](image)

**Figure 76**  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 77 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 Switches” on page 262).

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

![Figure 78 A connection to the module is made]
3 Type 
? and press enter to see the available commands.

![Telnet Commands](image)

**Figure 79** Telnet Commands

**Table 27** Telnet Commands

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

4 To change a parameter follows the style:

- parameter value, for example:

```
  ip 134.40.28.56
```

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.

![Figure 80](image1.png)

Figure 80 Telnet - Current settings in "Using Stored" mode

Figure 81 Telnet - Change IP settings

6 Change the IP address (in this example 192.168.254.12) and type “/” to list current settings.

TCP/IP status - here ready
connected to PC with controller software (e.g. Agilent ChemStation), here not connected

![Figure 81](image2.png)

change of IP setting to
Initialization mode is Using Stored
active TCP/IP settings
stored TCP/IP settings in non-volatile memory
connected to PC with controller software (e.g. Agilent ChemStation), here not connected
7 When you have finished typing the configuration parameters, type `exit` and press `Enter` to exit with storing parameters.

![Connection to host lost.](image)

**Figure 82** 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 192.168.254.12.
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.

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.
LAN Configuration
Manual Configuration
14 Appendix

General Safety Information  276
  General Safety Information  276
  Safety Standards  276
  General  276
  Before Applying Power  277
  Ground the Instrument  277
  Do Not Operate in an Explosive Atmosphere  278
  Do Not Remove the Instrument Cover  278
  Do Not Modify the Instrument  278
  In Case of Damage  278
  Solvents  279
  Safety Symbols  280

Waste Electrical and Electronic Equipment Directive  282
Radio Interference  283
Sound Emission  284
UV-Radiation  285
Solvent Information  286

Declaration of Conformity for HOX2 Filter  287
Installation of Stainless Steel Cladded PEEK Capillaries  288
  First Step: Finger-tight Fitting  289
  Second Step: Installation to Connector  290
  Removing Capillaries  294
  Agilent Technologies on Internet  295

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

General Safety Information

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

**WARNING**

Ensure the proper usage of the equipment.

The protection provided by the equipment may be impaired.

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

Safety Standards

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

General

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

**WARNING**

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

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

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

→ Make all connections to the unit before applying power.

**NOTE**

Note the instrument’s external markings described under “Safety Symbols” on page 280.

Ground the Instrument

**WARNING**

Missing electrical ground
Electrical shock

→ If your product is provided with a grounding type power plug, the instrument chassis and cover must be connected to an electrical ground to minimize shock hazard.

→ The ground pin must be firmly connected to an electrical ground (safety ground) terminal at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.
Do Not Operate in an Explosive Atmosphere

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

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

Do Not Remove the Instrument Cover

**WARNING** Instrument covers removed
Electrical shock

 ➔ Do Not Remove the Instrument Cover

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

Do Not Modify the Instrument

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

In Case of Damage

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

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

WARNING

Toxic, flammable and hazardous solvents, samples and reagents

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

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

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

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

➔ Do not operate the instrument in an explosive atmosphere.

➔ Reduce the volume of substances to the minimum required for the analysis.

➔ Never exceed the maximum permissible volume of solvents (8 L) in the solvent cabinet. Do not use bottles that exceed the maximum permissible volume as specified in the usage guideline for solvent cabinet.

➔ Ground the waste container.

➔ Regularly check the filling level of the waste container. The residual free volume in the waste container must be large enough to collect the waste liquid.

➔ To achieve maximal safety, regularly check the tubing for correct installation.

NOTE

For details, see the usage guideline for the solvent cabinet. A printed copy of the guideline has been shipped with the solvent cabinet, electronic copies are available in the Agilent Information Center or via the Internet.
### Safety Symbols

<table>
<thead>
<tr>
<th>Table 28</th>
<th>Symbols</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Symbol]</td>
<td>The apparatus is marked with this symbol when the user should refer to the instruction manual in order to protect risk of harm to the operator and to protect the apparatus against damage.</td>
</tr>
<tr>
<td>![Symbol]</td>
<td>Indicates dangerous voltages.</td>
</tr>
<tr>
<td>![Symbol]</td>
<td>Indicates a protected ground terminal.</td>
</tr>
<tr>
<td>![Symbol]</td>
<td>The apparatus is marked with this symbol when hot surfaces are available and the user should not touch it when heated up.</td>
</tr>
<tr>
<td>![Symbol]</td>
<td>Cooling unit is designed as vapor-compression refrigeration system. Contains fluorinated greenhouse gas (reftigerant) according to the Kyoto protocol. For specifications of refrigerant, charge capacity, carbon dioxide equivalent (CDE), and global warming potential (GWP) see instrument label.</td>
</tr>
<tr>
<td>![Symbol]</td>
<td>Confirms that a manufactured product complies with all applicable European Community directives. The European Declaration of Conformity is available at: <a href="http://regulations.corporate.agilent.com/DoC/search.htm">http://regulations.corporate.agilent.com/DoC/search.htm</a></td>
</tr>
<tr>
<td>![Symbol]</td>
<td>Manufacturing date.</td>
</tr>
<tr>
<td>![Symbol]</td>
<td>Power symbol indicates On/Off. The apparatus is not completely disconnected from the mains supply when the power switch is in the Off position</td>
</tr>
</tbody>
</table>
| ![Symbol] | Pacemaker  
Magnets could affect the functioning of pacemakers and implanted heart defibrillators.  
A pacemaker could switch into test mode and cause illness. A heart defibrillator may stop working. If you wear these devices keep at least 55 mm distance to magnets. Warn others who wear these devices from getting too close to magnets. |
Magnetic field
Magnets produce a far-reaching, strong magnetic field. They could damage TVs and laptops, computer hard drives, credit and ATM cards, data storage media, mechanical watches, hearing aids and speakers. Keep magnets at least 25 mm away from devices and objects that could be damaged by strong magnetic fields.

Indicates a pinching or crushing hazard

Indicates a piercing or cutting hazard.

### Table 28 Symbols

<table>
<thead>
<tr>
<th>符号</th>
<th>描述</th>
</tr>
</thead>
</table>
|警示标志 |警告标志。

### 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

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

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


**NOTE**

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

Product Category:

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

**NOTE**

Do not dispose of in domestic household waste

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

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

Test and Measurement

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

Manufacturer’s Declaration

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

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

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 29  UV-Radiation Limits**

<table>
<thead>
<tr>
<th>Exposure/day</th>
<th>Effective Irradiance</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 hours</td>
<td>0.1 µW/cm²</td>
</tr>
<tr>
<td>10 minutes</td>
<td>5.0 µW/cm²</td>
</tr>
</tbody>
</table>

Typically the radiation values are much smaller than these limits:

**Table 30  UV-Radiation Typical Values**

<table>
<thead>
<tr>
<th>Position</th>
<th>Effective Irradiance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lamp installed, 50 cm distance</td>
<td>Average 0.016 µW/cm²</td>
</tr>
<tr>
<td>Lamp installed, 50 cm distance</td>
<td>Maximum 0.14 µW/cm²</td>
</tr>
</tbody>
</table>

NOTE

This information is only valid for UV-lamps without cover (e.g. 2140-0590 and 2140-0813).
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.

Use of Solvents

Observe the following recommendations on the use of solvents.

- Brown glass ware can avoid growth of algae.
- 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:
    \[ 2\text{CHCl}_3 + \text{O}_2 \rightarrow 2\text{COCl}_2 + 2\text{HCl} \]
    This reaction, in which stainless steel probably acts as a catalyst, occurs quickly with dried chloroform if the drying process removes the stabilizing alcohol,
  - Chromatographic grade ethers, which can contain peroxides (for example, THF, dioxane, di-isopropyl ether) 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

We herewith inform you that the

Holmium Oxide Glass Filter

used in Agilent's 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

<table>
<thead>
<tr>
<th>Product Number</th>
<th>Series</th>
<th>Measured Wavelength</th>
<th>Wavelength Accuracy</th>
<th>Optical Bandwidth</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1315x, G1365x</td>
<td>1100, 1200, 1260</td>
<td>361.0 nm 418.9 nm 536.7 nm</td>
<td>+/- 1 nm</td>
<td>2 nm</td>
</tr>
<tr>
<td>G7115x, G7165x</td>
<td>1260</td>
<td>453.7 nm 536.7 nm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G1600x, G7100x</td>
<td>CE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G1314x</td>
<td>1100, 1200, 1260, 1290</td>
<td>360.8 nm 418.5 nm 536.4 nm</td>
<td>+/- 1 nm</td>
<td>6 nm</td>
</tr>
<tr>
<td>G7114x</td>
<td>1260, 1290</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G426x, ..., 94x</td>
<td>1120, 1220</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*) The variation in Measured Wavelength depends on the different Optical Bandwidth.

28-Oct-2014

(R&D Manager)

(Quality Manager)
Installation of Stainless Steel Cladded PEEK Capillaries

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

The 1260 Infinity Bio-inert LC system uses PEEK capillaries that are 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 290 or “Second Step: Installation to Soft Connectors” on page 291), 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, refer to the Technical Note "Installation of stainless steel cladded PEEK capillaries" (p/n G5611-90120).

First installation of a capillary to a soft connector

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

Second and subsequent installations of a capillary to a soft connector

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 31** Summary for second step

<table>
<thead>
<tr>
<th>2nd Step</th>
<th>First installation</th>
<th>Subsequent installations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hard connectors</strong></td>
<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
</tr>
<tr>
<td>0° possibly leaky</td>
<td>135° recommended range</td>
<td>90° recommended range</td>
</tr>
<tr>
<td>STOP</td>
<td>STOP</td>
<td></td>
</tr>
<tr>
<td><strong>Soft connectors</strong></td>
<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
</tr>
<tr>
<td>0° possibly leaky</td>
<td></td>
<td>180° recommended range</td>
</tr>
<tr>
<td>STOP</td>
<td>STOP</td>
<td></td>
</tr>
<tr>
<td>210° recommended range</td>
<td></td>
<td>180° recommended range</td>
</tr>
</tbody>
</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.

![Capillary fitting](image)

**Figure 84** Capillary fitting
Agilent Technologies on Internet

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http://www.agilent.com
Index

A
achromat
  source lens 16
Agilent Lab Advisor software 95
Agilent Lab Advisor 95
Agilent
  on internet 295
algae 286
ambient non-operating temperature 29
ambient operating temperature 29
analog signal output 32, 35
analog signal 247
analog
  cable 230
array 16
astm drift 137
ASTM
  environmental conditions 28
  reference 36

B
bandwidth 88
BCD
cable 235
Beer-Lambert (law) 71
bench space 28
bio-inert 168, 172, 178
  materials 23

C
cable
  analog 230
  BCD 235
data evaluation and control 31, 34
delay volume 85
detection
  compound classes 83
detector set up
    Open Lab ChemStation 42
detector warm up 91
detector
  achieving higher sensitivity 86
diode array 13, 11
  preparation 58
DHCP
general information 265
  setup 266
dimensions 29
diode
  array 17, 16
  width 33, 30
doors
  install 163, 163
  remove 163, 163
drift (ASTM) and noise 30, 33
DSP not running 116

D
D/A converter 149
DAC 149
dark current 151
data collection rate 89
data evaluation and control 31, 34
declaration of conformity 287
delay volume 85
detection
  compound classes 83
detector set up
    Open Lab ChemStation 42
detector warm up 91
detector
  achieving higher sensitivity 86
diode array 13, 11
  preparation 58
DHCP
general information 265
  setup 266
dimensions 29
diode
  array 17, 16
  width 33, 30
doors
  install 163, 163
  remove 163, 163
drift (ASTM) and noise 30, 33
DSP not running 116

E
electrical connections
  descriptions 243
electronic waste 282
electrostatic discharge (ESD) 160
EMF
  early maintenance feedback 256
entrance slit 16
environment 28, 28, 28
error messages
- compensation sensor open 105
- compensation sensor short 105
- cover violation 107
- diode current leakage 110
- DSP not running 116
- fan failed 106
- heater failed 115
- heater power at limit 115
- holmium oxide test failed 113
- ignition without cover 107, 107
- illegal temperature value from sensor at air inlet 114
- illegal value from sensor on main board 113
- leak sensor open 104
- leak sensor short 104
- leak 106
- lost CAN partner 103
- remote timeout 103
- shutdown 102
- timeout 102
- uv heater current 112
- uv ignition failed 111
- uv lamp current 110
- uv lamp voltage 111
- visible lamp current 109
- visible lamp voltage 109
- wavelength calibration failed 112
- wavelength recalibration lost 114
exchanging
- holmium oxide filter parts 224
extra-column volume
- description 85

firmware
- description 240
- main system 240
- resident system 240
- update tool 241
- updates 241, 200
- upgrade/downgrade 200
flow cell
- correction factors 72
- high pressure 176
- Max-Light cartridge flow cell 86
- Max-Light high sensitivity cell 86
- micro 172
- semi-micro 172
- solvent information 286
- specifications 34, 31
- standard 172
- support windows 16
frequency range 29

G
- general error messages 102
- GLP features 32, 35
- grating 16, 17

H
- holmium oxide filter parts 224
- holmium oxide filter 192
- holmium oxide
  - declaration of conformity 287
  - filter 16
  - test 134
- humidity 29

I
- information
  - on uv-radiation 285
- installation
  - bench space 28

environment 28, 28, 28
- site requirements 25
installing
- flow cell 168
install
- doors 163
- instrument layout 255
internet 295
introduction
  - optical unit parts 16

L
- lamps 16
LAN
- cable 237
- configuration switch 262
- configuration 259
- manual configuration with telnet 269
- manual configuration 268
- TCP/IP parameter configuration 261
- using default 264
- using stored 263
- what you have to do first 260

leak sensor open 104
- leak sensor short 104
- leak 106
- line frequency 29
- line voltage 29
- linear range 30, 33
- linearity
  - specifications 36
- lost CAN partner 103

M
- MAC

Agilent InfinityLab LC Series DAD WR and MWD User Manual 297
Index

address 260
maintenance
definition of 158
feedback 256
high pressure flow cell 176
lamp and flow cell RFID tag 202
micro flow cell 172
of the detector 157
overview 161
parts 203
replacing firmware 200
semi-micro flow cell 172
serial number and firmware revision 202
standard flow cell 172
manual configuration of LAN 268
materials
bio-inert 23
message
cover violation 107
diode current leakage 110
heater failed 115
heater power at limit 115
holmium oxide test failed 113
ignition without cover 107, 107
illegal temperature value from sensor at air inlet 114
illegal value from sensor on main board 113
remote timeout 103
uv heater current 112
uv ignition failed 111
uv lamp current 110
uv lamp voltage 111
visible lamp current 109
visible lamp voltage 109
wavelength calibration failed 112
module firmware
replace 200

N
nano flow cell 187
negative absorbance 80
noise and drift (ASTM) 30, 33
Noise and Linearity specifications 36
noise 137
non-operating altitude 29
non-operating temperature 29

O
operating Altitude 29
operating temperature 29
optimization
detector performance 68
detector sensitivity 86
for sensitivity, selectivity, linearity, dispersion 71
how to get the best performance margins for negative absorbance of selectivity 81
overview 69
peak width 73
sample and reference wavelength 75
slit width 78
spectra acquisition 80
wavelength and bandwidth 86

P
parts identification
cables 227
for maintenance 203
holmium oxide filter 224
parts
leak system 225
overview 204
peak width (response time) 73
peak width 89
performance optimization 68
photometric accuracy 72
physical specifications 29
power consideration 26
power consumption 29
power cords 27
programmable slit width 30, 33

R
radio interference 283
recyclable material 32, 35
reference conditions
ASTM 36
remote (ERI) 247
remote cable 232
remove doors 163
removing flow cell 168
repairs
cleaning the instrument 162
replacing firmware 200
replacing capillaries 183, 178
lamp 164
leak handling system parts 198
nano flow cell 187
response time (peak width) 73
response time versus time constant 36
response time 89
RFID tag 10
RS-232C cable 238
running the sample 60

S
safety class I 276
safety
  general information 276
  standards 29
  symbols 280
sample and reference wavelength 75
selectivity optimization 81
self test 124
serial number
  information 244
set up
  detector 42
settings
  method parameters 46
shutdown 102
signal wavelength 88
site requirements
  power cords 27
  specifications 25
slit test 141
slit width 30, 33, 78
solvents 286
sound emission 284
special interfaces 248
special settings
  boot main 253
  boot-resident 253
specification
  physical 29
specifications
  analog signal output 35, 32
  communications 35, 32
  control and data evaluation 34, 31
  diode width 33, 30
  flow cell 34, 31
  GLP features 35, 32
  linear range 33, 30
  noise and drift (ASTM) 33, 30
  noise and linearity 36
  programmable slit width 33, 30
  safety and maintenance 35, 32
wavelength accuracy 33, 30
wavelength bunching 33, 30
wavelength range 33, 30
spectra
  acquisition 80
spectrograph
  diodes per nm 16
standard flow cell
  capillaries 183, 178
suppression
  quantifying 81
T
TCP/IP parameter configuration 261
telnet
  configuration 269
temperature sensor 106
test function
  astm drift 137
  cell test 129
  conditions 122
  D/A converter 149
  DAC 149
  dark current 151
  failing 123
  intensity test 126
  introduction 118
  noise 137
  self test 124
  slit 141
  wavelength calibration 146
  wavelength verification 144
tests
  available tests vs interface 94
  filter 132
  holmium oxide 134
time constant versus response time 36
timeout 102
troubleshooting
  available tests vs interface 94
U
USB 246
Using
  detector 58
  priming and purging the system 54
  requirements and conditions 56
  running the sample 60
  typical chromatogram 57
uv-radiation 285
V
variable entrance slit 16
voltage range 29
W
warm up of detector 91
waste
  electrical and electronic equipment 282
wavelength and bandwidth
  optimization 86
wavelength calibration 146
wavelength recalibration lost 114
wavelength verification
  test 144
wavelength
  accuracy 33, 30
  bunching 33, 30
  range 33, 30
WEEE directive 282
weight 29
In This Book

This manual contains technical reference information about the Agilent 1260 Infinity II Diode Array and Multiple Wavelength Detectors G7115A WR and G7165A.

The manual describes the following:
• introduction and specifications,
• using and optimizing,
• troubleshooting and diagnose,
• maintenance,
• parts identification,
• hardware information,
• safety and related information.