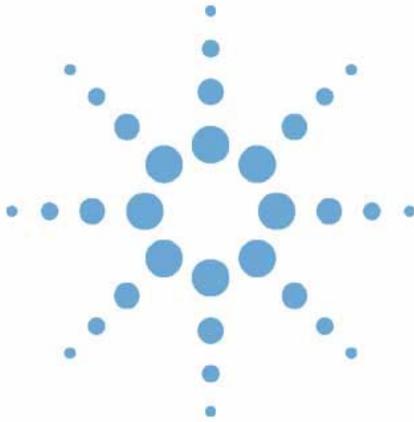




# Agilent 1100 Series Diode Array and Multiple Wavelength Detectors



**Reference Manual**



**Agilent Technologies**

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### Software Revision

This guide is valid for A.01.xx revisions of the Agilent 1100 Series Diode Array and Multiple Wavelength Detectors software, where xx refers to minor revisions of the software that do not affect the technical accuracy of this guide.

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

## In This Guide...

This manual contains information for using your Diode Array and Multiple Wavelength Detectors.

### **1 Installing the Detector**

How to install the detector

### **2 How to optimize the Detector**

How to optimize the detector

### **3 Troubleshooting and Test Functions**

The detector's built-in troubleshooting and test functions

### **4 Repairing the Detector**

Instructions on how to repair the detector

### **5 Identifying Parts and Materials**

Detailed illustrations and listings for parts and materials identification for the detector

### **6 Introduction to the Detector**

An introduction to the detector, instrument overview, theory of operation, external communication and internal connectors

### **7 Control Module Screens for Agilent 1100 DAD and MWD**

This chapter is intended to introduce an operator to the screens available for operation of the Agilent 1100 diode array detector (DAD) with the Agilent 1100 control module.

### **8 Specifications**

Performance specifications of the detector

### **Annex A Safety Information**



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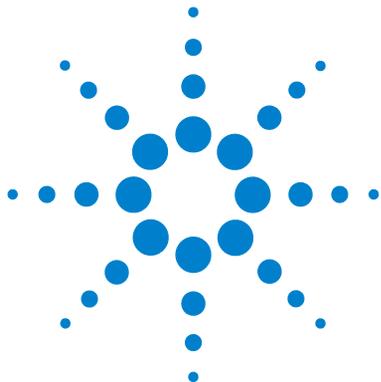
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## Site Requirements

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

### Power Consideration

The detector power supply has wide ranging capabilities and accepts any line voltage in the range mentioned in Table 1. Consequently, there is no voltage selector in the rear of the detector. There are also no externally accessible fuses, because automatic electronic fuses are implemented in the power supply.

#### **WARNING**

**To disconnect the detector from line, unplug the power cord. The power supply still uses some power, even if the power switch on the front panel is turned off.**

---

#### **WARNING**

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

---

#### **CAUTION**

Make sure to have easy access to the power cable of the instrument, in order to disconnect the instrument from line.

---

### Power Cords

Different power cords are offered as options with the detector. The female end of all power cords is identical. It plugs into the power-input socket at the rear of the detector. The male end of each power cord is different and designed to match the wall socket of a particular country or region.

**WARNING**

Never operate your instrumentation from a power outlet that has no ground connection. Never use a power cord other than the Agilent Technologies power cord designed for your region.

---

**WARNING**

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

---

**Bench Space**

The detector dimensions and weight (see Table 1) allows you to place the detector 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 should carry a Agilent 1100 Series system, make sure that the bench is designed to bear the weight of all modules.

The detector should be operated in a horizontal position.

**Environment**

Your detector will work within the specifications at ambient temperatures and relative humidity described in Table 1.

ASTM drift tests require a temperature change below 2 °C/hour (3.6 °F/hour) over one hour period. Our published drift specification (refer also to “[Performance Specifications](#)” on page 296) 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.

**CAUTION**

Do not store, ship or use your detector under conditions where temperature fluctuations could cause condensation within the detector. Condensation will damage the system electronics. If your detector was shipped in cold weather, leave it in its box and allow it to warm up slowly to room temperature to avoid condensation.

---

## Physical Specifications

**Table 1** Physical Specifications

Type	Specification	Comments
Weight	11.5 kg (26 lbs)	
Dimensions (width × depth × height)	345 × 435 × 140 mm (13.5 × 17 × 5.5 inches)	
Line voltage	100 – 120 or 220 – 240 VAC, ± 10 %	Wide-ranging capability
Line frequency	50 or 60 Hz ± 5 %	
Power consumption (G1315/65B)	300 VA / 125 W / 427 BTU	Maximum
Ambient operating temperature	0 – 55 °C (32 – 131 °F)	
Ambient non-operating temperature	-40 – 70 °C (-4 – 158 °F)	
Humidity	< 95%, at 25 – 40 °C (77 – 104 °F)	Non-condensing
Operating altitude	Up to 2000 m (6500 ft)	
Non-operating altitude	Up to 4600 m (14950 ft)	For storing the detector
Safety standards: IEC, CSA, UL, EN	Installation category II, pollution degree 2	

# Unpacking the Detector

## Damaged Packaging

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

### CAUTION

If there are signs of damage, please do not attempt to install the detector.

## Delivery Checklist

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

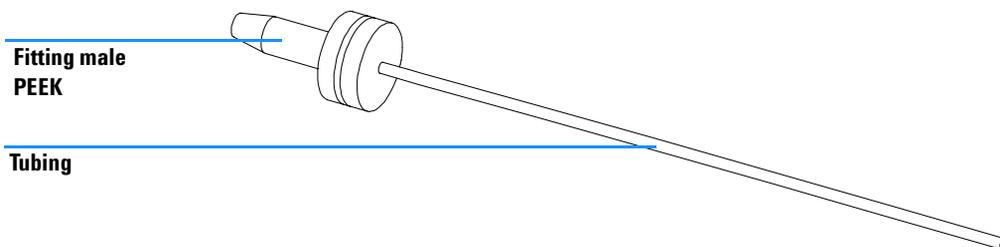
**Table 2** Detector Checklist

Description	Quantity
Detector	1
Power cable	1
UV-lamp (Part number 5181-1530)	1
CAN cable (Part number 5181-1516)	1
Flow cell	As ordered
<i>Reference Manual</i>	1
Accessory kit (see Table 3)	1

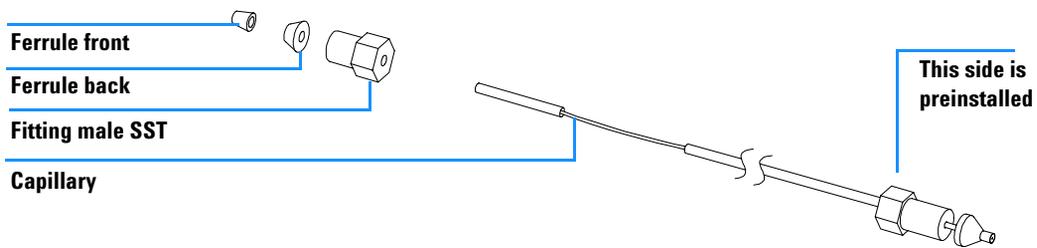
### Detector Accessory Kit Contents

**Table 3** Accessory Kit Contents (Part Number G1315-68705)

Description	Part Number	Quantity
Teflon Tubing flexible i.d. 0.8 mm (flow cell to waste), re-order 5 m	5062-2462	2 m
Corrugated tubing (to waste), re-order 5 m	5062-2463	1.2 m
Fitting male PEEK	0100-1516	2
Capillary column-detector 380 mm lg, 0.17 mm i.d. includes:	G1315-87311	1
Ferrule front SST	0100-0043	2
Ferrule back SST	0100-0044	2
Fitting SST	79814-22406	2
Hex key set 1 – 5 mm	8710-0641	1
Wrench open end 1/4 – 5/16 inch	8710-0510	1
Wrench open end 4 mm	8710-1534	1
ESD wrist strap	9300-1408	1



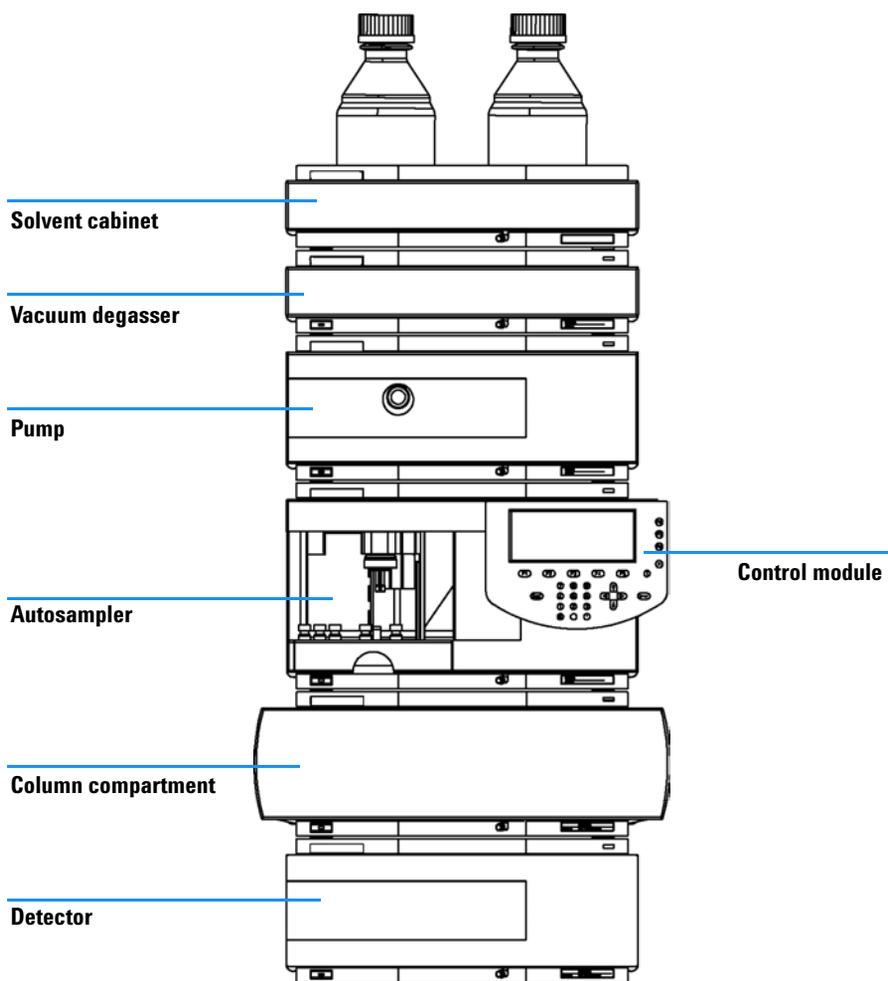
**Figure 1** Waste Tubing Parts



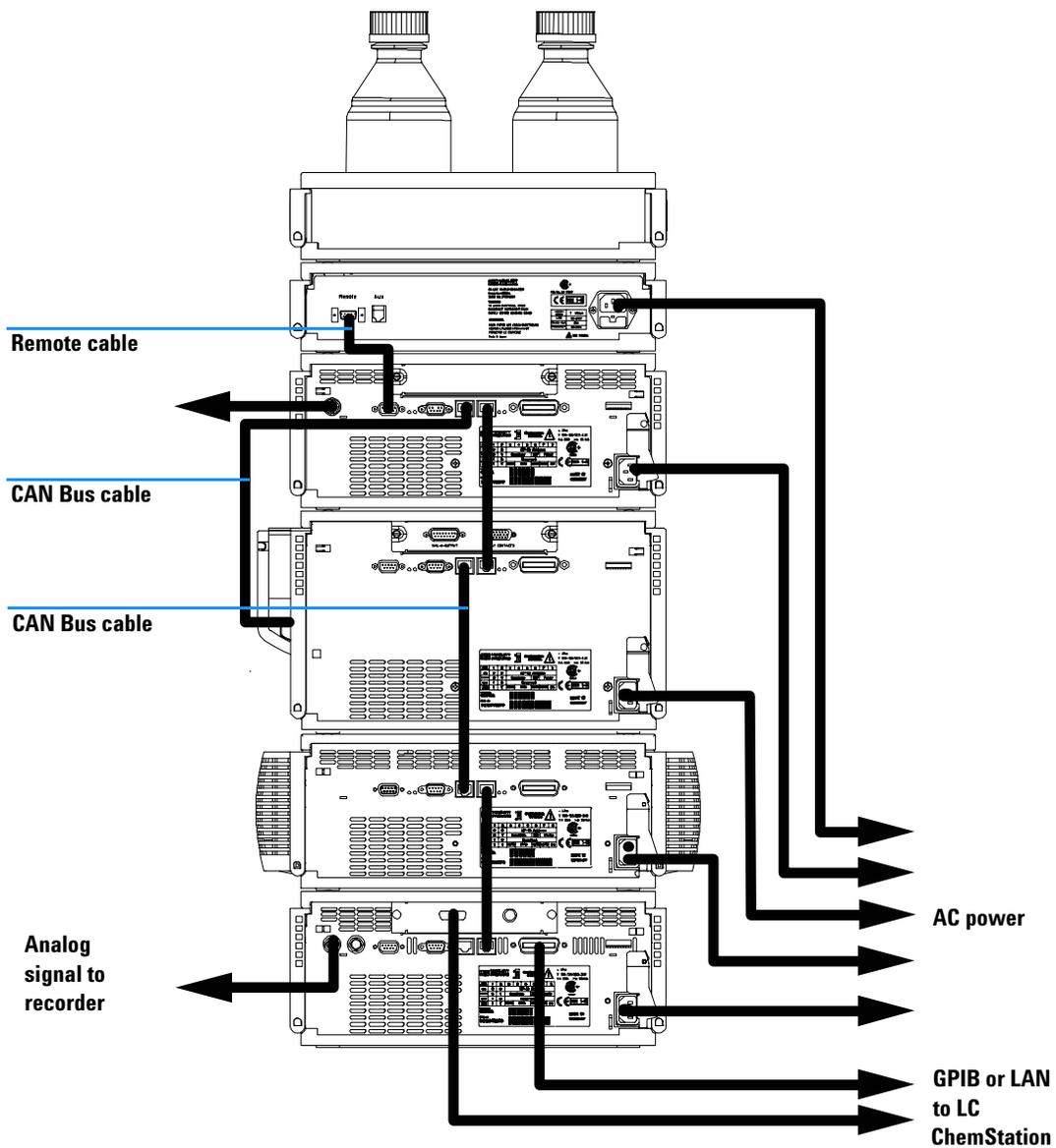
**Figure 2** Inlet Capillary (Column-Detector) Parts

## Optimizing the Stack Configuration

If your detector is part of a complete Agilent 1100 Series system, you can ensure optimum performance by installing the following configuration. This configuration optimizes the system flow path, ensuring minimum delay volume.



**Figure 3** Recommended Stack Configuration (Front View)



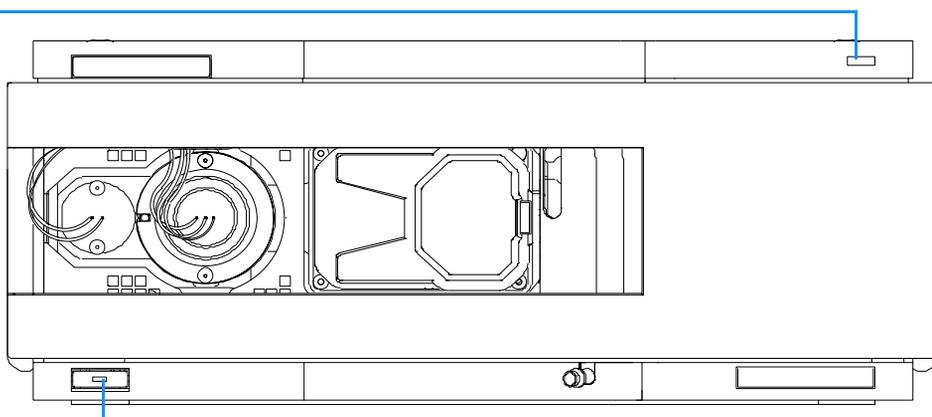
**Figure 4** Recommended Stack Configuration (Rear View)

## Installing the Detector

<b>Preparations</b>	Locate bench space Provide power connections Unpack the detector
<b>Parts required</b>	Detector Power cord, for other cables see below and <a href="#">“Cable Overview”</a> on page 210 ChemStation and/or Control Module G1323A/B

- 1 Install the LAN interface board in the detector (if required), see [“Replacing the Interface Board”](#) on page 179.
- 2 Place the detector in the stack or on the bench in a horizontal position.
- 3 Ensure the line power switch at the front of the detector is OFF.

Status indicator  
green/yellow/red



Line power switch  
with green light

**Figure 5** Front View of Detector

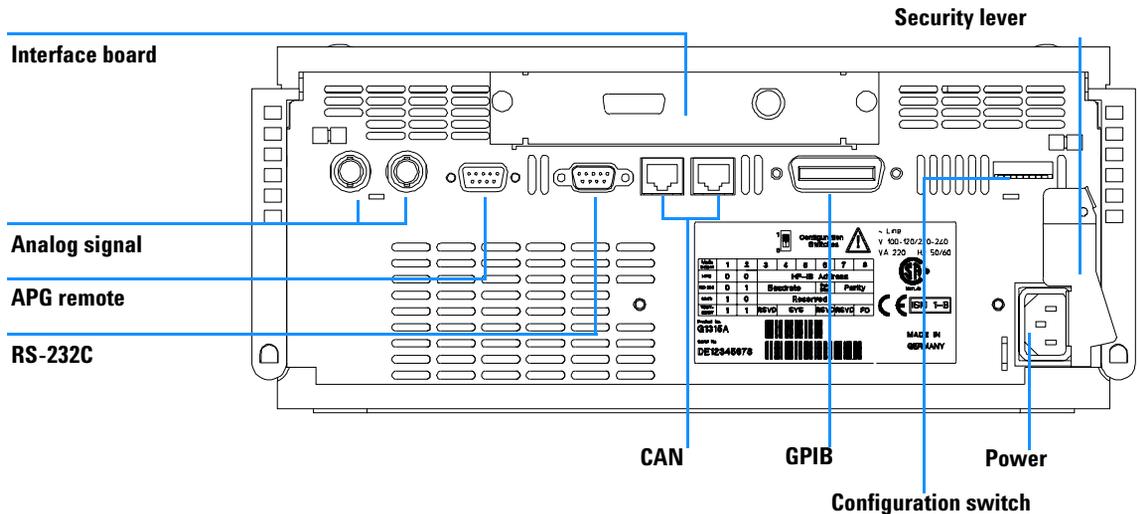
- 4 Connect the power cable to the power connector at the rear of the detector.
- 5 Connect the CAN cable to other Agilent 1100 Series modules.
- 6 If a Agilent ChemStation is the controller, connect either
  - the GPIB cable to the detector or
  - the LAN connection to the LAN interface board in the detector.

#### NOTE

If a Agilent 1100 DAD/MWD/FLD is in the system, the LAN/GPIB should be connected to the DAD/MWD/FLD (due to higher data load).

- 7 Connect the analog cable(s) (optional).
- 8 Connect the APG remote cable (optional) for non-Agilent 1100 Series instruments.
- 9 Turn on power by pushing the button at the lower left hand side of the detector. The status LED should be green.

## 1 Installing the Detector



**Figure 6** Rear View of Detector

### NOTE

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

### WARNING

To disconnect the detector from line, unplug the power cord. The power supply still uses some power, even if the power switch at the front panel is turned off.

### NOTE

The detector was shipped with default configuration settings. To change these settings see “[Setting the 8-bit Configuration Switch](#)” on page 261.

## Flow Connections to the Detector

<b>Preparations</b>	Detector is installed in the LC system.
<b>Parts required</b>	Other modules Parts from accessory kit, see " <a href="#">Detector Accessory Kit Contents</a> " on page 18. Two wrenches 1/4 – 5/16 inch for capillary connections

### WARNING

**When working with solvents please observe appropriate safety procedures (for example, goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the solvent vendor, especially when toxic or hazardous solvents are used.**

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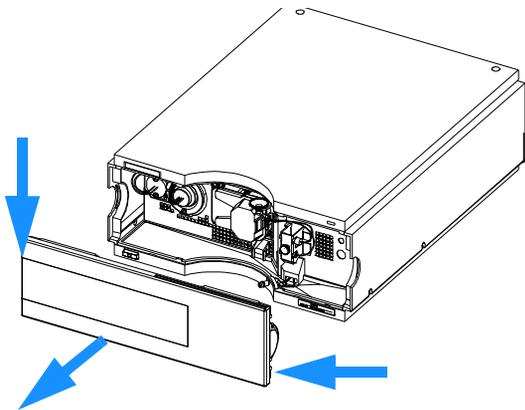
### NOTE

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

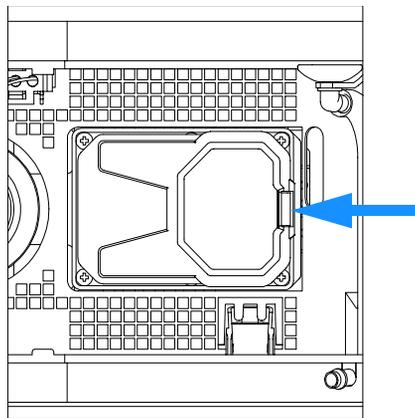
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## 1 Installing the Detector

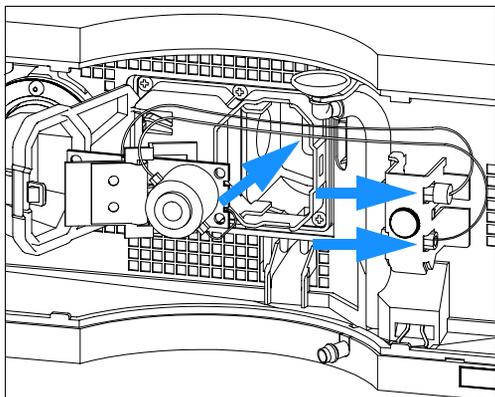
**1** Press the release buttons and remove the front cover to gain access to the flow cell area.



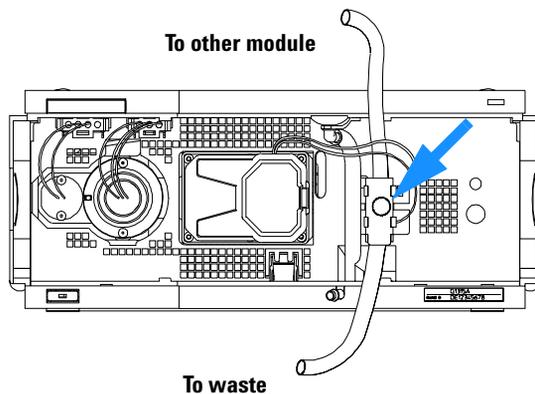
**2** Press the release button and open the flow cell door.



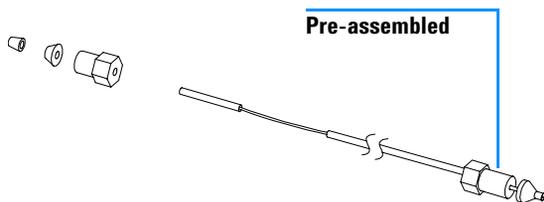
**3** Insert the flow cell and install the capillaries to the capillary holder (top is inlet, bottom is outlet).



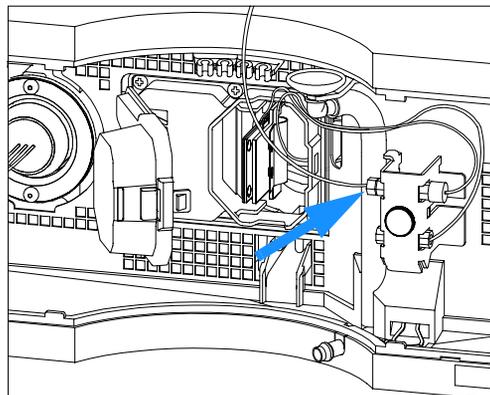
**4** If another Agilent 1100 Series module is positioned on top of the detector, route the tubing assembly waste from the accessory kit behind the capillary holder and connect the top end to the other module's waste outlet.



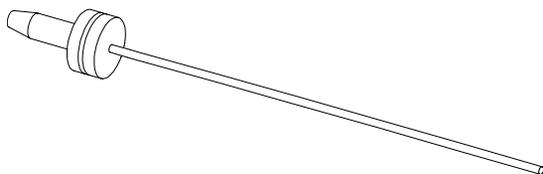
**5** Assemble the column-detector capillary from the accessory kit. One side is already factory-assembled



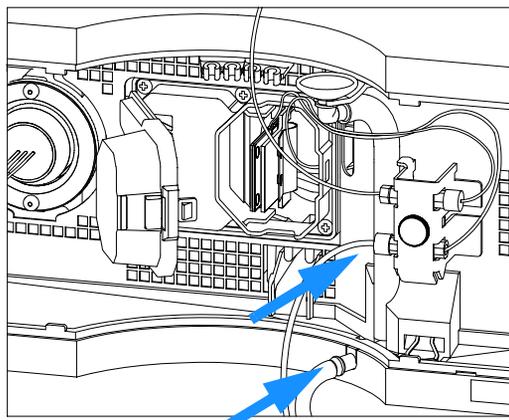
**6** Connect the newly assembled fitting of the capillary to the top fitting holder and the other end to the column.



**7** Assemble the waste tubing from the accessory kit.

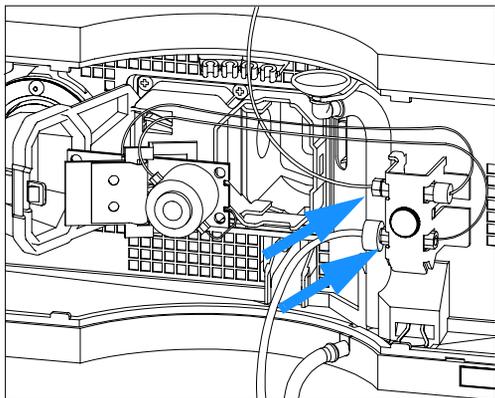


**8** Connect the waste tubing to the bottom fitting holder and a waste tubing to the leak outlet.

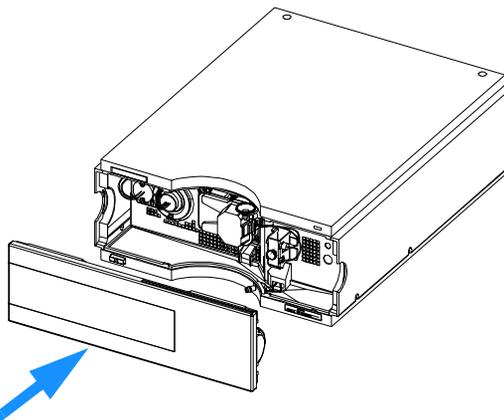


## 1 Installing the Detector

**9** Remove the flow cell and establish a flow and observe for leaks.



**10** Insert the flow cell, close the cover and replace the front cover.

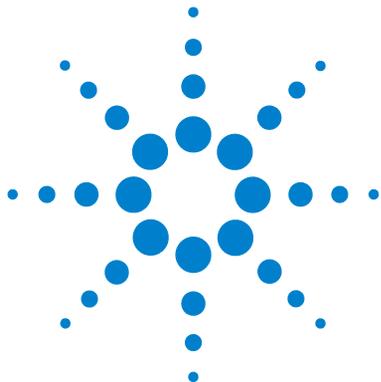


**The installation of the detector is now complete.**

### NOTE

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

Some types of the Agilent deuterium lamps show a light ring during operation. This is not harmful, refer to "[UV-Radiation](#)" on page 307.



## 2 How to optimize the Detector

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Optimization Overview 31

Optimizing for Sensitivity, Selectivity, Linearity and Dispersion 33

Optimizing Selectivity 44



## 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 technics. Some of these technics may not be available in the instrument firmware or the user interfaces (Control Module and/or Agilent Chemstation).

---

### 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 4** Optimization Overview

Parameter	Impact
<b>1</b> Selection of flow cell <ul style="list-style-type: none"> <li>Choose flow cell according to used column, see <a href="#">Figure 7</a>.</li> </ul>	<ul style="list-style-type: none"> <li>peak resolution versus sensitivity</li> </ul>
<b>2</b> Connection of flow cell <ul style="list-style-type: none"> <li>For flow rates from 0.5 ml/min connect column using the zero-dead-volume fittings of the detector.</li> <li>For small column i.d. (e.g 1 mm) the inlet capillary of the micro flow cell can be connected directly to the column.</li> </ul>	<ul style="list-style-type: none"> <li>chromatographic resolution</li> </ul>
<b>3</b> Setting the peak width (response time) <ul style="list-style-type: none"> <li>Use peak width according <a href="#">Figure 7</a> as starting point.</li> <li>Set the peak-width close to the width of a narrow peak of interest in your chromatogram.</li> </ul>	<ul style="list-style-type: none"> <li>peak resolution versus sensitivity versus disk space</li> </ul>
<b>4</b> Setting wavelength and bandwidth <ul style="list-style-type: none"> <li>Sample wavelength:               <ul style="list-style-type: none"> <li>Never miss a peak by the use of a browser wavelength like 250 nm with 100 nm bandwidth.</li> <li>Select specific wavelength with reduced bandwidth if you need selectivity, e.g. 250,10 nm and 360,100 nm as reference wavelength.</li> <li>Set the sample wavelength to a peak or valley in the spectrum to get best linearity for high concentrations.</li> </ul> </li> <li>Reference wavelength:               <ul style="list-style-type: none"> <li>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).</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>sensitivity versus selectivity</li> <li>sensitivity versus linearity</li> <li>baseline drift due to RI effects.</li> </ul>

## 2 How to optimize the Detector

**Table 4** Optimization Overview, continued

Parameter	Impact
<b>5</b> Setting the slit width <ul style="list-style-type: none"> <li>• Use 4 nm slit for normal applications.</li> <li>• Use narrow slit (e.g. 1 nm) if your analytes have narrow absorbance bands and for high concentrations.</li> <li>• Use a wide slit (e.g. 16 nm) to detect very low concentrations.</li> <li>• Optimizing spectral acquisition (DAD only)</li> <li>• Select spectra acquisition mode according to your needs (see <a href="#">“Options for storing spectra”</a> on page 42).</li> <li>• Set the spectral wavelength range (for colorless samples 190...400 nm is sufficient).</li> <li>• Set step to 4 nm for normal use; set small step (and slit width) if high resolution of spectra with fine structure is wanted.</li> </ul>	<ul style="list-style-type: none"> <li>• spectral resolution, sensitivity and linearity.</li> </ul>

Typical column length	Typical peak width	Recommended flow cell				
T ≤ 5 cm	0.025 min	500 nl flow cell				
10 cm	0.05 min		Semi-micro flow cell			High pressure flow cell for pressures above 100 bar
20 cm	0.1 min			Standard flow cell		
≥ 40 cm	0.2 min					
	Typical flow rate	0.01 ... 0.2 ml/min	0.2 ... 0.4 ml/min	0.4 ... 0.4 ml/min	1 ... 2 ml/min	
	Internal column diameter	0.5 ... 1 mm	2.1 mm	3.0 mm	4.6 mm	

**Figure 7** Choosing a Flow Cell

## 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.

$$\text{Absorbance} = -\log T = \log \frac{I_0}{I} = \epsilon \cdot C \cdot d$$

where

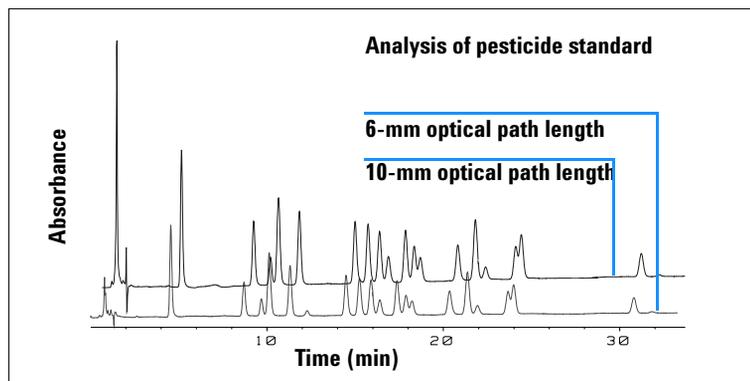
- T is the transmission, defined as the quotient of the intensity of the transmitted light I divided by the intensity of the incident light,  $I_0$ ,
- $\epsilon$  is the extinction coefficient, which is a characteristic of a given substance under a precisely-defined set of conditions of wavelength, solvent, temperature and other parameters,
- C is the concentration of the absorbing species (usually in g/l or mg/l), and
- d 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 8](#) the noise increased by less than 10 % but a 70 % increase in signal intensity was achieved by increasing the path length from 6 mm to 10 mm.

When increasing the path length, the cell volume usually increases – in our example from 5 – 13  $\mu\text{l}$ . Typically, this causes more peak dispersion. As [Figure 8](#) 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).

## 2 How to optimize the Detector



**Figure 8** Influence of Cell Path Length on Signal Height

Traditionally LC analysis with UV detectors is based on comparing measurements with internal or external standards. To check photometric accuracy of the Agilent 1100 DAD/MWD it is necessary to have more precise information on path lengths of the flow cells.

The correct response is:

expected response \* correction factor

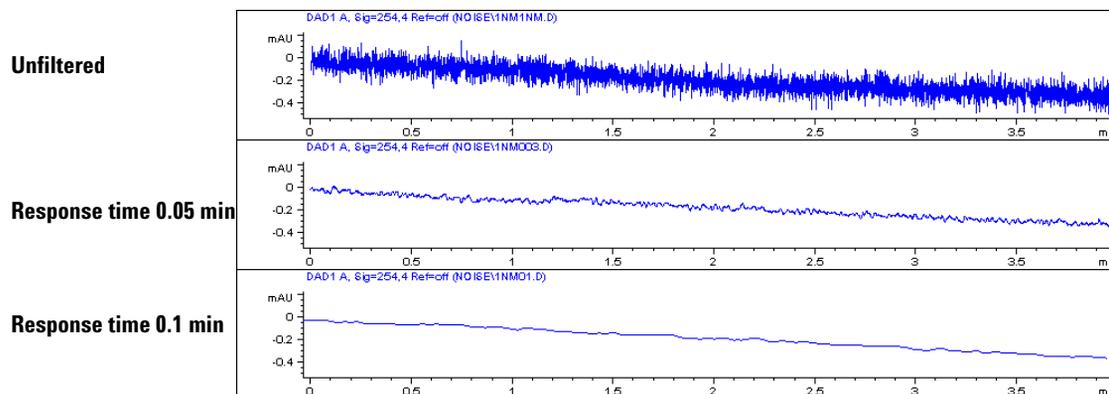
Please find below the details of the Agilent 1100 DAD/MWD flow cells:

**Table 5** Correction factors for Agilent 1100 DAD/MWD flow cells

Flow cell type	Cell volume	Part number	Path length (nominal)	Path length (actual)	Correction factor
Standard flow cell	13 $\mu$ l	G1315-60012	10 mm	9.80 $\pm$ 0.07 mm	10/9.8
Semi-micro flow cell	5 $\mu$ l	G1315-60011	6 mm	5.80 $\pm$ 0.07 mm	6/5.8
80 Nanoliter flow cell kit	0.08 $\mu$ l	G1315-68716	6 mm	6.00 $\pm$ 0.02 mm	6/6
500 Nanoliter flow cell kit	0.5 $\mu$ l	G1315-68724	10 mm	10.00 $\pm$ 0.02 mm	10/10
High Pressure flow cell	1.7 $\mu$ l	G1315-60015	6 mm	5.75 $\pm$ 0.07 mm	6/5.75

## 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 (see [Figure 9](#)), 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 9** Influence of Response Time on Signal and Noise

[Figure 6](#) lists the filter choices of the detector. To get optimum results, set peak width as close as possible to a narrow peak of interest in your chromatogram. Response time will be approximately 1/3 of the peak width, resulting in less than 5 % peak-height reduction and less than 5 % additional peak dispersion. Decreasing the peak width setting in the detector will result in less than 5 % gain in peak height but baseline noise will increase by a factor of 1.4 for a factor of 2 response-time reduction. Increasing peak width (response time) by factor of two from the recommended setting (over-filtering) will reduce peak height by about 20 % and reduce baseline noise by a factor of 1.4. This gives you the best possible signal-to-noise ratio, but may affect peak resolution.

**Table 6** Peak Width — Response Time — Data Rate

Peak Width	Response Time	Data Rate
0.01 min	0.2 s	20 Hz
0.02 min	0.5 s	10 Hz
0.05 min	1.0 s	5 Hz
0.10 min	2.0 s	2.5 Hz
0.20 min	4.0 s	1.25 Hz
0.40 min	8.0 s	0.6 Hz
0.80 min	16.0 s	0.3 Hz

## 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 5 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.

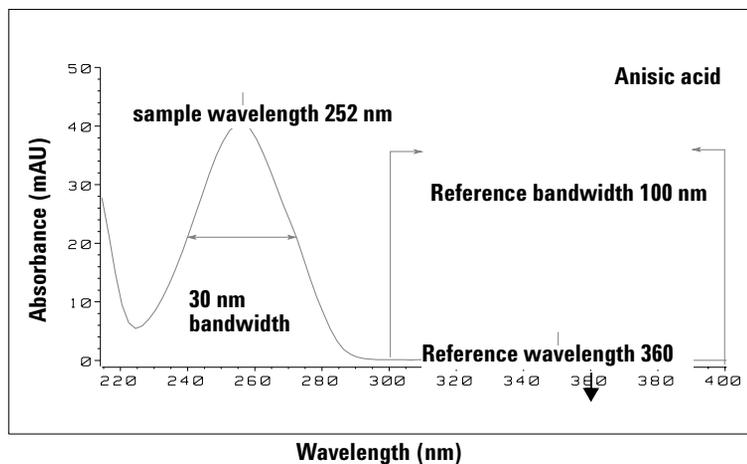
The signals comprises a series of data points over time, with the average absorbance in the sample wavelength band minus the average absorbance of the reference wavelength band.

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 10** shows the spectrum of anisic acid as an example.

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

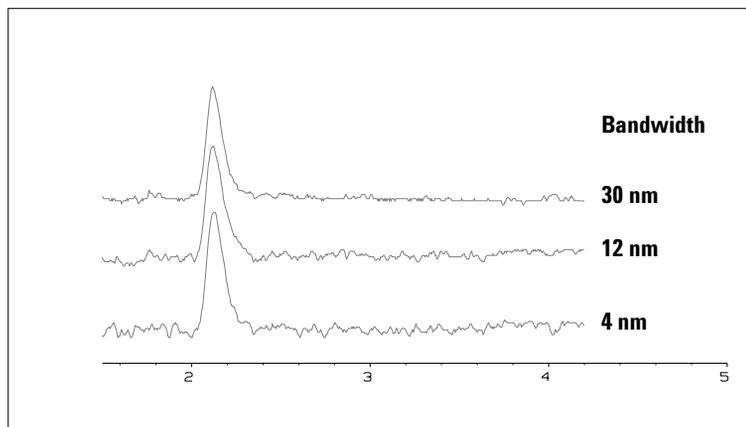
If you work with high concentrations, you may get better linearity above 1.5 AU by setting the sample wavelength to a valley in the spectrum, like 225 nm for anisic acid.



**Figure 10** Optimization of Wavelength Setting

## 2 How to optimize the Detector

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.

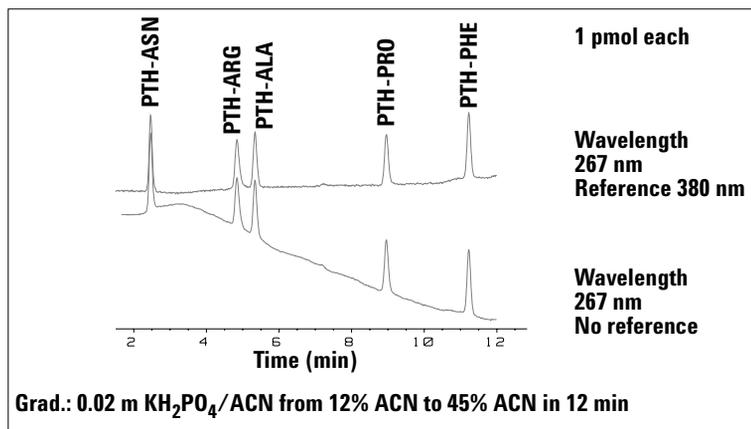


**Figure 11** Influence of Bandwidth on Signal and Noise

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 12](#) 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.



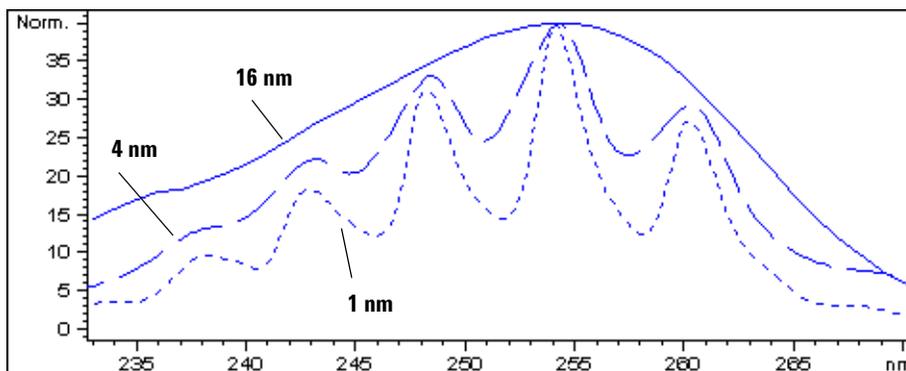
**Figure 12** Gradient Analysis of PTH-Amino Acids (1 pmol each), with and without Reference

## Slit Width

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

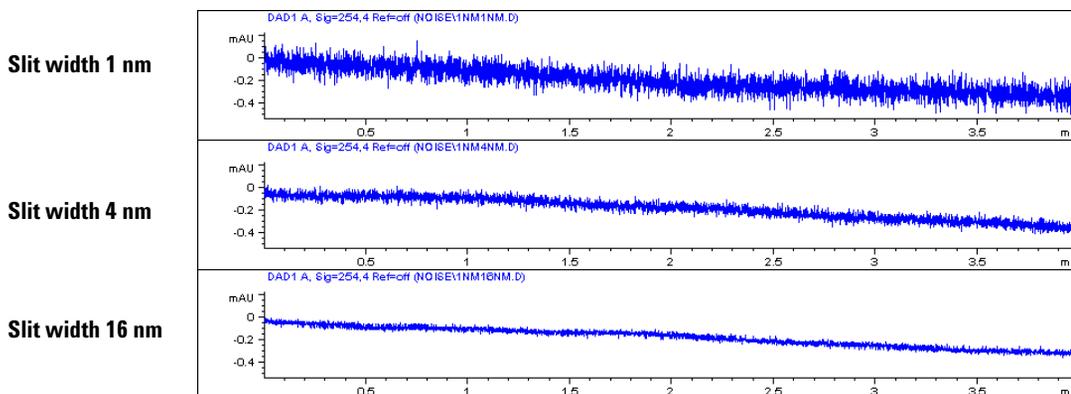
A narrow slit provides spectral resolution for analytes with very fine structures in the absorbance spectrum. An example of such a spectrum is benzene. The five main absorbance bands (fingers) are only 2.5 nm wide and just 6 nm apart from each other.

## 2 How to optimize the Detector



**Figure 13** Benzene at 1, 4 and 16 nm slit width

A wide slit uses more of the light shining through the flow cell. This gives lower baseline noise as shown in [Figure 14](#).



**Figure 14** 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 (see [Figure 10](#)).

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.

### Options for storing spectra

None	Store signals only. No peak purity checks nor library search features can be used for samples analyzed with this setting.
Apex	Only one spectrum per peak is stored; a peak must be higher than the value entered in Threshold (see below).
Apex + baseline	Stores spectra for peaks > threshold at the top and at baseline before and after each peak recommended minimum to do library searches with baseline corrected spectra.
Apex + slope +baseline	Add spectra at the up and down slope; required to do a minimum peak purity check.
All in peak	All spectra during all peak > Threshold are stored; required for a full peak purity check.
Every 2nd spectrum	Only every second spectrum is stored, occupying only half the disk space.
All	All spectra are stored.

### 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 better display of the spectrum.

**Threshold**

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

**Margin for Negative Absorbance**

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

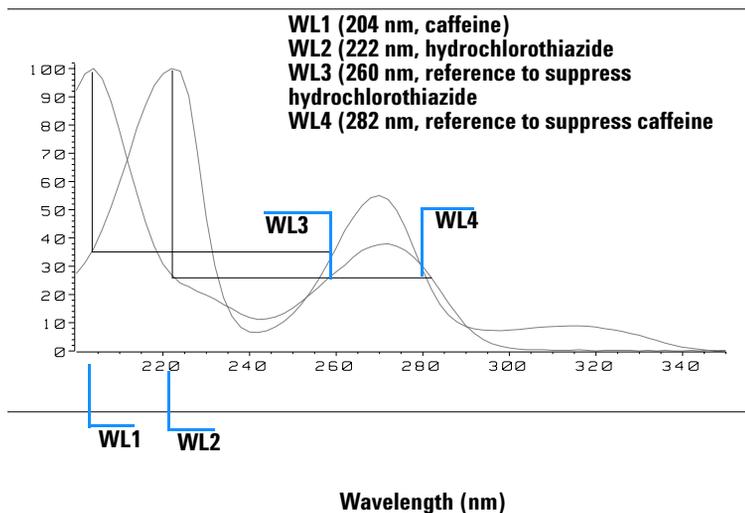
Only for such cases, increase the margin for negative absorbance to avoid overflow of the analog-to-digital converter.

## Optimizing Selectivity

### Quantifying Coeluting Peaks by Peak Suppression

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

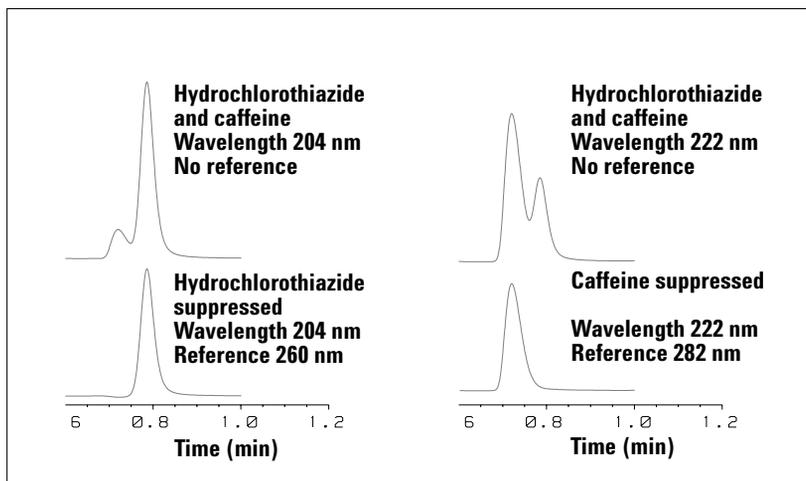
With a dual-channel detector based on diode-array technology, quantifying two compounds is possible even when both compounds absorb over the whole wavelength range. The procedure is called peak suppression or signal subtraction. As an example, the analysis of hydrochlorothiazide in the presence of caffeine is described. If hydrochlorothiazide is analyzed in biological samples, there is always a risk that caffeine is present which might interfere chromatographically with hydrochlorothiazide. As the spectra in [Figure 15](#) show, 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 15** 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 other, 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 16](#) shows the chromatographic results of the peak suppression technique.

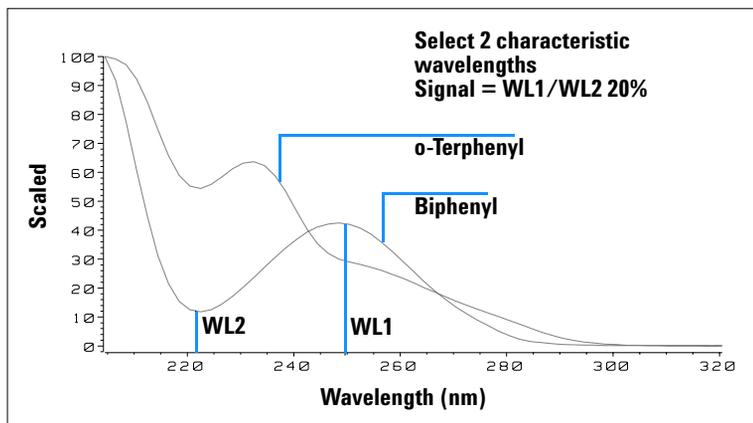
The trade-off for this procedure is a loss in sensitivity. The sample signal decreases by the absorbance at the reference wavelength relative to the signal wavelength. Sensitivity may be decreased by as much as 10–30 %.



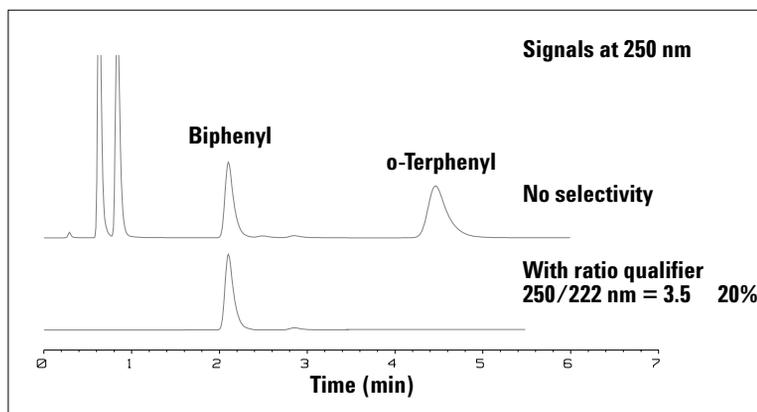
**Figure 16** Peak Suppression Using Reference Wavelength

## 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 postcolumn 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 17](#) and [Figure 18](#).



**Figure 17** Wavelength Selection for Ratio Qualifiers

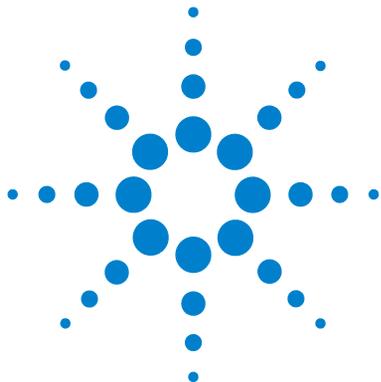


**Figure 18** Selectivity by Ratio Qualifiers

In a four-component mixture, only biphenyl was recorded. The other three peaks were suppressed because they did not meet the ratio-qualifier criterion and therefore the output was set to zero. The characteristic wavelengths 249 nm ( $\lambda_1$ ) and 224 nm ( $\lambda_2$ ) were found from the spectra shown in [Figure 17](#).

## 2 How to optimize the Detector

The ratio range was set at 2 – 2.4 ( $2.2 \pm 10\%$ ). 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 18). The others were not plotted.



## 3 Troubleshooting and Test Functions

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Error Messages	53
Wavelength Recalibration	84
Test Functions	85

This chapter describes the detector's built in troubleshooting and test functions.



## Overview of the Detector's Indicators and Test Functions

### Status Indicators

The detector is provided with two status indicators which indicate the operational state (prerun, run, and error states) of the detector. The status indicators provide a quick visual check of the operation of the detector (see [page 51](#)).

### Error Messages

In the event of an electronic, mechanical or hydraulic failure, the detector generates an error message in the user interface. For each message, a short description of the failure, a list of probable causes of the problem, and a list of suggested actions to fix the problem are provided (see [“Error Messages”](#) on page 53).

### Wavelength Recalibration

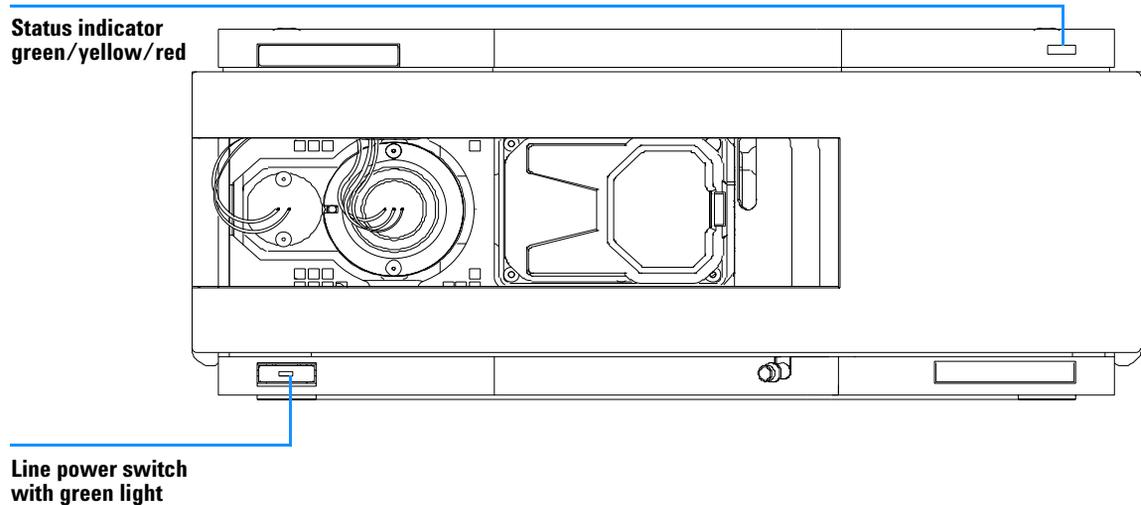
Wavelength recalibration is recommended after repair of internal components, and on a regular basis to ensure correct operation of the detector. The detector uses the deuterium alpha and beta emission lines for wavelength calibration (see [“Wavelength Recalibration”](#) on page 84).

### Test Functions

A series of test functions are available for troubleshooting and operational verification after exchanging internal components (see [“Test Functions”](#) on page 85).

## Status Indicators

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



**Figure 19** Location of Status Indicators

### Power Supply Indicator

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

### Detector Status Indicator

The detector status indicator indicates one of four possible detector conditions:

### 3 Troubleshooting and Test Functions

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

## 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 detector is switched on, and an entry is written into the detector logbook.

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

## Timeout

The timeout threshold was exceeded.

### Probable Causes

- The analysis was completed successfully, and the timeout function switched off the pump as requested.
- A not-ready state 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

An external instrument has generated a shut-down signal (through CAN or REMOTE lines).

The detector 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 Causes

- Leak detected in an external instrument with a remote connection to the system.
- Shut-down in an external instrument with a remote connection to the system.
- The degasser failed to generate sufficient vacuum for solvent degassing.

### Suggested Actions

- ✓ Fix the leak in the external instrument before restarting the pump.
- ✓ Check external instruments for a shut-down condition.
- ✓ Check the degasser for an error condition. Refer to the *Reference Manual* for the Aligent 1100 Series vacuum degasser.

## Remote Timeout

A not-ready condition is still present on the remote input.

When an analysis is started, the system expects all not-ready conditions (e.g. 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 Causes

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

### Suggested Actions

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

## Synchronization Lost

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 Causes

- CAN cable disconnected.
- Defective CAN cable.
- Defective main board in another module.

### Suggested Actions

- ✓ Ensure all the CAN cables are connected correctly.
- ✓ Switch off the system. Restart the system, and determine which module or modules are not recognized by the system.
- ✓ Ensure all CAN cables are installed correctly.

## Leak

A leak was detected in the detector.

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 detector main board.

#### Probable Causes

- Loose fittings.
- Broken capillary.
- Leaking flow cell.

#### Suggested Actions

- ✓ Ensure all fittings are tight.
- ✓ Exchange defective capillaries.
- ✓ Exchange flow cell components.

#### Additional Information

Detector leak error may be caused by the Aligent 1100 sampler. In each sampler injection sequence, step# 2 ejects the mobile phase stored in the metering head during the previous injection. This mobile phase is ejected through the short plastic tube connected to port# 4 of the sampler switching valve. The output of port# 4 is integrated into the sampler's contingency leak drain system, which eventually terminates in the leak pan of the bottom module of the stack - the detector. With normal injection volumes and run times, the output of port# 4 is small, and evaporates right in the sampler leak pan. However, the output of port# 4 is significant, and a substantial volume of ejected mobile phase reaches the detector leak pan.

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

- 1 The waste drain plumbing orientation, shown in step 4 on [page 26](#), eliminates the possibility of any leak drainage from above reaching the detector leak pan. The leak drain for the detector can be connected to the detector's leak drain fitting, and taken to waste separately.
- 2 If it is desired that the system has only one leak drain tube, then it's possible to increase the length of the small plastic tube which is connected

to port# 4 of the sampler switching valve. This tube can then be taken to waste separately. The tube which normally serves as the detector cell outlet tube can be used for this purpose.

## Leak Sensor Open

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

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

### Probable Causes

- Leak sensor not connected to the detector main board.
- Defective leak sensor.

### Suggested Actions

- ✓ Ensure the leak sensor is connected correctly.
- ✓ Exchange the leak sensor.

## Leak Sensor Short

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

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

### Probable Causes

- Defective leak sensor.

### Suggested Actions

- ✓ Exchange the leak sensor.

## Compensation Sensor Open

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

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

### Probable Causes

- Defective detector main board.

### Suggested Actions

- ✓ Exchange the detector main board.

## Compensation Sensor Short

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

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

### Probable Causes

- Defective detector main board.

### Suggested Actions

- ✓ Exchange the detector main board.

## Fan Failed

The cooling fan in the detector has failed.

The hall sensor on the fan shaft is used by the detector main board to monitor the fan speed. If the fan speed falls below two revolutions/second for more than five seconds, the error message is generated.

#### Probable Causes

- Fan cable disconnected.
- Defective fan.
- Defective detector main board.

#### Suggested Actions

- ✓ Ensure the fan is connected correctly.
- ✓ Exchange fan.
- ✓ Exchange the detector main board.

## Open Cover

The top foam has been removed.

The sensor on the detector 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 Causes

- The top foam was removed during operation.
- Foam not activating the sensor.

### Suggested Actions

- ✓ Replace the top foam.
- ✓ Exchange the foam.

## Cover Violation

The top foam has been removed.

The sensor on the detector 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 the lamps with the foam removed), the lamps are switched off, and the error message is generated.

#### Probable Causes

- The top foam was removed during operation.
- Foam not activating the sensor.

#### Suggested Actions

- ✓ Replace the top foam.
- ✓ Exchange the foam.

## Visible Lamp Current

The visible lamp current is missing.

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

### Probable Causes

- Visible lamp disconnected.
- Defective visible lamp.
- Defective detector main board.
- Defective power supply.

### Suggested Actions

- ✓ Ensure the visible lamp connector is seated firmly.
- ✓ Exchange the visible lamp.
- ✓ Exchange the detector main board.
- ✓ Exchange the power supply.

## Visible Lamp Voltage

The visible lamp voltage is missing.

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

### Probable Causes

- Defective detector main board.
- Defective power supply.

### Suggested Actions

- ✓ Exchange the detector main board.
- ✓ Exchange the power supply.

## Communication Error

An internal communication error between the main processor and the digital-signal processor has occurred.

### Probable Causes

- Random communication error.
- Defective detector main board.

### Suggested Actions

- ✓ Switch the detector off and on again at the power switch. If the error reoccurs, exchange the detector main board.

## Calibration Values Invalid

The calibration values read from the spectrometer ROM are invalid.

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

### Probable Causes

- Defective detector main board.
- Defective optical unit.

### Suggested Actions

- ✓ Exchange the detector main board.
- ✓ Exchange the optical unit.

## Diode Current Leakage

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 Causes

- Defective optical unit.
- Defective detector main board.

### Suggested Actions

- ✓ Exchange the optical unit.
- ✓ Defective detector main board.

## Holmium Oxide Test Failed

The holmium oxide test in the detector has failed.

During the holmium test, the detector moves the holmium filter through the light path while monitoring the detector signal response. As the edge of the filter passes through the light path, the signal is interrupted. This is used to determine the position of the filter, and whether the filter is moving correctly. If the filter fails to move, the error message is generated.

### Probable Causes

- Lamps switched off.
- Defective or dirty flow cell.
- Defective filter assembly.
- Defective achromat assembly.
- Defective optical unit.

### Suggested Actions

- ✓ Ensure the lamps are switched on.
- ✓ Ensure the flow cell is inserted correctly, and is free from contamination (cell windows, buffers etc.).
- ✓ Exchange the filter assembly.
- ✓ Exchange the achromat assembly.
- ✓ Exchange the optical unit.

## UV Lamp Current

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 Causes

- UV lamp disconnected.
- Defective UV lamp or non-Agilent lamp.
- Defective detector main board.
- Defective power supply.

### Suggested Actions

- ✓ Ensure the UV lamp connector is seated firmly.
- ✓ Exchange the UV lamp.
- ✓ Exchange the detector main board.
- ✓ Exchange the power supply.

## UV Lamp Voltage

The UV lamp anode voltage is missing.

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

### Probable Causes

- Defective UV lamp or non-Agilent lamp.
- Defective detector main board.
- Defective power supply.

### Suggested Actions

- ✓ Exchange the UV lamp.
- ✓ Exchange the detector main board.
- ✓ Exchange the power supply.

## UV Ignition Failed

The UV lamp failed to ignite.

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

### Probable Causes

- Lamp not connected.
- Defective UV lamp or non-Agilent lamp.
- Defective detector main board.
- Defective power supply.

### Suggested Actions

- ✓ Ensure the lamp is connected.
- ✓ Exchange the UV lamp.
- ✓ Exchange the detector main board.
- ✓ Exchange the power supply.

## UV Heater Current

The UV lamp heater current is missing.

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

#### Probable Causes

- UV Lamp not connected.
- Ignition started without the top foam in place.
- Defective UV lamp or non-Agilent lamp.
- Defective detector main board.
- Defective power supply.

#### Suggested Actions

- ✓ Ensure the UV lamp is connected.
- ✓ Replace the top foam, and turn on the lamp.
- ✓ Exchange the UV lamp.
- ✓ Exchange the detector main board.
- ✓ Exchange the power supply.

## **New Messages with the G1315B and G1365B detectors**

With the introduction of the G1315B DAD and the G1365B MWD a few new messages have been added to address the additional heating control for stabilization of the baseline in unstable environment.

## Module Type Changed

At switch-on, the detector has recognized a new configuration. Only G1315B and G1365B detectors have built-in hardware for temperature control. The type of the module changed from A to B or vice versa because the hardware for the temperature control was either detected or not detected.

The parameter of the event determines the new module type:

0 means	G1315	no temperature hardware detected
1 means	G1315	temperature hardware detected
2 means	G1365	no temperature hardware detected
3 means	G1365	temperature hardware detected

Look at the product identifier to check if your detector is of type A (G1315A or G1365A) or B (G1315B or G1365B) and proceed accordingly.

### Type A, Parameter 0 or 2

Probable Causes

- Main board has been exchanged

Suggested Actions

- ✓ Power cycle the detector

### Type B, Parameter 0 or 2

Probable Causes

- Defective or missing heater connector

Suggested Actions

- ✓ Ensure the connector to the detector main board is seated firmly and power cycle the detector. At next switch-on you will get the same error message, but with parameter 1 or 3 because the temperature hardware is detected again (see below).

**Type B, Parameter 1 or 3**

## Probable Causes

- Detector has recognized the hardware for temperature control. This is because the detector didn't find the temperature hardware at last switch-on.

## Suggested Actions

- ✓ Power cycle the detector.

## Illegal Value From Temperature Sensor Mounted On The Fan Assembly

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 Causes

- The sensor is defect
- Detector is exposed to illegal ambient conditions.

### Suggested Actions

- ✓ Ensure the connector to the detector main board is seated firmly.
- ✓ Verify that the ambient conditions are within the allowed range.
- ✓ Exchange temperature sensor assembly.

## Illegal Value From „Air Inlet" Temperature Sensor

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 Causes

- The sensor is defect
- Detector is exposed to illegal ambient conditions.

### Suggested Actions

- ✓ Verify that the ambient conditions are within the allowed range.
- ✓ Exchange detector main board.

## Heater Failed

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

#### Probable Causes

- Defective connector or cable.
- Defective heater.

#### Suggested Actions

- ✓ Ensure the connector to the detector main board is seated firmly.
- ✓ Exchange heater assembly.

## Heater Power At Limit

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

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

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

### Probable Causes

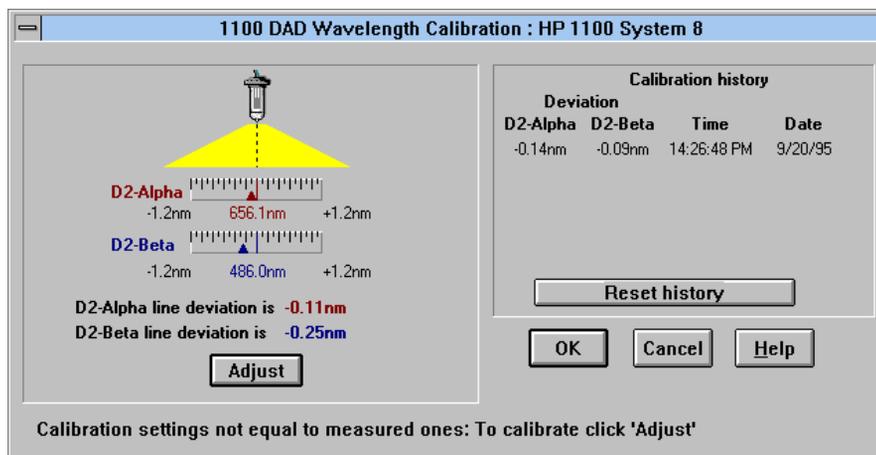
- Ambient conditions have changed too much during the run, so that optimum results may not be guaranteed.

### Suggested Actions

- ✓ Verify that the reproducibility of your results is not affected
- ✓ Expose the detector to more stable ambient conditions.

## Wavelength Recalibration

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 calibration is started, the 1-nm slit is moved into the light path automatically, and the gain is set to zero. To eliminate effects due to absorbing solvents, the test should be done with water in the flow cell. After calibration, the holmium oxide test (see [Figure “Holmium Oxide Test”](#) on page 86) provides verification of wavelength accuracy at three additional wavelengths. Wavelength calibration should be done after maintenance of the flow cell, lamp exchange, or after major repair, like processor board or optical unit exchange, see also [“Replacing the Detector’s Firmware”](#) on page 180.



**Figure 20** Wavelength Calibration

## Test Functions

### **Holmium Oxide Test**

The built-in holmium oxide filter is used for verification of wavelength accuracy at three additional wavelengths. The test evaluates the results automatically, and provides a spectrum of the holmium oxide filter.

### **Intensity Test**

The intensity test checks the lamp intensities (UV and visible lamps) over the complete spectral range. The test evaluates the results automatically, and provides an intensity spectrum.

### **Cell Test**

The cell test compares the lamp intensities with and without flow cell installed. The intensity ratio is an indicator of the amount of light absorbed by the flow cell (e.g. contaminated or dirty cell windows).

### **Dark-Current Test**

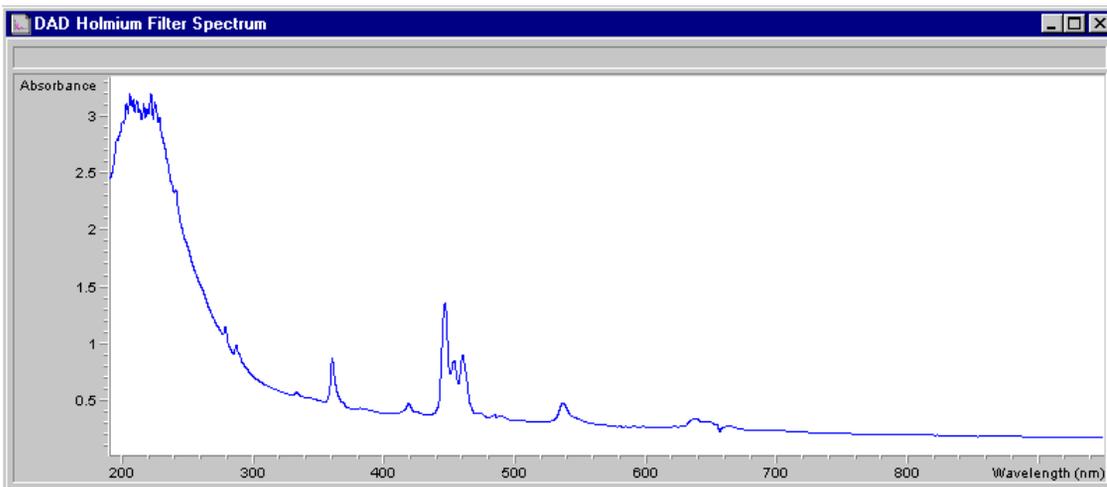
The dark-current test measures the leakage current from each optical diode. The test evaluates the results automatically, and provides a graphical output of the results.

### **Filter Test**

The filter test checks the filter motor for correct movement, and checks the absorbance of the holmium oxide filter in order to determine whether the filter is dirty or contaminated.

## Holmium Oxide Test

The holmium oxide test uses three characteristic absorbance maxima of the built-in holmium oxide filter to verify wavelength accuracy (see also “[Wavelength Recalibration](#)” on page 84). 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.



**Figure 21** Holmium Oxide Test

**NOTE**

See also “[Declaration of Conformity for HOX2 Filter](#)” on page 310.

### Holmium Oxide Test Evaluation

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 22).

	Limits	Measured	Result
Date: 31.03.99; Time: 10:45:15			
Wavelength 1: 361.0 nm	360..362 nm	360.9 nm	Passed
Wavelength 2: 453.7 nm	452.7..454.7 nm	453.8 nm	Passed
Wavelength 3: 536.7 nm	535.7..537.7 nm	537.1 nm	Passed

**Figure 22** Holmium Oxide Test Results

**Test Failed**

Probable Causes

- Absorbing solvent or air bubble in flow cell.
- Incorrect calibration
- Dirty or contaminated flow cell.
- Dirty or contaminated optical components (achromat, windows).
- Old or non-Agilent lamp.

Suggested Actions

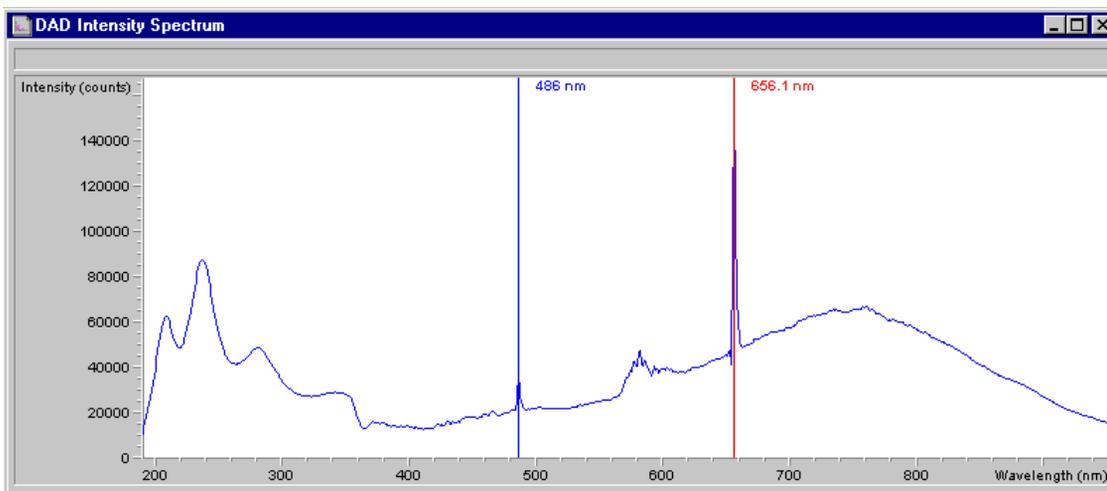
- ✓ Ensure the flow cell is filled with water.
- ✓ Recalibrate (see “Wavelength Recalibration” on page 84) and repeat the test.
- ✓ Run the cell test (see “Cell Test” on page 90). If the test fails, exchange the flow cell windows.
- ✓ Clean optical components with alcohol and lint-free cloth.
- ✓ Exchange the UV lamp.

## Intensity Test

**NOTE**

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

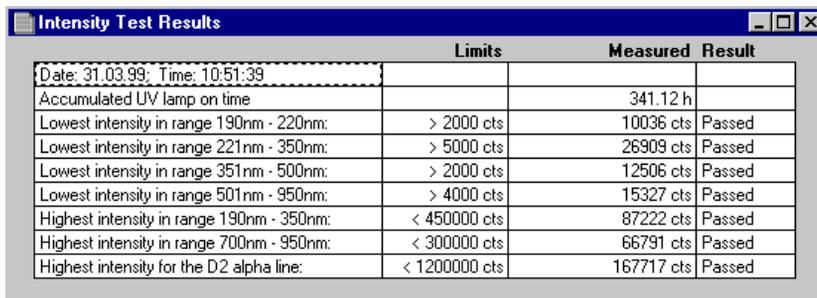
The intensity test measures the intensity of the deuterium and tungsten lamps over the full wavelength range (190 – 950 nm). Four spectral ranges are used to evaluate the intensity spectrum. The test is used to determine the performance of the lamps and optics (see also “Cell Test” on page 90). When the test is started, the 1-nm slit is moved into the light path automatically, and the gain is set to zero. To eliminate effects due to absorbing solvents, the test should be done with water in the flow cell. The shape of the intensity spectrum is primarily dependent on the lamp, grating, and diode array characteristics. Therefore, intensity spectra will differ slightly between instruments. [Figure 23](#) shows a typical intensity test spectrum.



**Figure 23** Intensity Test

## Intensity Test Evaluation

The Agilent ChemStation evaluates four spectral ranges automatically, and displays the limits for each range, the measured intensity counts, and *passed* or *failed* for each spectral range (see Figure 24).



	Limits	Measured	Result
Date: 31.03.99; Time: 10:51:39			
Accumulated UV lamp on time		341.12 h	
Lowest intensity in range 190nm - 220nm:	> 2000 cts	10036 cts	Passed
Lowest intensity in range 221nm - 350nm:	> 5000 cts	26909 cts	Passed
Lowest intensity in range 351nm - 500nm:	> 2000 cts	12506 cts	Passed
Lowest intensity in range 501nm - 950nm:	> 4000 cts	15327 cts	Passed
Highest intensity in range 190nm - 350nm:	< 450000 cts	87222 cts	Passed
Highest intensity in range 700nm - 950nm:	< 300000 cts	66791 cts	Passed
Highest intensity for the D2 alpha line:	< 1200000 cts	167717 cts	Passed

**Figure 24** Intensity Test Results

## Test Failed

### Probable Causes

- Absorbing solvent or air bubble in flow cell.
- Dirty or contaminated flow cell.
- Dirty or contaminated optical components (achromat, windows).
- Old or non-Agilent lamp.

### Suggested Actions

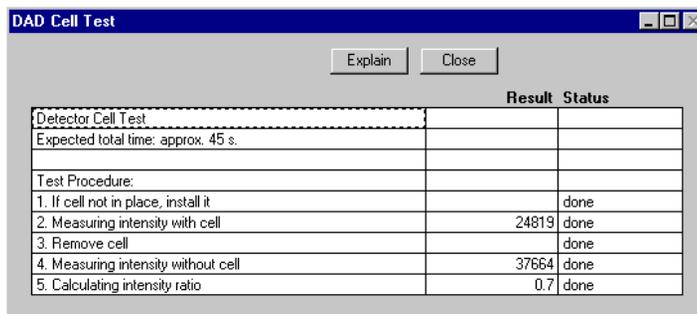
- ✓ Ensure the flow cell is filled with water, and free from air bubbles.
- ✓ Run the cell test (see “Cell Test” on page 90). If the test fails, exchange the flow cell windows.
- ✓ Clean optical components with alcohol and lint-free cloth.
- ✓ Exchange the lamp.

## Cell Test

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

### Cell Test Evaluation

The Aligent ChemStation calculates the intensity ratio automatically. The intensity ratio (typically between 0.5 and 0.7) is dependent on the degree of contamination of the flow cell windows, and on the type of flow cell used.



The screenshot shows a window titled "DAD Cell Test" with "Explain" and "Close" buttons. Below the buttons is a table with the following data:

	Result	Status
Detector Cell Test		
Expected total time: approx. 45 s.		
Test Procedure:		
1. If cell not in place, install it		done
2. Measuring intensity with cell	24819	done
3. Remove cell		done
4. Measuring intensity without cell	37664	done
5. Calculating intensity ratio	0.7	done

**Figure 25** Cell Test Results

### Test Failed (low ratio value)

#### Probable Causes

- Absorbing solvent or air bubble in flow cell.
- Dirty or contaminated flow cell.

#### Suggested Actions

- ✓ Ensure the flow cell is filled with water, and free from air bubbles.
- ✓ Exchange the flow cell windows.

## 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 (see Figure 26). The leakage current (represented in *counts*) for each diode should fall within the limits (red bands) shown in the plot (see Figure 26).

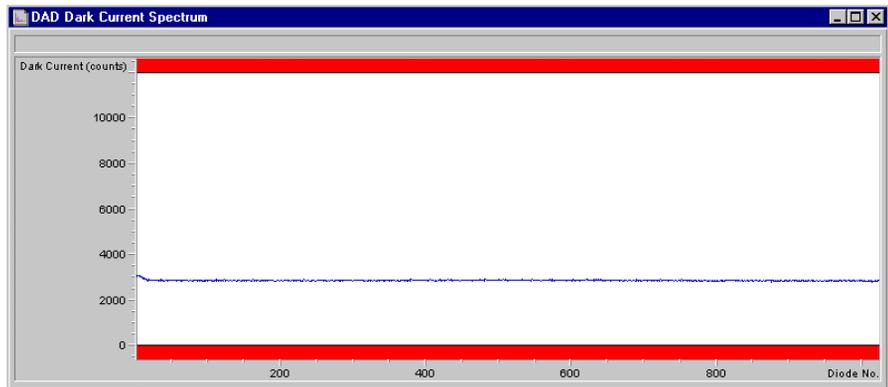


Figure 26 Dark-Current Test

## Dark-Current Test Evaluation

	Limits	Measured	Result
Date: 31.03.99; Time: 11:14:21			
Dark current maximum value	<= 12000 cts	3078 cts	Passed
Dark current minimum value	> 0 cts	2790 cts	Passed

Figure 27 Dark-Current Test Results

### 3 Troubleshooting and Test Functions

#### **Test Failed**

Probable Causes

- Defective optical unit.

Suggested Actions

- ✓ Exchange the optical unit.

## 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.

### Filter Test Evaluation

#### Test Failed

Probable Causes

- Filter assembly (lever and filter) not installed.
- Defective filter motor.

Suggested Actions

- ✓ Install the filter assembly.
- ✓ Exchange the filter motor.

#### Holmium Oxide Maximum out of Limits

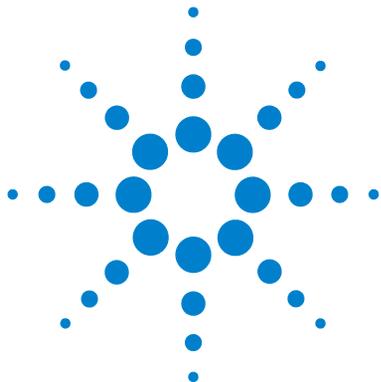
Probable Causes

- Holmium oxide filter not installed.
- Dirty or contaminated filter.

Suggested Actions

- ✓ Install the holmium oxide filter.
- ✓ Exchange the holmium oxide filter.

### **3 Troubleshooting and Test Functions**



## 4 Repairing the Detector

Introduction into Repairing the Detector	96
Overview of the Repairing of the Detector	99
Simple Repairs	101
Exchanging Internal Parts	138



## Introduction into Repairing the Detector

### Simple Repairs

The detector is designed for easy repair. The most frequent repairs such as lamp change and flow cell change can be done from the front of the detector with the detector in place in the system stack. These repairs are described in “Simple Repairs” on page 101.

### Exchanging Internal Parts

Some repairs may require exchange of defective internal parts. Exchange of these parts requires removing the detector from the stack, removing the covers, and disassembling the detector. The security lever at the power input socket prevents that the detector cover is taken off when line power is still connected. These repairs are described in “Exchanging Internal Parts” on page 138.

---

**WARNING**

To prevent personal injury, the power cable must be removed from the instrument before opening the detector cover. Do not connect the power cable to the detector while the covers are removed.

---

**WARNING**

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

---

**WARNING**

When working with solvents please observe appropriate safety procedures (for example, goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the solvent vendor, especially when toxic or hazardous solvents are used.

---

**CAUTION**

Electronic boards and components are sensitive to electronic discharge (ESD). In order to prevent damage always use an ESD protection (for example, the ESD wrist strap from the accessory kit) when handling electronic boards and components (see [“Using the ESD Strap”](#) on page 98).

---

**WARNING**

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.

**Cleaning the Detector**

The detector 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 detector.

**WARNING**

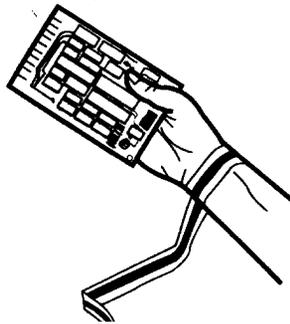
Do not let liquid drip into the detector. It could cause shock hazard and it could damage the detector.

---

## Using the ESD Strap

Electronic boards are sensitive to electronic discharge (ESD). In order to prevent damage, always use an ESD strap supplied in the standard accessory kit (see “[Accessory Kit](#)” on page 208) when handling electronic boards and components.

- 1 Unwrap the first two folds of the band and wrap the exposed adhesive side firmly around your wrist.
- 2 Unroll the rest of the band and peel the liner from the copper foil at the opposite end.
- 3 Attach the copper foil to a convenient and exposed electrical ground.



**Figure 28** Using the ESD Strap

## Overview of the Repairing of the Detector

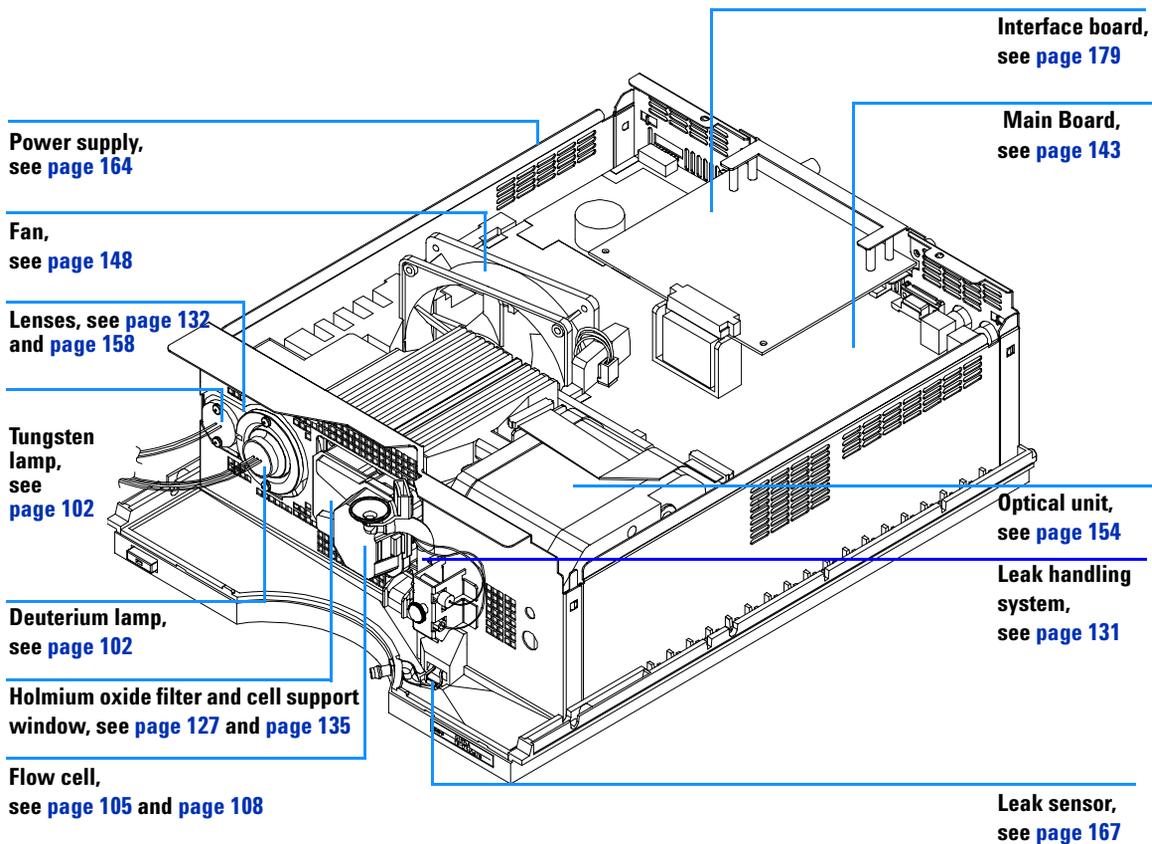
**NOTE**

With the introduction of the G1315B/G1365B DAD/MWD some of the metal plates look different (no air openings) compared to the G1315A/G1365A DAD/MWD. The figures have changed for specific repairs only.

---

[Figure 29](#) shows the main assemblies and their locations.

## 4 Repairing the Detector



**Figure 29** Main Assemblies

## Simple Repairs

On the following pages repairs are described that can be carried out without opening the main cover.

**Table 7** Simple Repairs

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

## Exchanging a Lamp

<b>When required</b>	If noise or drift exceeds application limits or lamp does not ignite
<b>Tools required</b>	Screwdriver POZI 1 PT3
<b>Parts required</b>	Longlife Deuterium lamp 2140-0813 (without black cover) Longlife Deuterium lamp 5181-1530 (with black cover) Deuterium lamp 2140-0590 (without black cover) Tungsten lamp G1103-60001

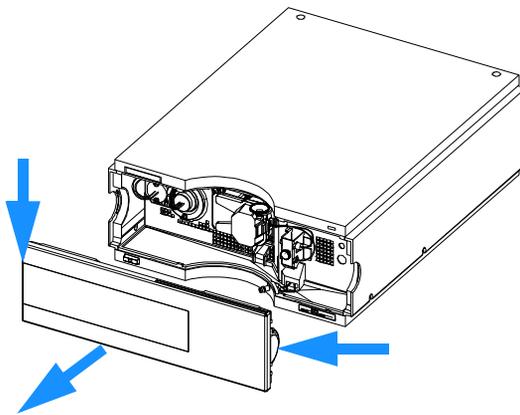
### Preparations for this procedure:

- Turn the lamp(s) off.

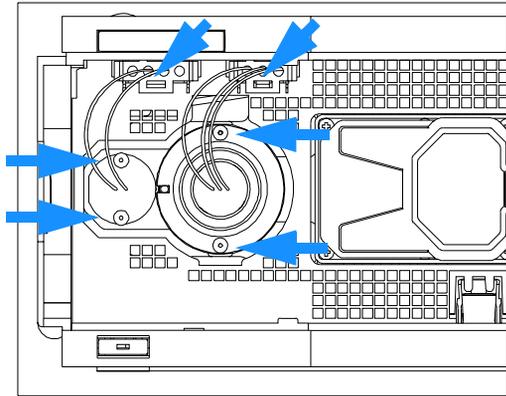
### CAUTION:

**If the detector has been in use, the lamp may be hot.  
If so, wait five minutes until lamp cools off.**

- 1 Press the release buttons and remove the front cover to have access to the lamp area.

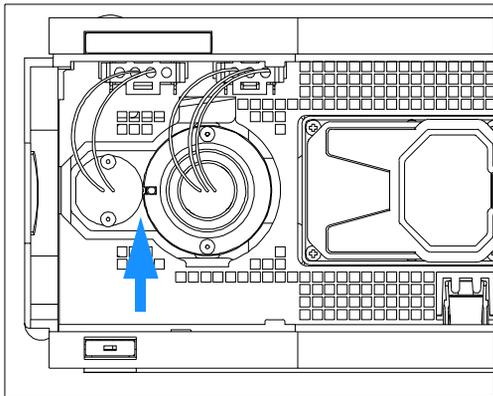


- 2** Disconnect lamp from the connector and unscrew the lamp.

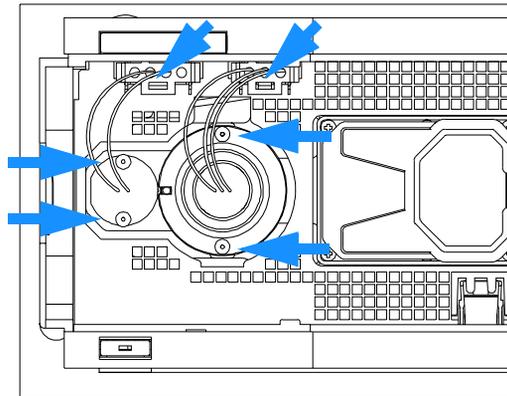


- 3** Remove the lamp. Do not touch the glass bulb with your fingers.

- 4** When replacing the vis-lamp, assure that the vis-lamp is inserted as shown (flat edge towards the deuterium lamp - opposite as in the figure).

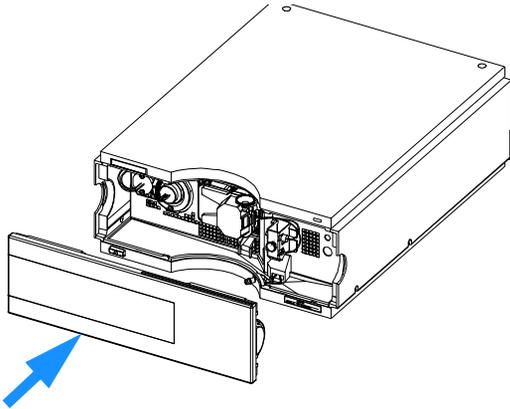


- 5** Insert the lamp. Fix the screws and reconnect the lamp to connector.



## 4 Repairing the Detector

6 Replace the front cover.



### Next steps:

- Reset the lamp counter as described in the user interface documentation.
- Turn the lamp on.
- Give the lamp 10 minutes to warm up.
- Perform an intensity test, see ["Intensity Test"](#) on page 88.

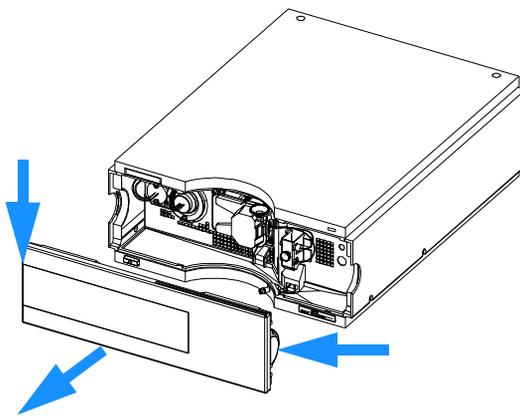
## Exchanging a Flow Cell

<b>When required</b>	If an application needs a different type of flow cell or the flow cell needs repair.
<b>Tools required</b>	Two 1/4 inch wrenches for capillary connections
<b>Parts required</b>	Standard flow cell, 10 mm, 13 $\mu$ l, 120 bar, G1315-60012 Semi-micro flow cell, 6 mm, 5 $\mu$ l, 120 bar, G1315-60011 High pressure flow cell, 6 mm, 1.7 $\mu$ l, 400 bar, G1315-60015 Nano flow cell, refer to <a href="#">"Nano Flow Cell - Replacing or Cleaning"</a> on page 122

### Preparations for this procedure:

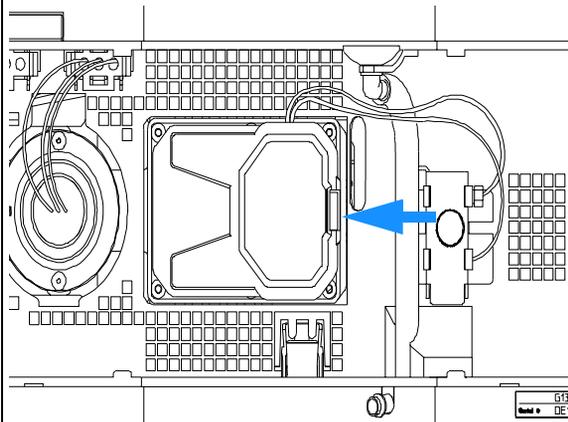
- Turn the lamp(s) off.

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

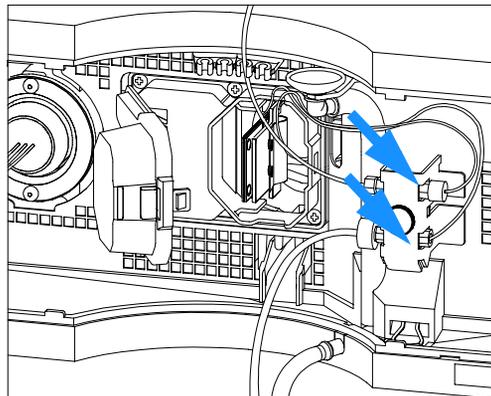


## 4 Repairing the Detector

- 2 Press the release button and open the flow cell door.



- 3 Disconnect the cell inlet and the cell outlet capillary and the waste capillary from the capillary holder.



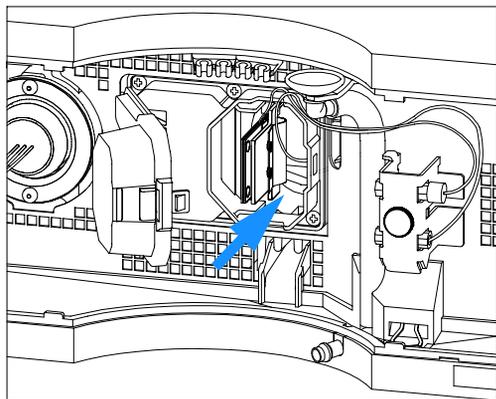
- 4 Remove the flow cell by pressing the flow cell holder.

### Note:

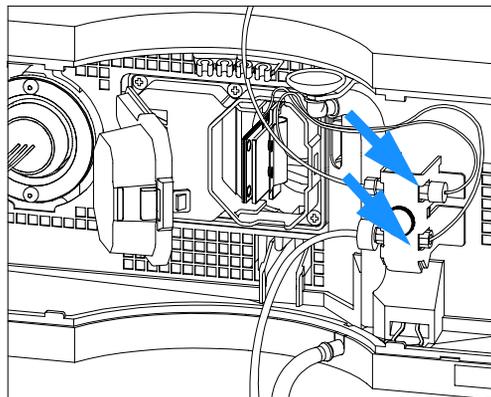
The label attached to the flow cell provides information on part number, path length and maximum pressure.

If you want to replace flow cell parts, see [“Repairing the Standard or Semi-Micro Flow Cell”](#) on page 108 or [“Repairing the Standard or Semi-Micro Flow Cell”](#) on page 108.

**5** Insert the flow cell into the cell compartment and close the cell door.



**6** Reconnect the waste capillary and the cell inlet and the cell outlet tubing to the capillary holder.



**Note:**

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

**Next steps:**

- Perform a wavelength calibration or holmium test (see “[Holmium Oxide Test](#)” on page 86), to check the correct positioning of the flow cell.
- Replace the front cover.

## Repairing the Standard or Semi-Micro Flow Cell

<b>When required</b>	If the flow cell needs repair due to leaks or contaminations (reduced light throughput)
<b>Tools required</b>	Two 1/4 inch wrenches for capillary connections hexagonal key 4 mm Tooth picks
<b>Parts required</b>	For parts, see <a href="#">“Standard Flow Cell”</a> on page 186 and <a href="#">“Semi-Micro Flow Cell”</a> on page 188

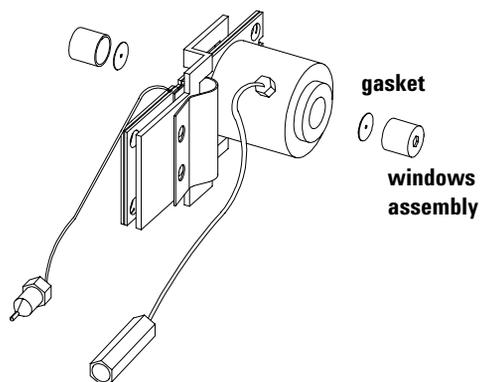
### NOTE

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

#### Preparations for this procedure:

- Turn off the flow.
- Remove the front cover.
- Remove the flow cell, see [“Exchanging a Flow Cell”](#) on page 105.

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



**Note:**

**If you want to replace the gasket only, continue with step 8.**

**Do not mix the gasket #6 and #7. They are different for standard and semi-mirco flow cell.**

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

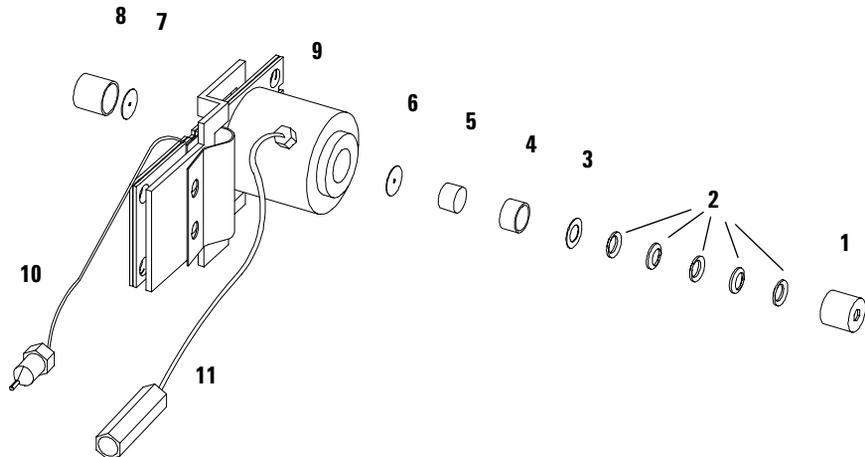
**3** If the washers fall out of the window assembly, they must be inserted in the correct order with the Teflon® ring to prevent any leaks from the flow cell window.

**Orientation of Flow Cell Parts**

**NOTE**

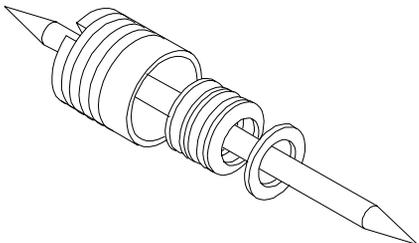
**Gaskets # 6 and #7 have different hole diameters**

- 1** window screw
- 2** spring washers
- 3** compression washer
- 4** window holder
- 5** quartz window
- 6** gasket
- 7** gasket
- 8** window screw contains items 2, 3, 4 and 5
- 9** flow cell
- 10** inlet capillary
- 11** outlet capillary

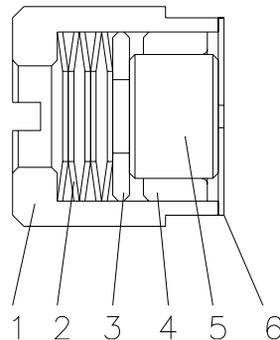


## 4 Repairing the Detector

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



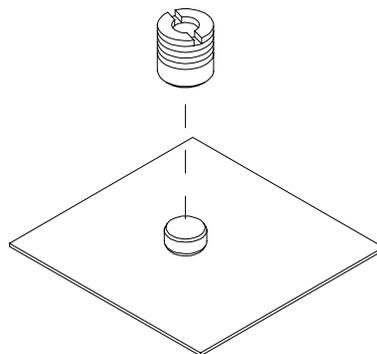
**5** Correct orientation of spring washers [2] is required.



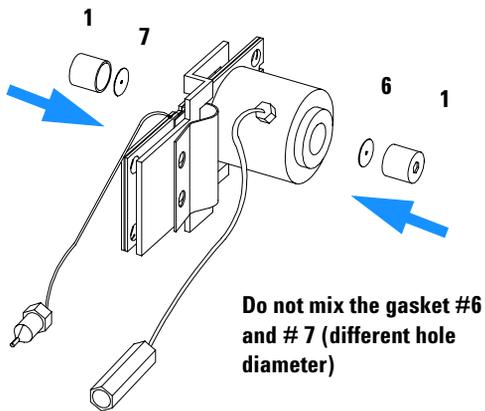
**6** Press the Teflon® ring into the window assembly.



**7** Press the window assembly onto the new or cleaned quartz window.



8 Insert a new gasket [6, 7] and the window assembly [1] into the cell body. Assure, that the gasket is on the bottom.



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

**Next steps:**

- Reconnect the capillaries, see [“Exchanging a Flow Cell”](#) on page 105.
- Perform a leak test.
- Insert the flow cell.
- Replace the front cover
- Perform a wavelength calibration, see [“Wavelength Recalibration”](#) on page 84 or holmium test, see [“Holmium Oxide Test”](#) on page 86 to check the correct positioning of the flow cell.

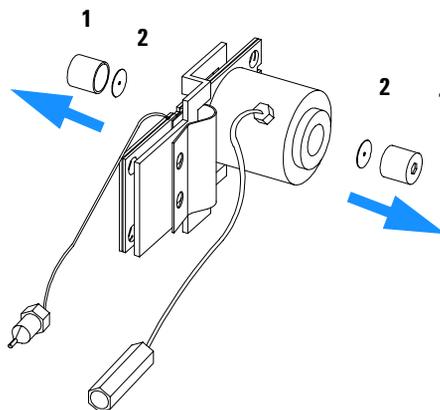
## Repairing the High Pressure Flow Cell

<b>When required</b>	If the flow cell needs repair due to leaks or contaminations (reduced light throughput)
<b>Tools required</b>	Two 1/4 inch wrenches for capillary connections hexagonal key 4 mm Tooth picks
<b>Parts required</b>	For parts see “High Pressure Flow Cell” on page 190

### Preparations for this procedure:

- Turn off the flow.
- Remove the front cover.
- Remove the flow cell, see “Exchanging a Flow Cell” on page 105.

1 Remove the window assembly (1) and the gasket (2) from the cell body.



If you want to replace the gasket only, continue with step 8.

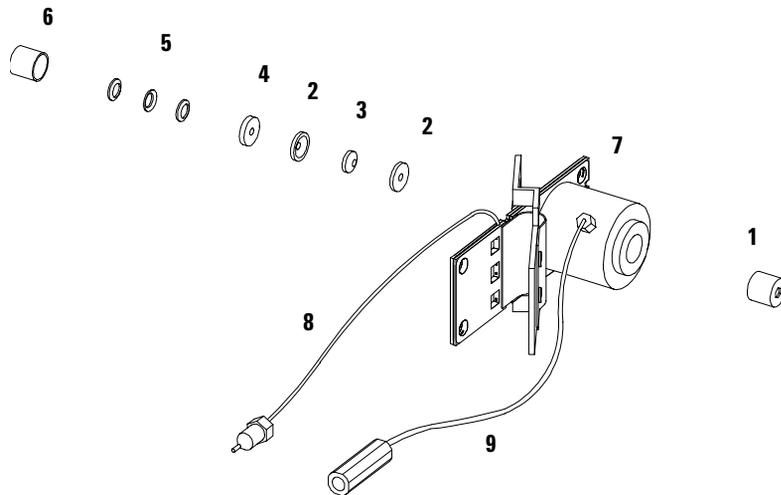
2 Use a tooth pick to remove the quartz window from the window assembly.

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

Follow the procedure **“Repairing the Standard or Semi-Micro Flow Cell”** on page 108 for reassembling.

**Orientation of Flow Cell Parts**

- 1 window screw
- contains items 2, 3, 4, 5 and 6
- 2 seal ring
- 3 quartz window
- 4 compression washer
- 5 spring washers
- 4 window holder
- 6 window screw
- 7 flow cell
- 8 inlet capillary
- 9 outlet capillary



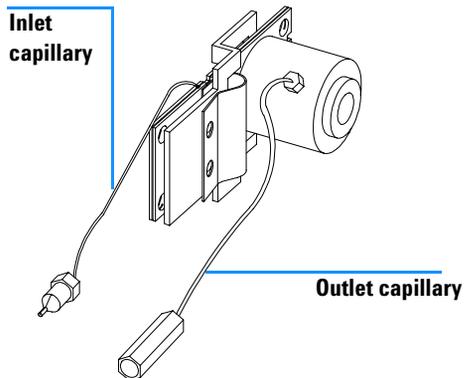
## Replacing Capillaries on a Standard Flow Cell

<b>When required</b>	If the capillary is blocked
<b>Tools required</b>	Two 1/4 inch wrenches for capillary connections Wrench 4 mm for capillary connections Screwdriver Pozi 1 PT3
<b>Parts required</b>	For parts see “ <a href="#">Standard Flow Cell</a> ” on page 186

### Preparations for this procedure:

- Turn off the flow.
- Remove the front cover.
- Remove the flow cell, see “[Exchanging a Flow Cell](#)” on page 105.

1 Identify the inlet and outlet capillaries.

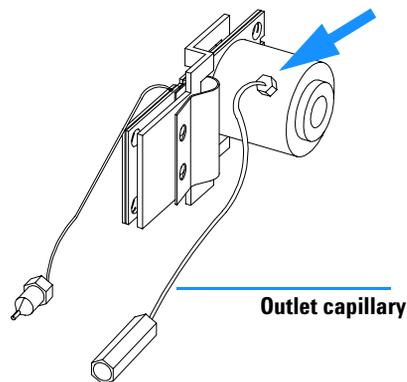


**Notes**

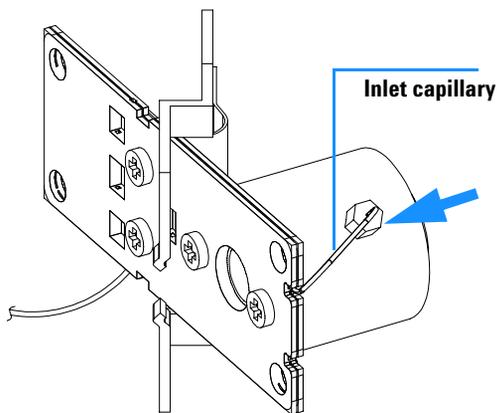
The fittings at the flow cell body are special types for low dead volumes and not compatible with other fittings.

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.

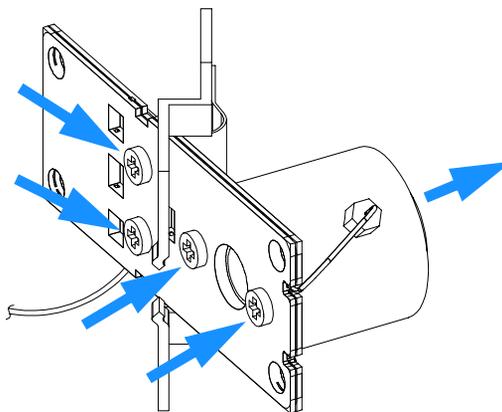
2 After replacing the outlet capillary, fix it handtight first. Then do a 1/4 turn with a 4-mm wrench.



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

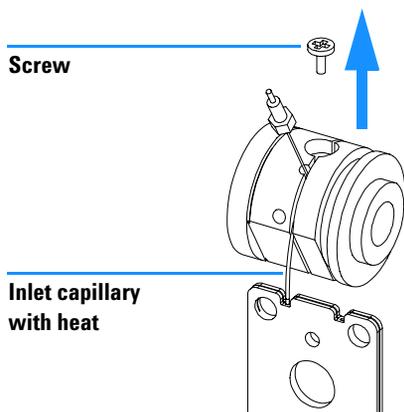


4 Unscrew the cell body from the heat exchanger and the heat exchanger from the clamp unit.

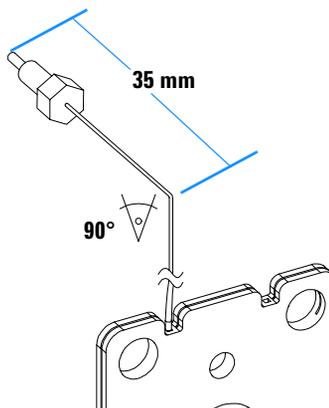


## 4 Repairing the Detector

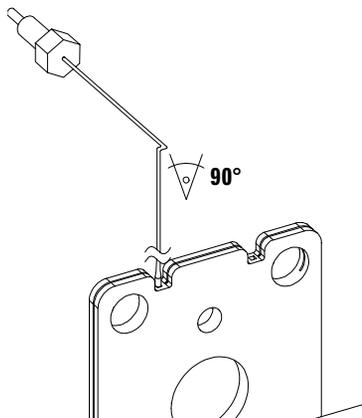
**5** Unscrew the fixing screw and unwrap the inlet capillary from the groove in the flow cell body.



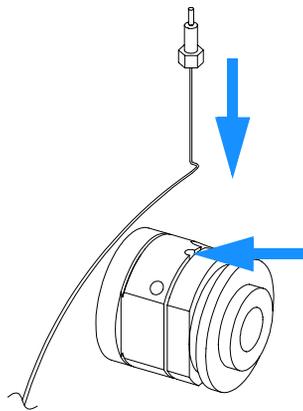
**6** Take the new inlet capillary and bend it 90° about 35 mm from its end.



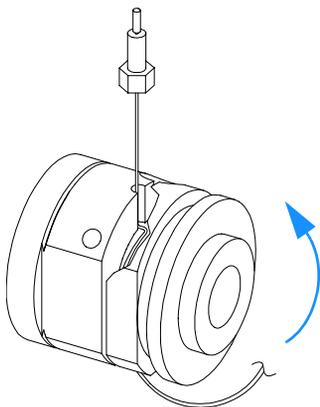
**7** Bend the capillary again by 90° as shown below.



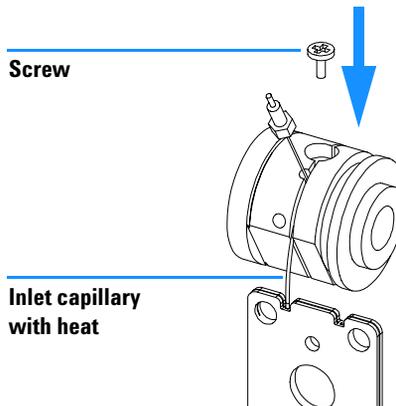
**8** Insert the capillary into the hole between fixing screw and the inlet fitting.



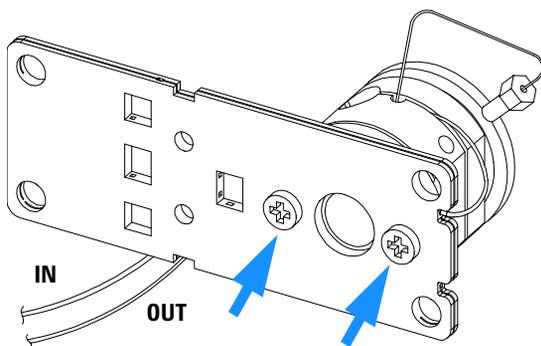
**9** The capillary lays in the groove and should be tied around the body (in the groove) 5 times.



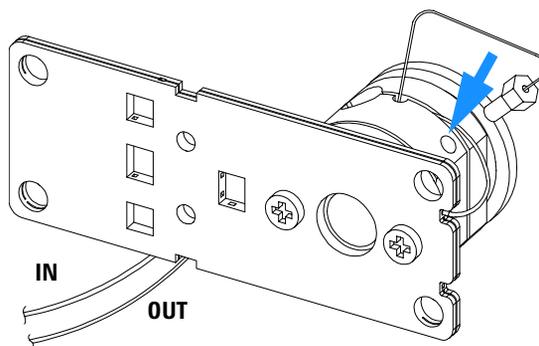
**10** Insert the fixing screw, so that the capillary cannot leave the groove.



**11** Fix the flow cell body to the heat exchanger.

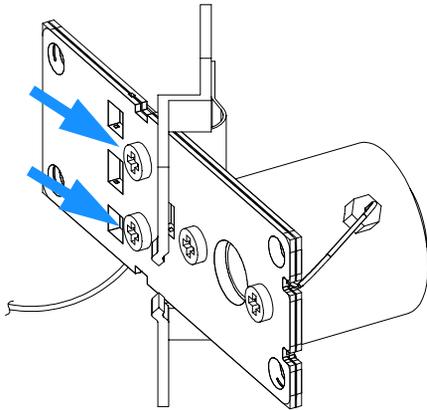


**12** Fix the inlet capillary to the flow cell body handtight first. Then do a 1/4 turn with a 4-mm wrench.



## 4 Repairing the Detector

**13** Fix the new heat exchanger to the clamp unit.



### Next steps:

- Reconnect the capillaries, see [“Exchanging a Flow Cell”](#) on page 105.
- Perform a leak test.
- Insert the flow cell.
- Replace the front cover.
- Perform a wavelength calibration, see [“Wavelength Recalibration”](#) on page 84 or holmium test, see [“Holmium Oxide Test”](#) on page 86 to check the correct positioning of the flow cell.

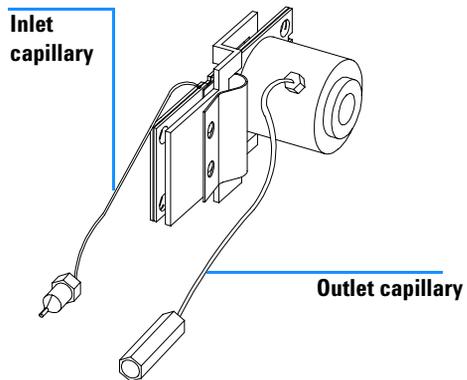
## Replacing Capillaries on a Semi-Micro and High Pressure Flow Cell

<b>When required</b>	If the capillary is blocked
<b>Tools required</b>	Two 1/4 inch wrenches for capillary connections Wrench 4 mm for capillary connections Screwdriver Pozi 1 PT3
<b>Parts required</b>	For parts see " <a href="#">Semi-Micro Flow Cell</a> " on page 188

### Preparations for this procedure:

- Turn off the flow.
- Remove the front cover.
- Remove the flow cell, see "[Exchanging a Flow Cell](#)" on page 105.

1 Identify the inlet and outlet capillaries.



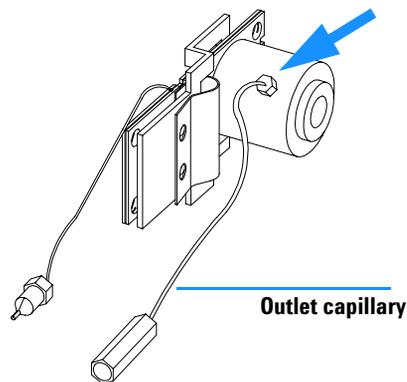
## 4 Repairing the Detector

### Notes

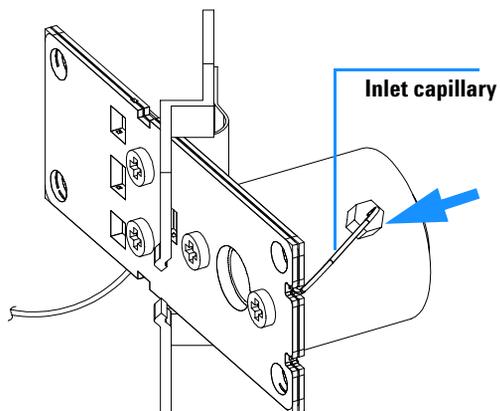
The fittings at the flow cell body are special types for low dead volumes and not compatible with other fittings.

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.

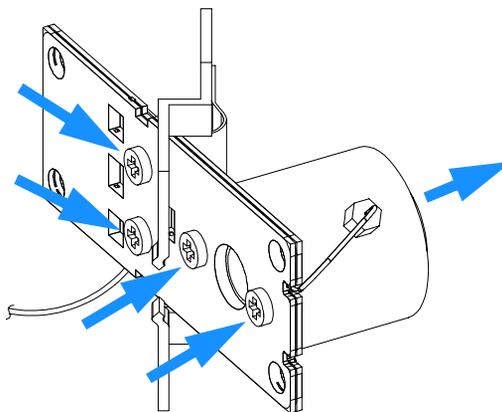
2 After replacing the outlet capillary, fix it handtight first. Then do a 1/4 turn with a 4-mm wrench.



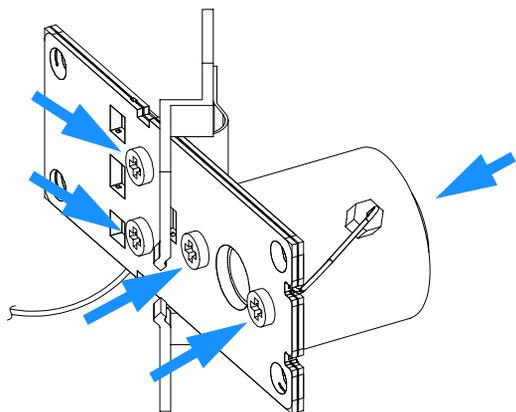
3 To replace the inlet capillary, use a 4-mm wrench for the fitting.



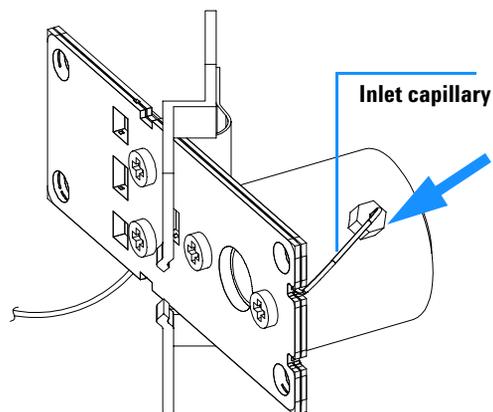
4 Unscrew the cell body from the heat exchanger and the heat exchanger from the clamp unit.



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



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



**Next steps:**

- Reconnect the capillaries, see “[Exchanging a Flow Cell](#)” on page 105.
- Perform a leak test.
- Insert the flow cell.
- Replace the front cover.
- Perform a wavelength calibration, see “[Wavelength Recalibration](#)” on page 84 or holmium test, see “[Holmium Oxide Test](#)” on page 86 to check the correct positioning of the flow cell.

## Nano Flow Cell - Replacing or Cleaning

<b>When required</b>	If parts are contaminated or leaky.
<b>Tools required</b>	Screwdriver POZI 1 PT3 Two 1/4 inch wrenches for capillary connections
<b>Parts required</b>	For parts identification refer to “Nano Flow Cells” on page 192 (80 nl and 500 nl).

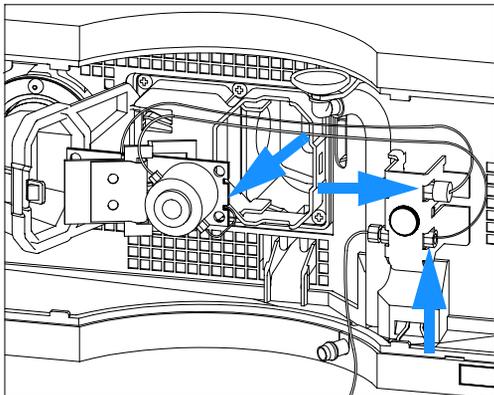
### NOTE

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

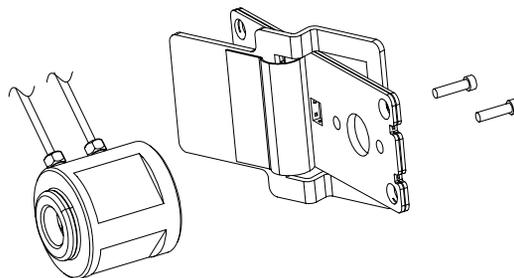
### NOTE

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

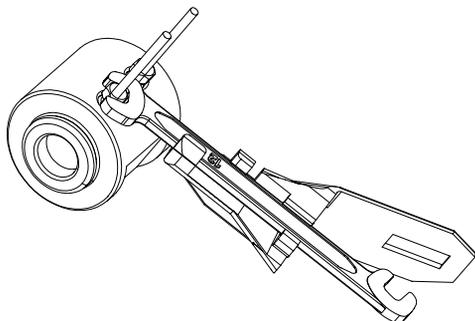
**1** Disconnect the capillaries from the capillary holder and remove the flow cell.



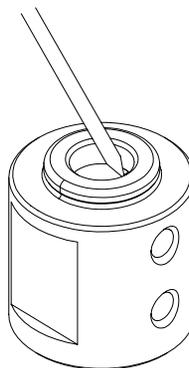
**2** Unscrew the cell body from the holder.



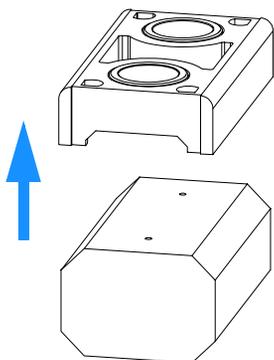
**3** Unscrew the capillaries from the flow cell. DO NOT use the adapter at this time!



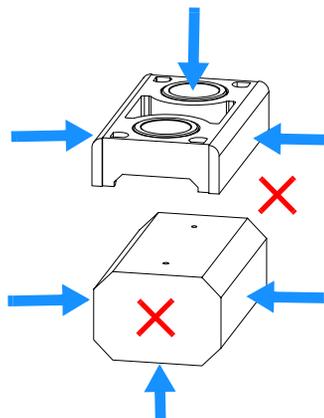
**4** Using for example a toothpick, press on the plastic part and slide the quartz body out of the cell housing.



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

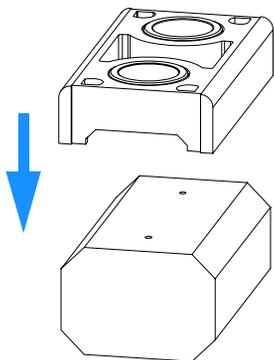


**6** This figure shows the correct holding of the quartz body and the cell seal assembly.

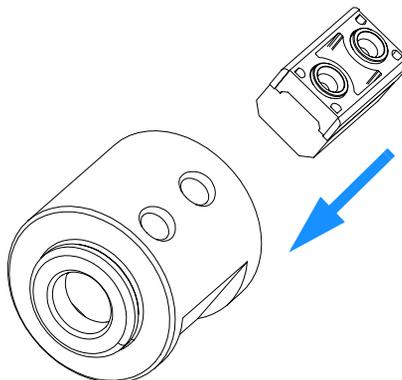


## 4 Repairing the Detector

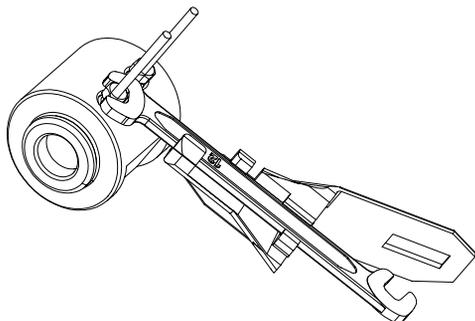
**7** Replace the cell seal assembly onto the quartz body. Always use a new seal assembly to exclude damage during disassembling.



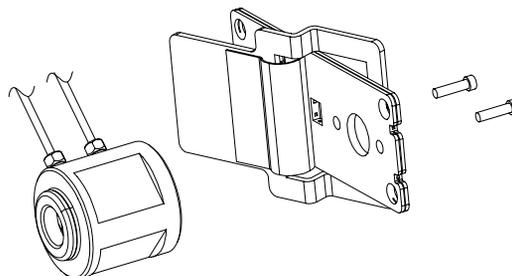
**8** Slide the quartz body completely into the cell body to the front stop (use for example a toothpick).



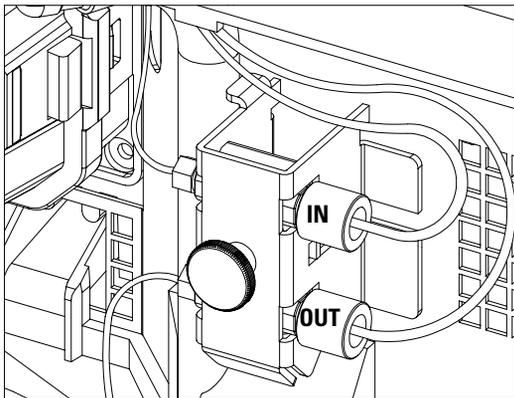
**9** Insert the flow cell capillaries and tighten them fingertight. Use the wrench and torque adapter as described on [page 126](#) and tighten the fittings alternately.



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



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



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

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

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

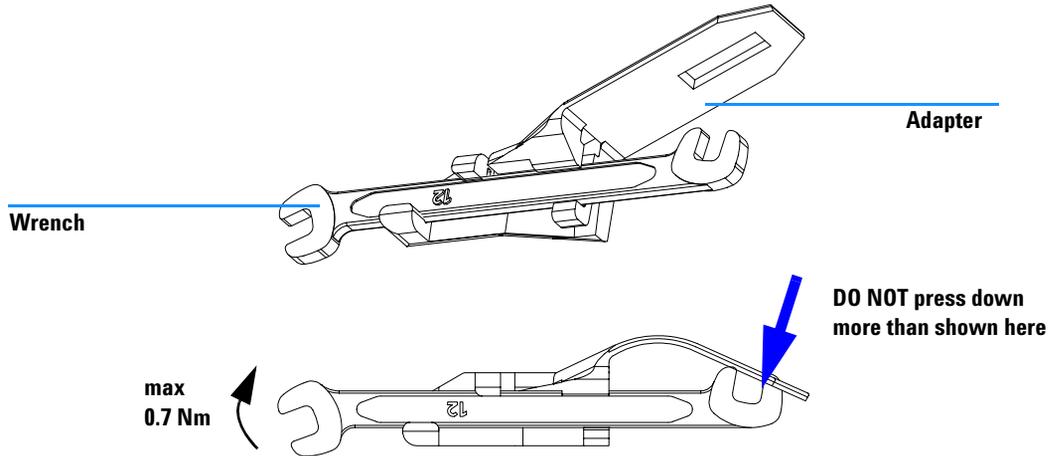
#### NOTE

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

#### NOTE

With the instrument accessory kit comes a 4-mm wrench and with the Sealing Kit a special adapter. Both together work as a torque wrench with pre-defined torque (maximum allowed torque for the cell fittings is 0.7 Nm). It can be used to tight the capillary fittings at the flow cell body. The wrench has to be plugged into the adapter as shown in [Figure 30](#).

## 4 Repairing the Detector



**Figure 30** Wrench plus Torque Adapter

## Cleaning or Exchanging the Holmium Oxide Filter

<b>When required</b>	If holmium oxide filter is contaminated
<b>Tools required</b>	Screwdriver POZI 1 PT3 Screwdriver flat blade Two 1/4 inch wrenches for capillary connections A pair of tweezers
<b>Parts required</b>	Holmium oxide filter 79880-22711

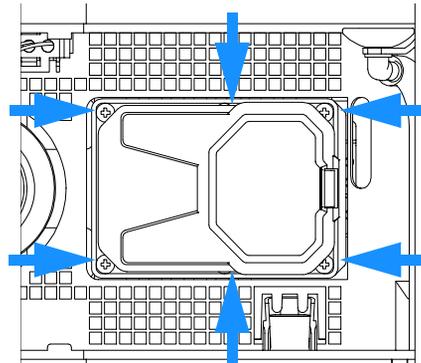
### NOTE

See also “[Declaration of Conformity for HOX2 Filter](#)” on page 310.

#### Preparations for this procedure:

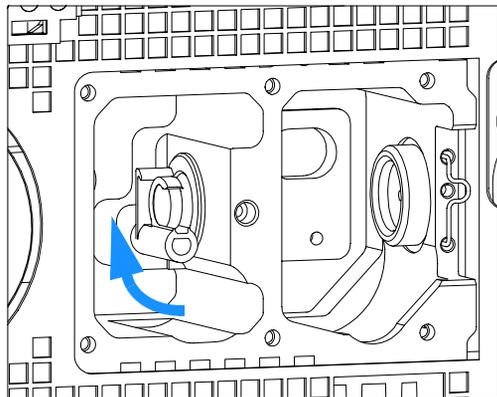
- Turn off the flow.
- Remove the front cover.
- Remove the flow cell, see “[Exchanging a Flow Cell](#)” on page 105.

1 Unscrew the six screws and remove the flow cell cover.

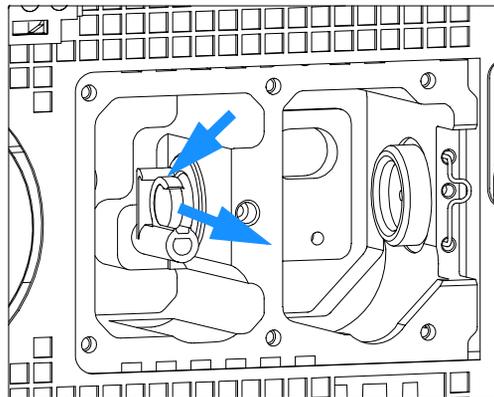


## 4 Repairing the Detector

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



- 3 While releasing the holder with a screwdriver, carefully remove the holmium oxide filter using a pair of tweezers covered with lint-free cloth or tape.

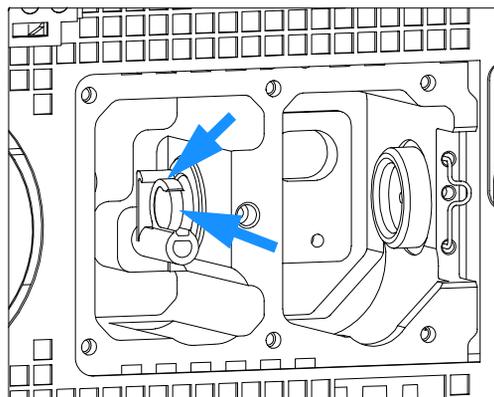


**Note:**

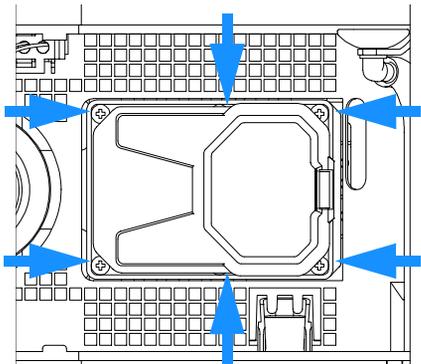
**Do not scratch the holmium oxide filter.**

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

- 4 While releasing the holder with a screw driver, carefully insert the holmium oxide filter.



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



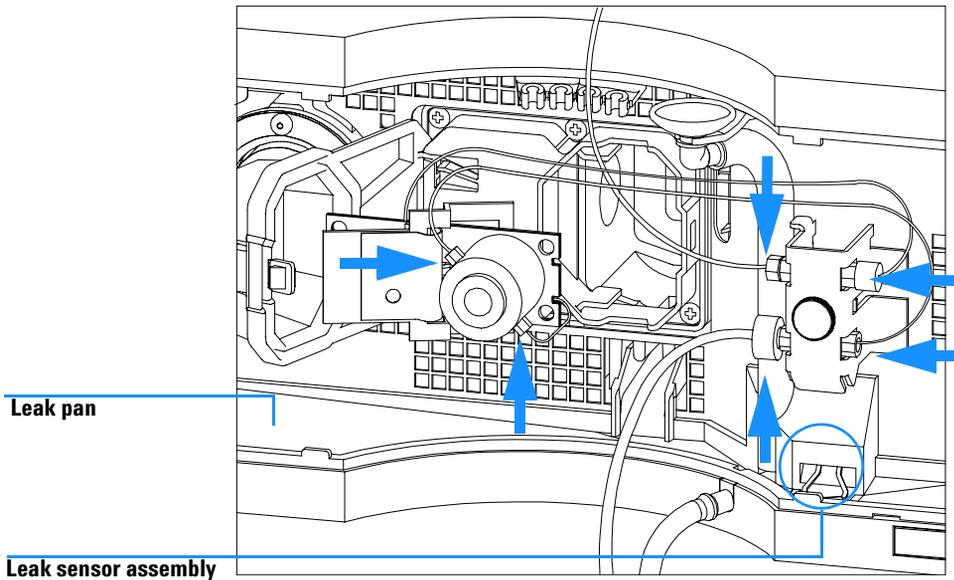
**Next steps:**

- Perform a holmium oxide test, see “[Holmium Oxide Test](#)” on page 86 to check the proper function of the holmium oxide filter.
- Insert the flow cell, see “[Exchanging a Flow Cell](#)” on page 105.
- Replace the front cover.
- Turn on the flow.

## Correcting Leaks

<b>When required</b>	If a leakage has occurred in the flow cell area or at the heat exchanger or at the capillary connections
<b>Tools required</b>	Tissue Two 1/4 inch wrenches for capillary connections
<b>Parts required</b>	None

- 1 Remove the front cover.
- 2 Use tissue to dry the leak sensor area and the leak pan.
- 3 Observe the capillary connections and the flow cell area for leaks and correct, if required.
- 4 Replace the front cover.

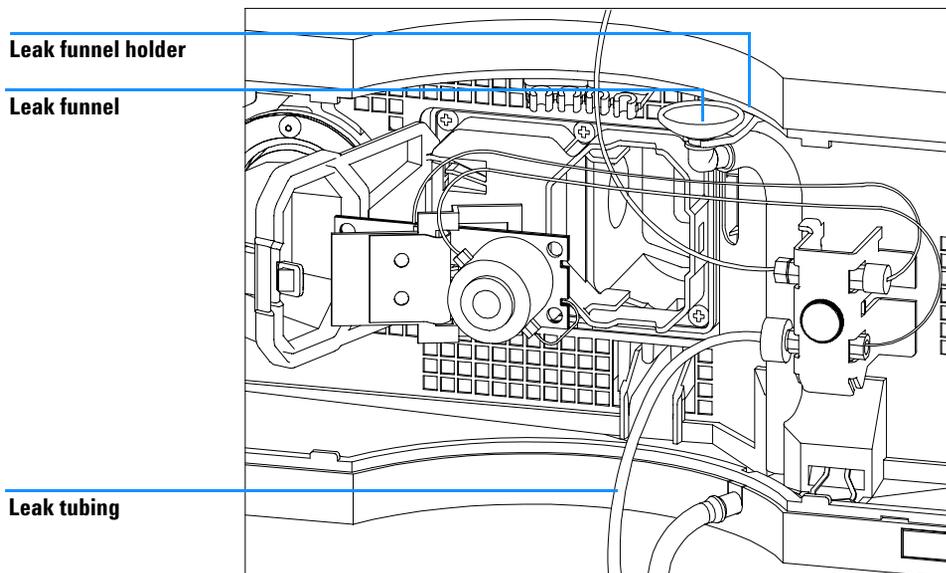


**Figure 31** Observing for Leaks

## Replacing Leak Handling System Parts

<b>When required</b>	If the parts are corroded or broken
<b>Tools required</b>	None
<b>Parts required</b>	Leak funnel 5061-3356 Leak funnel holder 5041-8389 Leak tubing (120 mm) 0890-1711

- 1 Remove the front cover.
- 2 Pull the leak funnel out of the leak funnel holder.
- 3 Pull out the leak funnel with the tubing.
- 4 Insert the leak funnel with the tubing in its position.
- 5 Insert the leak funnel into the leak funnel holder.
- 6 Replace the front cover.



**Figure 32** Replacing Leak Handling System Parts

## Cleaning or Replacing Coupling Lens Assembly

<b>When required</b>	The coupling lens assembly is located between the tungsten and the deuterium lamp. It may be replaced when light transmission is reduced and a lamp exchange or window cleaning does not improve the light throughput.
<b>Tools required</b>	Screwdriver POZI 1 PT3 hexagonal key 1.5 mm A pointed pair of pliers
<b>Parts required</b>	Coupling lens assembly G1103-68001

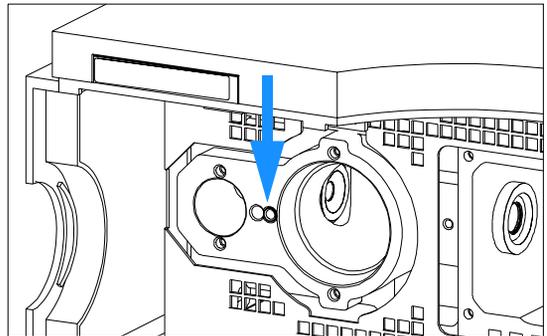
### Preparations for this procedure:

- Turn off the lamp(s).

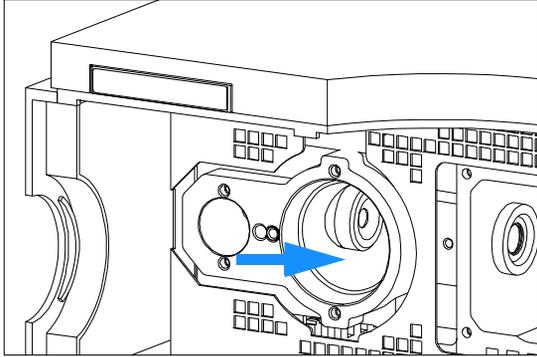
**If the detector was in use, the lamp may be hot. If so, wait five minutes until lamp cools off.**

- Remove the front cover.
- Remove both lamps, see “[Exchanging a Lamp](#)” on page 102.

- 1 Use the 1.5-mm hex key to loosen the setscrew that secures the lens assembly.

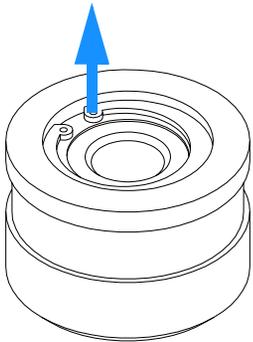


**2** Carefully slide the lens assembly to the right into the deuterium lamp area by pushing it from the tungsten lamp side with the hex key.

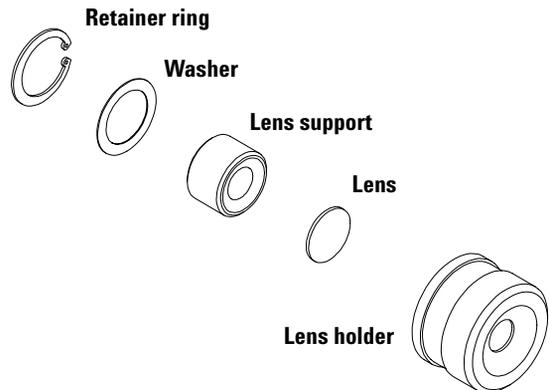


**3** Remove the lens assembly completely.

**4** The assembly may be disassembled using a pair of pliers to remove the retainer ring.

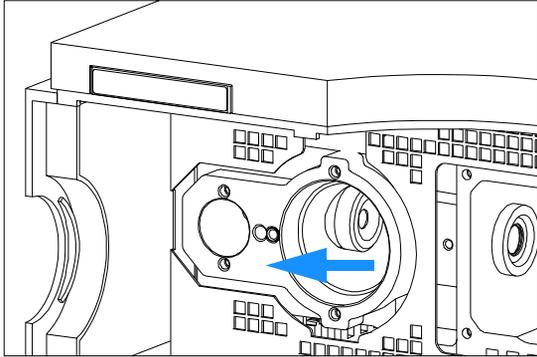


**5** The lens may be cleaned or the complete assembly must be exchanged.

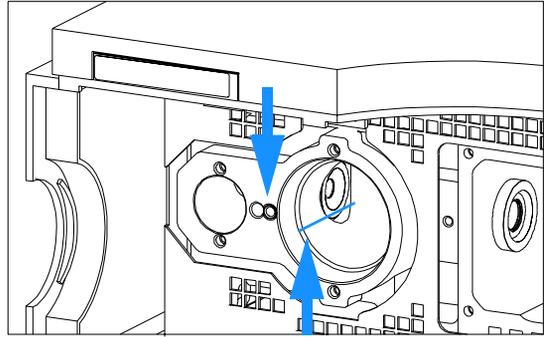


## 4 Repairing the Detector

6 Insert the rebuilt or new lens assembly and slide it into its holder.



7 Align the lens assembly with the wall of the deuterium area. Fix the setscrew that secures the lens assembly.



### Next steps:

- Replace both lamps.
- Perform an intensity test to check the proper function.
- Replace the front cover.

## Cleaning or Replacing Cell Support Window

<b>When required</b>	This window is located between the holmium oxide filter and the flow cell. It may be replaced when the transmission of light is reduced and a lamp exchange or a window cleaning does not improve the light throughput.
<b>Tools required</b>	Screwdriver POZI 1 PT3 hexagonal key 1.5 mm Pointed pair of pliers
<b>Parts required</b>	Cell support window 79880-28111 Cell support window assembly G1315-65202 For others., see “Cell Support Assembly” on page 200

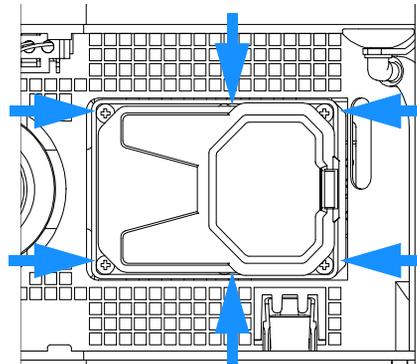
### Preparations for this procedure are:

- Turn off the lamp(s).

**If the detector was in use, the lamp may be hot. If so, wait 5 minutes until lamp cools.**

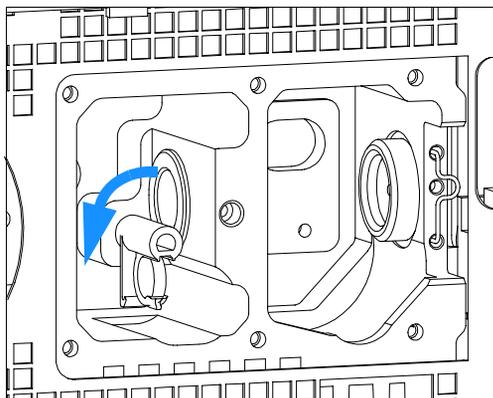
- Remove the front cover.
- Remove the flow cell, see “Exchanging a Flow Cell” on page 105.

### 1 Unscrew the six screws and remove the flow cell cover.

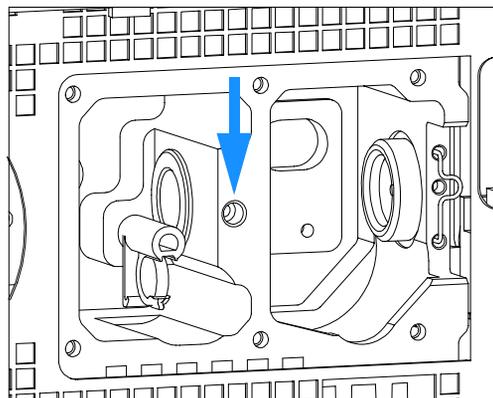


## 4 Repairing the Detector

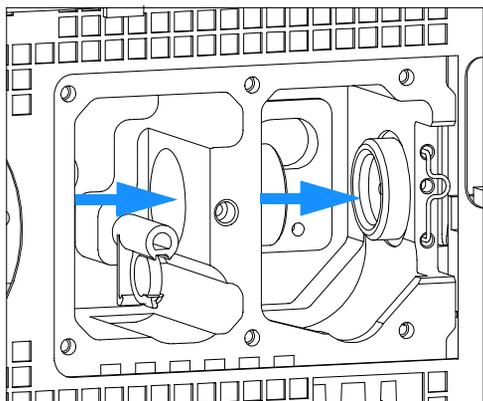
- 2** If not already in this position, move the holmium oxide filter down.



- 3** Use the 1.5-mm hex key to loosen the setscrew that secures the cell support assembly.

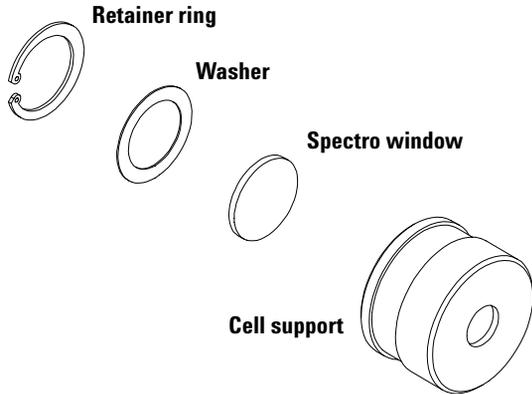


- 4** Carefully slide the assembly to the right into the flow cell compartment by pushing it from the holmium oxide filter side.

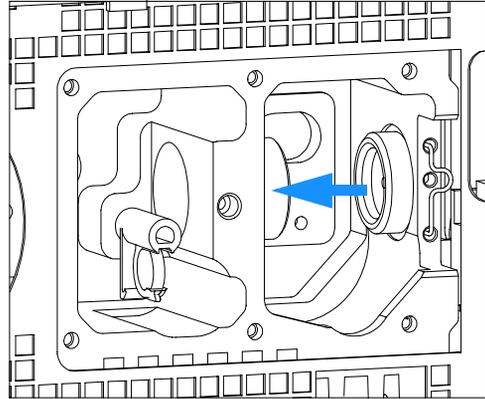


- 5** Remove the cell support assembly completely.

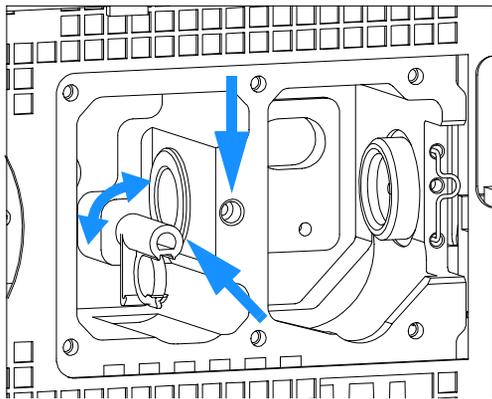
**6** The assembly may be disassembled using a pair of pliers to remove the retainer ring. The window may be cleaned or the complete assembly must be exchanged.



**7** Insert the rebuilt or new assembly and slide it in until it is stopped by the filter lever.



**8** Leave slight clearance for movement of the filter lever between both, the lens assembly and the filter lever, and fix the setscrew.



**Next steps:**

- Perform a filter test to check the proper function.
- Replace the flow cell cover, see ["Cleaning or Exchanging the Holmium Oxide Filter"](#) on page 127.
- Replace both lamps.
- Replace the front cover.

## Exchanging Internal Parts

### WARNING

The following procedures require opening the main cover of the detector. Always ensure the detector is disconnected from the line power when the main cover is removed. The security lever at the power input socket prevents that the detector cover is taken off when line power is still connected.

---

### WARNING

To disconnect the detector from line, unplug the power cord. The power supply still uses some power, even if the switch on the front panel is turned off.

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

When working with solvents please observe appropriate safety procedures (for example, goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the solvent vendor, especially when toxic or hazardous solvents are used.

---

### NOTE

The electronics of the detector will not allow operation of the detector when the top cover and the top foam are removed. A safety light switch on the main board will inhibit the operation of the fan immediately. Voltages for the other electronic components will be turned off after 30 seconds. The status lamp will lit red and an error will be logged into the logbook of the user interface. Always operate the detector with the top covers in place.

---

### CAUTION

Electronic boards and components are sensitive to electronic discharge (ESD). In order to prevent damage always use an ESD protection (for example, the ESD wrist strap from the accessory kit) when handling electronic boards and components, see [“Using the ESD Strap”](#) on page 98.

---

**WARNING**

Eye damage may result from directly viewing the light produced by the deuterium lamp used in this product. Always turn off the deuterium lamp before removing the deuterium lamp.

**NOTE**

With the introduction of the G1315B/G1365B DAD/MWD some of the metal plates look different (no air openings) compared to the G1315A/G1365A DAD/MWD. The figures have changed for specific repairs only.

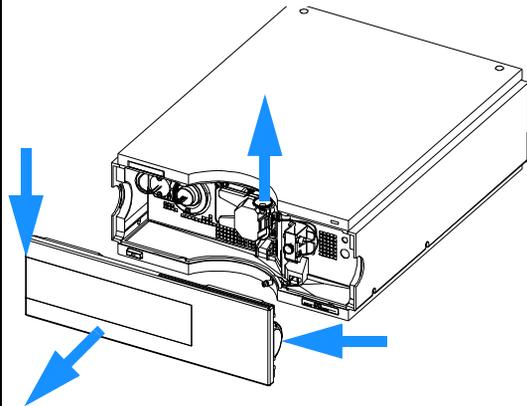
## Removing the Top Cover and Foam

<b>When required</b>	For all repairs inside the detector
<b>Tools required</b>	Screwdriver POZI 1 PT3 Screwdriver
<b>Parts required</b>	Depends on the work inside and the following procedures

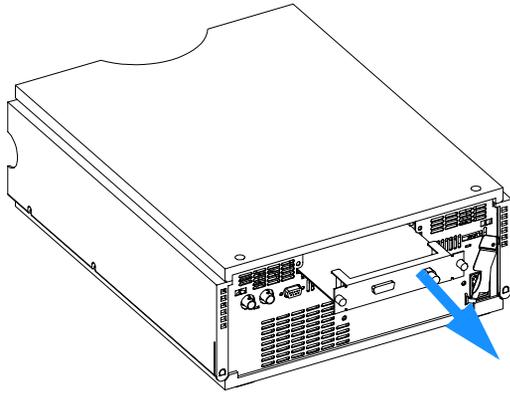
### Preparations for this procedure:

- Turn off the detector.
- Disconnect the power cable.
- Disconnect capillaries.
- Remove detector from stack and place it on the working bench.

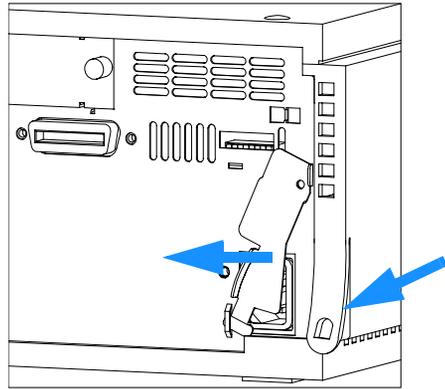
- 1 Press the release buttons and remove the front cover. Unclip the waste funnel assembly.



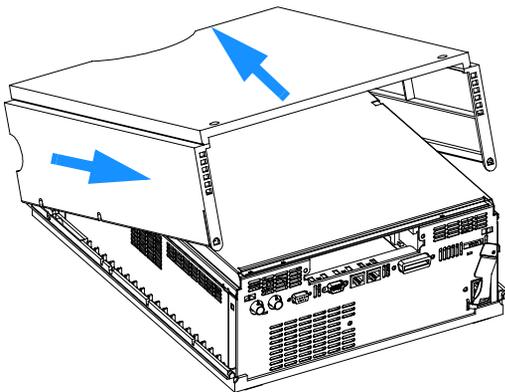
2 Install the ESD strap. If installed, unscrew and remove the interface board. Place the board on the ESD kit.



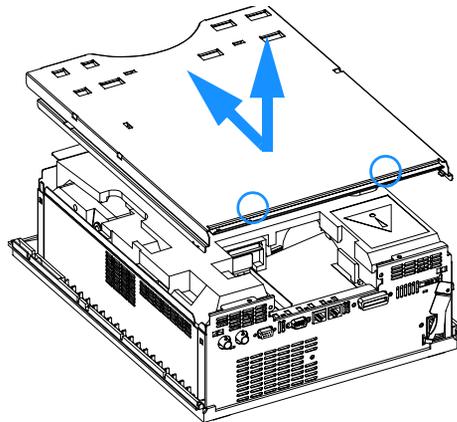
3 Move the power lock across the power inlet and lift the clips of the cover.



4 Lift the cover up and slide it towards the rear.

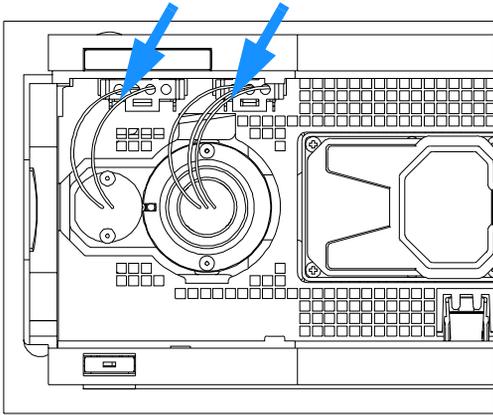


5 Unscrew the screws at the rear of the top plate, slide the plate towards the front and remove it.

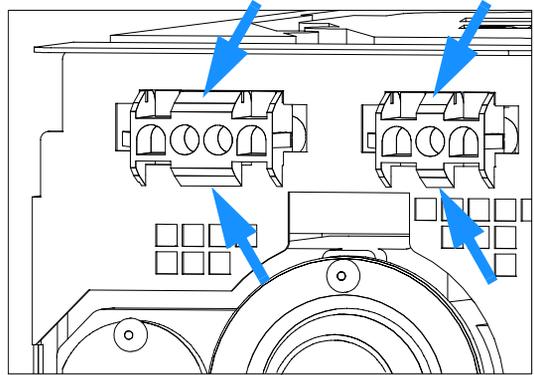


## 4 Repairing the Detector

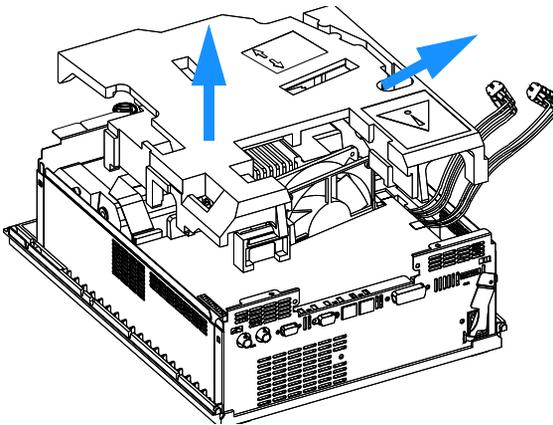
6 Disconnect the lamps from their connectors.



7 Remove the two lamp connectors towards the back by depressing their connector tabs with a screwdriver.



8 While removing the top foam section completely, route the lamp cables through the hole in the foam.



### Note:

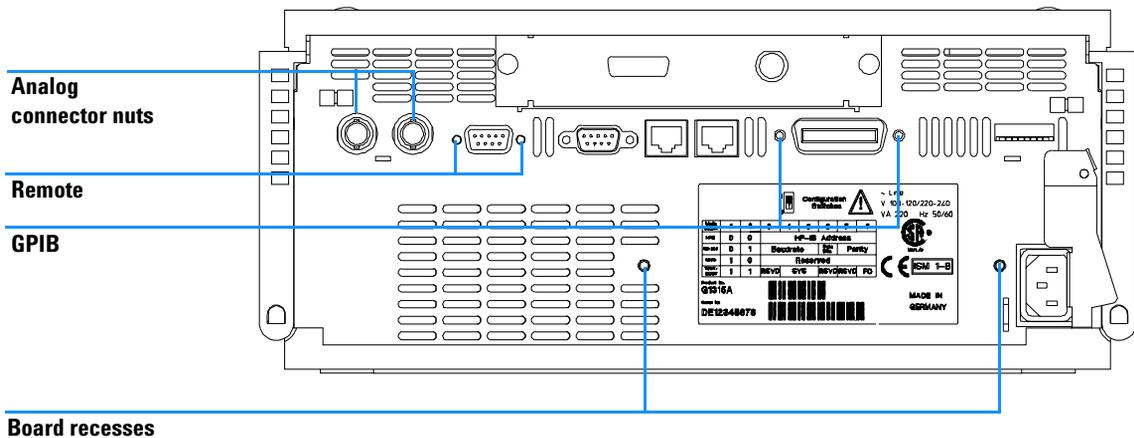
**Do not connect a power plug to the detector module after removing the top covers.**

**A safety light switch on the main board will turn off fan (immediately) and electronics (after 30 s) to avoid the operation with removed covers. An error will be generated (status lamp will light red) and the logbook will show an error message.**

## Exchanging the Detector Main Board

<b>When required</b>	If detector main board is defective or for repair on other assemblies
<b>Tools required</b>	Screwdriver POZI 1 PT3 Hexagonal wrenches 5 mm, 7 mm and 15 mm
<b>Parts required</b>	Detector main board (DAM) G1315-69540 (exchange assembly) for G1315A/B DAD Detector main board (MWM) G1365-69540 (exchange assembly) for G1365A/B MWD

- 1 Turn off the lamp.
- 2 Switch off the module, and disconnect the cables.
- 3 Remove module from stack and place it on the working bench.



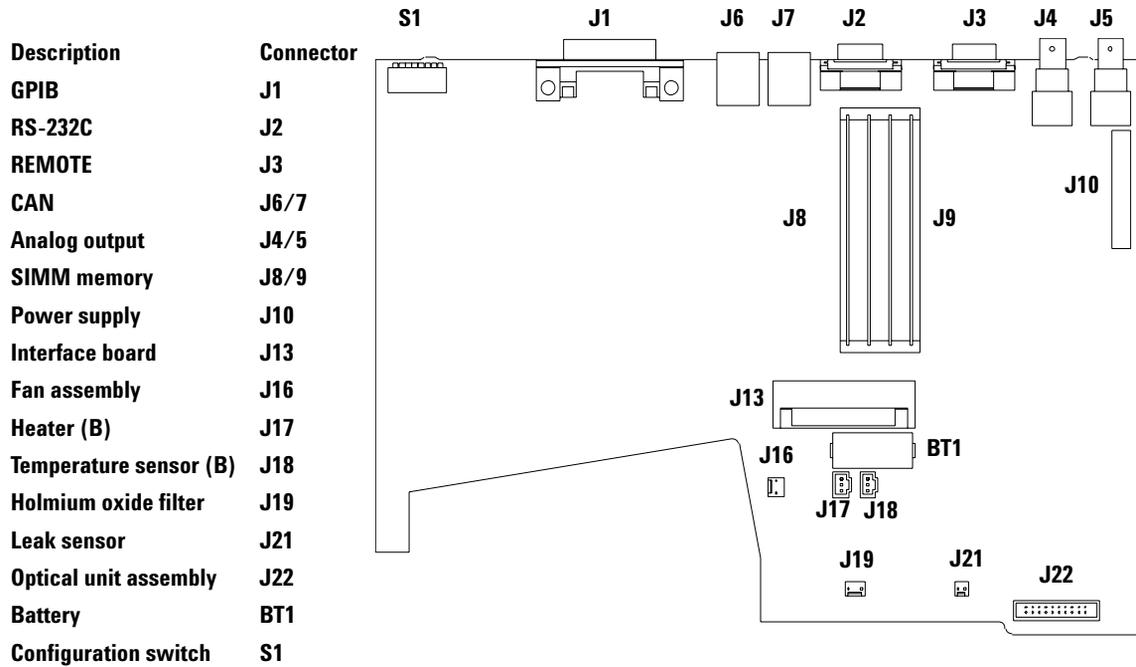
**Figure 33** Unscrew Connectors from Board

- 4 Remove the front cover, top cover and top foam section, see “[Removing the Top Cover and Foam](#)” on page 140.
- 5 Use a 5-mm and 7-mm wrench to unscrew the REMOTE and the GPIB connector and a 15-mm wrench to unscrew the nuts of the ANALOG connectors.
- 6 Disconnect all connectors from the detector main board.

## 4 Repairing the Detector

### NOTE

When removing connectors, counter-hold with one hand on connector J13.



**Figure 34** Location of Connectors on Detector Main Board

### NOTE

Since board version -66540, the external memory slots (SIMM) have been removed. The 1 MB RAM is now on-board and not upgradeable (not required for any applications).

- 7 Remove the detector main board. Place the board on the ESD kit.
- 8 In most cases the RFI spring plate remains on the interface connectors of the board. Carefully remove the spring plate and place it back into its position in the instrument before installing a new board.
- 9 On the new board check the switch setting of address switch S1, see [“Setting the 8-bit Configuration Switch”](#) on page 261.

**NOTE**

An incorrect switch setting (for example, TEST/BOOT) may cause the module to turn in a basic mode (yellow or red flashing status light). In such a case turn off the module, reset the address switches, and turn on the module again.

---

- 10 Install the new detector main board and reconnect the connectors. Assure that the board is fitted correctly into the board recess in the rear panel.
- 11 Refit the screws at the REMOTE and GPIB connectors and the nuts of the ANALOG connectors.
- 12 Reinstall the top foam section, top cover and front cover, see [“Replacing the Foam and the Top Cover”](#) on page 175.
- 13 Replace detector into the stack and reconnect the cables.

**NOTE**

If a new detector main board is installed, update the serial number information of the detector in the user interface, see procedure below.

---

- 14 Check the firmware revision of the module. If the firmware revision is older than the current firmware revision of the module, update the firmware using the standard firmware update procedure, see [“Replacing the Detector’s Firmware”](#) on page 180.

**NOTE**

The G1315B DAD and the G1365B MWD require firmware revision 4.x or above (main and resident).

---

## Entering the Serial Number using the Control Module

- 1 Connect the control module to the detector. Turn on the detector.
- 2 In the control module, press System (F5), then Records (F4). Using the up/down arrows, make sure that the detector is highlighted.
- 3 Press FW Update (F5). Now, press the m key. This will display a box which says Update Enter Serial#.
- 4 Press Enter. This will display the box labeled Serial#.
- 5 Alphabetic characters and numbers are created using the up and down arrows. In the box labeled Serial#, enter the 10-character serial number for the detector. When the 10-character serial number is entered, press Enter to highlight the complete serial number. Then, press Done (F6).

### NOTE

For firmware revisions below A.02.00 it is important *never* to press Done if the Serial# box is blank. In this case, the module can no longer be recognized by either the control module or the Agilent ChemStation. The main board must then be replaced.

---

- 6 Turn the detector off, then on again. The Records screen should display the correct serial number for this module.
- 7 If a Agilent ChemStation is also connected, restart the Agilent ChemStation now as well.

## Entering the Serial Number using the Agilent ChemStation

Module serial numbers are entered by typing specific commands in the command line at the bottom of the main user interface screen.

- 1 To enter a module serial number, type the following command in the command line (depends on the detector type, either DAD or MWD):

```
print sendmodule$(ldad, "ser YYYYYYYYYY")
```

```
print sendmodule$(lmwd, "ser YYYYYYYYYY")
```

Where:

YYYYYYYYYY is the 10-character serial number of the module in question.

### NOTE

The first two characters are letters, which should be capitalized.

The reply line will respond with RA 0000 SER followed by the module serial number you just entered.

- 2 Turn off the detector, then on again. Then, restart the Agilent ChemStation. If the serial number you have just entered is different than the original module serial number, you will be given the opportunity to edit the configure 1100 access screen during the restart of the Agilent ChemStation.
- 3 After start up, the serial number you have just entered can be seen under the Instrument menu of the main user interface screen. The serial number of the detector can also be seen by typing the following command into the command line (depends on the detector type, either DAD or MWD):

```
print sendmodule$ (ldad, "ser?")
```

```
print sendmodule$ (lmwd, "ser?")
```

The reply line will give the module serial number.

## Exchanging the Fan (G1315A/G1365A)

**NOTE**

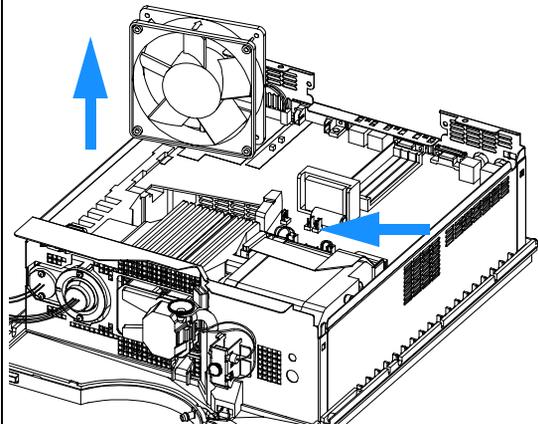
Use this procedure for the the G1315A/G1365A only. For G1315B/G1365B detectors refer to “Replacing Fan Parts (G1315B/G1365B)” on page 150.

<b>When required</b>	If the fan is defective or noisy
<b>Tools required</b>	Screwdriver POZI 1 PT3
<b>Parts required</b>	Fan assembly 3160-1016

**Preparations for this procedure:**

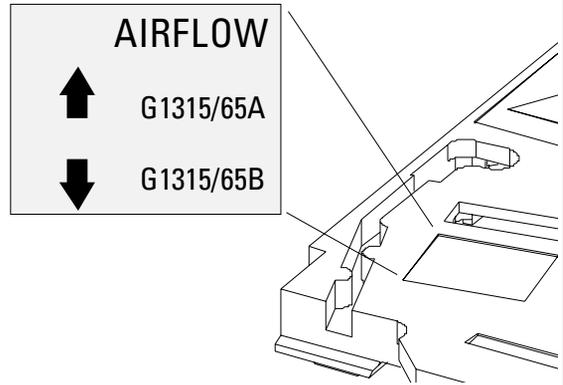
- Turn off the lamp.
- Switch off the detector, and disconnect the cables and acpillaries.
- Remove detector from stack and place it on the working bench.
- Remove front cover, top cover and top foam section, see “Removing the Top Cover and Foam” on page 140.

**1** Disconnect the connectors from the main board (fan J16) and pull the fan assembly out of its location.

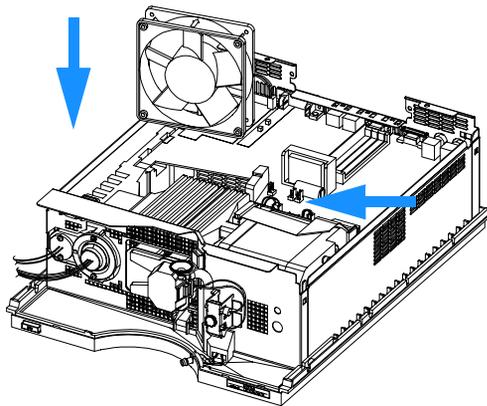


The fan must be installed in the correct orientation (see arrow on the fan) to ensure optimum cooling and operation of the detector. The direction of air flow is from the front towards the rear.

The figure below shows the required air flow direction.



2 Insert the fan assembly into its location and Reconnect the connector to the main board (fan J16), see figure below for location.



**Next steps:**

- Reinstall the top foam section, top cover and front cover, see ["Replacing the Foam and the Top Cover"](#) on page 175.
- Replace the detector into the stack.
- Reconnect cables, capillaries and turn on detector

## Replacing Fan Parts (G1315B/G1365B)

### NOTE

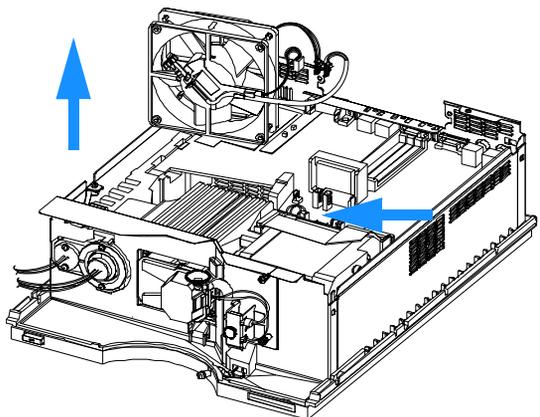
With the introduction of the G1315B/G1365B DAD/MWD a heater and a temperature sensor was added to the standard fan assembly. Also the air flow direction is reversed (now: rear to front). Use this procedure for the the G1315B/G1365B only. For G1315A/G1365A detectors refer to “[Exchanging the Fan \(G1315A/G1365A\)](#)” on page 148.

<b>When required</b>	If the fan is defective or noisy, if the temperature sensor or the heater fails
<b>Tools required</b>	Screwdriver POZI 1 PT3, a pair of pliers
<b>Parts required</b>	Fan assembly 3160-1016, Temperature sensor assembly G1315-60000, Heater assembly G1315-60003

### Preparations for this procedure:

- Turn off the lamp.
- Switch off the detector, and disconnect the cables and capillaries.
- Remove detector from stack and place it on the working bench.
- Remove front cover, top cover and top foam section, see “[Removing the Top Cover and Foam](#)” on page 140.

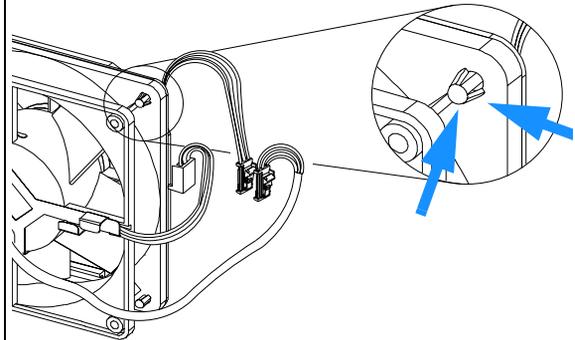
- 1 Disconnect the connectors from the main board; fan (J16), temperature sensor (J18) and heater (J17) and pull the fan assembly out of its location.



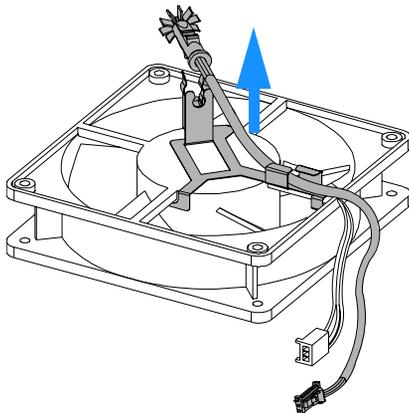
**The heater and temperature sensor assemblies are clipped into the fan assembly. In case the temperature sensor or the heater assembly fails, they can be unclipped separately from the fan assembly.**

**If the fan is defective, unclip both, the temperature sensor assembly and the heater assembly from the fan as described in the next steps.**

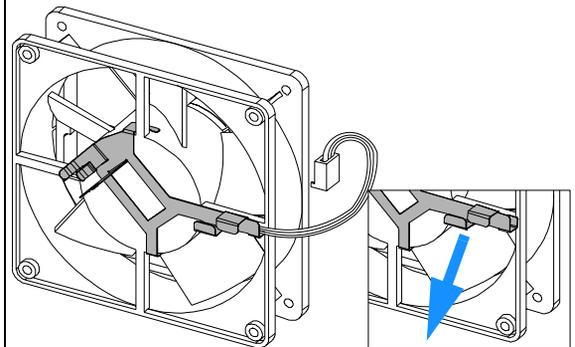
**2** To unclip the heater from the fan, use a pair of pliers, squeeze the clips and push them through the hole. Repeat this with the three remaining clips.



**3** If required, remove the sensor out of its holder.

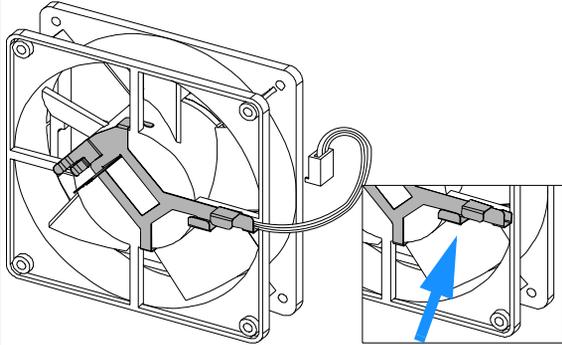


**4** To unclip the sensor holder from the fan, pull it carefully from its position pushing into the direction the arrow points to.



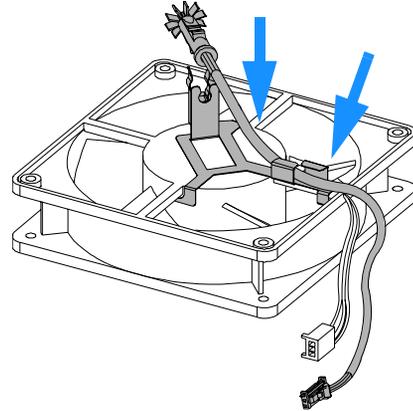
## 4 Repairing the Detector

**5** To re-install the sensor holder (here shown with the sensor), bring the holder into its position and slide it carefully across the fan cable.

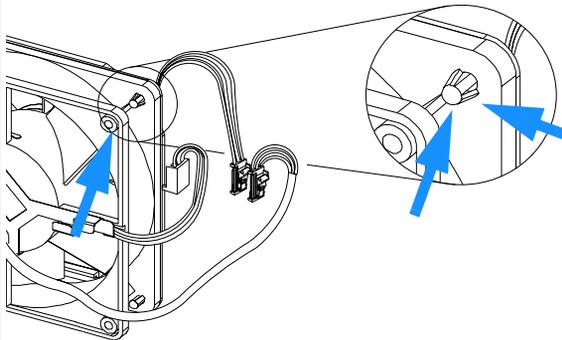


**6** Clip the sensor carefully into its holder and route the cables as shown.

**Assure, that the fan rotates smoothly without any scraping noise. Otherwise correct the position of the sensor holder.**

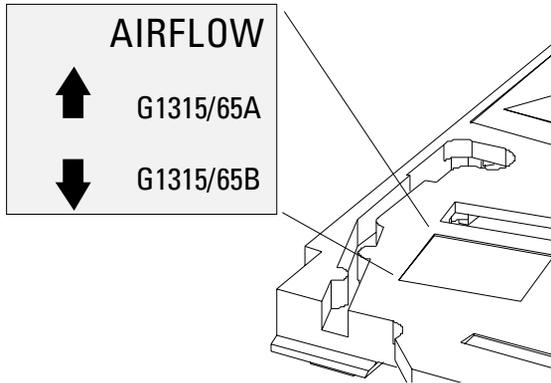


**7** Position the heater assembly as shown and clip the heater onto the fan. The cables should be oriented towards the left corner.

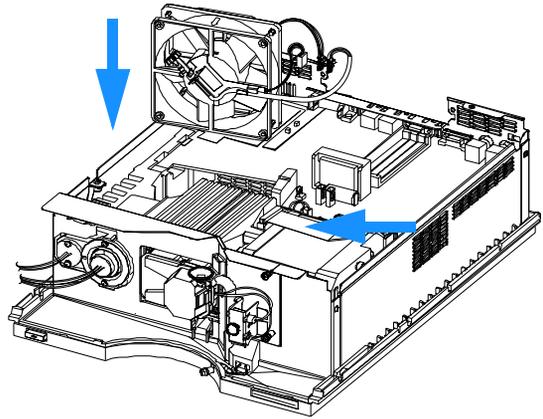


**The fan must be installed in the correct orientation (see arrow on the fan) to ensure optimum cooling and operation of the detector. The direction of air flow is from the rear towards the front (see figure on next page).**

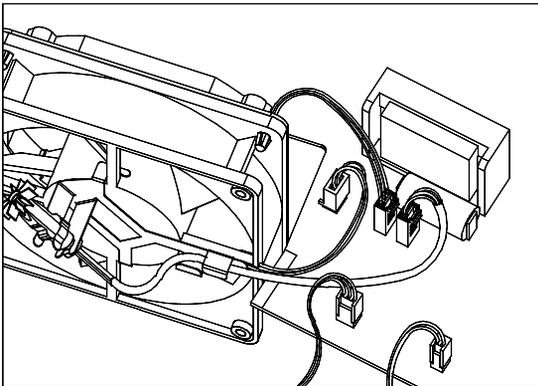
The figure below shows the required air flow direction.



8 Insert the fan assembly into its location.



9 Reconnect the connectors to the main board (fan J16), temperature sensor (J18) and heater (J17), see figure below for location.



**Next Steps:**

- Reinstall the top foam section, top cover and front cover, see ["Replacing the Foam and the Top Cover"](#) on page 175.
- Turn on the detector and prove, that the fan rotates smoothly without any scraping noise. Otherwise repeat step 5 and step 6 on [page 152](#).
- Replace the detector into the stack.
- Reconnect cables, capillaries and turn on detector

## Removing the Optical Unit (G1315A/G1365A)

### NOTE

Use this procedure for the the G1315A/G1365A only. For G1315B/G1365B detectors refer to [“Removing the Optical Unit \(G1315B/G1365B\)”](#) on page 156.

---

<b>When required</b>	For all repairs inside the optical unit
<b>Tools required</b>	Screwdriver POZI 1 PT3
<b>Parts required</b>	Optical unit G1315-69002 (exchange assembly) or Individual parts depending on the following procedures

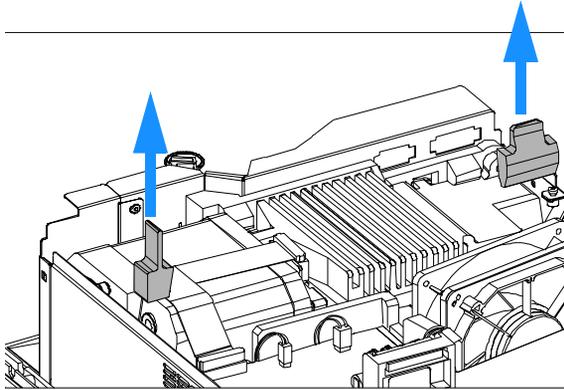
### NOTE

Use this procedure for the G1315A/G1365A only.

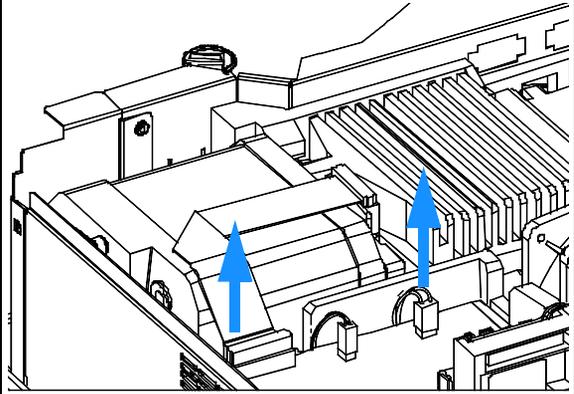
---

- 1 Turn off the lamp.
- 2 Switch off detector, and disconnect power cable.
- 3 Remove detector from stack and place it on working bench.
- 4 Remove front cover, top cover and top foam section, see [“Removing the Top Cover and Foam”](#) on page 140.
- 5 Remove both lamps from the optical unit, see [“Exchanging a Lamp”](#) on page 102 (**G1315A/G1365A only!**).
- 6 Remove flow cell, see [“Exchanging a Flow Cell”](#) on page 105.
- 7 Remove flow cell cover, see [“Cleaning or Exchanging the Holmium Oxide Filter”](#) on page 127 (**G1315A/G1365A only!**).

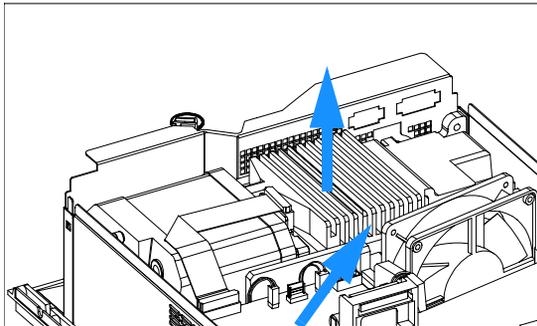
**10** Remove the two rubber shock absorbers.



**11** Disconnect the SCI cable (J23) and the holmium oxide filter motor (J19) from the detector main board.



**12** Remove the optical unit from the instrument holding the one hand at back of the heat sink.



## Removing the Optical Unit (G1315B/G1365B)

<b>When required</b>	For all repairs inside the optical unit
<b>Tools required</b>	Screwdriver POZI 1 PT3
<b>Parts required</b>	Optical unit G1315-69002 (exchange assembly) or Individual parts depending on the following procedures

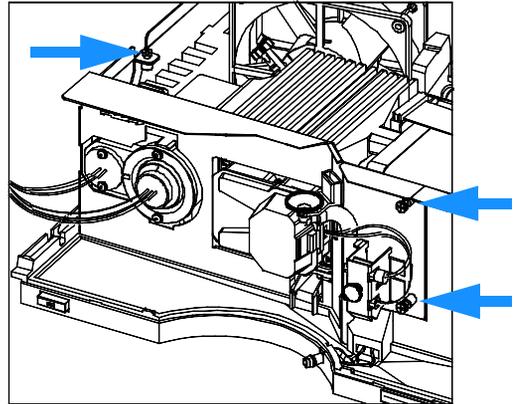
### NOTE

With the introduction of the G1315B/G1365B DAD/MWD the appearance of the z-plane (front metal plane) has been changed (no holes any more) and an isolation seal between the optical unit and the z-plane. Therefore, some of the figures may still show the old appearance of the G1315A/G1365A. For G1315A/G1365A detectors refer to [“Removing the Optical Unit \(G1315A/G1365A\)”](#) on page 154.

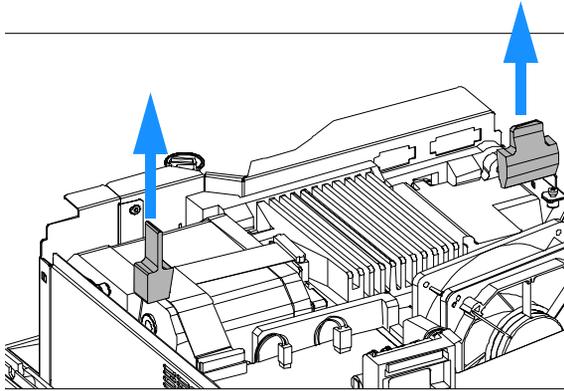
#### Preparations for this procedure:

- Turn off the lamp.
- Switch off detector, and disconnect power cable.
- Remove detector from stack and place it on working bench.
- Remove front cover, top cover and top foam section, see [“Removing the Top Cover and Foam”](#) on page 140.

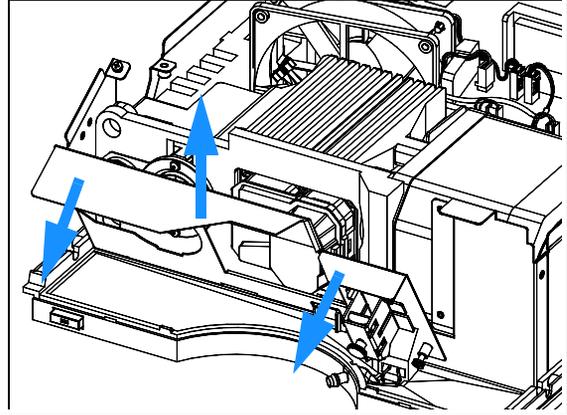
1. Loosen the screw on the left side of the z-plane and the two screws near the hydraulic connection.



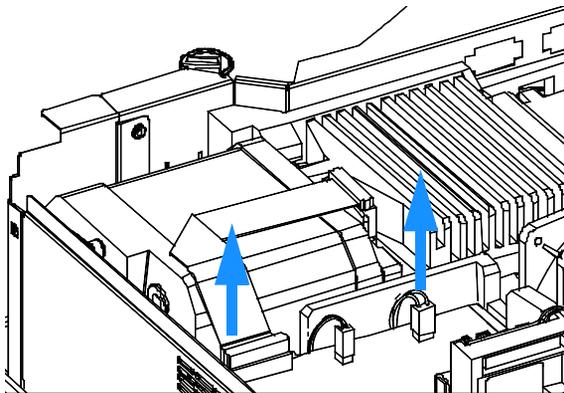
**2** Remove the two rubber shock absorbers.



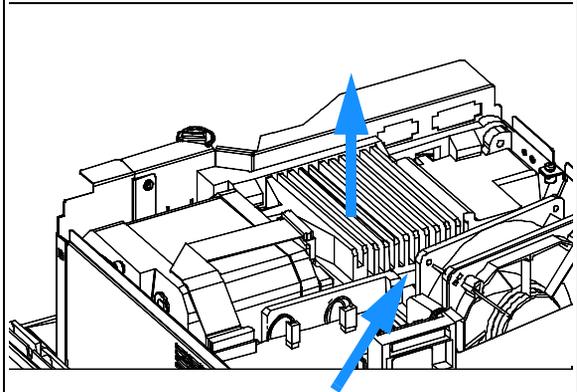
**3** Slide the z-plane to the front and remove it from the module.



**4** Disconnect the SCI cable (J23) and the holmium oxide filter motor (J19) from the detector main board.



**5** Remove the optical unit from the instrument holding the one hand at back of the heat sink.



## Exchanging the Source Lens (Achromat) Assembly

<b>When required</b>	The source lens (achromat) assembly might be cleaned or replaced when the transmission of light is reduced and a lamp exchange or new spectro windows do not improve the light throughput
<b>Tools required</b>	Screwdriver POZI 1 PT3 hexagonal key 1.5 mm A pointed pair of pliers
<b>Parts required</b>	Source lens (achromat) assembly G1315-65201 (includes filter lever G1315-45001) Spectro window 79880-28111 Filter lever G1315-45001

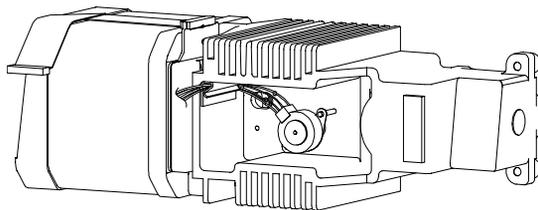
### NOTE

If the filter motor was removed, the filter lever should not be reused. Always use a new filter lever to assure correct fit on the filter motor shaft.

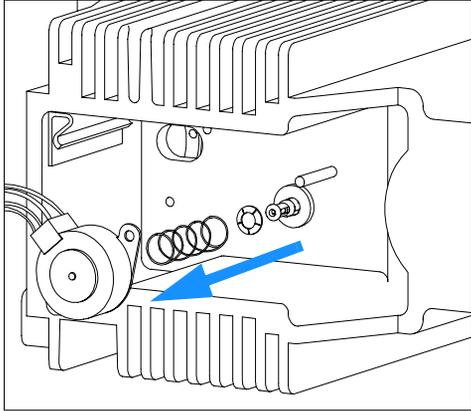
#### Preparations for this procedure:

- Turn off the lamp.
- Switch off detector and disconnect the power cable.
- Remove detector from stack and place it on the working bench.
- Remove the front cover, top cover and top foam section, see “[Removing the Top Cover and Foam](#)” on page 140.
- Remove the optical unit, see “[Removing the Optical Unit \(G1315A/G1365A\)](#)” on page 154 or “[Removing the Optical Unit \(G1315B/G1365B\)](#)” on page 156.

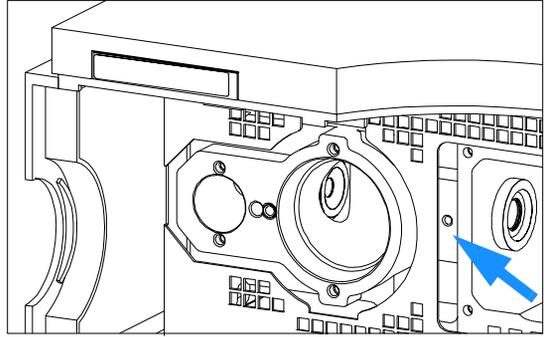
1 Place the optical unit on your bench.



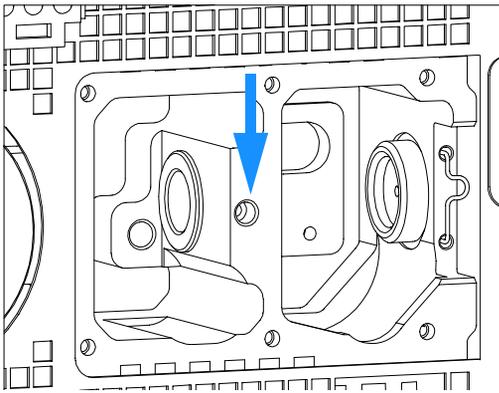
**2** Pull the filter motor off the shaft. Keep the spring and the lever fixture in a safe place. Remove the filter lever on the other side.



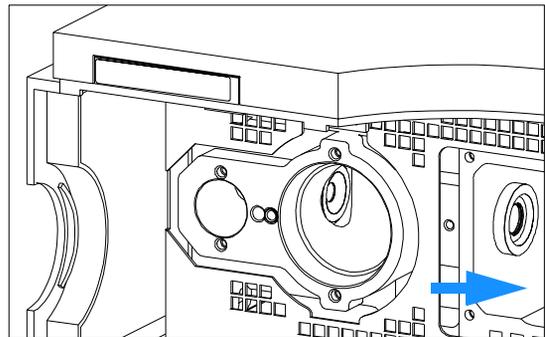
**3** Use the 1.5-mm hexagonal key to loosen the setscrew that secures the source lens assembly.



**4** Use the 1.5-mm hexagonal key to loosen the setscrew that secures the cell support assembly.

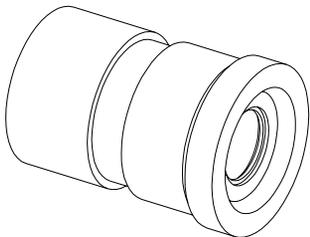


**5** Carefully slide the assembly to the right by pushing it from the deuterium lamp side with a hexagonal wrench.

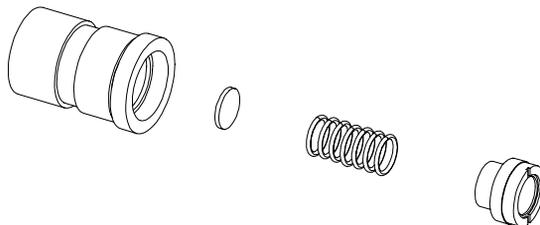


## 4 Repairing the Detector

**6** Remove the achromat assembly.



**7** Use a metal blade (12-mm width, 1-mm thick) to unscrew the lens achromatic.



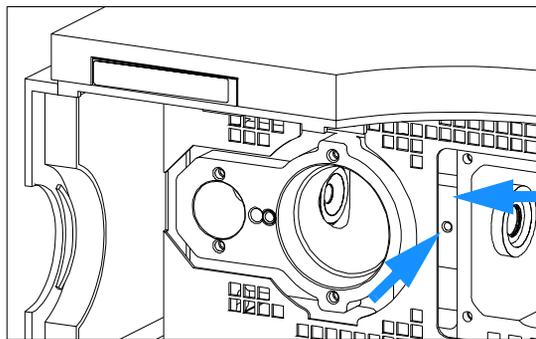
**8** Remove the spring and the spectro window from the holder.

**9** Clean (with alcohol and lint-free cloth) or replace the spectro window.

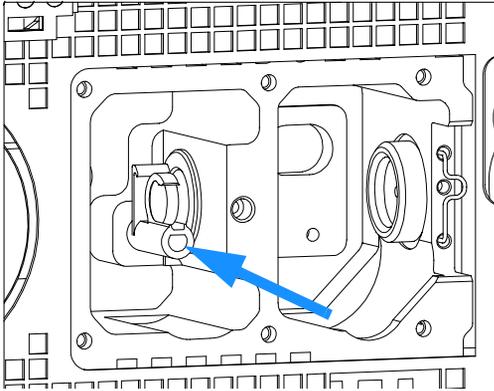
**Do not clean the achromatic lens with any liquid. To clean use dry air only.**

**10** Replace all parts into the holder and tighten the lens achromatic with the metal blade.

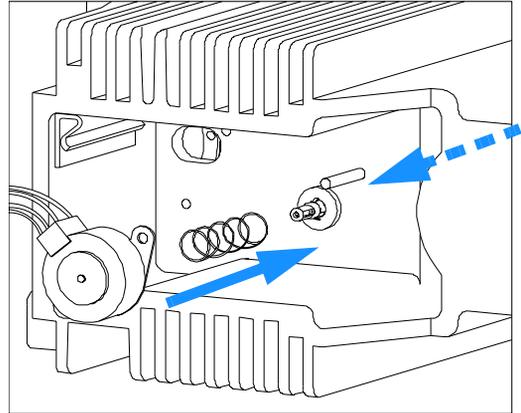
**11** Replace the achromat assembly, move it completely into the optical and fix the setscrew.



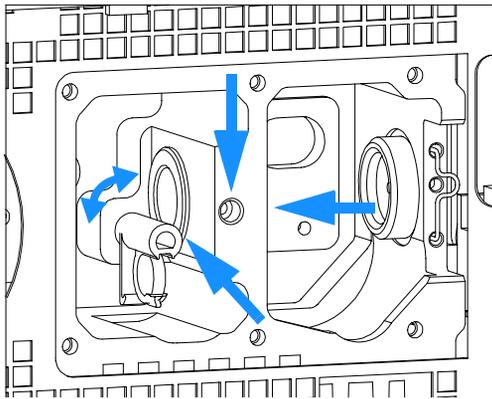
**12** Before installing the filter motor, press the filter lever in from the other side.



**13** While counter-holding the filter lever, insert the filter motor onto the filter shaft until it clicks into the final position.



**14** Slide in the cell support assembly until it is stopped by the holmium filter. Leave about 0.2-mm clearance for movement of the filter lever between both the lens assembly and the filter lever, and fix the setscrew.



**Next steps:**

- Check that the filter lever is moveable.
- Reinstall the optical unit, see [“Installing the Optical Unit \(G1315A/G1365A\)”](#) on page 171 or [“Removing the Optical Unit \(G1315B/G1365B\)”](#) on page 156.
- Reinstall the flow cell, see [“Exchanging a Flow Cell”](#) on page 105.
- Reinstall the front cover, top cover and top foam section, see [“Exchanging the Detector Main Board”](#) on page 143.
- Replace detector into the stack.
- Reconnect the cables and turn on the detector.

## Replacing the Holmium Oxide Filter Motor

<b>When required</b>	If defective
<b>Tools required</b>	Screwdriver POZI 1 PT3 hexagonal key 3 mm
<b>Parts required</b>	Filter motor assembly G1315-68700 (includes filter lever G1315-45001 and spring 1460-1510) For others see <a href="#">“Holmium Oxide Filter”</a> on page 197

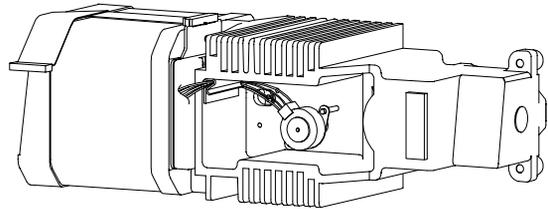
### NOTE

If the filter motor was removed, the filter lever should not be reused. Always use a new filter lever to assure correct fit on the filter motor shaft.

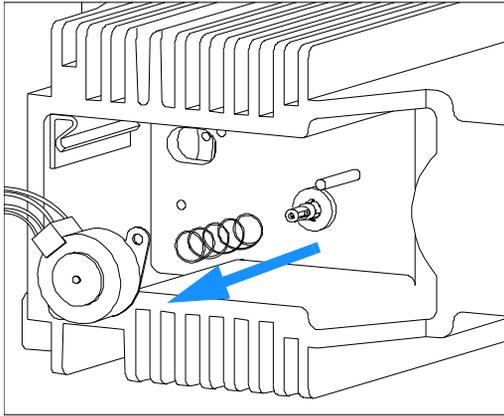
#### Preparations for this procedure:

- Turn off the lamp.
- Switch off the detector, and disconnect the power cable.
- Remove detector from stack and place it on working bench.
- Remove front cover, top cover and top foam section, see [“Removing the Top Cover and Foam”](#) on page 140.
- Remove optical unit, see [“Removing the Optical Unit \(G1315A/G1365A\)”](#) on page 154 or [“Removing the Optical Unit \(G1315B/G1365B\)”](#) on page 156.

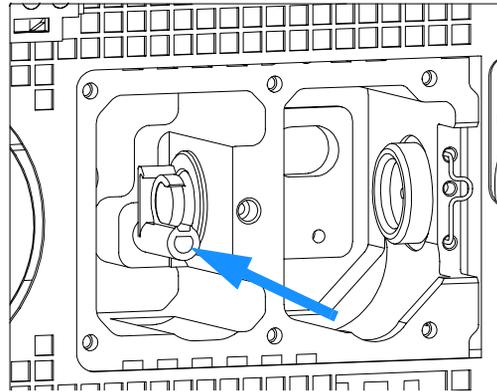
1 Place the optical unit on your bench.



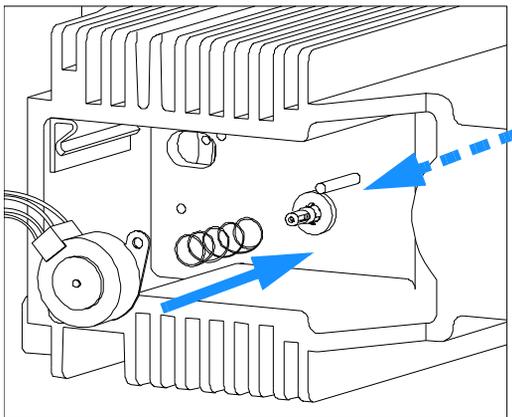
**2** Pull the filter motor off the shaft. Keep the spring in a safe place.



**3** Before installing the filter motor, press the filter lever in from the other side.



**4** While counter-holding the filter lever, press the filter motor onto the filter shaft until it clicks into the final position.



**Next steps:**

- Check that the filter lever is moveable.
- Reinstall the optical unit, see [“Installing the Optical Unit \(G1315A/G1365A\)”](#) on page 171 or [“Removing the Optical Unit \(G1315B/G1365B\)”](#) on page 156.
- Reconnect the filter motor cable to connector J18 (G1315/65A) or J19 (G1315/65B) on the detector main board.
- Reinstall the front cover, top cover and top foam section, see [“Replacing the Foam and the Top Cover”](#) on page 175.
- Replace the detector into the stack.
- Reconnect the power cable and turn on detector.

## Exchanging the Power Supply

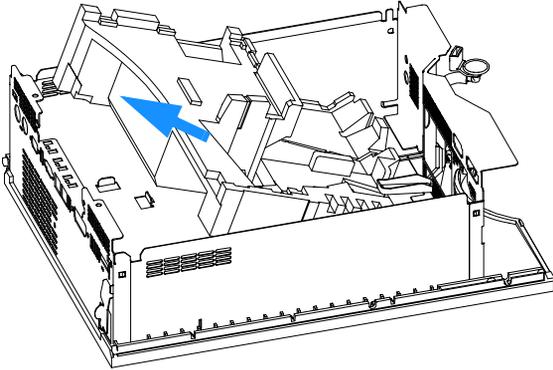
<b>When required</b>	If defective
<b>Tools required</b>	Screwdriver POZI 1 PT3 Wrench 1/4 inch Wrench 5 mm Wrench 7 mm
<b>Parts required</b>	Power supply 0950-2528

### NOTE

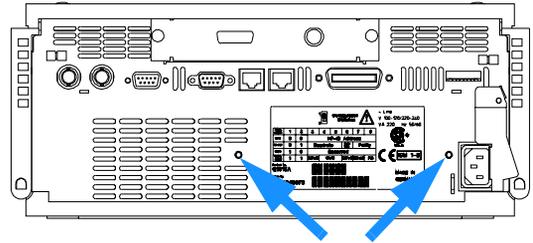
The repair level of the power supply assembly is exchanging the complete assembly. No serviceable parts are inside.

- 1 Turn off the lamp.
- 2 Switch off the detector, and disconnect the cables.
- 3 Remove the detector from the stack and place it on the working bench.
- 4 Remove the front cover, top cover and top foam section, see [“Removing the Top Cover and Foam”](#) on page 140.
- 5 Remove the detector main board, see [“Exchanging the Detector Main Board”](#) on page 143.
- 6 Remove the fan assembly, see [“Exchanging the Fan \(G1315A/G1365A\)”](#) on page 148 or [“Replacing Fan Parts \(G1315B/G1365B\)”](#) on page 150.
- 7 Remove the optical unit, see [“Removing the Optical Unit \(G1315A/G1365A\)”](#) on page 154 or [“Removing the Optical Unit \(G1315B/G1365B\)”](#) on page 156.

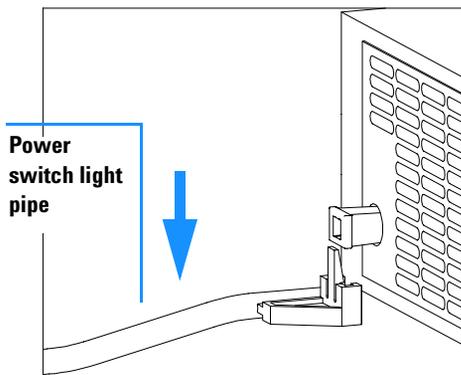
**5** Carefully remove the bottom foam part by sliding it out towards the rear.



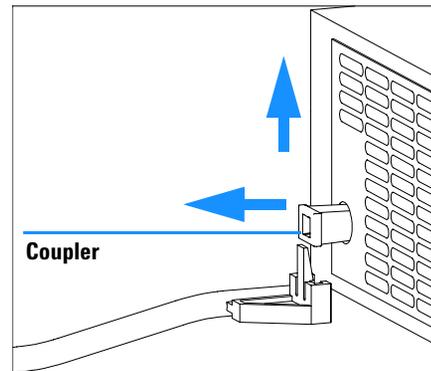
**6** Unscrew the power supply at the rear of the module.



**7** Press down the power switch light pipe to remove it from the coupler.



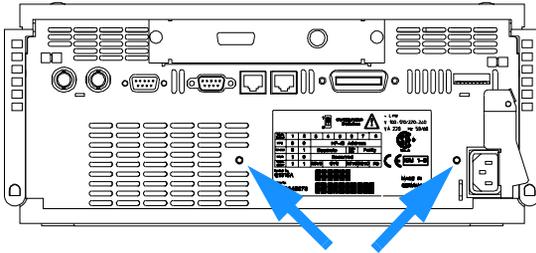
**8** Remove the power supply completely. Re-use the coupler on the new power supply.



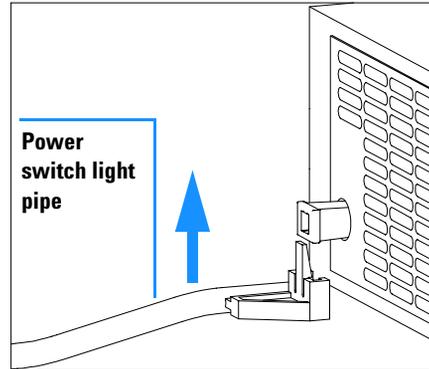
**The repair level of the power supply assembly is exchange of the complete assembly. No serviceable parts inside.**

## 4 Repairing the Detector

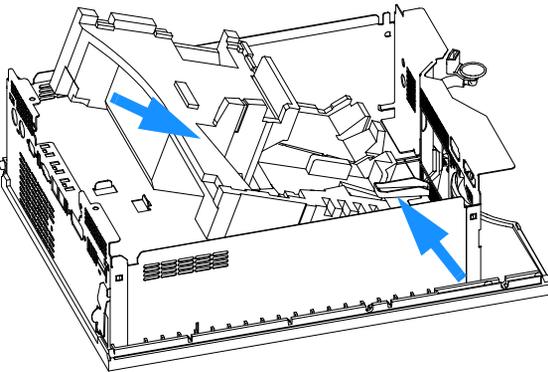
**9** Insert the power supply into its location and fix it with the screws at the rear panel.



**10** Press down and clip in the power switch light pipe into the power supply.



**11** Reinstall bottom foam part. Slide it in underneath the leak drain.



### Next steps:

- Reinstall the processor board, see [“Exchanging the Detector Main Board”](#) on page 143.
- Reinstall the fan assembly, see [“Exchanging the Fan \(G1315A/G1365A\)”](#) on page 148 or [“Replacing Fan Parts \(G1315B/G1365B\)”](#) on page 150.
- Reinstall the optical unit, see [“Installing the Optical Unit \(G1315A/G1365A\)”](#) on page 171 or [“Removing the Optical Unit \(G1315B/G1365B\)”](#) on page 156.
- Reinstall the front cover, top cover and top foam section, see [“Replacing the Foam and the Top Cover”](#) on page 175.
- Replace detector into the stack.
- Reconnect the power cable and turn on the detector.

## Exchanging the Leak Sensor

<b>When required</b>	If defective
<b>Tools required</b>	Screwdriver POZI 1 PT3
<b>Parts required</b>	Leak sensor assembly 5061-3356

**WARNING**

**Do not switch on the detector when the cover is removed.**

---

**CAUTION**

Electronic boards and components are sensitive to electronic discharge (ESD). In order to prevent damage always use an ESD protection (for example, the ESD wrist strap from the accessory kit) when handling electronic boards and components, see [“Using the ESD Strap”](#) on page 98.

---

- 1 Turn off the lamp.
- 2 Switch off the detector and disconnect the cables.
- 3 Remove detector from stack and place it on the working bench.
- 4 Remove the front cover, top cover and top foam section, see [“Removing the Top Cover and Foam”](#) on page 140.
- 5 Remove the optical unit, see [“Removing the Optical Unit \(G1315A/G1365A\)”](#) on page 154 or [“Removing the Optical Unit \(G1315B/G1365B\)”](#) on page 156.
- 6 Disconnect the leak sensor cable from the detector main board (J21).

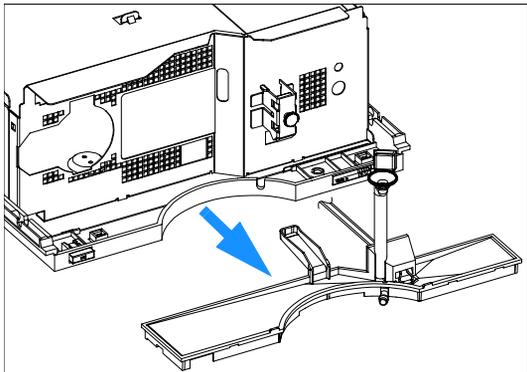
**NOTE**

On the G1315B DAD and G1365B MWD the leak sensor can be pulled out without the removing the leak pan (the next steps describe the procedure for the G1315A/G1365A).

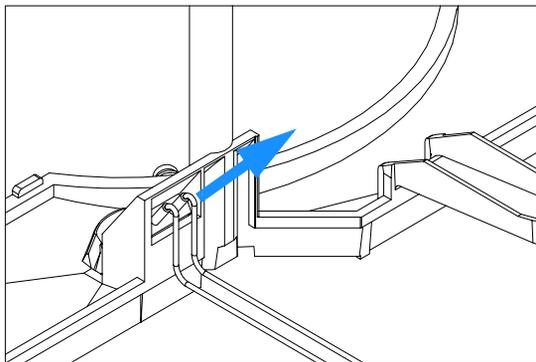
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## 4 Repairing the Detector

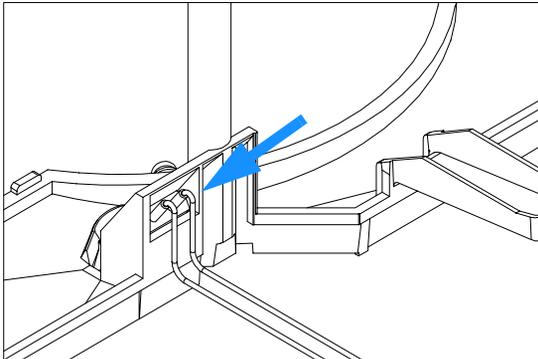
**12** Remove the leak pan from the cabinet bottom.



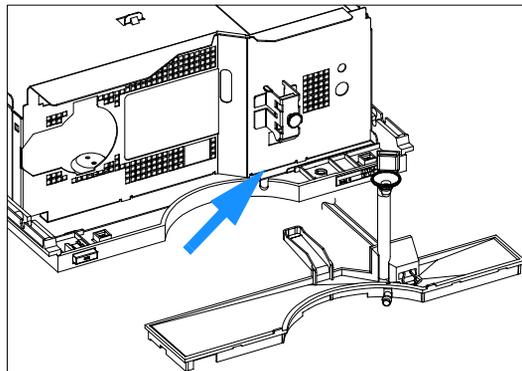
**13** Remove the leak sensor assembly from the leak pan.



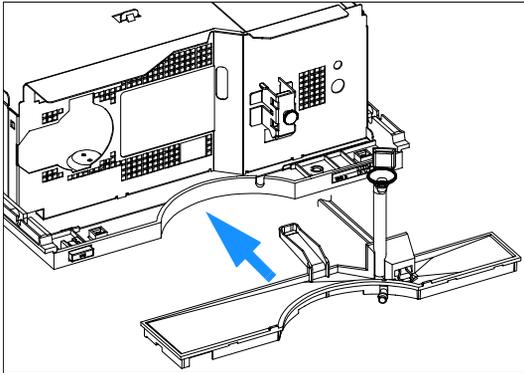
**14** Replace the leak sensor assembly into the leak pan.



**15** Route the leak sensor cable through the z-plane.



**16** Replace the leak pan into the cabinet bottom.



**Next steps:**

- Reconnect the leak sensor cable to the processor board (J21).
- Replace the optical unit, see [“Installing the Optical Unit \(G1315A/G1365A\)”](#) on page 171 or [“Installing the Optical Unit \(G1315B/G1365B\)”](#) on page 173.
- Replace the front cover, top cover and top foam section, see [“Replacing the Foam and the Top Cover”](#) on page 175.
- Replace the detector into the stack.
- Reconnect the cables.
- Turn on the detector.

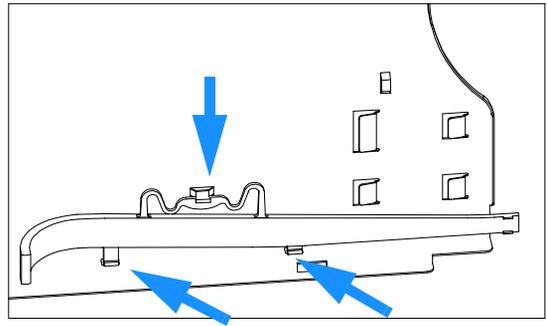
## Replacing Status Light Pipe

<b>When required</b>	If part was broken or removed
<b>Tools required</b>	Screwdriver POZI 1 PT3
<b>Parts required</b>	Status light pipe 5041-8384

### Preparations for this procedure:

- Remove the front cover and top cover, see [“Removing the Top Cover and Foam”](#) on page 140.

1 The status light pipe is clipped into the top cover.



### Next steps:

- Replace the top cover, see [“Replacing the Foam and the Top Cover”](#) on page 175.
- Replace the detector into the stack and reconnect the cables and capillaries.
- Turn on the detector.

## Installing the Optical Unit (G1315A/G1365A)

<b>When required</b>	When repairs have been completed
<b>Tools required</b>	Screwdriver POZI 1 PT3

### NOTE

Use this procedure for the the G1315A/G1365A only. For G1315B/G1365B detectors refer to “[Installing the Optical Unit \(G1315B/G1365B\)](#)” on page 173

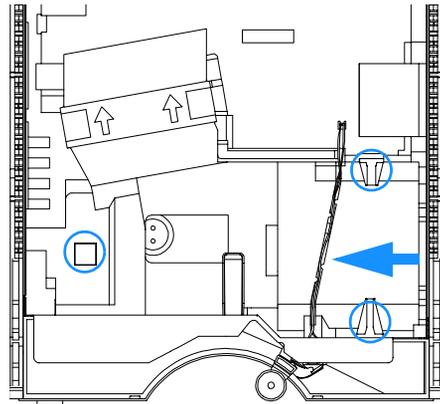
### CAUTION

The fan must be installed in the correct orientation to ensure correct cooling and operation of the detector, see “[Exchanging the Fan \(G1315A/G1365A\)](#)” on page 148.

#### Preparations for this procedure:

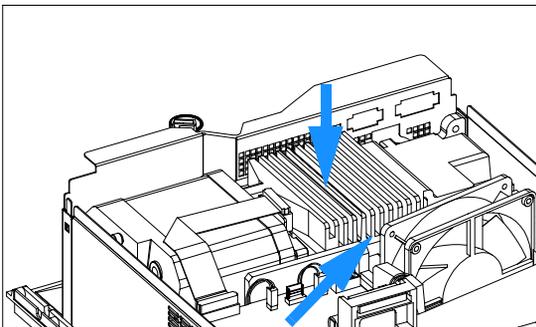
- The power supply, the fan and the processor board are already installed.

- 1 Check that the shock absorbers and the leak sensor cable is placed correctly.

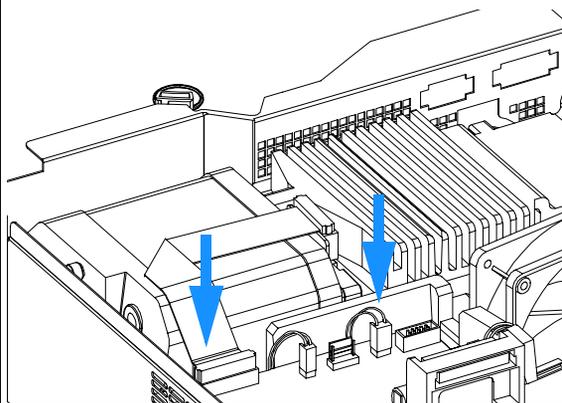


## 4 Repairing the Detector

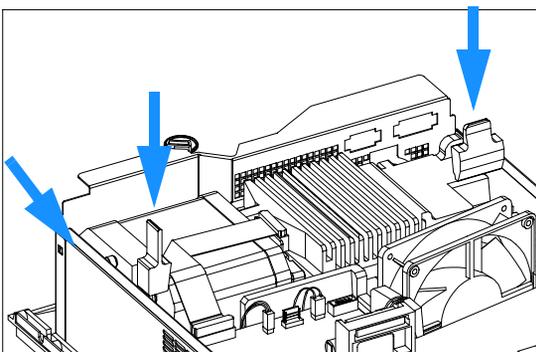
**2** Carefully insert the optical unit into the instrument holding the one hand at back of the heat sink.



**3** Reconnect the SCI cable (J23) and the holmium oxide filter motor (J19) to the detector main board.



**4** Replace the two rubber shock absorbers and reconnect the ground connector.



### Next steps:

- Reinstall the fan assembly (J16). Ensure the correct direction of air flow.
- Reinstall the flow cell cover, see [“Cleaning or Exchanging the Holmium Oxide Filter”](#) on page 127.
- Reinstall the flow cell, see [“Exchanging a Flow Cell”](#) on page 105.
- Reinstall the lamps, see [“Exchanging a Lamp”](#) on page 102.
- Reinstall the front cover, top cover and top foam section, see [“Replacing the Foam and the Top Cover”](#) on page 175.
- Replace detector into the stack.
- Reconnect the power cable and turn on the detector.

### NOTE

If a new optical is installed, perform a [“Wavelength Recalibration”](#) on page 84 to add the recalibration parameters into the detector main board’s memory after turning on the detector.

## Installing the Optical Unit (G1315B/G1365B)

<b>When required</b>	When repairs have been completed
<b>Tools required</b>	Screwdriver POZI 1 PT3

### NOTE

Use this procedure for the the G1315B/G1365B only. For G1315A/G1365A detectors refer to “[Installing the Optical Unit \(G1315A/G1365A\)](#)” on page 171.

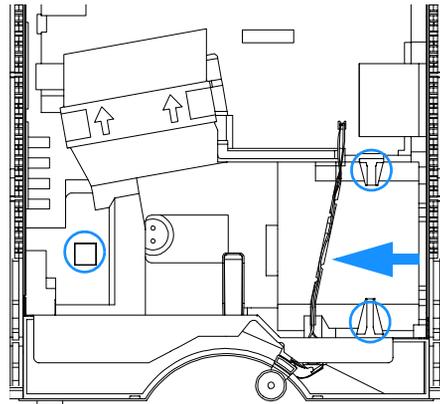
### CAUTION

The fan must be installed in the correct orientation to ensure correct cooling and operation of the detector, see “[Replacing Fan Parts \(G1315B/G1365B\)](#)” on page 150.

#### Preparations for this procedure:

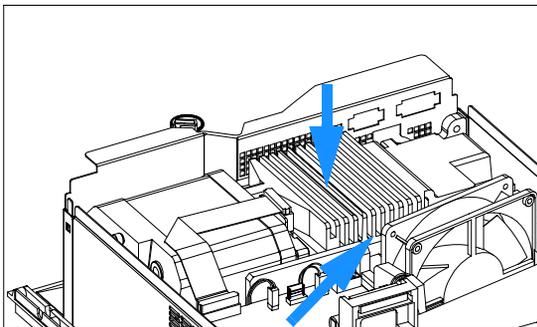
- The power supply, the fan and the processor board are already installed.

- 1 Check that the shock absorbers and the leak sensor cable is placed correctly.

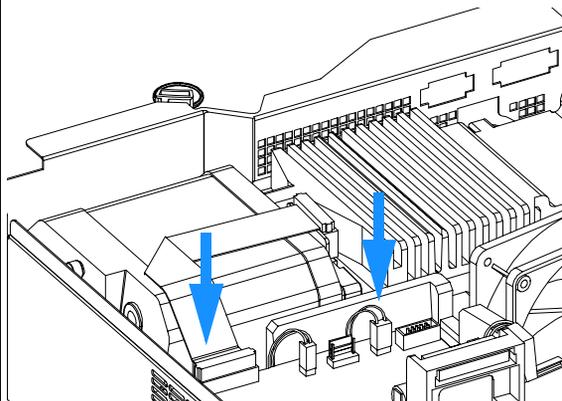


## 4 Repairing the Detector

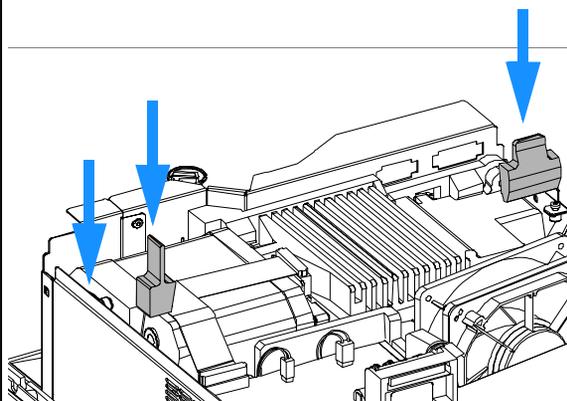
**2** Carefully insert the optical unit into the instrument holding the one hand at back of the heat sink.



**3** Reconnect the SCI cable (J23) and the holmium oxide filter motor (J19) to the detector main board.



**4** Replace the two rubber shock absorbers and reconnect the ground connector.



### Next steps:

- Reinstall the fan assembly (J16). Ensure the correct direction of air flow.
- Reinstall the flow cell cover, see [“Cleaning or Exchanging the Holmium Oxide Filter”](#) on page 127.
- Reinstall the flow cell, see [“Exchanging a Flow Cell”](#) on page 105.
- Reinstall the lamps, see [“Exchanging a Lamp”](#) on page 102.
- Reinstall the front cover, top cover and top foam section, see [“Replacing the Foam and the Top Cover”](#) on page 175.
- Replace detector into the stack.
- Reconnect the power cable and turn on the detector.

### NOTE

If a new optical is installed, perform a [“Wavelength Recalibration”](#) on page 84 to add the recalibration parameters into the detector main board’s memory after turning on the detector.

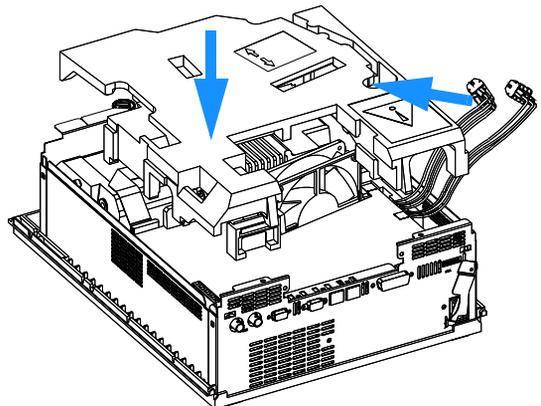
## Replacing the Foam and the Top Cover

<b>When required</b>	When all repairs have been completed
<b>Tools required</b>	Screwdriver POZI 1 PT3
<b>Prerequisites</b>	The detector is open and other procedures have been carried out

### Preparations for this procedure:

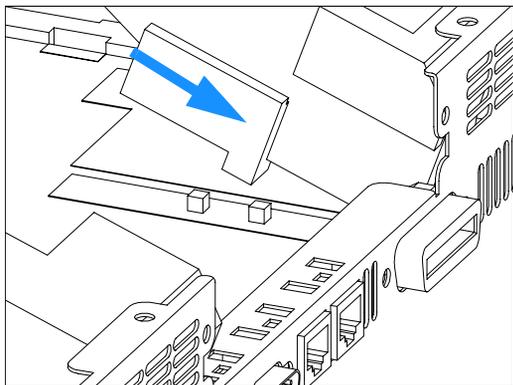
- All the work within the module should be completed.

- 1 Route the lamp connector cables through the hole in the foam.

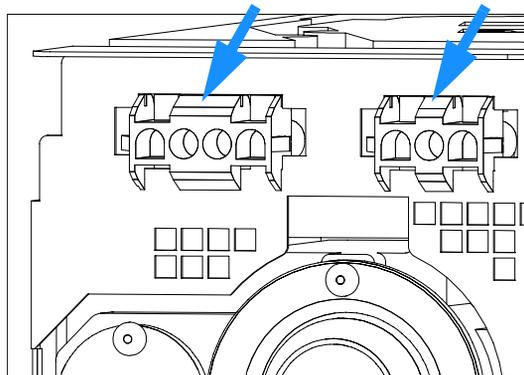


## 4 Repairing the Detector

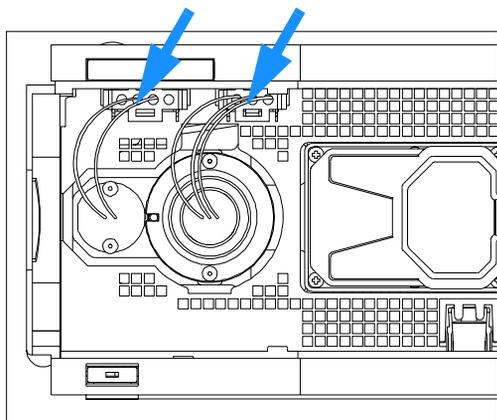
- 2 Insert the foam and make sure that the foam is installed correctly.



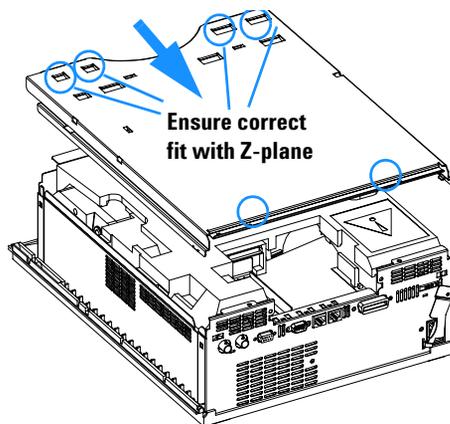
- 3 Press the lamp cables into the foam channel and reconnect the lamp connectors to the front panel.



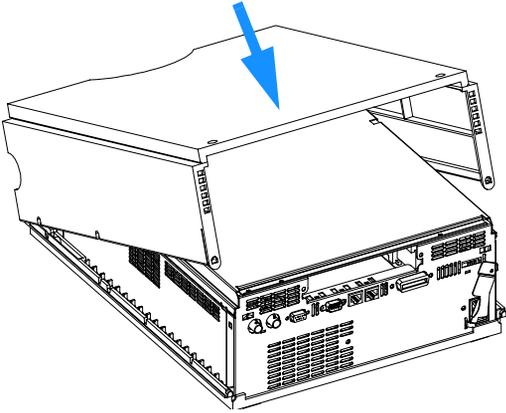
- 4 Reconnect the lamps.



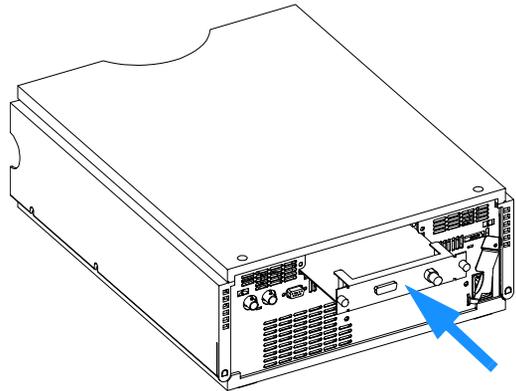
- 5 Slide the top plate towards the rear and fix the top plate screws.



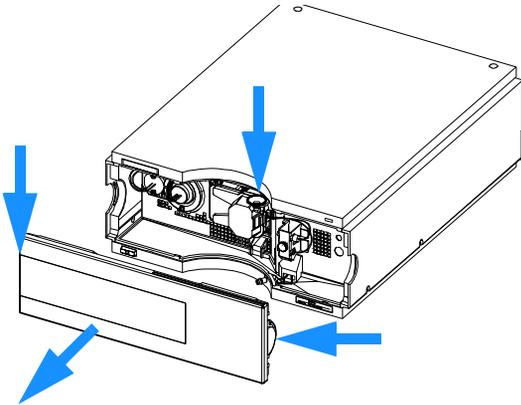
6 Replace the cover.



7 If required, insert the interface board and fix the screws.



8 Replace waste funnel assembly and the front panel.



**Next steps:**

- Replace the detector into the stack.
- Reconnect the hydraulic connections
- Reconnect the power cable and turn on the detector.

## Assembling the Main Cover

<b>When required</b>	If cover is broken
<b>Tools required</b>	None
<b>Parts required</b>	Plastics kit 5062-8582 (includes base, top, left and right)

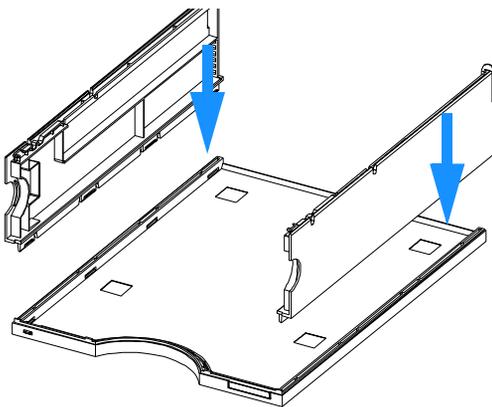
**NOTE**

The plastics kit contains all parts, but it is not assembled.

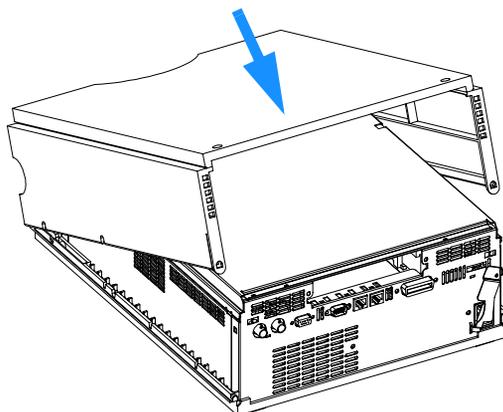
**WARNING**

In case you insert the left or right side in the opposite position, you may not be able to remove the side from the top part.

1 Place the top part on the bench and insert the left and right side into the top part.



2 Replace the cover.



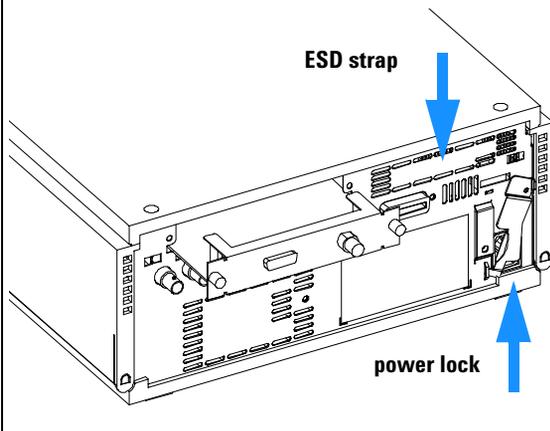
3 Replace the detector into the stack and reconnect the cables and capillaries.

4 Turn on the detector.

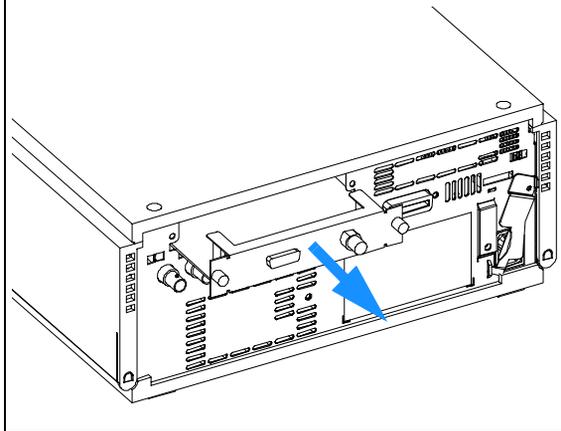
## Replacing the Interface Board

<b>When required</b>	For all repairs inside the detector or for installation of the board
<b>Part required</b>	Interface board (BCD) G1351-68701 with external contacts and BCD outputs, see “BCD Board” on page 253 Interface board (LAN) see “LAN Communication Interface Board” on page 255.
<b>Tools required</b>	None

**1** Install the ESD strap. Move the power lock across the power inlet.



**2** If required, unscrew and remove the interface board. Place the board on the ESD kit.



**3** If required, insert the interface board and fix the screws.

### Next steps:

- Remove the ESD strap.
- Reinstall the module into the stack.

## Replacing the Detector's Firmware

The installation of new firmware is required:

- if new version solves problems of currently installed version, or
- if after exchange of the detector main board (DAM or MWM) the version on board is older than previous installed one.

To upgrade the detector's firmware the following steps have to be performed:

**1** Load the firmware into the detector, see help system of your user interface.

### NOTE

The G1315B DAD and the G1365B MWD require firmware revision 4.x or above (main and resident).

---

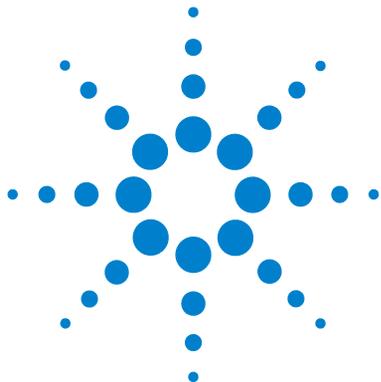
**2** Perform a [“Wavelength Recalibration”](#) on page 84 to add the recalibration parameters into the board's memory.

### NOTE

The wavelength recalibration should be performed after at least 10 minutes of warm-up time of the lamp.

---

**3** If detector main board was replaced, reenter the serial number information of the module through the user interface, see [“Entering the Serial Number using the Control Module”](#) on page 146 or [“Entering the Serial Number using the Agilent ChemStation”](#) on page 147.



## 5 Identifying Parts and Materials

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LAN Cables	226



## Overview of Main Assemblies

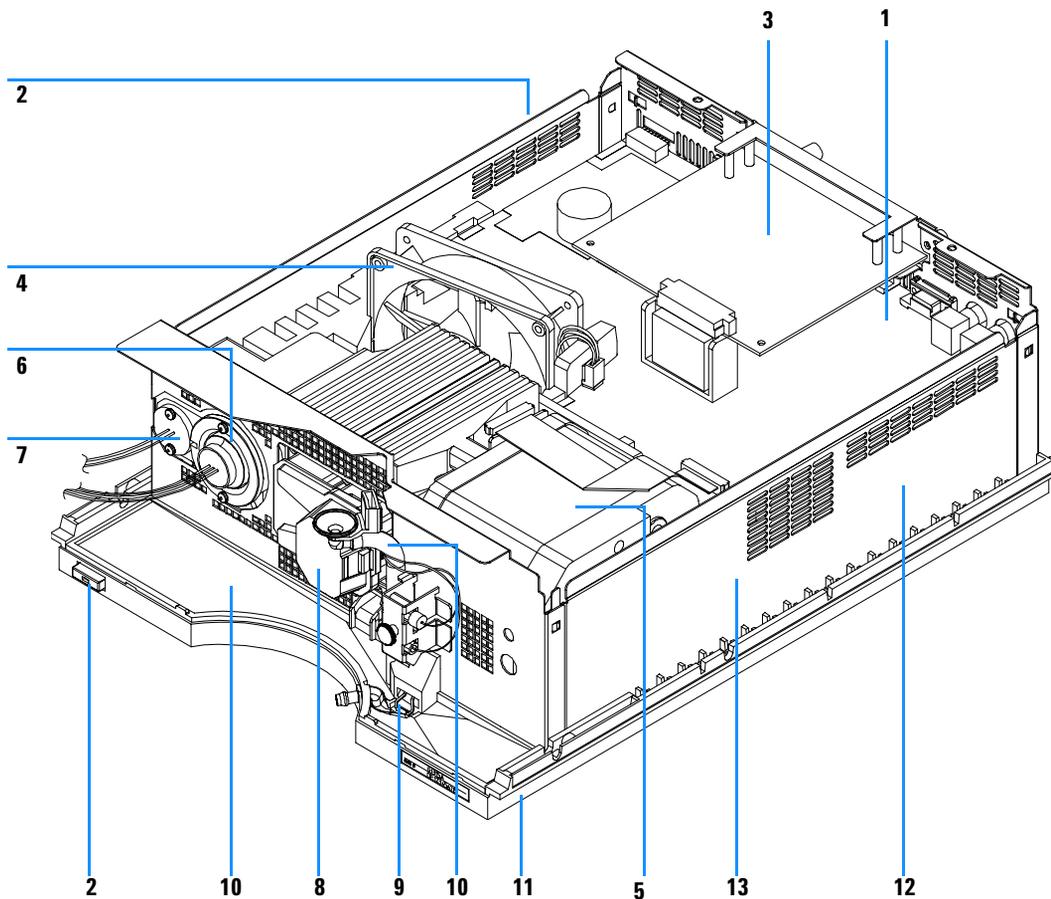


Figure 35 Overview of Main Assemblies

**Table 8** Main Assemblies

Item	Description	Part Number
1	Main board DAM for G1315A/B DAD (exchange assembly)	G1315-69540
	Main board DAM for G1365A/B MWD (exchange assembly)	G1365-69540
	Hexagonal nut for GPIB connector	0380-0643
	Hexagonal nut for RS-232C connector	1251-7788
	Nut for analog connector	2940-0256
	Washer for analog connector	2190-0699
	Cable CAN to Agilent 1100 Series modules	5181-1516
2	Power supply, for power and status light parts see <a href="#">page 206</a>	0950-2528
3	Interface board BCD (BCD/external contacts)	G1351-68701
	Fuse for BCD board, 250 mA (total of 4 are on the board)	2110-0004
	LAN Communication Interface Board (G1369A)	G1369-60001
4	Fan assembly, for G1315B/G1365B heater and sensor see <a href="#">page 196</a>	3160-1016
5	Optical unit (exchange assembly), for additional optical unit parts, see <a href="#">page 184</a>	G1315-69002
6	Longlife Deuterium lamp <b>without</b> counter (no mercury) (without black cover)	2140-0813
	Longlife Deuterium lamp <b>without</b> counter (no mercury) (with black cover)	5181-1530
	Deuterium lamp without counter (no mercury) (without black cover)	2140-0590
7	Tungsten lamp	G1103-60001
8	For details see <a href="#">page 186</a> for standard flow cell, <a href="#">page 188</a> for semi-micro flow cell, or <a href="#">page 190</a> for high-pressure flow cell	
9	Leak sensor assembly	5061-3356
10	Leak handling parts, see <a href="#">page 207</a>	
11	Front cover and plastic parts (housing), see <a href="#">page 204</a>	
12	Sheet metal parts, see <a href="#">page 202</a>	
13	Foam parts, see <a href="#">page 205</a>	

## Optical Unit Assembly

**Table 9** Optical Unit Assembly

Item	Description	Part Number
1	Optical unit (exchange assembly)	G1315-69002
2	Semi-flow cell, 6 mm, 5 $\mu$ l, maximum pressure 120 bar, see <a href="#">page 186</a>	G1315-60011
2	Standard flow cell, 10 mm, 13 $\mu$ l, maximum pressure 120 bar, see <a href="#">page 186</a>	G1315-60012
2	High Pressure flow cell, 6 mm 1.7 $\mu$ l, maximum pressure 400 bar, see <a href="#">page 190</a>	G1315-60015
3	Longlife Deuterium lamp <b>without</b> counter (no mercury) (without black cover)	2140-0813
	Longlife Deuterium lamp <b>without</b> counter (no mercury) (with black cover)	5181-1530
	Deuterium lamp without counter (no mercury) (without black cover)	2140-0590
4	Tungsten lamp	G1103-60001
5	Inlet capillary, 380 mm lg, 0.17 mm i.d., 0.6 mm o.d., for details see <a href="#">page 208</a>	G1315-87311
	Zero dead volume fitting	0100-0900
6	Cable SCI - DAM	G1315-61604
7	Damping kit, includes 6 bumpers	G1315-68706
8	Flow cell door (seal included)	G1315-68707
	Screws M3 for flow cell door (6 $\times$ )	5022-2112
9	Plug hole for lamp housing	6960-0002
10, 11, 12	Holmium oxide filter parts, see <a href="#">page 197</a>	
13	Spring, for other holmium oxide filter parts, see <a href="#">page 197</a>	1460-1510
14	Coupling lens assembly, for other coupling lens assembly parts, see <a href="#">page 198</a>	G1103-68001
15	Source lens (achromat) assembly, for other source lens assembly parts, see <a href="#">page 199</a>	G1315-65201
16	Cell support assembly, for other cell support assembly parts, see <a href="#">page 200</a>	G1315-65202
17	Sealing for G1315B/G1365B	G1315-47103

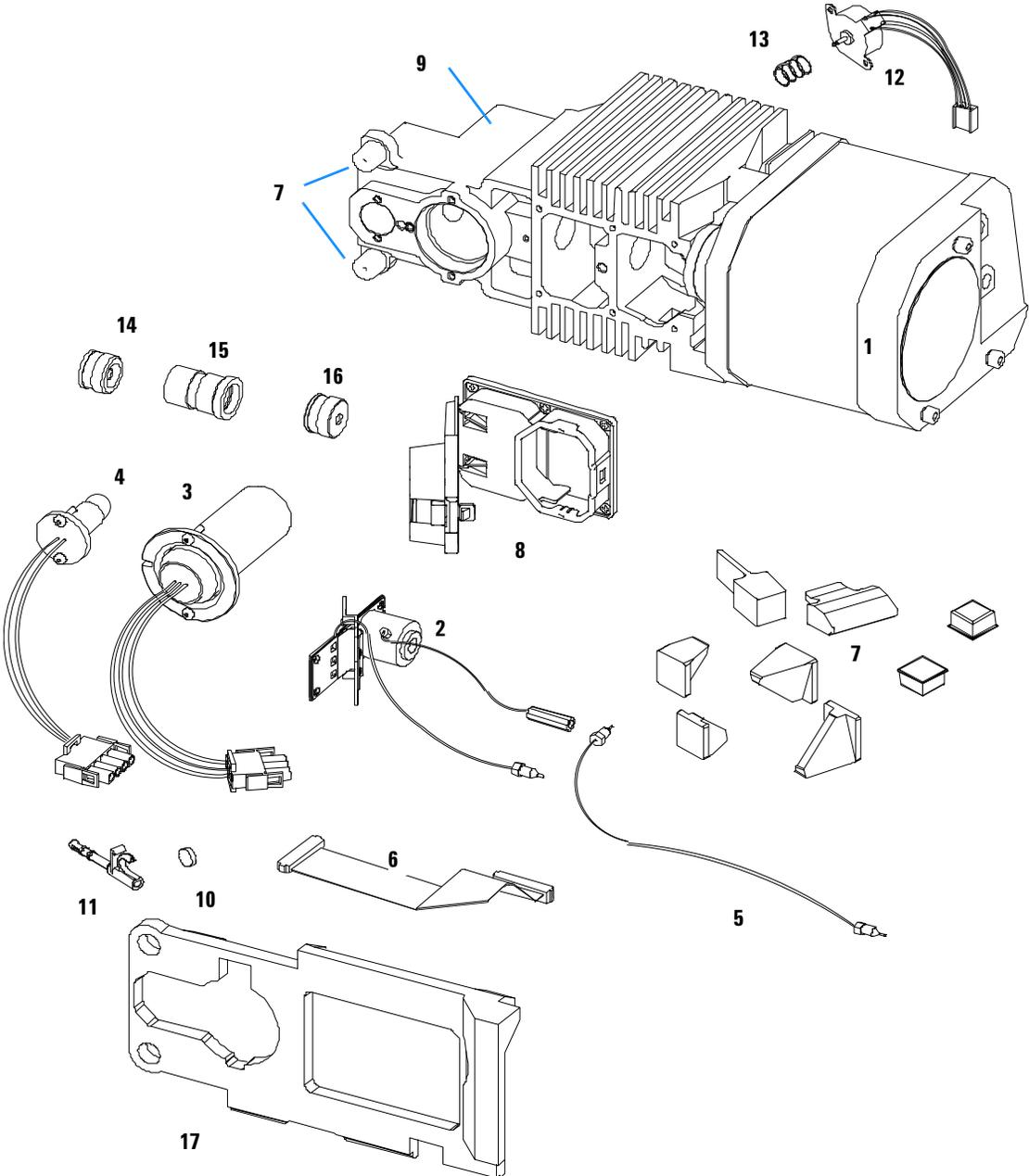
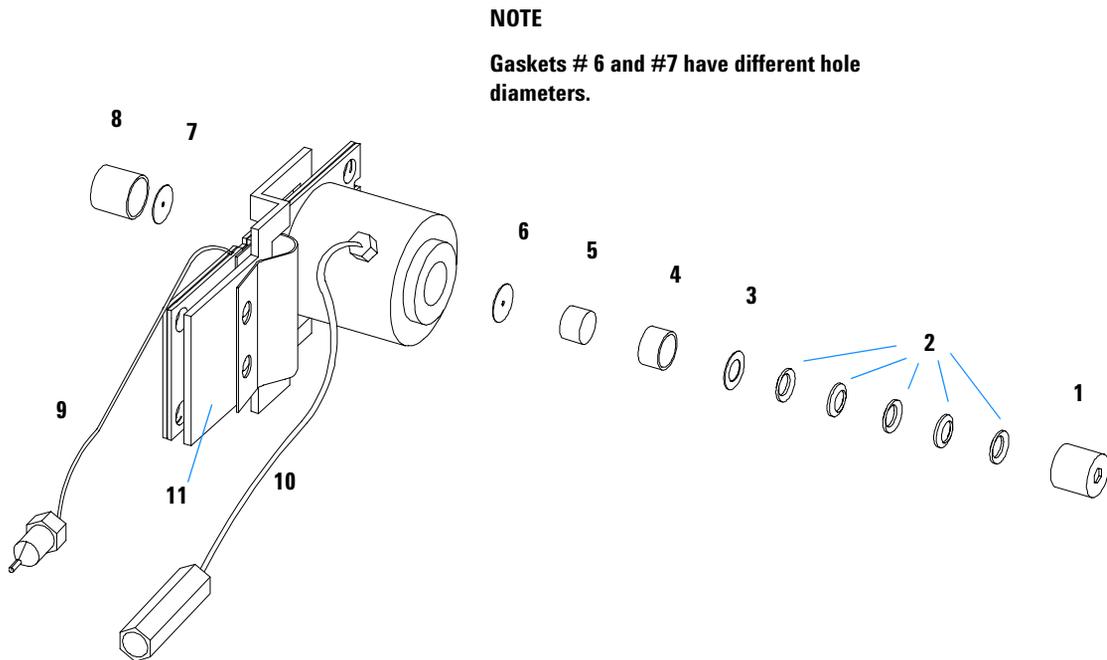


Figure 36 Optical Unit Parts

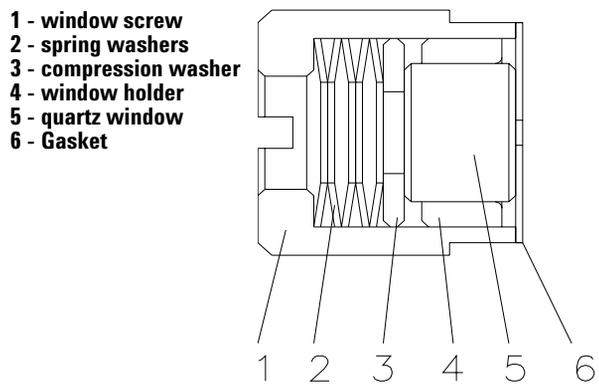
## Standard Flow Cell

**Table 10** Standard Flow Cell Parts

Item	Description	Part Number
	Standard flow cell assembly, 10 mm, 13 $\mu$ l, maximum pressure 120 bar	G1315-60012
1	Window screw	79883-22402
2	Spring washers, pack of 10	5062-8553
3	Compression washer	79883-28801
4	Window holder	79883-22301
5	Quartz window	1000-0488
6	Gasket BACK (Teflon), 2.3 mm hole, outlet side	See kits below
7	Gasket FRONT (Teflon), 1.3 mm hole, inlet side	See kits below
8	Window assembly, comprises item 1, 2, 3, 4, 5	No part number
9	Capillary IN (0.17 mm, 590 mm lg) including heat exchanger	G1315-87321
10	Capillary OUT (0.17 mm, 200 mm lg)	G1315-87302
11	Clamp unit	G1315-84901
	Screw M 2.5, 4 mm lg for cell body/clamp	0515-1056
	Zero dead volume fitting	0100-0900
	Cell repair kit STD, includes window screw kit, 4mm hexagonal wrench and seal kit	G1315-68712
	Seal kit BACK for STD flow cell, qty=12 of item 6	G1315-68711
	Seal kit FRONT for STD flow cell, qty=12 of item 7	G1315-68710
	Window screw kit, includes 2 quartz windows, 2 compression washers, 2 window holders, 2 window screws and 10 spring washers	79883-68703



**Figure 37** Standard Flow Cell Parts

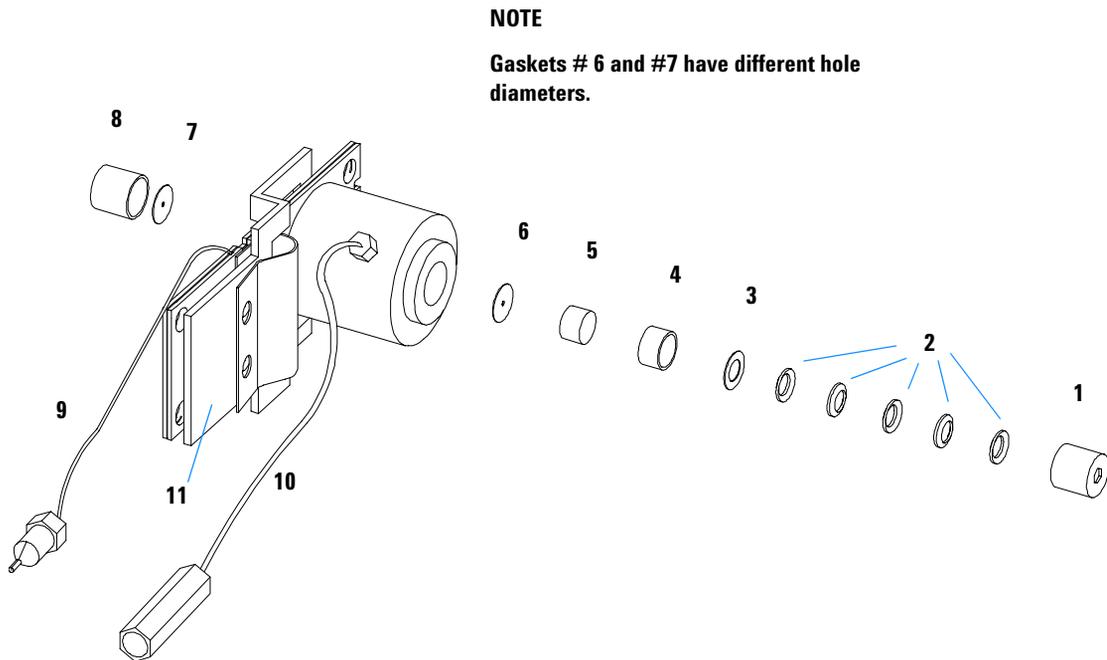


**Figure 38** Orientation of Spring Washers.

## Semi-Micro Flow Cell

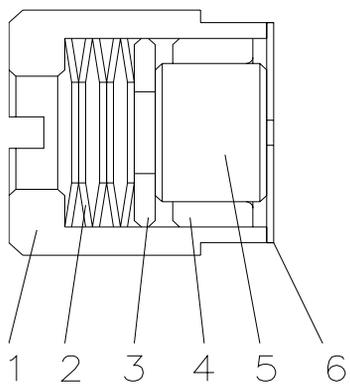
**Table 11** Semi-Micro Flow Cell Parts

Item	Description	Part Number
	Semi-micro flow cell assembly, 6 mm, 5 µl, maximum pressure 120 bar	<a href="#">G1315-60011</a>
1	Window screw	<a href="#">79883-22402</a>
2	Spring washers, pack of 10	<a href="#">5062-8553</a>
3	Compression washer	<a href="#">79883-28801</a>
4	Window holder	<a href="#">79883-22301</a>
5	Quartz window	<a href="#">1000-0488</a>
6	Gasket BACK (Teflon), 1.8 mm hole, outlet side	See kits below
7	Gasket FRONT (Teflon), 1.3 mm hole, inlet side	See kits below
8	Window assembly, comprises item 1, 2, 3, 4, 5	No part number
9	Capillary IN (0.12 mm, 290 mm lg) including heat exchanger	<a href="#">G1315-87325</a>
10	Capillary OUT (0.12 mm, 200 mm lg)	<a href="#">G1315-87306</a>
10	Capillary OUT (0.17 mm, 200 mm lg)	<a href="#">G1315-87302</a>
11	Clamp unit	<a href="#">G1315-84901</a>
	Screw M 2.5, 4 mm lg for cell body/clamp	<a href="#">0515-1056</a>
	Zero dead volume fitting	<a href="#">0100-0900</a>
	Cell repair kit semi-micro, includes window screw kit, 4 mm hexagonal wrench and seal kits	<a href="#">G1315-68713</a>
	Seal kit BACK for semi-micro flow cell, qty=12 of item 6	<a href="#">79883-68702</a>
	Seal kit FRONT for semi-micro flow cell, qty=12 of item 7	<a href="#">G1315-68710</a>
	Window screw kit, includes 2 quartz windows, 2 compression washers, 2 window holders, 2 window screws and 10 spring washers	<a href="#">79883-68703</a>



**Figure 39** Semi-Micro Flow Cell Parts

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

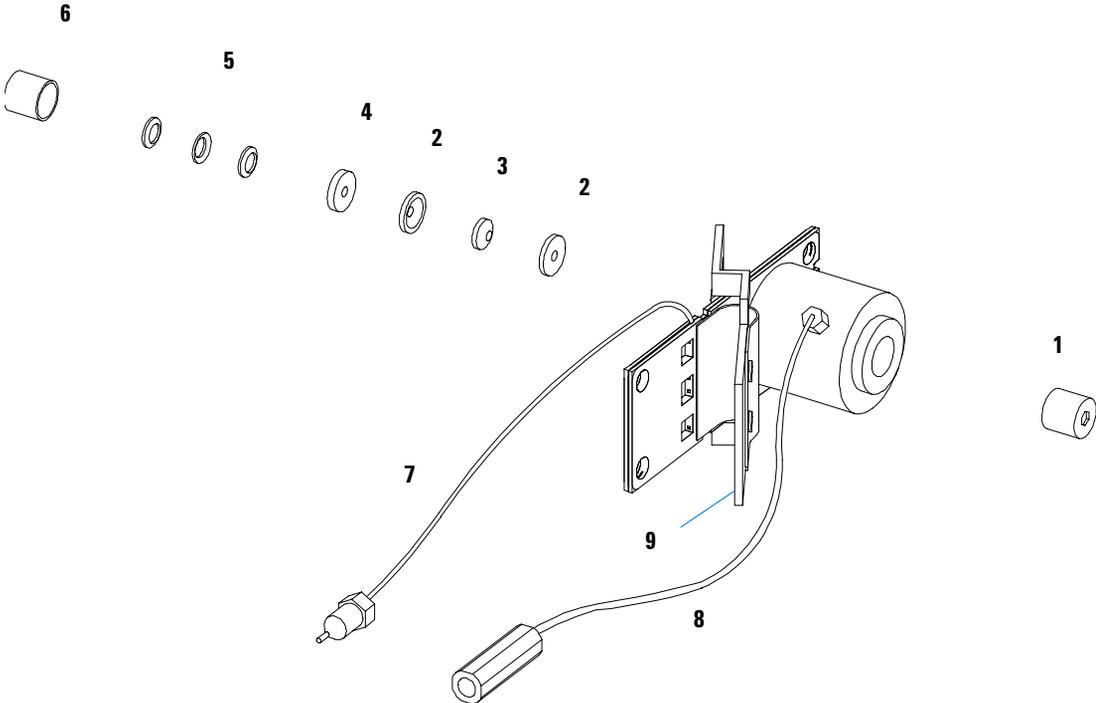


**Figure 40** Orientation of Spring Washers.

## High Pressure Flow Cell

**Table 12** Repair Parts: Micro Flow Cell Assembly

Item	Description	Part Number
	High pressure flow cell assembly, 6 mm, 1.7 $\mu$ l, maximum pressure 400 bar	G1315-60015
1	Window assembly, comprises items 2, 3, 4, 5 and 6	
2	Seal ring	79883-27101
3	Quartz window	1000-0953
4	Compression washer	79883-28802
5	Spring washers (pack of 10)	5062-8553
6	Window screw	79883-22404
7	Capillary IN (0.12 mm, 290 mm lg) including heat exchanger	G1315-87325
8	Capillary OUT (0.12 mm, 200 mm lg)	G1315-87306
9	Clamp unit	G1315-84901
	Screw M 2.5, 4 mm lg for cell body/clamp unit	0515-1056
	Capillary (0.12 mm, 150 mm lg)	G1315-87312
	Capillary (0.17 mm, 380 mm lg)	G1315-87311
	Cell Repair Kit Agilent, includes 1 quartz window, 5 spring washers, 2 seal rings	79883-68700



**Figure 41** High Pressure Flow Cell Assembly Parts

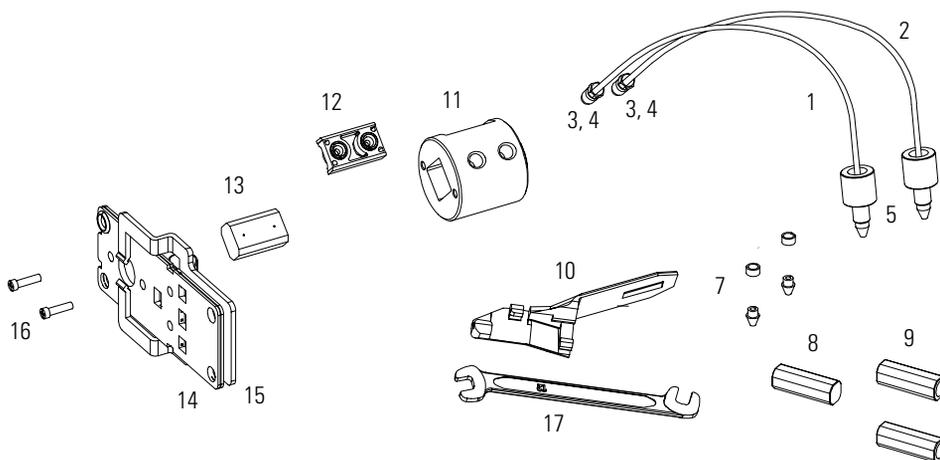
## Nano Flow Cells

The following kits are available:

**Table 13** Nano-flow cell kits

Description	Part number
500 nl Flow Cell Kit includes Flow cell assembly (10 mm, 500 nl, 5 MPa) completely assembled (includes items 1, 2, 3, 4, 10, 11, 12, 13, 14, 15, and 16)	G1315-68724
80 nl Flow Cell Kit includes Flow cell assembly (10 mm, 500 nl, 5 MPa) completely assembled (includes items 1, 2, 3, 4, 10, 11, 12, 13, 14, 15, and 16)	G1315-68716

Figure 42 shows all parts delivered with the nano-flow cell kits.



**Figure 42** Content of kits

Table 14 lists the generic parts for both nano-flow cells:

**Table 14** Generic Parts

<b>Item</b>	<b>Description</b>	<b>Part Number</b>
3	Fitting Screw (for 4 mm wrench), QTY=2 (reorder 10/pk)	5063-6593
4	Cell ferrules are factory installed	
5	PEEK fitting 1/32" (not attached to capillaries), (reorder 10/pk)	5065-4422
7	Litetouch ferrules LT-100, (1/32" Ferrule and SS lock ring), QTY=2 (reorder 10/pk)	5063-6592
8	Union Adjustment Tool, used for item #7	5022-2146
9	ZDV SS Union, no fitting, QTY=2	5022-2184
10	Torque Adapter	G1315-45003
14	Handle for clamp unit	G1315-84902
15	Clamp unit	G1315-84901
16	Screw M 2.5, 4 mm long for cell body/clamp	0515-1056
17	Wrench open end 4 mm (supplied with standard accessory kit G1315-68705 of your detector)	8710-1534

Table 15 lists the specific parts for the 500 nl flow cell.

**Table 15** Specific 500 nl Flow Cell Parts

Item	Description	Part Number
	500 nl Flow Cell Kit	G1315-68724
1	PEEK coated fused silica capillary Inlet (100 $\mu\text{m}$ ) <b>pre-mounted to cell</b> , includes Inlet capillary, 300 mm long, 100 $\mu\text{m}$ i.d. with pre-fixed ferrules (#4) and fittings (#3), plus one PEEK Fitting FT (#5)	G1315-87333
2	PEEK coated fused silica capillary Outlet (100 $\mu\text{m}$ ) <b>pre-mounted to cell</b> , includes Outlet capillary, 120 mm long, 100 $\mu\text{m}$ i.d. with pre-fixed ferrules (#4) and fitting (#3), plus one PEEK Fitting FT (#5)	G1315-87338
1	PEEK coated fused silica capillary Inlet (50 $\mu\text{m}$ ) <b>alternative</b> , includes Inlet capillary, 400 mm long, 50 $\mu\text{m}$ i.d. with pre-fixed ferrules (#4) and fittings (#3), plus one PEEK Fitting FT (#5)	G1315-87323
2	PEEK coated fused silica capillary Outlet (50 $\mu\text{m}$ ), <b>alternative</b> , includes Outlet capillary, 120 mm long, 50 $\mu\text{m}$ i.d. with pre-fixed ferrules (#4) and fitting (#3), plus one PEEK Fitting FT (#5)	G1315-87328
1	PEEK coated fused silica capillary Inlet (50 $\mu\text{m}$ ) <b>for earlier 500 nl version kits</b> , includes Inlet capillary, 400 mm long, 50 $\mu\text{m}$ i.d. with pre-fixed ferrules (#4) and fittings (#3), plus one PEEK Fitting FT (#5)	G1315-87323
2	PEEK coated fused silica capillary Outlet (75 $\mu\text{m}$ ) <b>for earlier 500 nl version kits</b> , includes Outlet capillary, 700 mm long, 75 $\mu\text{m}$ i.d. with pre-fixed ferrules (#4) and fitting (#3), plus one PEEK Fitting FT (#5)	G1315-68708
	Sealing Kit, includes items #10, #12 (QTY=2) and #7 (QTY=5)	G1315-68715

Table 16 lists the specific parts for the 80 nl flow cell.

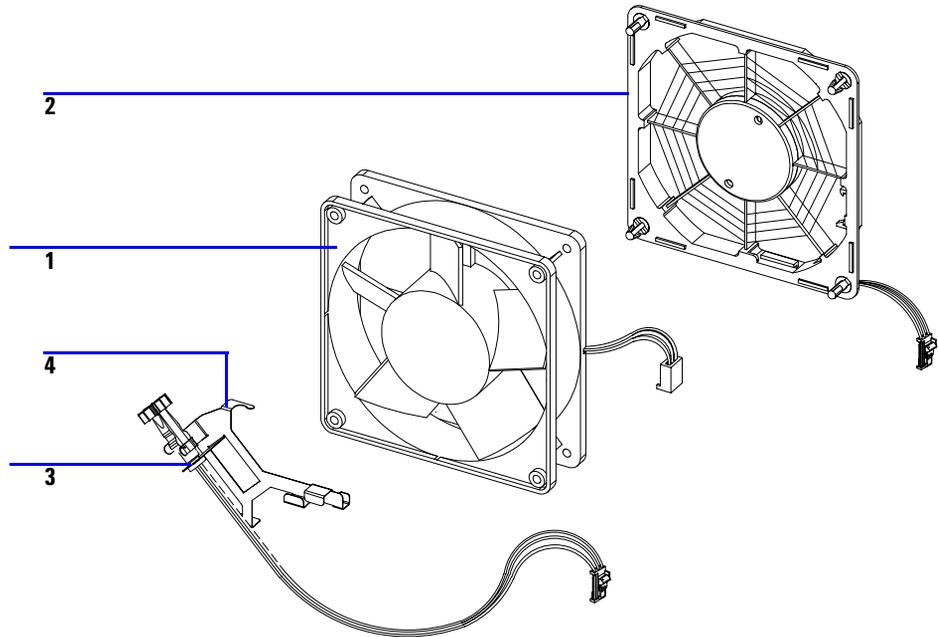
**Table 16** Specific 80 nl Flow Cell Parts

Item	Description	Part Number
	80 nl Flow Cell Kit	G1315-68716
1	PEEK coated fused silica capillary Inlet (50 $\mu\text{m}$ ) <b>pre-mounted to cell</b> , includes Inlet capillary, 400 mm long, 50 $\mu\text{m}$ i.d. with pre-fixed ferrules (#4) and fittings (#3), plus one PEEK Fitting FT (#5)	G1315-87323
2	PEEK coated fused silica capillary Outlet (50 $\mu\text{m}$ ) <b>pre-mounted to cell</b> , includes Outlet capillary, 120 mm long, 50 $\mu\text{m}$ i.d. with pre-fixed ferrules (#4) and fitting (#3), plus one PEEK Fitting FT (#5)	G1315-87328
1	PEEK coated fused silica capillary Inlet (25 $\mu\text{m}$ ) <b>alternative</b> , includes Inlet capillary, 200 mm long, 25 $\mu\text{m}$ i.d. with pre-fixed ferrules (#4) and fittings (#3), plus one PEEK Fitting FT (#5)	G1315-87313
2	PEEK coated fused silica capillary Outlet (25 $\mu\text{m}$ ) <b>alternative</b> , includes Outlet capillary, 600 mm long, 25 $\mu\text{m}$ i.d. with pre-fixed ferrules (#4) and fitting (#3), plus one PEEK Fitting FT (#5)	G1315-87318
	Sealing Kit 80 nl cell, includes items #10, #12 (QTY=2), #7 (QTY=5)and Lite Touch Sleeves (QTY=5)	G1315-68725

## Fan Assembly Parts

**Table 17** Fan Assembly Parts

Item	Description	Part Number
1	Fan (for all DAD/MWDs)	3160-1016
2	Heater assembly (G1315/65B only)	G1315-60000
3	Temperature sensor assembly (G1315/65B only)	G1315-60003
4	Sensor holder (G1315/65B only)	G1315-22300



**Figure 43** Fan Assembly Parts

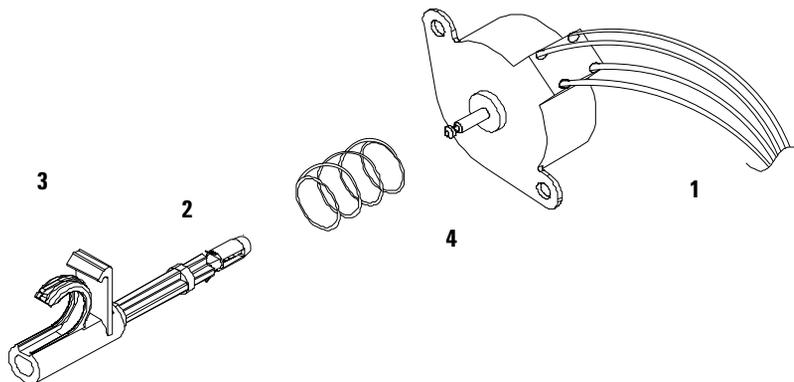
## Holmium Oxide Filter

**Table 18** Holmium Oxide Filter Assembly Parts

Item	Description	Part Number
1	Holmium oxide filter motor assembly, includes items 2 and 4	G1315-68700
2	Holmium oxide filter lever	G1315-45001
3	Holmium oxide filter	79880-22711
4	Spring	1460-1510

### 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.

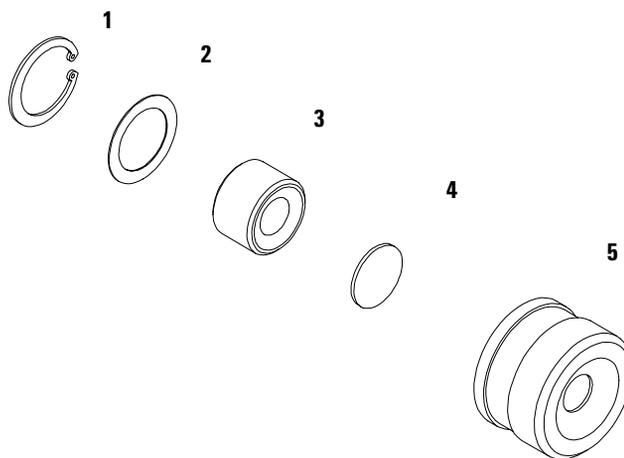


**Figure 44** Holmium Oxide Filter Parts

## Coupling Lens Assembly

**Table 19** Coupling Lens Assembly

Item	Description	Part Number
	Coupling lens assembly	<a href="#">G1103-68001</a>
1	Retainer ring	
2	Washer-spring wavy	
3	Lens support	
4	Lens	
5	Lens holder	



**Figure 45** Coupling Lens Assembly Parts

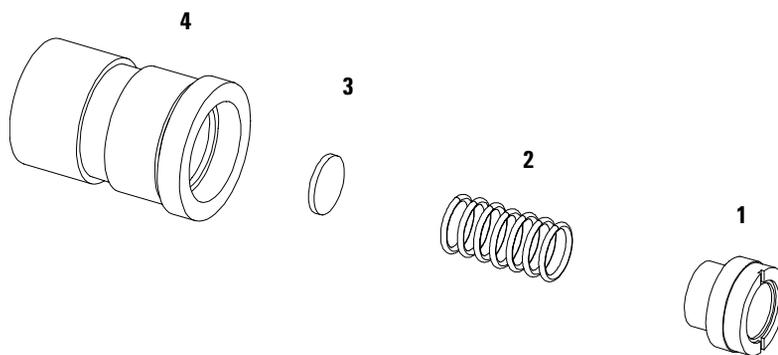
## Source Lens (Achromat) Assembly

**Table 20** Source Lens Assembly

Item	Description	Part Number
	Source lens (achromat) assembly includes a filter lever <a href="#">G1315-45001</a>	<a href="#">G1315-65201</a>
1	Lens achromatic	<a href="#">1000-0486</a>
2	Spring compression	<a href="#">1460-2255</a>
3	Spectro window	<a href="#">79880-28111</a>
4	Holder	

### 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.

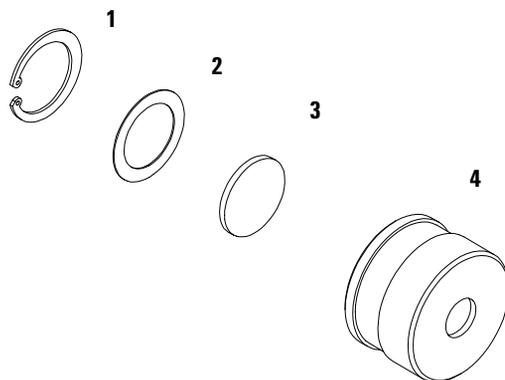


**Figure 46** Source Lens (Achromat) Assembly Parts

## Cell Support Assembly

**Table 21** Cell Support Assembly

Item	Description	Part Number
	Cell support assembly	<a href="#">G1315-65202</a>
1	Retainer ring	<a href="#">0510-1638</a>
2	Washer-spring wavy	<a href="#">3050-1591</a>
3	Spectro window	<a href="#">79880-28111</a>
4	Cell support	<a href="#">G1315-24701</a>

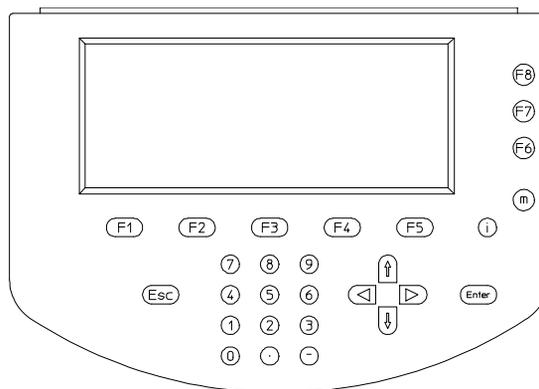


**Figure 47** Cell Support Assembly Parts

## Control Module

**Table 22** Control Module Parts

Item	Description	Part Number
	Control Module, replacement part including cable	<a href="#">G1323-67001</a>
	Plastic Housing Kit, includes front, back and a clamp	<a href="#">5062-8583</a>
	CAN cable Agilent 1100 module to control module	<a href="#">G1323-81600</a>



**Figure 48** Control Module

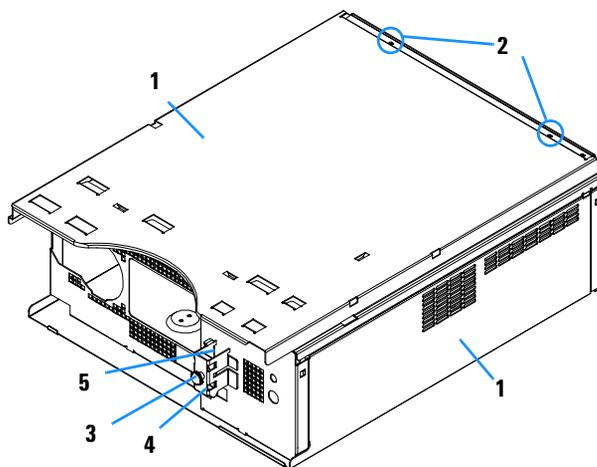
## Sheet Metal Kit (G1315A/G1365A)

**NOTE**

For the information on the sheet metal kit for the G1315B and G1365B refer to “[Sheet Metal Kit \(G1315B/G1365B\)](#)” on page 203.

**Table 23** Sheet Metal Kit Parts (G1315A/G1365A)

Item	Description	Part Number
1	Sheet metal kit includes case and top cover	G1315-68701
2	Screws M3 for cover and flow cell door	5022-2112
3	Thumb screw for union holder	0515-2769
4	Zero dead volume fitting	0100-0900
5	Union holder clamp	G1315-05205


**Figure 49** Sheet Metal Kit Parts (G1315A/G1365A)

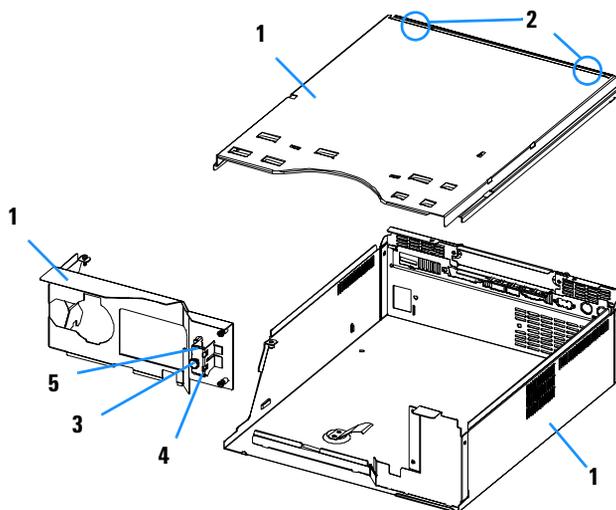
## Sheet Metal Kit (G1315B/G1365B)

### NOTE

For the information on the sheet metal kit for the G1315A and G1365A refer to “Sheet Metal Kit (G1315A/G1365A)” on page 202.

**Table 24** Sheet Metal Kit Parts (G1315B/G1365B)

Item	Description	Part Number
1	Sheet metal kit includes case, top cover and front	G1315-68721
2	Screws M3 for cover and flow cell door	5022-2112
3	Thumb screw for union holder	0515-2769
4	Zero dead volume fitting	0100-0900
5	Union holder clamp	G1315-05205



**Figure 50** Sheet Metal Kit Parts (G1315B/G1365B)

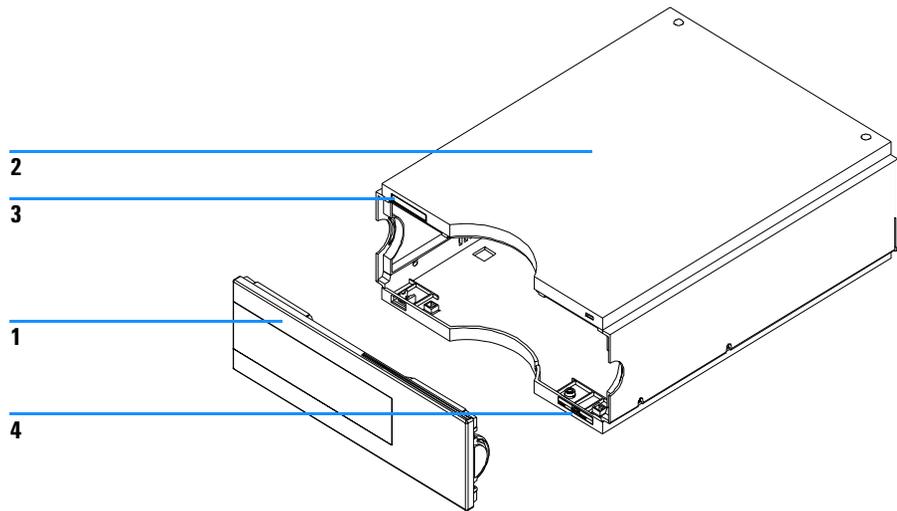
## Plastic Parts

**Table 25** Plastics Parts

Item	Description	Part Number
1	Front cover	5062-8582
2	Plastics, includes base, sides and top	5062-8565
3	Name plate Agilent 1100 Series	5042-1381
4	Name plate Serial Number (w/o serial number)	5042-1314

**NOTE**

For correct assembling of the top and sides, see [“Assembling the Main Cover”](#) on page 178.



**Figure 51** Plastic Parts

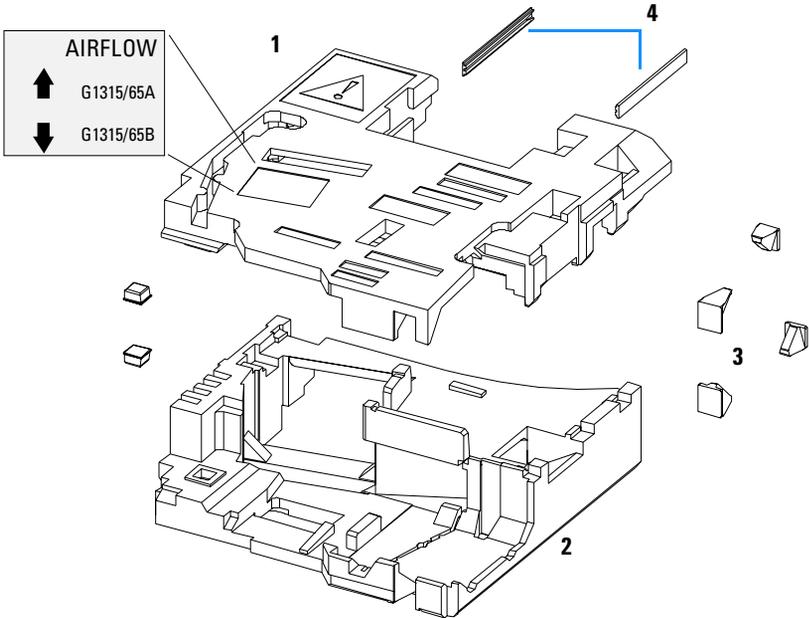
# Foam Parts

**Table 26** Foam Parts

Item	Description	Part Number
1, 2	EPP foam kit, includes base and top	<a href="#">G1315-68722</a>
3	Damper kit (includes 7 bumpers)	<a href="#">G1315-68706</a>
4	Guides for interface board	<a href="#">5041-8395</a>

**NOTE**

Do not order the individual part numbers mentioned on the foam.

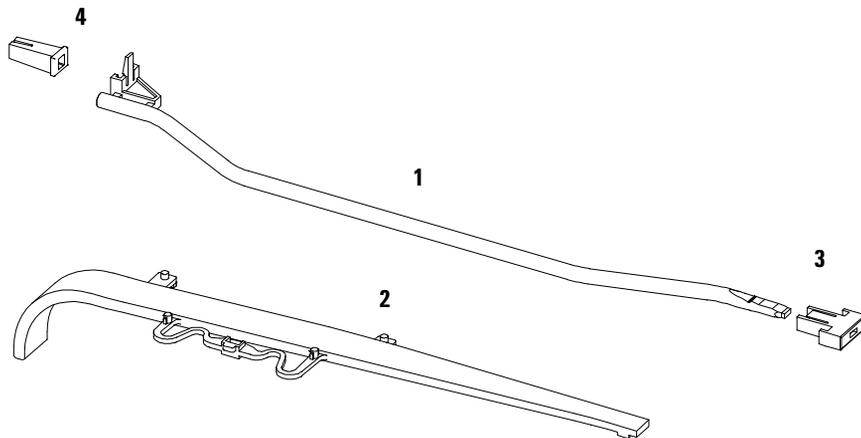


**Figure 52** Foam Parts

## Power and Status Light Pipes

**Table 27** Power and Status Light Pipes

Item	Description	Part Number
	Power supply assembly	0950-2528
	Screw M4 x 0.7, 8 mm lg, to fix power supply at rear panel	0515-0910
	Washer	2190-0409
1	Power light pipe	5041-8382
2	Status light pipe	5041-8384
3	Power switch button	5041-8381
4	Coupler for power supply actuator	5041-8383

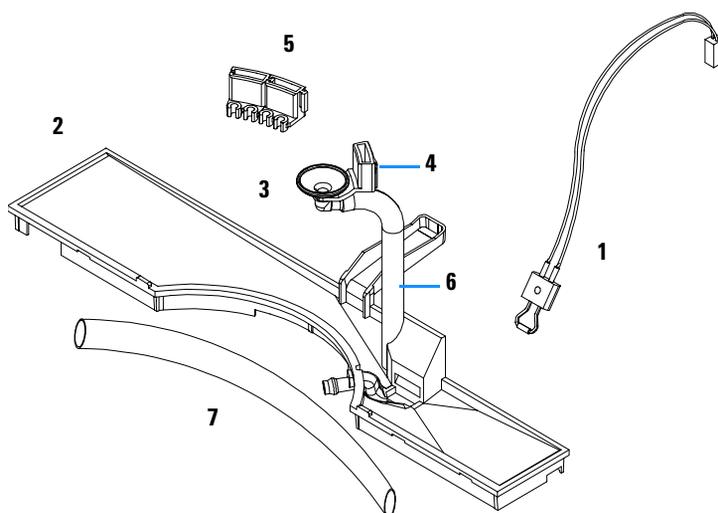


**Figure 53** Power and Status Light Pipe

## Leak Parts

**Table 28** Leak Parts

Item	Description	Part Number
1	Leak sensor assembly	5061-3356
2	Leak pan	G1315-45501
3	Leak funnel	5041-8388
4	Leak funnel holder	5041-8389
5	Clip	5041-8387
6	Corrugated tubing, 120 mm lg, re-order 5 m	5062-2463
7	Corrugated tubing, 120 mm lg, re-order 5 m	5062-2463



**Figure 54** Leak Parts

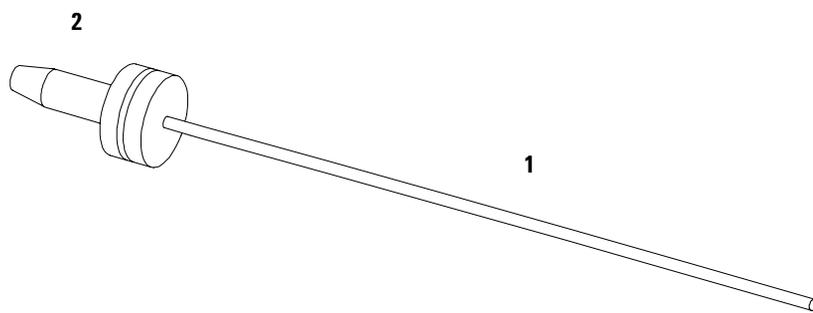
## Accessory Kit

This kit contains some accessories and tools needed for the installation and repair of the detector.

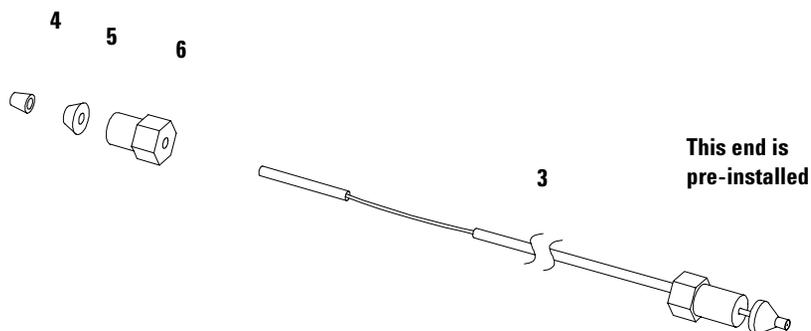
**Table 29** Accessory Kit Parts

Item	Description	Part Number
	Accessory kit	G1315-68705
	Corrugated tubing (to waste), re-order 5 m	5062-2463
1	Teflon Tubing flexible i.d. 0.8 mm (flow cell to waste), re-order 5 m	5062-2462
2	Fitting male PEEK, Qty=1	0100-1516
3	Capillary column – detector 380 mm lg, 0.17 i.d. includes items 4, 5 and 6 (not assembled)	G1315-87311
4	Ferrule front SST, qty=2	0100-0043
5	Ferrule back SST, qty=2	0100-0044
6	Fitting SST, qty=2	79814-22406
	Hex key set 1 – 5 mm	8710-0641
	Wrench open end 1/4 – 5/16 inch	8710-0510
	Wrench open end 4 mm	8710-1534
	ESD wrist strap	9300-1408

For item number refer to [Figure 55](#) and [Figure 56](#).



**Figure 55** Waste Tubing Parts



**Figure 56** Inlet Capillary (Column-Detector) Parts

## Cable Overview

**WARNING**

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

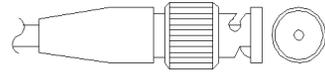
**Table 30** Cables Overview

Type	Description	Part Number
<b>Analog cables</b>	3390/2/3 integrators	01040-60101
	3394/6 integrators	35900-60750
	35900A A/D converter	35900-60750
	General purpose (spade lugs)	01046-60105
<b>Remote cables</b>	3390 integrator	01046-60203
	3392/3 integrators	01046-60206
	3394 integrator	01046-60210
	3396A (Series I) integrator	03394-60600
	3396 Series II / 3395A integrator, see <a href="#">page 217</a>	
	3396 Series III / 3395B integrator	03396-61010
	Agilent 1100 / 1050 modules / 1046A FLD	5061-3378
	1046A FLD	5061-3378
	35900A A/D converter	5061-3378
	1090 liquid chromatographs	01046-60202
	Signal distribution module	01046-60202

**Table 30** Cables Overview, continued

<b>Type</b>	<b>Description</b>	<b>Part Number</b>
<b>BCD cables</b>	3396 integrator	<a href="#">03396-60560</a>
	General purpose (spade Lugs)	<a href="#">G1351-81600</a>
<b>Auxiliary</b>	Agilent 1100 Series vacuum degasser	<a href="#">G1322-61600</a>
<b>CAN cables</b>	Agilent 1100 module to module, 0.5 m	<a href="#">5181-1516</a>
	Agilent 1100 module to module, 1 m	<a href="#">5181-1519</a>
	Agilent 1100 module to control module	<a href="#">G1323-81600</a>
<b>External contacts</b>	Agilent 1100 Series interface board to general purpose	<a href="#">G1103-61611</a>
<b>GPIB cable</b>	Agilent 1100 module to Agilent ChemStation, 1 m	<a href="#">10833A</a>
	Agilent 1100 module to Agilent ChemStation, 2 m	<a href="#">10833B</a>
<b>RS-232 cable</b>	Agilent 1100 module to a computer This kit contains a 9-pin female to 9-pin female Null Modem (printer) cable and one adapter.	<a href="#">34398A</a>
<b>LAN cable</b>	Cross-over network cable (shielded, 3 m long), (for point to point connection)	<a href="#">5023-0203</a>
	Twisted pair network cable (shielded, 7 m long) (for hub connections)	<a href="#">5023-0202</a>

## Analog Cables

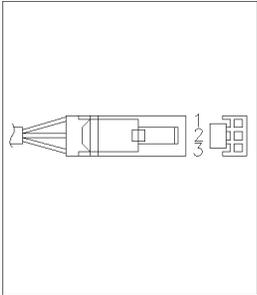


One end of these cables provides a BNC connector to be connected to Agilent 1100 Series modules. The other end depends on the instrument to which connection is being made.

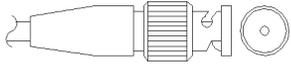
### Agilent 1100 to 3390/2/3 Integrators

Connector <b>01040-60101</b>	Pin <b>3390/2/3</b>	Pin <b>Agilent 1100</b>	Signal Name
	1	Shield	Ground
	2		Not connected
	3	Center	Signal +
	4		Connected to pin 6
	5	Shield	Analog -
	6		Connected to pin 4
	7		Key
	8		Not connected

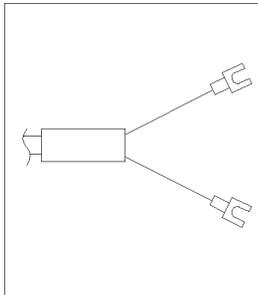
### Agilent 1100 to 3394/6 Integrators

Connector <b>35900-60750</b>	Pin <b>3394/6</b>	Pin <b>Agilent 1100</b>	Signal Name
	1		Not connected
	2	Shield	Analog -
	3	Center	Analog +

### Agilent 1100 to BNC Connector

Connector <b>8120-1840</b>	Pin <b>BNC</b>	Pin <b>Agilent 1100</b>	Signal Name
	Shield	Shield	Analog -
	Center	Center	Analog +

**Agilent 1100 to General Purpose**

Connector <b>01046-60105</b>	Pin <b>3394/6</b>	Pin <b>Agilent 1100</b>	Signal Name
	1		Not connected
	2	Black	Analog -
	3	Red	Analog +

## Remote Cables

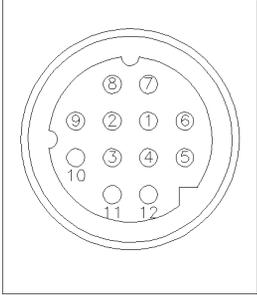


One end of these cables provides a Aligent Technologies APG (Analytical Products Group) remote connector to be connected to Agilent 1100 Series modules. The other end depends on the instrument to be connected to.

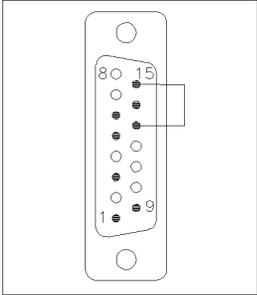
### Agilent 1100 to 3390 Integrators

Connector <b>01046-60203</b>	Pin <b>3390</b>	Pin <b>Agilent 1100</b>	Signal Name	Active (TTL)
	2	1 - White	Digital ground	
	NC	2 - Brown	Prepare run	Low
	7	3 - Gray	Start	Low
	NC	4 - Blue	Shut down	Low
	NC	5 - Pink	Not connected	
	NC	6 - Yellow	Power on	High
	NC	7 - Red	Ready	High
	NC	8 - Green	Stop	Low
	NC	9 - Black	Start request	Low

**Agilent 1100 to 3392/3 Integrators**

Connector <b>01046-60206</b>	Pin <b>3392/3</b>	Pin <b>Agilent 1100</b>	Signal Name	Active (TTL)
 <p>4 - Key</p>	3	1 - White	Digital ground	
	NC	2 - Brown	Prepare run	Low
	11	3 - Gray	Start	Low
	NC	4 - Blue	Shut down	Low
	NC	5 - Pink	Not connected	
	NC	6 - Yellow	Power on	High
	9	7 - Red	Ready	High
	1	8 - Green	Stop	Low
	NC	9 - Black	Start request	Low

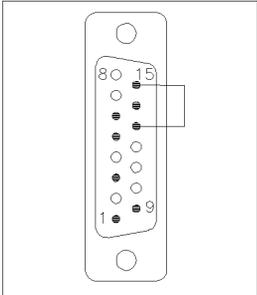
**Agilent 1100 to 3394 Integrators**

Connector <b>01046-60210</b>	Pin <b>3394</b>	Pin <b>Agilent 1100</b>	Signal Name	Active (TTL)
	9	1 - White	Digital ground	
	NC	2 - Brown	Prepare run	Low
	3	3 - Gray	Start	Low
	NC	4 - Blue	Shut down	Low
	NC	5 - Pink	Not connected	
	NC	6 - Yellow	Power on	High
	5,14	7 - Red	Ready	High
	6	8 - Green	Stop	Low
	1	9 - Black	Start request	Low
	13, 15		Not connected	

**NOTE**

START and STOP are connected via diodes to pin 3 of the 3394 connector.

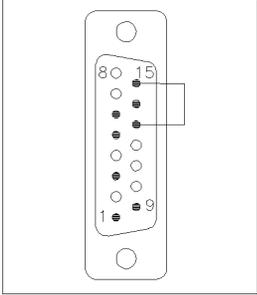
**Agilent 1100 to 3396A Integrators**

Connector <b>03394-60600</b>	Pin <b>3394</b>	Pin <b>Agilent 1100</b>	Signal Name	Active (TTL)
	9	1 - White	Digital ground	
	NC	2 - Brown	Prepare run	Low
	3	3 - Gray	Start	Low
	NC	4 - Blue	Shut down	Low
	NC	5 - Pink	Not connected	
	NC	6 - Yellow	Power on	High
	5,14	7 - Red	Ready	High
	1	8 - Green	Stop	Low
	NC	9 - Black	Start request	Low
	13, 15		Not connected	

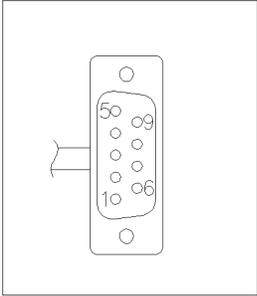
**Agilent 1100 to 3396 Series II / 3395A Integrators**

Use the cable [03394-60600](#) and cut pin #5 on the integrator side. Otherwise the integrator prints START; not ready.

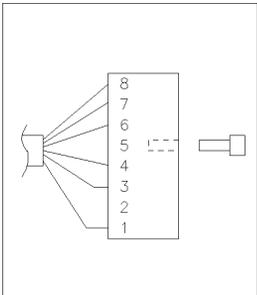
**Agilent 1100 to 3396 Series III / 3395B Integrators**

Connector <b>03396-61010</b>	Pin <b>33XX</b>	Pin <b>Agilent 1100</b>	Signal Name	Active (TTL)
	9	1 - White	Digital ground	
	NC	2 - Brown	Prepare run	Low
	3	3 - Gray	Start	Low
	NC	4 - Blue	Shut down	Low
	NC	5 - Pink	Not connected	
	NC	6 - Yellow	Power on	High
	14	7 - Red	Ready	High
	4	8 - Green	Stop	Low
	NC	9 - Black	Start request	Low
	13, 15		Not connected	

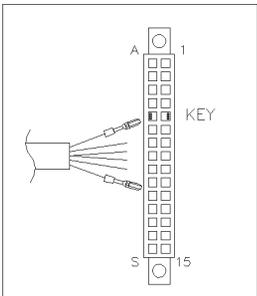
**Agilent 1100 to HP 1050, HP 1046A or Agilent 35900 A/D Converters**

Connector <b>5061-3378</b>	Pin <b>HP 1050 / ...</b>	Pin <b>Agilent 1100</b>	Signal Name	Active (TTL)
	1 - White	1 - White	Digital ground	
	2 - Brown	2 - Brown	Prepare run	Low
	3 - Gray	3 - Gray	Start	Low
	4 - Blue	4 - Blue	Shut down	Low
	5 - Pink	5 - Pink	Not connected	
	6 - Yellow	6 - Yellow	Power on	High
	7 - Red	7 - Red	Ready	High
	8 - Green	8 - Green	Stop	Low
	9 - Black	9 - Black	Start request	Low

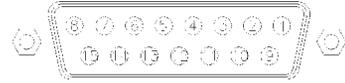
**Agilent 1100 to HP 1090 LC or Signal Distribution Module**

Connector <b>01046-60202</b>	Pin HP 1090	Pin Agilent 1100	Signal Name	Active (TTL)
 <p>5 - Key</p>	1	1 - White	Digital ground	
	NC	2 - Brown	Prepare run	Low
	4	3 - Gray	Start	Low
	7	4 - Blue	Shut down	Low
	8	5 - Pink	Not connected	
	NC	6 - Yellow	Power on	High
	3	7 - Red	Ready	High
	6	8 - Green	Stop	Low
	NC	9 - Black	Start request	Low

**Agilent 1100 to General Purpose**

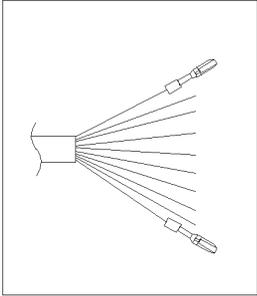
Connector <b>01046-60201</b>	Pin Universal	Pin Agilent 1100	Signal Name	Active (TTL)
		1 - White	Digital ground	
		2 - Brown	Prepare run	Low
		3 - Gray	Start	Low
		4 - Blue	Shut down	Low
		5 - Pink	Not connected	
		6 - Yellow	Power on	High
		7 - Red	Ready	High
		8 - Green	Stop	Low
		9 - Black	Start request	Low

## BCD Cables

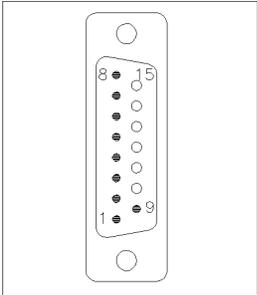


One end of these cables provides a 15-pin BCD connector to be connected to the Agilent 1100 Series modules. The other end depends on the instrument to be connected to

### Agilent 1100 to General Purpose

Connector <b>G1351-81600</b>	Wire Color	Pin Agilent 1100	Signal Name	BCD Digit
	Green	1	BCD 5	20
	Violet	2	BCD 7	80
	Blue	3	BCD 6	40
	Yellow	4	BCD 4	10
	Black	5	BCD 0	1
	Orange	6	BCD 3	8
	Red	7	BCD 2	4
	Brown	8	BCD 1	2
	Gray	9	Digital ground	Gray
	Gray/pink	10	BCD 11	800
	Red/blue	11	BCD 10	400
	White/green	12	BCD 9	200
	Brown/green	13	BCD 8	100
	not connected	14		
	not connected	15	+5 V	Low

**Agilent 1100 to 3396 Integrators**

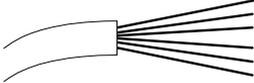
Connector <b>03396-60560</b>	Pin <b>3392/3</b>	Pin <b>Agilent 1100</b>	Signal Name	BCD Digit
	1	1	BCD 5	20
	2	2	BCD 7	80
	3	3	BCD 6	40
	4	4	BCD 4	10
	5	5	BCD0	1
	6	6	BCD 3	8
	7	7	BCD 2	4
	8	8	BCD 1	2
	9	9	Digital ground	
	NC	15	+ 5 V	Low

## Auxiliary Cable



One end of this cable provides a modular plug to be connected to the Agilent 1100 Series vacuum degasser. The other end is for general purpose.

### Agilent 1100 Series Degasser to general purposes

Connector <b>G1322-61600</b>	Color	Pin Agilent 1100	Signal Name
	White	1	Ground
	Brown	2	Pressure signal
	Green	3	
	Yellow	4	
	Grey	5	DC + 5 V IN
	Pink	6	Vent

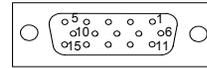
## CAN Cable



Both ends of this cable provide a modular plug to be connected to Agilent 1100 Series module's CAN-bus connectors.

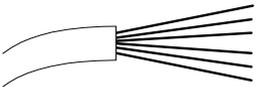
Agilent 1100 module to module, 0.5 m	<a href="#">5181-1516</a>
Agilent 1100 module to module, 1 m	<a href="#">5181-1519</a>
Agilent 1100 module to control module	<a href="#">G1323-81600</a>

## External Contact Cable



One end of this cable provides a 15-pin plug to be connected to Agilent 1100 Series module's interface board. The other end is for general purpose.

### Agilent 1100 Series Interface Board to general purposes

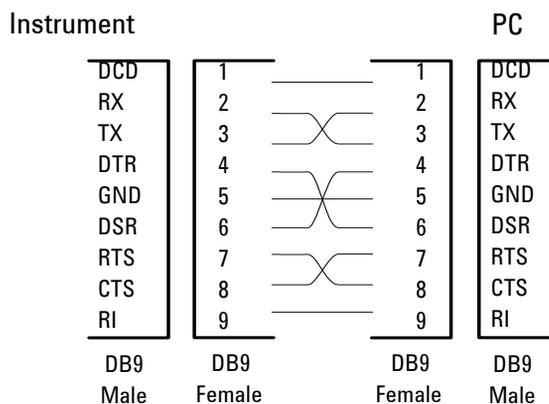
Connector <b>G1103-61611</b>	Color	Pin Agilent 1100	Signal Name
	White	1	EXT 1
	Brown	2	EXT 1
	Green	3	EXT 2
	Yellow	4	EXT 2
	Grey	5	EXT 3
	Pink	6	EXT 3
	Blue	7	EXT 4
	Red	8	EXT 4
	Black	9	Not connected
	Violet	10	Not connected
	Grey/pink	11	Not connected
	Red/blue	12	Not connected
	White/green	13	Not connected
	Brown/green	14	Not connected
	White/yellow	15	Not connected

## RS-232 Cable Kit

This kit contains a 9-pin female to 9-pin female Null Modem (printer) cable and one adapter. Use the cable and adapter to connect Agilent Technologies instruments with 9-pin male RS-232 connectors to most PCs or printers.

### Agilent 1100 module to PC

#### RS-232 Cable Kit 34398As

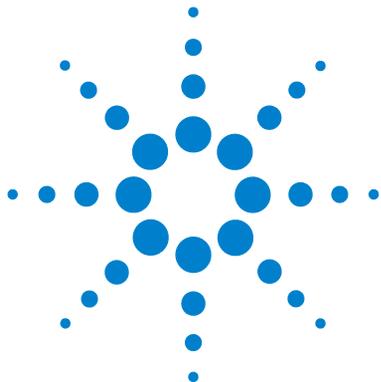


## LAN Cables

### Recommended Cables

**Table 31**

Description	Part number
Cross-over network cable (shielded, 3 m long), (for point to point connection)	<a href="#">5023-0203</a>
Twisted pair network cable (shielded, 7 m long) (for hub connections)	<a href="#">5023-0202</a>



## 6 Introduction to the Detector

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## Introduction to the Detector

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

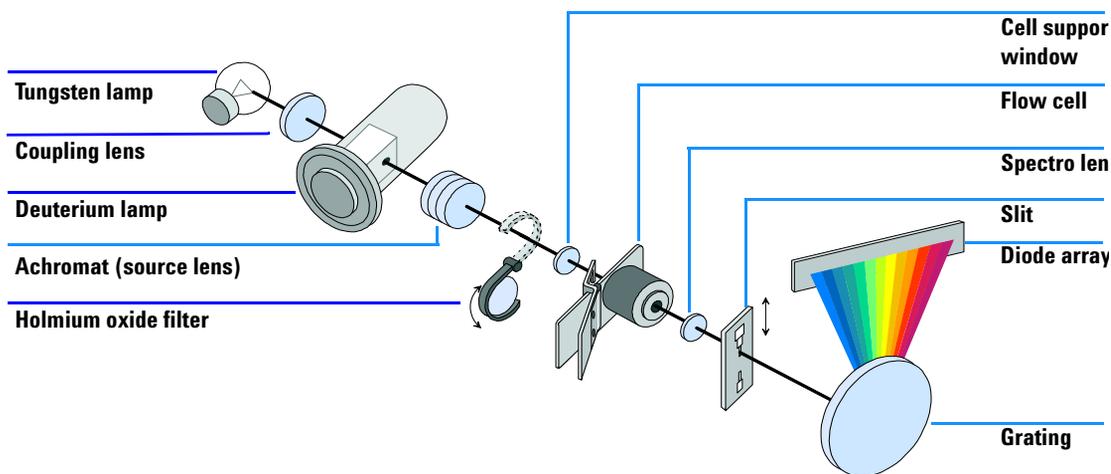
- long-life deuterium and tungsten lamps for highest intensity and lowest detection limit over a wavelength range of 190–950 nm,
- no loss in sensitivity for up to five wavelengths simultaneous,
- programmable slit from 1–16 nm for complete optimization of sensitivity, linearity and spectral resolution,
- optional flow-cell cartridges (standard 10 mm 13 µl, semi-micro 6 mm 5 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 (G1315B DAD and G1365B MWD).

For specifications, see [“Performance Specifications”](#) on page 296.

## Optical System Overview

### Optical System

The optical system of the detector is shown in [Figure 57](#). 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 57** Optical System of the Detector

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

wavelength range. The light source for the visible and SWNIR wavelength range is a low noise tungsten lamp. This lamp emits light over the wavelength range 470 – 950 nm.

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

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

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

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

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

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

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

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

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

## Electrical Connections

- The GPIB connector is used to connect the detector with a computer. The address and control switch module next to the GPIB connector determines the GPIB address of your detector. The switches are preset to a default address (see “[GPIB Default Addresses](#)” on page 262) which is recognized once after power is switched on.
- The CAN bus is a serial bus with high speed data transfer. The two connectors for the CAN bus are used for internal Agilent 1100 Series module data transfer and synchronization.
- Two independent analog outputs provide signals for integrators or data handling systems.
- The interface board slot is used for external contacts and BCD bottle number output or LAN connections.
- The REMOTE connector may be used in combination with other analytical instruments from Aligent Technologies if you want to use features such as start, stop, common shut down, prepare, and so on.
- With the appropriate software, the RS-232C connector may be used to control the detector from a computer through a RS-232C connection. This connector is activated and can be configured with the configuration switch next to the GPIB connector (see “[Communication Settings for RS-232C Communication](#)” on page 263). See your software documentation for further information.
- The power input socket accepts a line voltage of 100 – 120 V or 220 – 240 V AC  $\pm$  10 % with a line frequency of 50 or 60 Hz. Maximum power consumption is 300 VA/125 W. There is no voltage selector on your detector because the power supply has a wide-ranging capability. There are no externally accessible fuses, because automatic electronic fuses are implemented in the power supply. The security lever at the power input socket prevents that the detector cover is taken off when line power is still connected.

**WARNING**

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

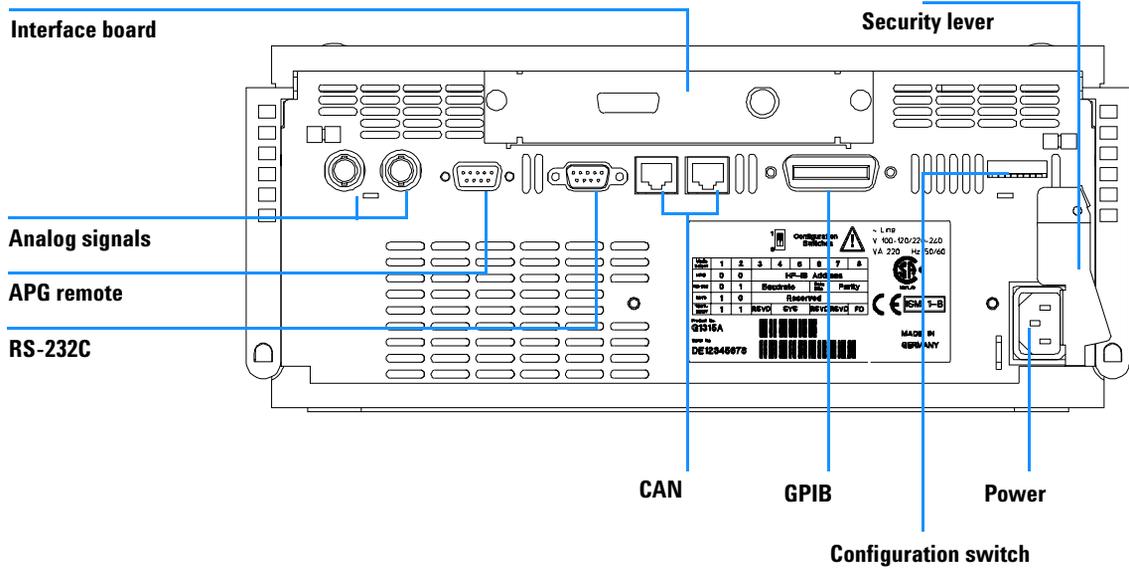


Figure 58 Electrical Connections

## Instrument Layout

The industrial design of the detector 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 detector 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 detector 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

The detector provides two EMF counters for the lamps. The counters increment increments with lamp use, and can be assigned a maximum limit which provides visual feedback in the user interface when the limit is exceeded. The counters can be reset to zero after the lamp is exchanged. The detector provides the following EMF counters:

- Deuterium Lamp On-Time
- Tungsten Lamp On-Time

### 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 lamp burn time is dependent on the requirements for the analysis (high or low sensitivity analysis, wavelength etc.), 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, no EMF limit should be set. When instrument performance indicates maintenance is necessary, take note of the values displayed by lamp 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.

## Electronics

The electronics are comprised of four main components:

- **detector main board** (DAM/MWM), see [page 238](#).
- **power supply**, see [page 266](#).

Optional:

- **interface board** (BCD/external contacts), see [page 253](#).
- **interface board** (LAN), see [page 255](#).

## Detector Main Board (DAM/MWM)

This board controls all information and activities of all assemblies within the detector. Through interfaces (LAN, CAN, GPIB or RS-232C) connected to the user interface, the operator enters parameters, changes modes and controls the detector.

### **ASIC — Application Specific Integrated Circuit**

The 304-pin application specific integrated circuit (ASIC) provides interfacing to external devices through drivers, including LAN, GPIB, CAN, APG remote, and RS-232C. It also provides generic functionality like PWM (pulse width modulation) and digital encoder reading.

### **Main processor**

The Motorola MC 68332 microprocessor acts as the main processor with a clock frequency of 16 MHz. It exchanges data with the ASIC through the core bus as well as with the PSRAM (pseudo-static random access memory) of  $2 \times 512$  kilobyte, the flash EEPROM (electrically erasable programmable read-only memory) of 1 MB and the  $1 \times 32$  KB battery-backed NV-RAM (non-volatile). Battery life is designed to last for more than 25 years under normal operating conditions.

Control lines provide communication to the lamp supply section, which controls the deuterium and tungsten lamps. The main processor is connected to the SSP (signal and spectra processor) through an 8-bit parallel bus.

### **SSP — Signal and Spectra Processor**

The SSP (signal and spectra processor) utilizing a dedicated ASIC and RAM of  $3 \times 128$  KB, converts the 1024 raw data values to intensity and absorbance values.

Conversion and subsequent calculation to achieve absorbance values include the following tasks:

- dark current correction,
- PDA (photo diode array) temperature compensation,
- absorbance calculation, and
- signal averaging.

### **SIMM Memory Module**

The main board versions -66500, -66520 and -66530 provided 4 slots for extended memory (up to  $4 \times 1$  MB or up to  $4 \times 4$  MB to accommodate more run buffer (signal and spectral data). Only 1 MB was used (no need to upgrade for any application). With main board version -66540 the slots were removed and the 1 MB memory is now on-board (no upgrade possible)

### **Firmware**

For an outline of the firmware, see [“Firmware Description”](#) on page 246. In case you require exact mathematical equations for the transformation, see the *Understanding Your Agilent ChemStation* handbook.

### **Leak Sensor**

This block consists of a PTC for the leak detection and a NTC for the ambient temperature compensation. A leak would cool down the PTC and this change in resistance would generate a leak signal.

### **Fan Drive**

The operation of the fan is controlled by the main processor and runs with constant revolution. The fan produces a sense signal which is derived from the revolution. This sense signal is used for diagnostics.

### **On-board Battery**

An on-board lithium battery buffers the electronic memory when the module is turned off.

For safety information on lithium batteries see [“Lithium Batteries Information”](#) on page 303.



## SCI Board

The SCI (spectrograph connector interface), located on the optical unit assembly is the interface between micro-slit, PDA and detector main board. In addition, wavelength calibration data and manufacturing data from the manufacturing process (for example, serial number, dates, and so on) are stored in the EEPROM.

## PDA Signal Conditioning Electronics

Data is transferred from the photodiode array (PDA) through the spectrograph connector interface (SCI) board to the PDA signal conditioning electronics. The PDA signal conditioning electronics adjusts the signal levels to provide an appropriate output signal.

## A/D Converter

The output signal from the PDA signal conditioning electronics is directed to the 16-bit /160-kHz A/D converter. Multiplexing is used to monitor test signals for diagnostic purposes including GND, reference voltage ( $V_{ref}$ ), and a ramp signal. These signals are used to verify the front end electronics separately from the PDA. The signal from the PDA temperature sensor is used for temperature compensation.

## PFP (PDA Front-end Processor)

The PFP on this board utilizing RAM of  $3 \times 32$  KB and  $1 \times 8$  KB and the EPLD (electronically programmable logic device) forwards the data from the 16-bit A/D converter. It provides timing and control for the photodiode readout and the A/D conversion.

## Analog Outputs

There are two independent analog outputs (0...1 V full scale). Digital data from the ASIC is converted into a pulse-width modulated signal (PWM). The PWM signal is then fed to an amplitude modulator, which precisely turns the reference signal on and off. This signal then passes to a low-pass filter section.

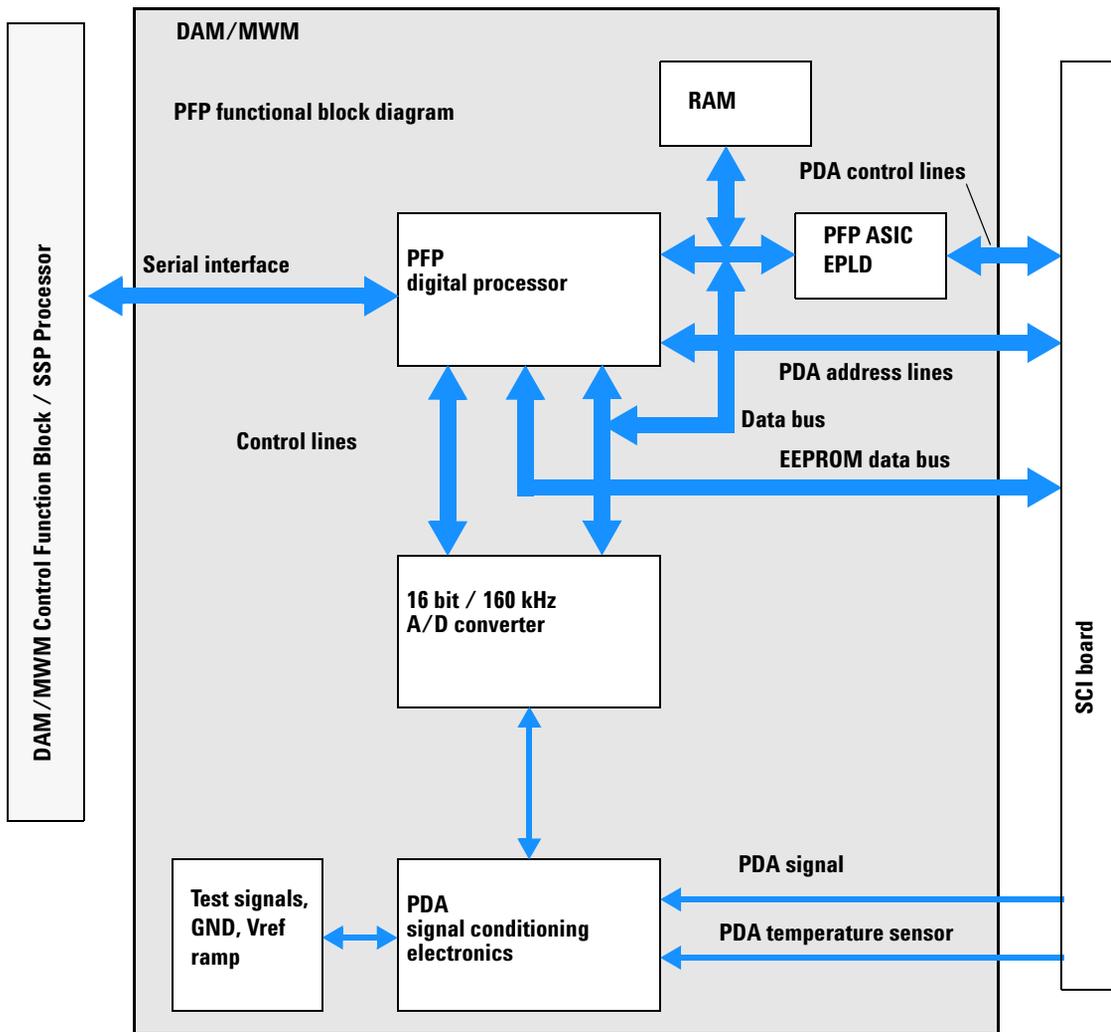


Figure 60 Block Diagram PFP Functions

### **Deuterium Lamp Filament Control**

Before ignition, the deuterium lamp filament control circuit provides a constant voltage of 2.5 VDC at approximately 6 A to the filament of the deuterium lamp. The deuterium lamp filament control circuit is enabled by the processor on the DAM board.

### **Deuterium Lamp Current Control**

The deuterium lamp current control circuit comprises two parts. One part generates an ignition pulse of 600 VDC for the lamp, resulting in lamp ignition. After ignition this voltage is disabled. The other part is a constant current source of 320 mA at an operating voltage of about 85 VDC for stable operating conditions and light emission of the deuterium lamp. The deuterium lamp current control circuit is supervised by the processor on the DAM board.

### **Igniting the Deuterium Lamp**

The deuterium lamp is heated for several seconds prior to ignition. The deuterium lamp current control circuit gives an ignition pulse to the lamp, resulting in lamp ignition. The filament control circuit disables the filament voltage if the lamp was ignited successfully.

If the deuterium lamp failed to ignite, the whole sequence is repeated after a wait sequence for cooling down. If the deuterium lamp still does not ignite, an error message occurs.

### **Tungsten Lamp Voltage Control**

The tungsten lamp voltage is generated by the tungsten lamp voltage control circuit which is enabled by the processor. This circuit provides a constant voltage of 6 VDC to operate the tungsten lamp.

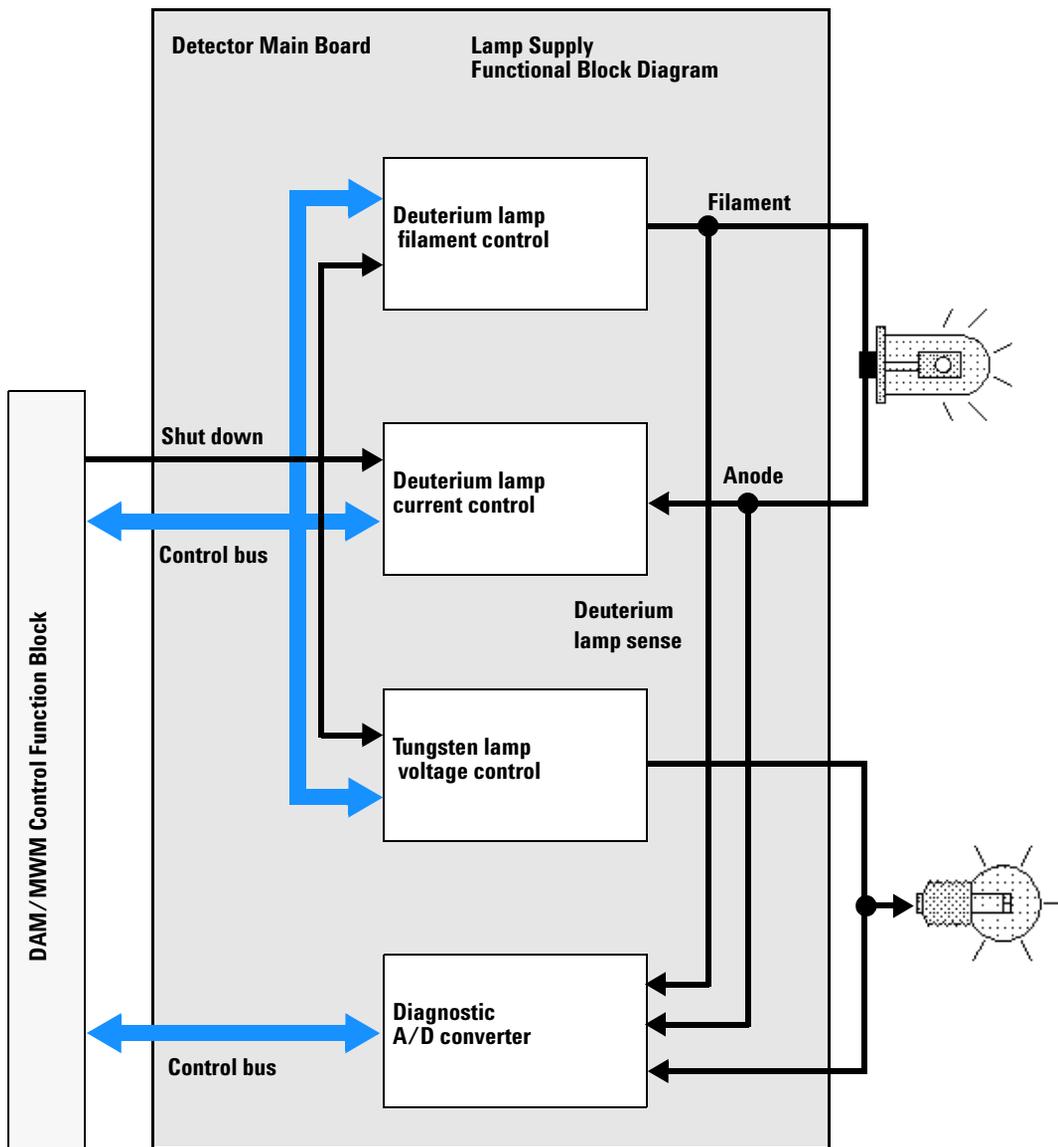


Figure 61 Block Diagram Lamp Supply Functions

### **Diagnostic A/D Converter**

The diagnostic A/D converter senses currents and voltages of the deuterium and tungsten lamps and converts the analog signals into digital values. The digital values are transferred via the control bus on the detector main board. When values are outside the normal range, an appropriate error message is generated and the lamps will be switched off.

### **Safety Switches**

If the EPP foam is removed while the instrument is still on, the safety light switches are activated and the deuterium lamp, the tungsten lamps and the fan are switched off.

### **Interfaces**

For detailed information on interfaces, see [“Interfaces”](#) on page 256.

### **Temperature Control**

The G1315B/G165B detectors are equipped with a temperature control to improve the baseline stability in unstable environments (e.g. strong variation of the temperature due to air condition systems). A heater and a temperature sensor assembly have been added and are controlled by the detector main board and its firmware. The temperature at the fan is compared with a temperature sensor on the main board. Depending on the difference the heater in front of the fan is controlled. There are no parameters to be set for the temperature control.

## 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 series modules. Its properties are:

- the complete communication capabilities (GPIB, CAN and RS-232C),
- memory management,
- ability to update the firmware of the 'main system'.

### Main System

Its properties are:

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

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

- run synchronization through APG remote
- error handling,
- diagnostic functions,
- or module specific functions like
- internal events such as lamp control, filter movements,
- raw data collection and conversion to absorbance (see [“Raw Data Conversion to Absorbance”](#) on page 248).

## Firmware Updates

Firmware updates can be done using your user interface:

- handheld control module with files from a PC-card or
- Agilent ChemStation with files from floppy disk

The file naming conventions are:

xxxx-vvv.DLB, where

xxxx is the product number, for example, 1315 for the G1315A DAD, and

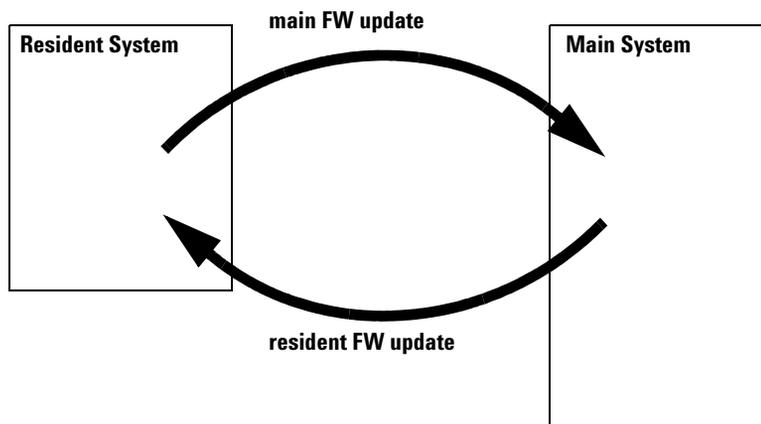
vvv is the revision number, for example 104 is revision 1.04

For instructions refer to your user interface.

### 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.



**Figure 62** Firmware Update Mechanism

## Raw Data Conversion to Absorbance

The raw data flow (from the photodiode array) and conversion to absorbance spectra for each data point is a multiple step process. This process is outlined in this section. For exact mathematical equations for the transformation, see the *Understanding Your Agilent ChemStation* handbook. [Figure 63](#) shows the firmware flow diagram.

### Subtract Dark Signal

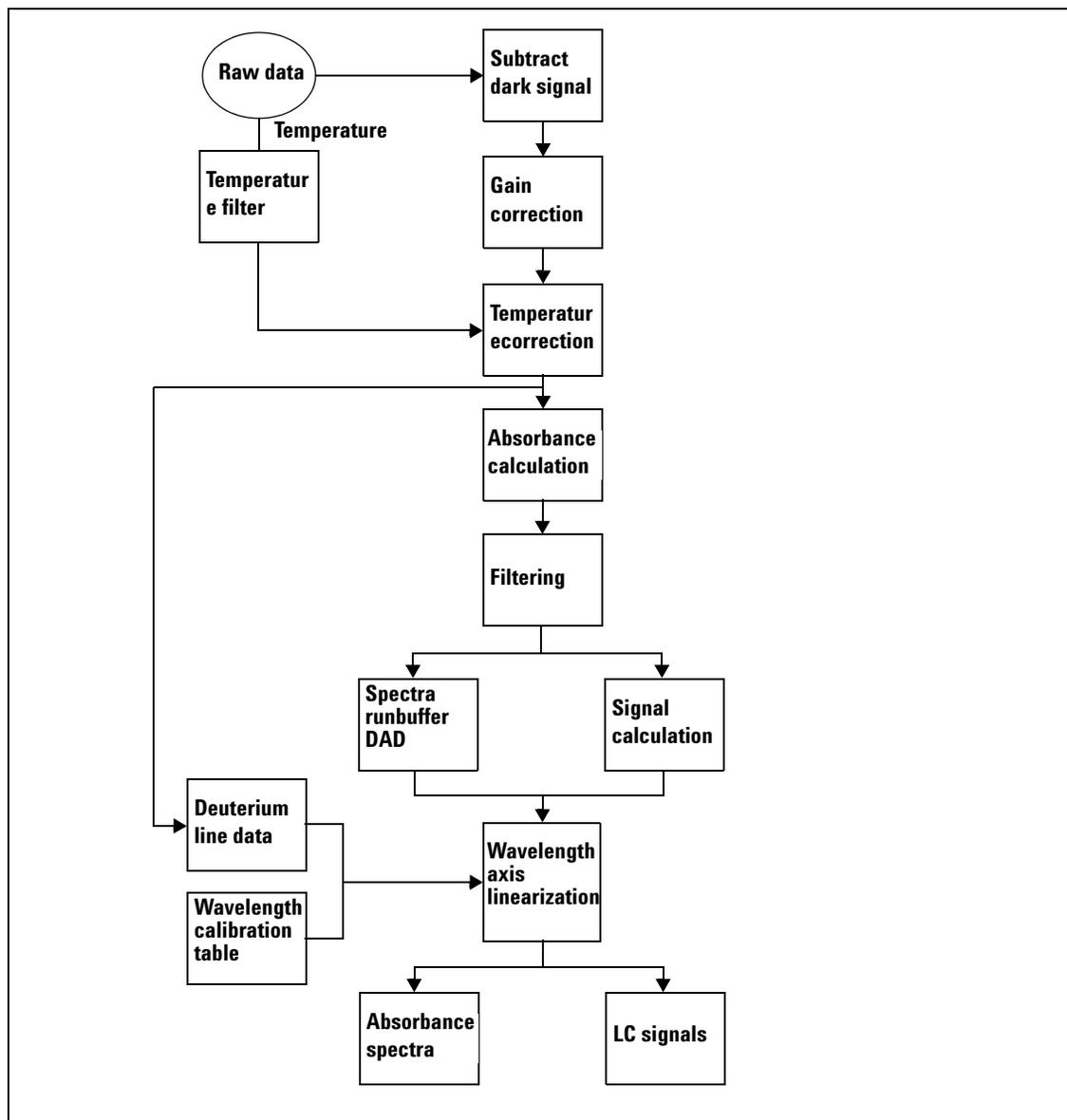
Raw data coming from the photodiode array via the signal conditioning electronics (which includes a variable gain amplifier) are read from the A/D converter. For details, see “[A/D Converter](#)” on page 241. These raw data are intensity values of each photodiode of the array.

During a blank measurement a dark signal and electronic offset measurement is performed for each diode on the photodiode array. This offset spectrum is stored and subtracted from all subsequent intensity spectra to give dark signal corrected intensity spectra.

### Gain Correction

During a blank measurement every photodiode is assigned a gain value, depending on the amount of light falling on the diode array. These gain values are stored in a table. They are used to adjust the amplification factor in the signal conditioning electronics. This process is used to adjust small signal levels to the optimum range of the A/D converter.

The DSP firmware uses the gain table to adjust the dark signal corrected intensity spectra.



**Figure 63** Firmware Flow Diagram

### **Temperature Correction**

The quantum efficiency of the photodiode array depends on the temperature and is different for each wavelength. The temperature dependency follows a monotone increasing function over the wavelength scale, which means it increases with longer wavelengths (above 600 nm).

To correct the intensity spectrum for temperature effects, the temperature on the photodiode array is averaged. With the help of a function, correction factors for each wavelength are calculated. The temperature factors are used to correct the intensity spectrum.

### **Temperature Filter**

The temperature filter determines whether the temperature has been changed significantly. Only in this case, temperature correction is applied.

### **Absorbance Calculation and Filtering**

To form an absorbance spectrum, the logarithm of the blank medium's intensity spectrum is subtracted from the logarithm of the sample's intensity spectrum.

Spectral filtering is used for noise reduction. Spectra are taken at faster rates than the corresponding integration time, set in the Agilent ChemStation's user interface. Absorbance values of all wavelength form one absorbance spectrum.

### **Spectra Runbuffer (DAD Only)**

Absorbance spectra are intermediately stored here if the acquisition of spectra is faster than the processing and data communication to the Agilent ChemStation. Intensity values can also be stored for special purposes, for example, diagnostic reasons.

### **Wavelength Axis Linearization, Deuterium Line Data, Wavelength Calibration Table**

1024 photodiodes are located on the array to give a sampling interval of nominal <1 nm in the UV wavelength range. In the visible and short wave near infrared wavelength ranges, the sampling interval is slightly higher. To correct for this optical non-linearity and to convert from discrete diode distances to a

continuous, linear scale, an interpolation algorithm is applied. This algorithm uses a wavelength calibration table and actual wavelength data, derived from the deuterium emission lines at 486 nm and 656 nm.

Wavelength calibration is done for each individual spectrograph during the production process. The individual calibration coefficients are stored in the wavelength calibration table in an EEPROM (electrically erasable PROM), which is part of the spectrograph electronics. Actually two sets of coefficients are used, one set for the wavelength range below the second order filter, located on the photodiode array, and one set for the upper wavelength range. During each start-up of the spectrophotometer, each discrete wavelength value is assigned a photodiode of the array.

Recalibration in the diagnostic section of your Agilent ChemStation software can be performed to compensate for minor deviations from initial production conditions. Recalibration is achieved using the deuterium line data, that is, the exact positions of the deuterium emission lines at 486 nm and 656 nm. With the user interface, the operator can include the new parameters in the wavelength calibration table to calculate a table of correction coefficients which are applied to each spectrum.

## Rawdata File

The runbuffer within the detector is used for signal and spectra data only. If the runbuffer is full, no further signal data are entered. This will guarantee useful signal data but may cause loss of interesting spectral data. The runbuffer can hold about 90 spectra depending on the settings and may be expanded by additional memory on the detector main board (SIMM modules).

## Peak Detector

The peak detector (PD) always uses signal A as the *pilot* signal. The PD is adjusted by means of two setpoints: peakwidth and threshold. Both setpoints are time-programmable. While the PD-threshold is a method parameter of its own, the PD-peakwidth parameter is derived from the general peakwidth (PKWD) parameter. At the start of the run, the value for the PD-peakwidth is set equal to the PKWD setpoint. The peak detector recognizes changes in the

slope of this signal (upslope, apex, downslope and baseline) and stores spectra according to the operator's instructions. During the run the PD-peakwidth parameter can be changed by time-programming.

## Spectra Acquisition Modes (DAD only)

The spectra acquisition mode allows automatic storage of spectra during a run. The mode can be changed during the run by time-programming.

The modes in detail are:

**Table 32** Spectra Acquisition Modes

Mode	Description
none	no spectra is stored
apex	top of peak spectra is stored
apex + baselines	last baseline spectrum before peak, top of peak spectrum and first baseline spectrum after peak is stored.
apex + slopes	spectrum in peak upslope, at top of peak and in peak downslope is stored.
apex + slopes + baselines	combined apex + slopes and apex + baselines.
all in peak	compared to storing all spectra periodically, only stores spectra within a peak at doubled period. Starts with last baseline spectrum before peak and ends with first baseline spectrum after peak. If baseline spectra are not detected, the spectrum before the first spectrum in peak or the spectrum after the last spectrum within the peak is stored instead.
all 2nd in peak	only the 2nd spectra of a peak is stored.
all	periodically all spectra are stored. The period depends on the peakwidth setting. For peakwidth setting=0 (narrowest peak), the spectrum data rate would be 20 Hz.
all second	periodically every 2nd spectra is stored (50 % of mode <i>all</i> ).

## Optional Interface Boards

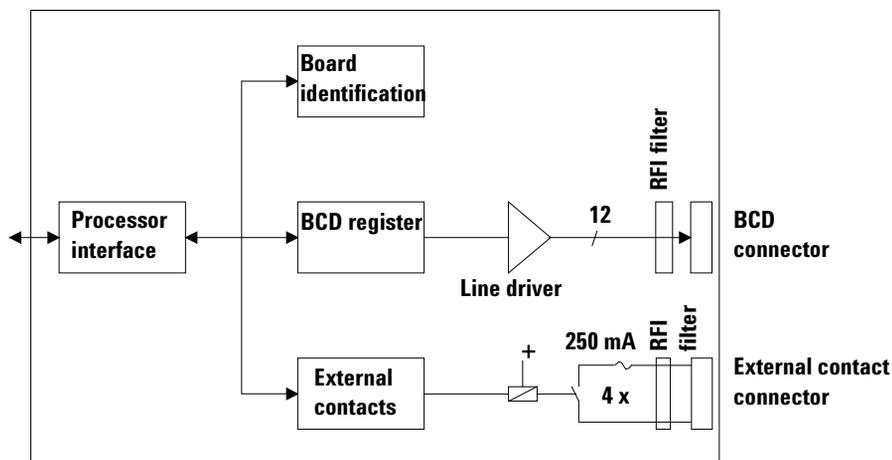
The Agilent 1100 Series modules have one optional board slot that allows addition of an interface board to the modules.

**Table 33** Optional Interface Boards

Description	Part Number
BCD Board	G1351-68701
Fuse 250 mA (four are on the board)	2110-0004
LAN Communication Interface Board	G1369A or G1369-60001

### BCD Board

The BCD board provides a BCD output for the bottle number of the Agilent 1100 Series autosampler and four external contacts. The external contact closure contacts are relay contacts. The maximum settings are: 30 V (AC/DC); 250 mA (fused).



**Figure 64** Block Diagram BCD Board

There are general purpose cables available to connect the BCD output, see “[BCD Cables](#)” on page 220 and the external outputs, see “[External Contact Cable](#)” on page 224 to external devices.

**Table 34** Detailed connector layout (1100)

Pin	Signal name	BCD digit
1	BCD 5	20
2	BCD 7	80
3	BCD 6	40
4	BCD 4	10
5	BCD 0	1
6	BCD 3	8
7	BCD 2	4
8	BCD 1	2
9	Digital ground	
10	BCD 11	800
11	BCD 10	400
12	BCD 9	200
13	BCD 8	100
14	not connected	
15	+5V	

## LAN Communication Interface Board

### NOTE

One board is required per Agilent 1100 stack. It is recommended to add the LAN board to the detector with highest data rate.

### NOTE

The LAN board can only be used together with:

a main board version G13XX-66520 (for G1315A, G1365A, G1314A, G1310A, G1311A, G1312A and G1313A) or newer and on all other 1100 modules.

a DOS-ChemStation software revision A.06.01 or above.

The following cards can be used with the Agilent 1100 modules.

**Table 35** LAN Boards

Type	Vendor	Supported networks
G1369A G1369-60001	Agilent Technologies	Fast Ethernet, Ethernet/802.3, RJ-45 (10/100Base-TX) <b>recommended for re-ordering</b>
J4106A (*)	Hewlett Packard	Ethernet/802.3, RJ-45 (10Base-T)
J4105A (*)	Hewlett Packard	Token Ring/802.5, DB9, RJ-45 (10Base-T)
J4100A (*)	Hewlett Packard	Fast Ethernet, Ethernet/802.3, RJ-45 (10/100Base-TX) + BNC (10Base2)

### NOTE

These cards (\*) may be longer orderable. Minimum firmware of these Hewlett Packard JetDirect cards is A.05.05.

### Recommended Cables

Cross-over network cable (shielded, 3 m long), (for point to point connection)	5023-0203
Twisted pair network cable (shielded, 7 m long) (for hub connections)	5023-0202

## Interfaces

The Agilent 1100 Series modules provide the following interfaces:

**Table 36** Agilent 1100 Series Interfaces

Interface Type	Pumps	Autosampler	DA Detector MW Detector FL Detector	VW Detector RI Detector	Thermostatted Column Compartment	Vacuum Degasser
CAN	Yes	Yes	Yes	Yes	Yes	No
GPIB	Yes	Yes	Yes	Yes	Yes	No
RS-232C	Yes	Yes	Yes	Yes	Yes	No
Remote	Yes	Yes	Yes	Yes	Yes	Yes
Analog	Yes	No	2 ×	1 ×	No	Yes*
Interface board	Yes	Yes	Yes	Yes	No	No

\* The vacuum degasser will have a special connector for specific use. For details see description of main board.

- CAN connectors as interface to other Agilent 1100 Series modules,
- GPIB connector as interface to the Agilent ChemStation,
- RS-232C as interface to a computer,
- REMOTE connector as interface to other Agilent products,
- Analog Output connector(s) for signal output, and
- Interface slot for specific interfacing (external contacts, BCD, LAN and so on).

For identification and location of the connectors [Figure 6](#) on page 24.

### WARNING

**Never use cables other than the ones supplied by Agilent Technologies to ensure proper functionality and compliance with safety or EMC regulations, see “[Cable Overview](#)” on page 210.**

## 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.

## GPIB Interface

The GPIB connector is used to connect the module with a computer. The address and control switches next to the GPIB connector determine the GPIB address of your module. The switches are preset to a default address and recognized by the operating software from Aligent Technologies.

**Table 37** Default Addresses

Autosampler	28	Autosampler	28
Pump	22	RID	29
FLD	23		
VWD	24	Autosampler (HP 1050)	18
Agilent 8453	25	Pump (HP 1050)	16
DAD/MWD	26	VWD (HP 1050)	10
Column Compartment	27	DAD (HP 1050)	17

## CAN Interface

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

## Remote Interface

The APG remote connector may be used in combination with other analytical instruments from Aligent Technologies if you want to use features such as common shut down, prepare, and so on.

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

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

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

- standard TTL levels (0 V is logic true, + 5 V is false),
- fan-out is 10,
- input load is 2.2 kOhm against + 5 V, and
- outputs are open collector type, inputs/outputs (wired-or technique).

**Table 38** Remote Signal Distribution

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

**Table 38** Remote Signal Distribution, continued

Pin	Signal	Description
8	STOP	(L) Request to reach system ready state as soon as possible (for example, stop run, abort or finish and stop injection). Receiver is any module performing run-time controlled activities.
9	START REQUEST	(L) Request to start injection cycle (for example, by start key on any module). Receiver is the autosampler.

## RS-232C

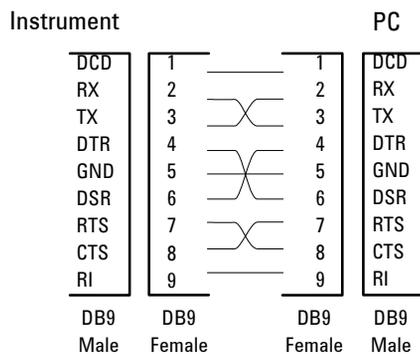
The RS-232C connector is used to control the instrument from a computer through RS-232C connection, using the appropriate software. This connector can be activated by the configuration switch module next to the GPIB connector.

The RS-232C is designed as DCE (Data Communication Equipment) with a 9-pin male SUB-D type connector. The pins are defined as follows:

**Table 39** RS-232C Connection Table

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

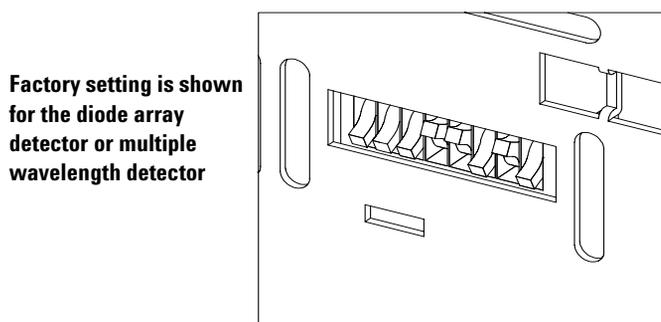
## 6 Introduction to the Detector



**Figure 65** RS-232 Cable

## Setting the 8-bit Configuration Switch

The 8-bit configuration switch is located next to the GPIB connector. Switch settings provide configuration parameters for GPIB address, serial communication protocol and instrument specific initialization procedures.



**Figure 66** 8-bit Configuration Switch

**Table 40** 8-bit Configuration Switch

Mode Select	1	2	3	4	5	6	7	8
GPIB	0	0		GPIB Address				
RS-232C	0	1	Baud rate			Data Bits	Parity	
Reserved	1	0	Reserved					
TEST/BOOT	1	1	RSVD	SYS		RSVD	RSVD	FC

Switches 1 and 2 define which set of parameters (for example, for GPIB, RS-232C, and so on) will be changed. Once the change has been completed, the instrument must be powered up again in order to store the values in the non-volatile memory.

In the non-volatile memory, the parameters are kept, regardless of whether you turn the instrument off and on again. They will be kept until the same set of parameters is changed and the power is reset. All other previously stored configuration settings will still remain in the non-volatile memory.

In this way, you can store more than one set of parameters using the same 8-bit configuration switch twice, for example, for both GPIB and RS-232C.

## GPIB Default Addresses

If you just want to change the GPIB address and need a detailed procedure, refer to the *Installing Your Agilent ChemStation System* handbook.

Default GPIB address is set to the following addresses:

**Table 41** Default Addresses for Agilent Series 1100 Modules

Module	Address	Binary Address
Pump	22	0 0 0 1 0 1 1 0
FLD	23	0 0 0 1 0 1 1 1
VWD	24	0 0 0 1 1 0 0 0
Agilent 8453	25	0 0 0 1 1 1 0 1
DAD/MWD	26	0 0 0 1 1 0 1 0
Column compartment	27	0 0 0 1 1 0 1 1
Autosampler	28	0 0 0 1 1 1 0 0
RID	29	0 0 0 1 1 1 0 1

where 0 means that the switch is down and 1 means that the switch is up.

## Communication Settings for RS-232C Communication

The communication protocol used in this instrument supports only hardware handshake (CTS/RTS).

Switches 1 in down and 2 in up position define that the RS-232C parameters will be changed. Once the change has been completed, the instrument must be powered up again in order to store the values in the non-volatile memory.

**Table 42** Communication Settings for RS-232C Communication

Mode Select	1	2	3	4	5	6	7	8
RS-232C	0	1	Baud rate			Data Bits	Parity	

Use the following tables for selecting the setting which you want to use for RS-232C communication. The number 0 means that the switch is down and 1 means that the switch is up.

**Table 43** Baud Rate Settings

Switches			Baud Rate	Switches			Baud Rate
3	4	5		3	4	5	
0	0	0	9600	1	0	0	9600
0	0	1	1200	1	0	1	14400
0	1	0	2400	1	1	0	19200
0	1	1	4800	1	1	1	38400

**Table 44** Data Bit Settings

Switch 6	Data Word Size
0	7 Bit Communication
1	8 Bit Communication

**Table 45** Parity Settings

Switches		Parity
7	8	
0	0	No Parity
1	0	Odd Parity
1	1	Even Parity

One start bit and one stop bit are always used (not selectable).

Per default, the module will turn into 19200 baud, 8 data bit with no parity.

## Forced Cold Start Settings

Switches 1 and 2 do not force storage of this set of parameters in non-volatile memory. Returning switches 1 and 2 to other positions (other than being both up) will allow for normal operation.

### CAUTION

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

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

**Table 46** Forced Cold Start Settings

Mode Select	1	2	3	4	5	6	7	8
TEST/BOOT	1	1	0	0	0	0	0	1

To return to normal operation, set switches back to your GPIB or RS 232 configuration settings.

## Stay-Resident Settings

Firmware update procedures may require this mode in case of firmware loading errors.

Switches 1 and 2 do not force storage of this set of parameters in non-volatile memory. Returning switches 1 and 2 to other positions (other than being both up) will allow for normal operation.

If you use the following switch settings and power the instrument up again, the instrument firmware stays in the resident part, that is, it is not operable as a detector. It only uses basic functions of the operating system for example, for communication.

**Table 47** Stay Resident Settings

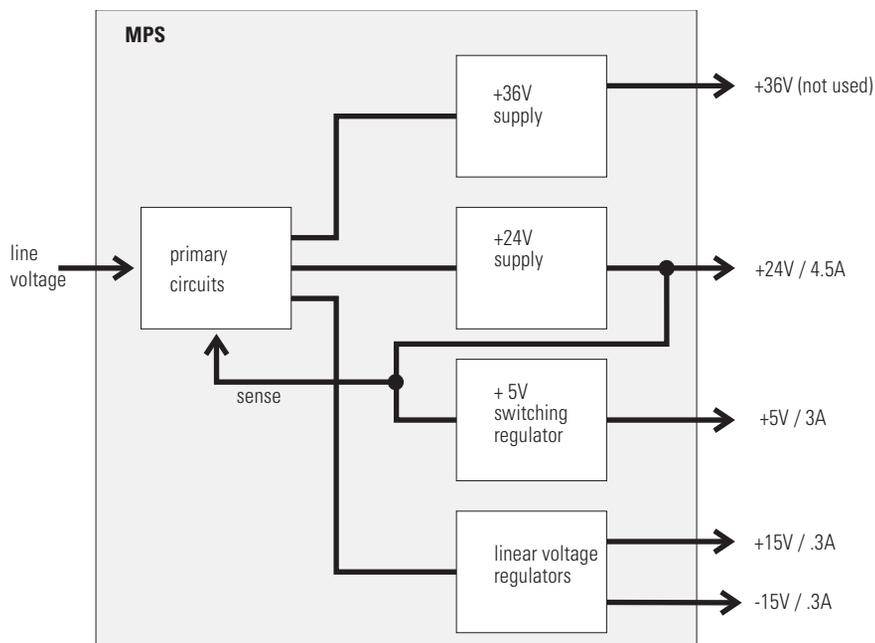
Mode Select	1	2	3	4	5	6	7	8
TEST/BOOT	1	1	0	0	1	0	0	0

To return to normal operation, set switches back to your GPIB or RS-232C configuration settings.

## The Main Power Supply Assembly

The main power supply comprises a closed assembly (no onsite repair possibility).

The power supply provides all DC voltages used in the module except for the voltages supplied by the lamp power supply to the deuterium and tungsten lamps in the detectors. The line voltage can vary in a range from 100 – 120 or 220 – 240 volts AC  $\pm 10\%$  and needs no manual setting.



**Figure 67** Main Power Supply (MPS) Blockdiagram

### WARNING

To disconnect the instrument from line, unplug the power cord. The power supply still uses some power, even if the power switch on the front panel is turned off.

No accessible hardware fuse is needed because the main power supply is safe against any short circuits or overload conditions on the output lines. When overload conditions occur, the power supply turns off all output voltages. Turning the line power off and on again resets the power supply to normal operation if the cause of the overload condition has been removed.

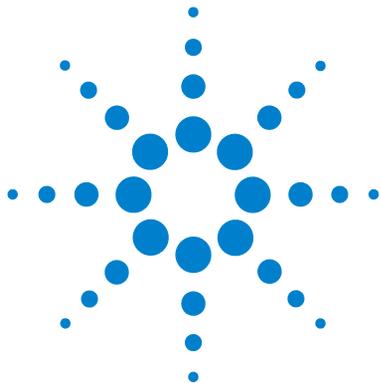
An over-temperature sensor in the main power supply is used to turn off output voltages if the temperature exceeds the acceptable limit (for example, if the cooling fan of the instrument fails). To reset the main power supply to normal operating conditions, turn the instrument off, wait until it is approximately at ambient temperature and turn the instrument on again.

The following table gives the specifications of the main power supply.

**Table 48** Main Power Supply Specifications

Maximum power	300 VA / 130 W	Continuous output
Line Input	100 – 120 or 220 – 240 volts AC ± 10 %, line frequency of 50/60 Hz	Wide ranging
Output 1	+ 24 V / 4.5 A (maximum)	total power consumption of + 24 V and + 36 V must not exceed 107 W.
Output 2	+ 36 V / 2.5 A (maximum)	
Output 3	+ 5 V / 3 A	
Output 4	+ 15 V / 0.3 A	
Output 5	- 15 V / 0.3 A	





## 7 Control Module Screens for Agilent 1100 DAD and MWD

Major keys on the Agilent 1100 Control Module	270
Control Module - Unsupported Module	271
Screens available from the Analysis screen	272
Screens available from the System screen	282
Screens available from the Records screen	284
Diagnostics and Tests	290



## Major keys on the Agilent 1100 Control Module

**Table 49**

ESC	Return to previous screen and scroll through top layer views (Analysis, Settings)
m	Open context sensitive menus
i	Information/help
Enter	Store changed parameters or execute the choice from a pull-down menu
On/Off	Switch on lamp(s)
Start	Start a run
Plot	View the chromatogram
Views	Change between view of analysis - status - system screens

### NOTE

The screens shown on the next pages are based on the following firmware revisions:  
 For the operation of the G1315B DAD and G1365B MWD you require:  
 Minimum Control Module firmware revision B.01.04 (G1323B).  
 Minimum LC Module firmware revision 4.xx.

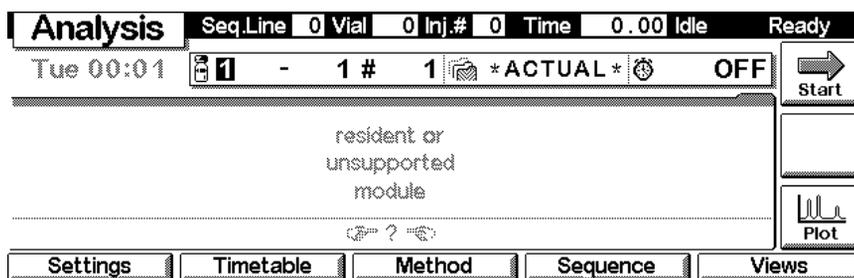
Some screens may differ slightly depending on the module type G1315A/B DAD or G1365A/B MWD.

### NOTE

In case the control module's display seems to be frozen (hang-up due to a communication problem on the CAN bus, unplug the control module from the LC module and reconnect.

## Control Module - Unsupported Module

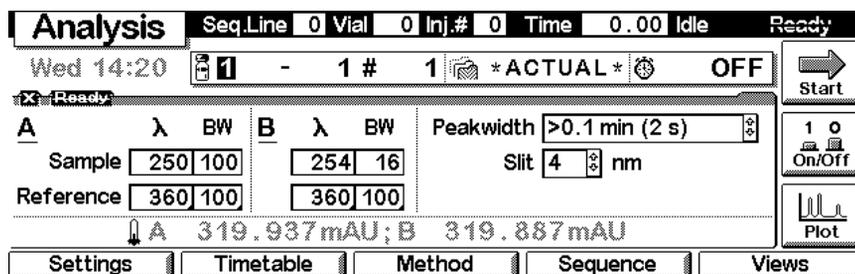
In case the control module shows the following screen and the yellow LED on the detector is not flashing, the used firmware in the Control Module is not able to control the G1315B DAD or G1365B MWD. These detectors require firmware revision B.01.04 or above (G1323B).



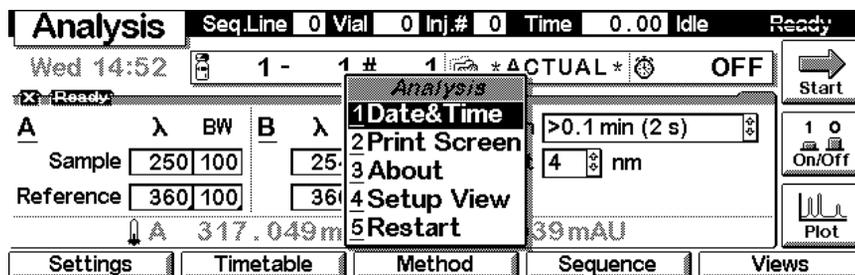
## Screens available from the Analysis screen

### The Analysis screen

This is the wake-up screen, if the Agilent 1100 detector is the only configured Agilent 1100 module. It is used to enter the most common detector method parameters.

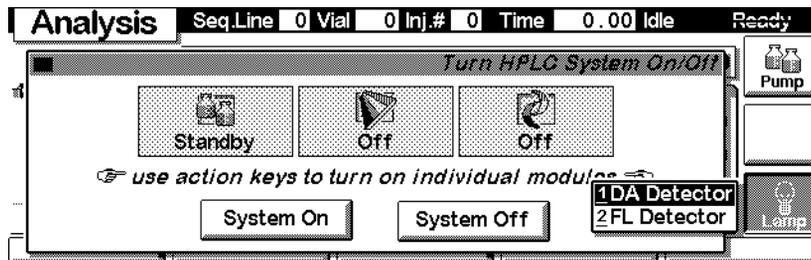


The **m**-key allows access to the context sensitive menu. **Setup view** leads you to add sections for additional Agilent 1100 modules. **Restart** re-boots the control module.

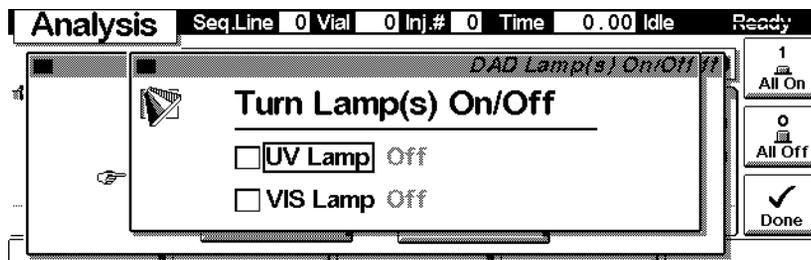


### Lamp ON/OFF

Use the F8 key (**On/Off**) to turn on the lamp(s). If more than one module is available, select the DAD or MWD from the pop-up menu.

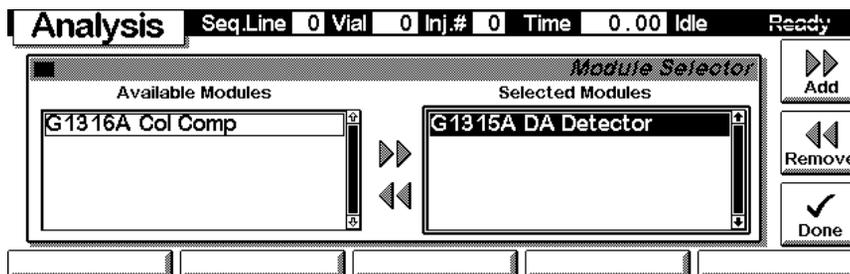


The lamp(s) can be selected individually.



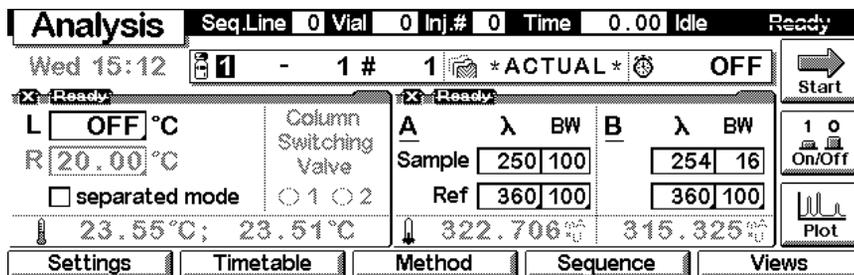
### Setup View

In the **Setup view**, e.g. another module can be added to the view.

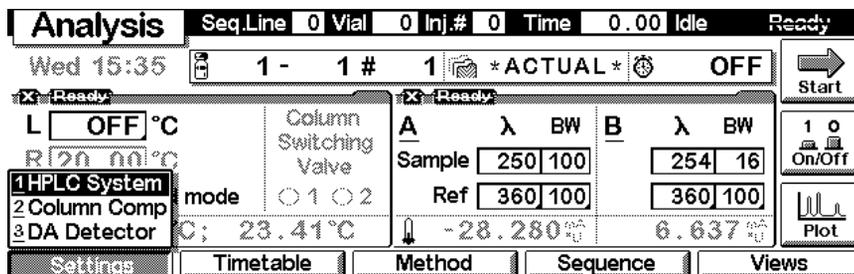


## 7 Control Module Screens for Agilent 1100 DAD and MWD

Here, e.g. the column compartment parameters are shown on the display as well. The number of parameters on the display are restricted as additional modules are added. Maximum 4 modules are shown automatically. If more modules are in the system, you have to choose in Setup view.

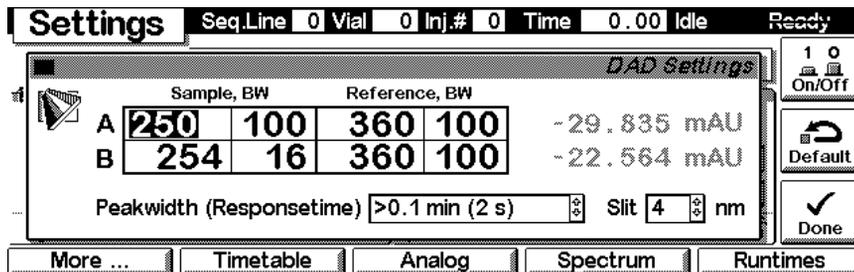


With the **Settings** key you open a pull-down menu where you can select the DAD modules.

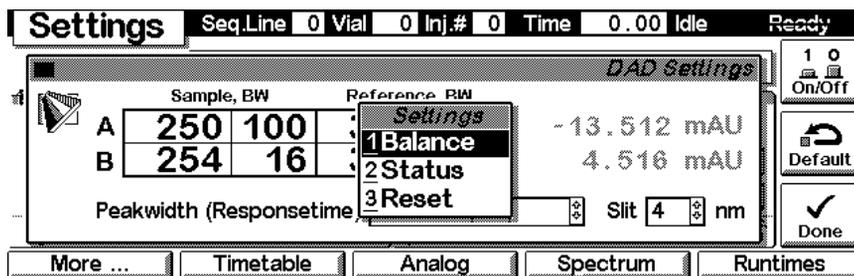


### Settings

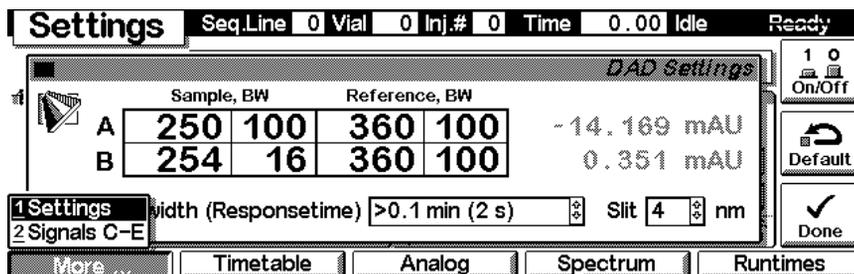
Within the **Settings** you can change the DAD or MWD parameters and with a different set of parameters available through the F1-5 keys. F7 key resets the DAD or MWD to default values. F8 opens a window to turn on the lamps.



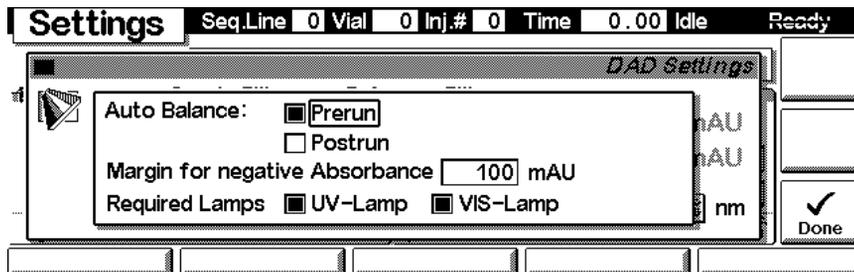
Use the **m**-key for the context sensitive menu. The **Status** command pulls up a monitor screen displaying signals and spectra as programmed. **Reset** will load the DAD or MWD default parameters. **Balance** brings the baseline back to set offset.



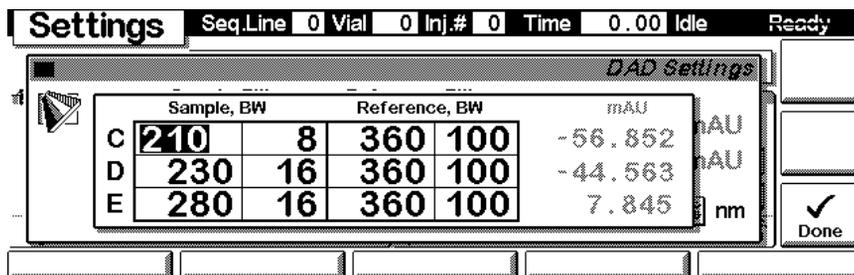
Use F1-key (**More**) opens a pull-down menu.



Selecting **More** and **Settings** pull down menu you can enter special DAD or MWD setpoints.

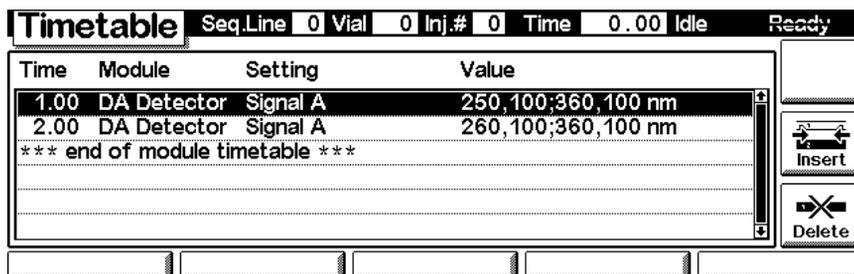


Selecting **More** and **Signals C-E** on the pull down menu you can enter additional DAD or MWD signal parameters.



### Settings - Timetable

With the F2 key (**Timetable**) you can list the timetable for the DAD or MWD. Press F7 key (**Insert**) to add entries or F6 key (**Delete**) to remove entries.



Press the F7 key (**Insert**) to add a timetable events. Use the F6 key (**Done**) to view the entered lines of the timetable.

**Timetable** Seq.Line 0 Vial 0 Inj.# 0 Time 0.00 Idle Ready

*Timetable Insert*

Time [min] 0.00 Module DA Detector Setting Signal A

Signal 250 100 360 100 nm

*fields change with setting selected*

Enter Done

Use the **m**-key for the context sensitive menu. It gives you additional tools for the timetable.

**Timetable** Seq.Line 0 Vial 0 Inj.# 0 Time 0.00 Idle Ready

Time	Module	Setting	Value
1.00	DA Detector	Signal A	;360, 100 nm
2.00	DA Detector	Signal A	;360, 100 nm
** end of module timetable			

*Timetable*

1 Copy Line

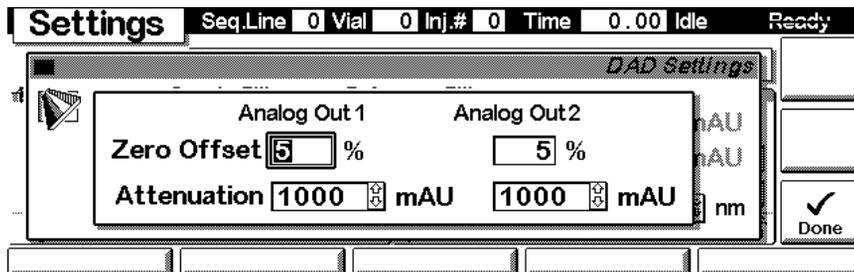
2 Paste Line

3 Print Timetable

Insert Delete

### Settings - Analog

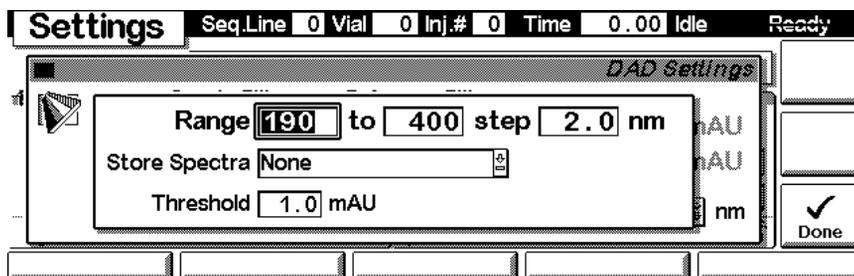
With the F3 key (**Analog**) you can change the settings for the analog outputs.



### Settings - Spectrum Range

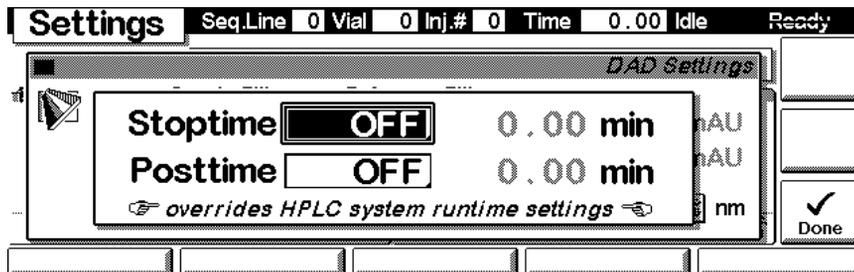
FOR G1315A/B DAD: With the F4 key (**Spectrum**) you can change the settings for the spectrum acquisition.

FOR G1365A/B MWD: You can change the settings for the spectrum acquisition (STOP FLOW). The spectrum is started via [“Sample, Holmium and Dark Current Spectrum”](#) on page 291.

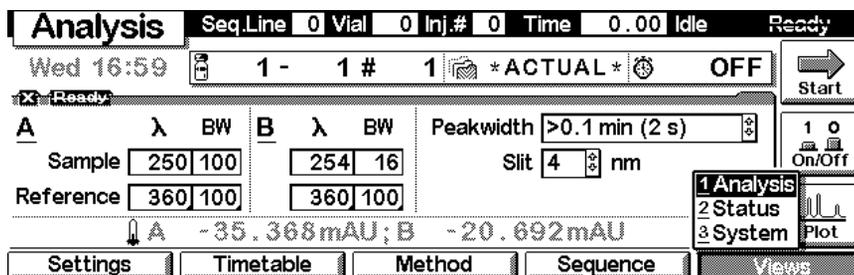


### Settings - Run times

With the F5 key (**Runtimes**) you can change the stop time and the post-run time.

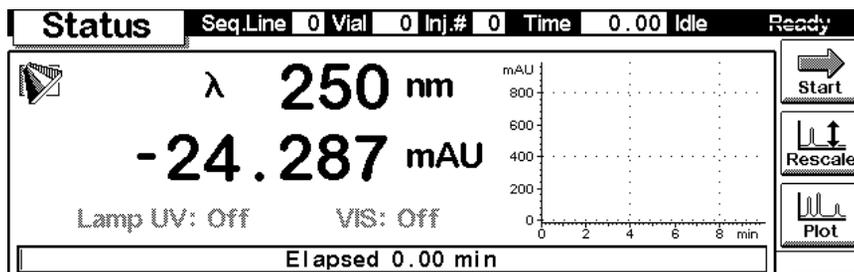


Press F5 key (Views) and select Status.



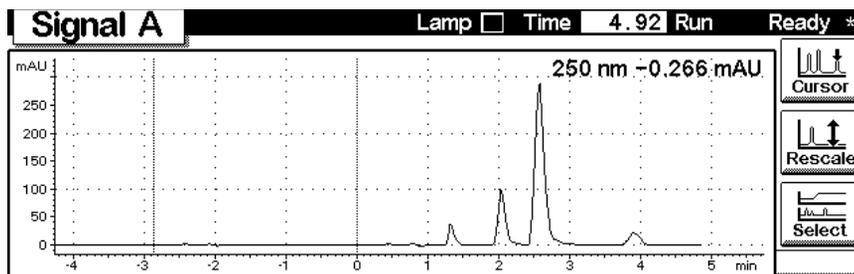
### Status

This is an example if an Agilent 1100 DAD or MWD is configured standalone.

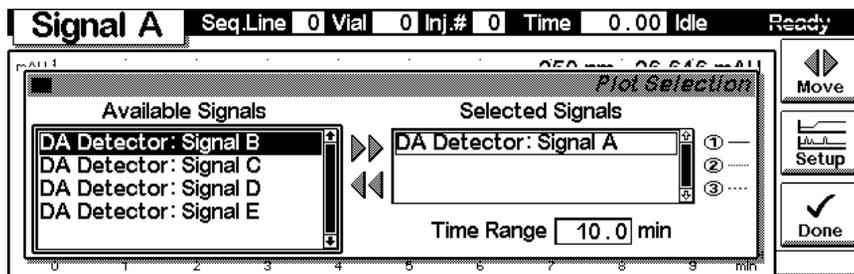


### Signal plot

Press F6 key (**Plot**) to enter the plot screen (available also from the **Analysis** and **System** screen). Here you can observe the online signal(s). To add additional online signals (maximum 3), press F6 key (**Select**). If more than one signal is configured (see next), use the 1-2-3 number key to switch between the signals.



Press F6 key (**Select**). Here you can add additional online signals (maximum are 3), press F6 key (**Select**). Additional signals could be also pressure or temperature signals from other modules. Use the Right/Left arrows to switch between Available and Selected Signals. Use the F8 key (**Move**) to enter available signals into the box for selected signals or vice versa.



## Method screens

Use ESC to return to the **Analysis** screen. Use the F3 key (**Method**) to view the parameters in a method and F8 key (**Save As**) to save the method in the module(s). The PC-Card key is only active when a PCMCIA card is inserted in the control module.

Method		Seq.Line	0	Vial	0	Inj.#	0	Time	0.00	Idle	Ready
Setting	Value	*ACTUAL*									
Stoptime	1.00 min										
Posttime	OFF										
Signal A	250, 100;360, 100 nm										
Signal B	254, 16;360, 100 nm										
Signal C	210, 8;360, 100 nm										
Signal D	230, 16;360, 100 nm										

Module

PC-Card

Timetable

Save As

Default

Print

Use F2 key (**PC-Card**) to save a method on a PCMCIA card. Use the Right/Left arrows to switch between PC-Card and Instrument window. Use the UP/Down arrows to select the method. Use the F7/F8 keys (**Copy**) to enter available signals into the box for selected signals or vice versa.

Method		Seq.Line	0	Vial	0	Inj.#	0	Time	0.00	Idle	Ready
Methods on PC-Card		Methods on PC-Card									
*** end of method list ***		Methods on Instrument									
DAD-1 11/12/98 11:52		*** end of method list ***									
*** end of method list ***											

Initialize

Copy

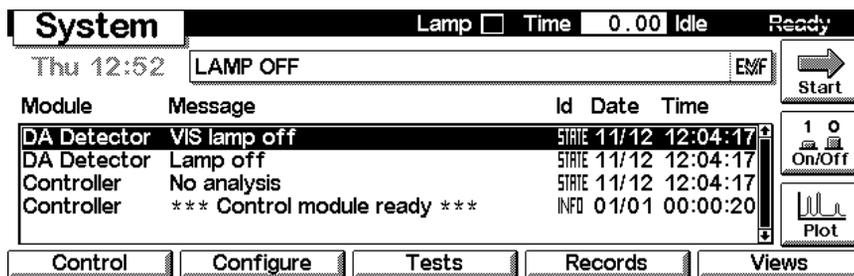
Copy

Delete

## Screens available from the System screen

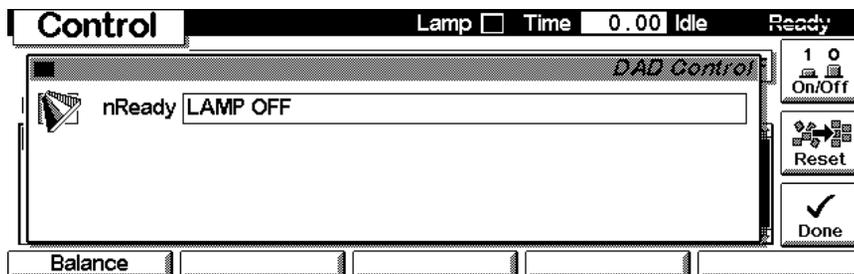
### System screen

Use the Esc key to receive **Views** on the F5 key. Choose **System** from the pull-down menu. This screen shows the last activities in the system.



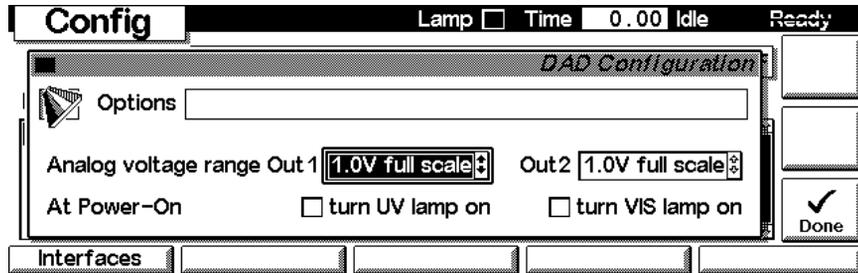
### System - Control

Use the F1 key (**Control**) to select the FL-Detector. Here you receive information about the not-ready conditions if needed. F2 key (**Reset**) does a re-initialization of the DAD or MWD.

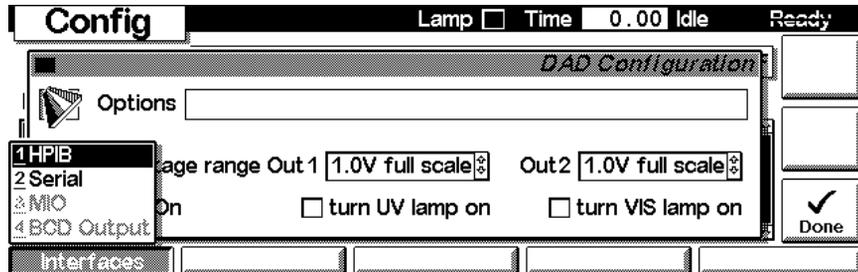


## System - Configuration

Use the **Esc** key to receive **Views** on the F5 key. Choose **System** from the pull-down menu. Use the F2 key (**Configure**) to select the DAD or MWD. Here you define further special setpoints for the DAD or MWD operation.



Use the F1 key (**Interfaces**) to access the interface settings (if required).



## Screens available from the Records screen

### Records screen

Use the Esc key to receive **Views** on the F5 key. Choose **System** from the pull-down menu. Use the F4 key (**Records**) to select the DAD or MWD. Errors are reported either into the **System Log** (F2) or **Error Log** (F3).

Records						Temp <input checked="" type="checkbox"/>	Lamp <input type="checkbox"/>	Time 0.00	Idle	Ready
Module	Product#	Serial#	Version	On-Time	EMF					
Controller	G1323A*	DE53300105	A.02.04	0d 00:05h						
Autosampler	G1313A	DE54900180	A.03.30	0d 01:22h						
Col Comp	G1316A*	US54300104	A.03.30	0d 02:22h						
DA Detector	G1315A	DE53500102	A.03.61	0d 02:03h						

Buttons: EMF, System Log, Error Log, Maint Log, FW Update

### System / Error Log

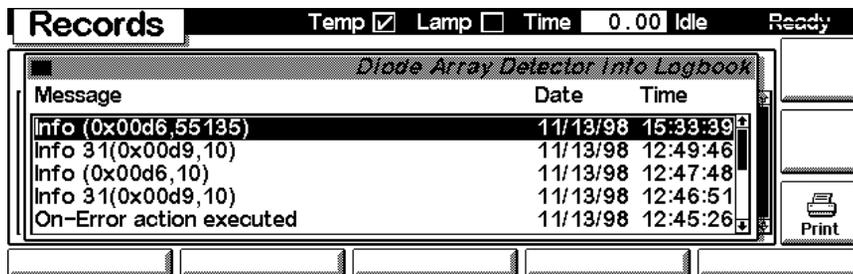
Use the F2 key (**System Log**) or F3 key (**Error Log**) to look for errors.

Records						Temp <input checked="" type="checkbox"/>	Lamp <input type="checkbox"/>	Time 0.00	Idle	Ready
Diode Array Detector Error Logbook										
Message	Date	Time								
Synchronization lost	11/13/98	12:45:25								
*** end of logbook ***										

Buttons: Print

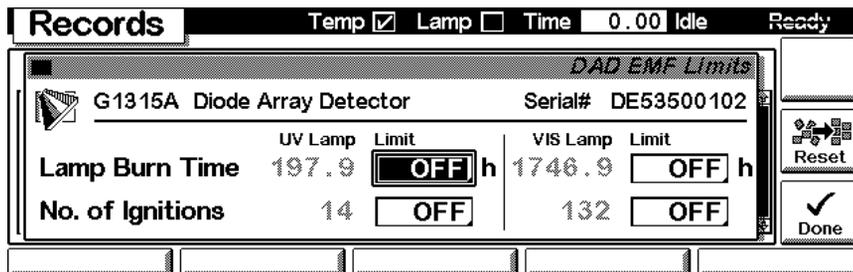
## Info Log

Use the **m**-key to receive a pop-up menu, Select **Info Log**. A list of the last events are listed. For troubleshooting reasons they can be printed or saved to a file on the PCMCIA card.

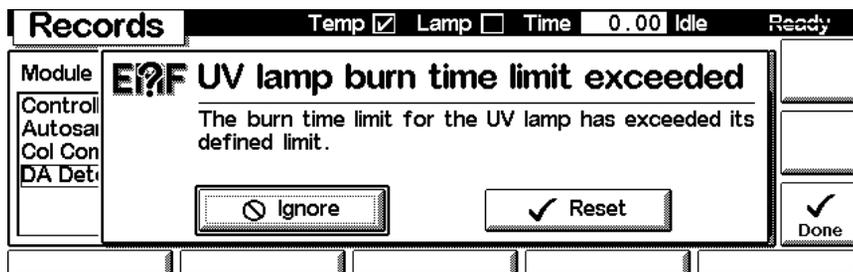


## EMF (Early Maintenance Feedback)

Use the F1 key (**EMF**) to set EMF parameters. Choose menu item 1 (**Setup limits**) to select lamp-on level for the UV and Vis lamp at which you want to receive a warning.

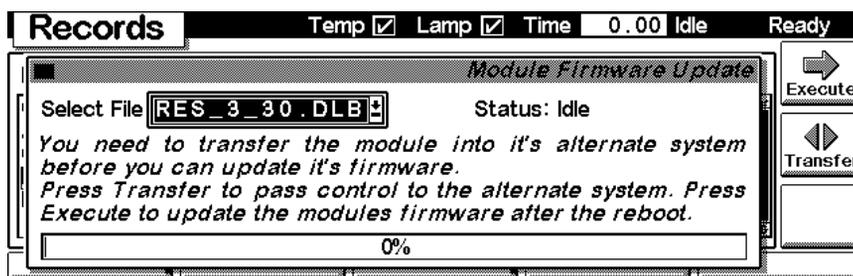


If a set limit has been exceeded, a message box will pop up. This will not stop a sequence or run (information only to plan maintenance activities). If you press **Reset**, the limits will be removed. **Ignore** will continue to keep the EMF flag set.

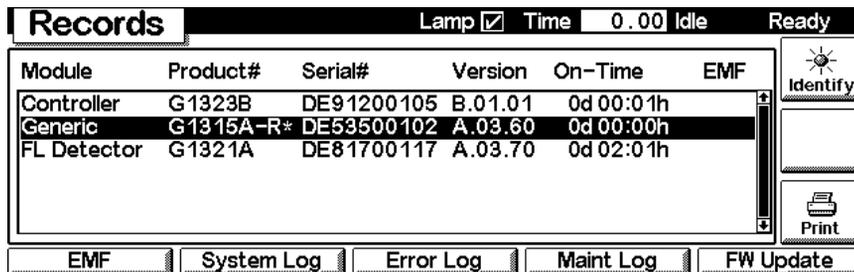


### Firmware Update

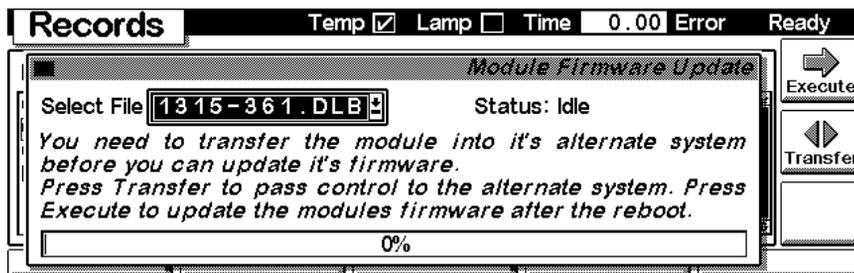
Use the Esc key to receive **Views** on the F5 key. Choose **System** from the pull-down menu. Use the F3 key (**Records**) to select the DAD or MWD. Use the F5 key (**FW Update**) to enter the Update section. If you want to update the resident firmware (together with specific main firmware revisions), select the a file from the PCMCIA card (RES\_n\_nn.DLB) and press execute. If you want to update the main firmware, press F7 key (**Transfer**) to turn the module into the resident mode (LED on module should blink yellow).



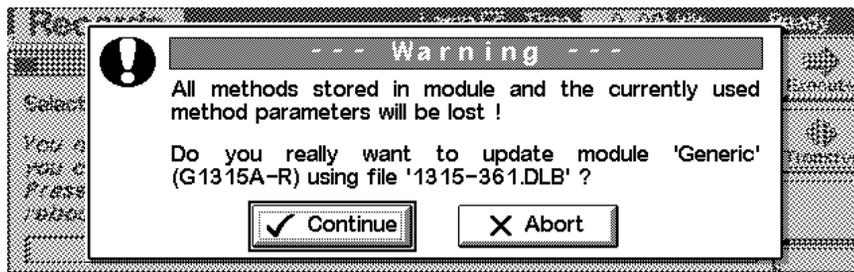
Use the Esc key to receive **Views** on the F5 key. Choose **System** from the pull-down menu. Use the F3 key (**Records**) to select the **Generic** module. In this screen the resident firmware revision is shown.



Use the F5 key (**FW Update**) to enter the Update section. Select the file from the PCMCIA card (1315-nnn.DLB for DAD or 1365-nnn.DLB for MWD) and press execute. When the update has finished the update, press F7 key (**Transfer**) to return the module into the normal mode (LED on module should stay yellow).

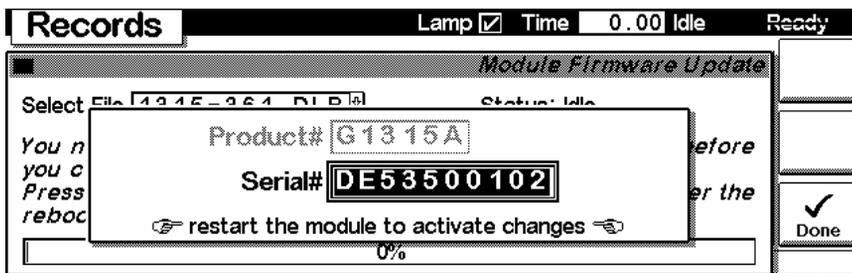
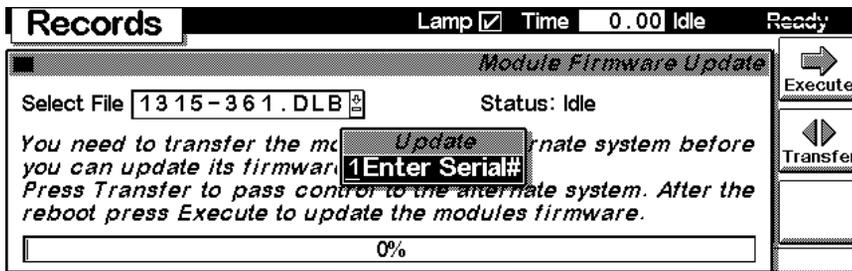


If you have not saved your methods, please do it before continuing. Otherwise they will be overwritten during the update process.



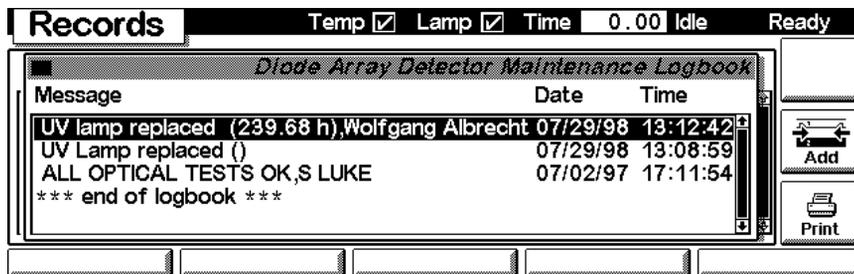
### Changing the serial number

In case the serial number of the module has to be added, use the **m**-key to open the menu **Enter Serial#**. Choose **System** from the pull-down menu. Use the F3 key (**Records**) to select the DAD or MWD. Use the F4 key (**Maint log**) to view and edit the maintenance logbook.

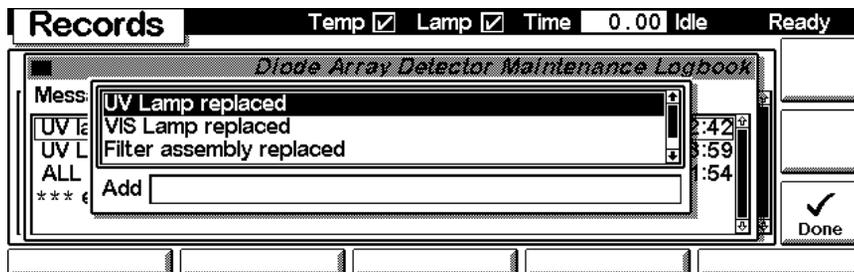


### Maintenance activities

Use the Esc key to receive **Views** on the F5 key. Choose **System** from the pull-down menu. Use the F3 key (**Records**) to select the DAD or MWD. Use the F4 key (**Maint log**) to view and edit the maintenance logbook.



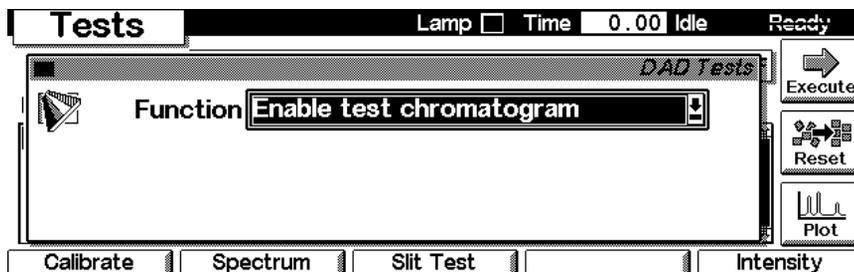
Use the F7 key (**Add**) to add new maintenance activities. If an activity is not listed, you can type the activity into the line "Add" using the control modules key pad.



## Diagnostics and Tests

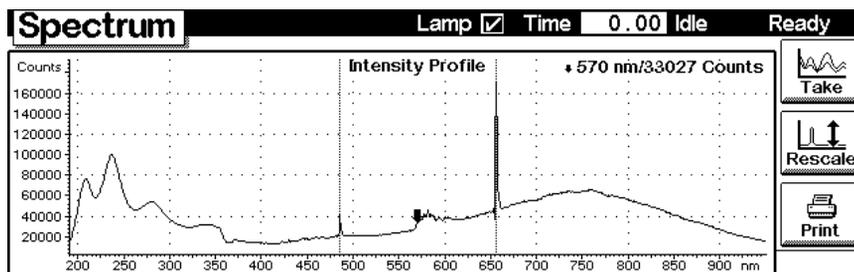
### Tests screen

Use the Esc key to receive **Views** on the F5 key. Choose **System** from the pull-down menu. Use the F3 key (**Tests**) to select the DAD or MWD. Several tests are available to test the Agilent 1100 DAD or MWD. Additional test are listed in the function box. Refer to “[Troubleshooting and Test Functions](#)” on page 49 for more information on the tests.



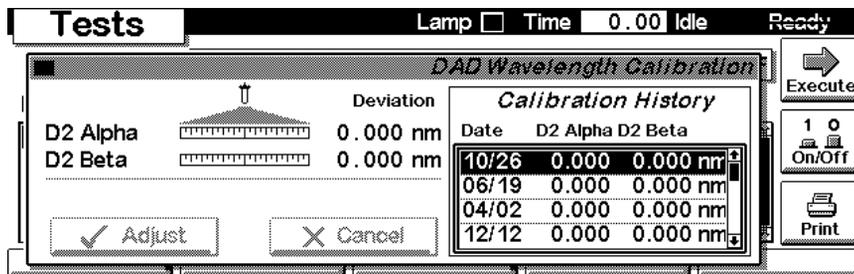
### Intensity Test

Use the F5 key (**Intensity**) to get the instrument profile (example with UV and Vis lamp on).



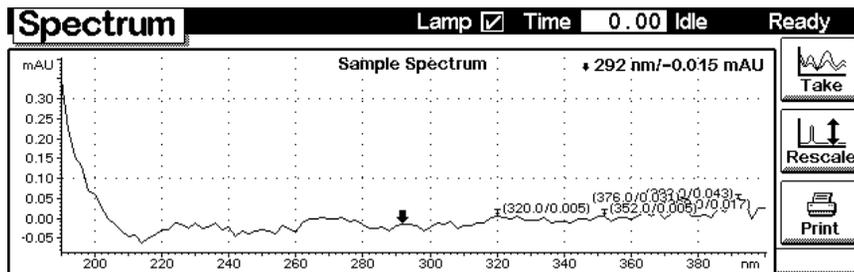
## Wavelength Calibration

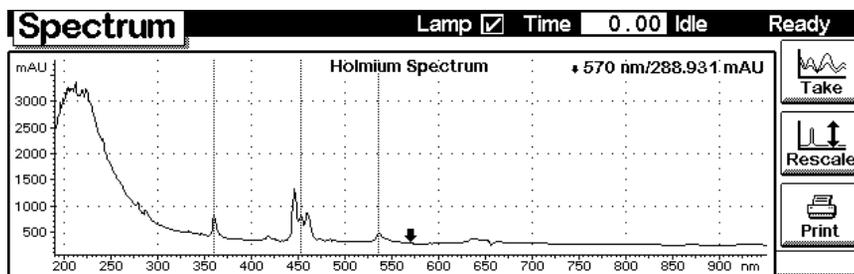
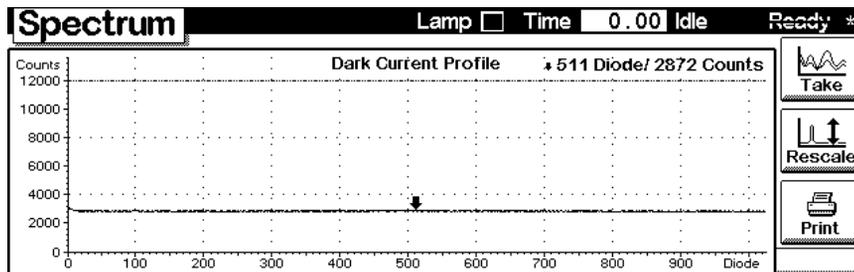
Use the F1 key (**Calibrate**) and then F8 key (**Execute**) to start the DAD or MWD wavelength calibration (with water in the flow cell). If a deviation is found, press **Adjust**.



## Sample, Holmium and Dark Current Spectrum

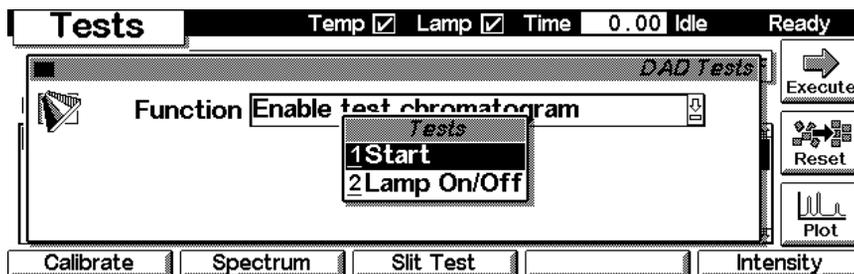
Use the F2 key (**Spectrum**) to take a spectrum (sample, dark current or holmium). Use the Left/Right arrow to move the cursor within the spectrum to find the wavelength of interest.



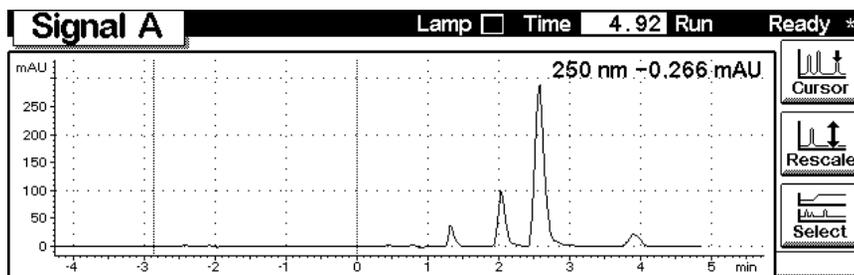


### Built-in Test Chromatogram (Simulation)

To start the built-in test chromatogram, use the F8 key (**Execute**) to enable the simulation. Then press the m-key to open the pop-up menu. Select **Start** to start a run (all modules in the Agilent 1100 system must be in ready state).

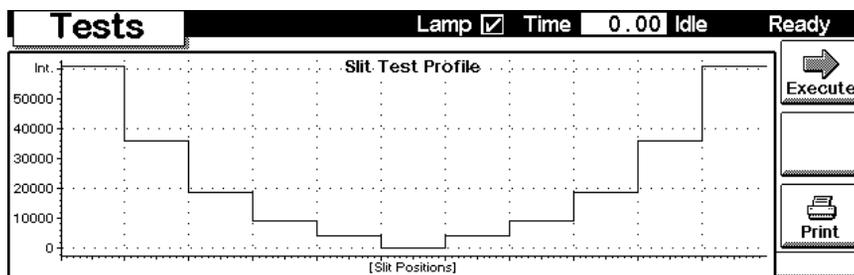


Use the F6 key (**Plot**) to view the signal. A simulated chromatogram (4 peaks) will repeat until the run is stopped. The signal is also available on the analog output. A change of the peak width will change the retention times.

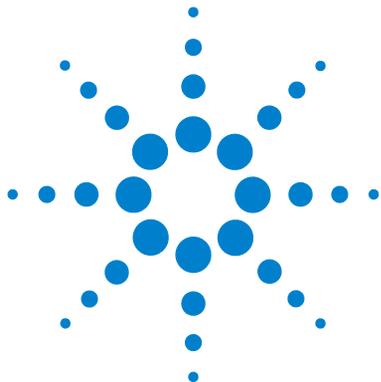


### Slit Test

Use the F3 key (**Slit Test**) to test the movement of the electromechanical slit assembly.



## **7 Control Module Screens for Agilent 1100 DAD and MWD**



## 8 Specifications

Performance Specifications [296](#)



## Performance Specifications

**Table 50** Performance Specifications Agilent 1100 Series DAD and MWD

Type	Specification	Comments
Detection type	1024-element photodiode array	
Light source	Deuterium and tungsten lamps	
Wavelength range	190 – 950 nm	
Short term noise (ASTM) Single and Multi-Wavelength	$\pm 1 \times 10^{-5}$ AU at 254 and 750 nm	See "" on page 297
Drift	$2 \times 10^{-3}$ AU/hr at 254 nm	See "" on page 297
Linear absorbance range	> 2 AU (upper limit)	See "" on page 297
Wavelength accuracy	$\pm 1$ nm	Self-calibration with deuterium lines, verification with holmium oxide filter
Wavelength bunching	1 – 400 nm	Programmable in steps of 1 nm
Slit width	1, 2, 4, 8, 16 nm	Programmable slit
Diode width	< 1 nm	
Flow cells	Standard: 13 $\mu$ l volume, 10 mm cell path length and 120 bar (1760 psi) pressure maximum Semi-Micro: 5 $\mu$ l volume, 6 mm cell path length and 120 bar (1760 psi) pressure maximum High pressure: 1.7 $\mu$ l volume, 6 mm cell path length and 400 bar (5880 psi) pressure maximum 500 nano: 0.5 $\mu$ l volume, 10 mm cell path length and 50 bar (725 psi) pressure maximum	See " <a href="#">Optimization Overview</a> " on page 31

**Table 50** Performance Specifications Agilent 1100 Series DAD and MWD, continued

Type	Specification	Comments
Control and data evaluation	Agilent ChemStation for LC	
Analog outputs	Recorder/integrator: 100 mV or 1 V, output range 0.001 – 2 AU, two outputs	
Communications	Controller-area network (CAN), GPIB, RS-232C, APG Remote: ready, start, stop and shut-down signals, LAN optional	
Safety and maintenance	Extensive diagnostics, error detection and display (through control module and ChemStation), leak detection, safe leak handling, leak output signal for shutdown of pumping system. Low voltages in major maintenance areas.	
GLP features	Early maintenance feedback (EMF) for continuous tracking of instrument usage in terms of lamp burn time with user-settable limits and feedback messages. Electronic records of maintenance and errors. Verification of wavelength accuracy with built-in holmium oxide filter.	
Housing	All materials recyclable.	

**NOTE**

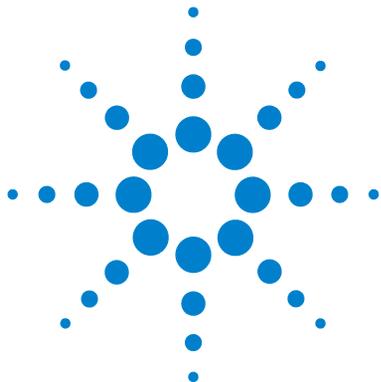
ASTM: “Standard Practice for Variable Wavelength Photometric Detectors Used in Liquid Chromatography”.

Reference conditions: cell path length 10 mm, response time 2 s, flow 1 ml/min LC-grade Methanol, slit width 4 nm.

Linearity measured with caffeine at 265 nm.

For environmental conditions refer to “[Environment](#)” on page 15.





## A Safety Information

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## **General Safety Information**

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

### **General**

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

This instrument is designed and certified as a general purpose laboratory instrument for research and routine application only. It is not certified for in-vitro or medical applications.

### **Operation**

Before applying power, comply with the installation section. Additionally the following must be observed.

Do not remove instrument covers when operating. Before the instrument is switched on, all protective earth terminals, extension cords, auto-transformers, and devices connected to it must be connected to a protective earth via a ground socket. Any interruption of the protective earth grounding will cause a potential shock hazard that could result in serious personal injury. Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any intended operation.

Make sure that only fuses with the required rated current and of the specified type (normal blow, time delay, and so on) are used for replacement. The use of repaired fuses and the short-circuiting of fuseholders must be avoided.

**CAUTION**

The operator of this instrument is advised that if the equipment is used in a manner not specified in this manual, the protection provided by the equipment may be impaired.

---

Some adjustments described in the manual, are made with power supplied to the instrument, and protective covers removed. Energy available at many points may, if contacted, result in personal injury.

Any adjustment, maintenance, and repair of the opened instrument under voltage should be avoided as much as possible. When inevitable, this should be carried out by a skilled person who is aware of the hazard involved. Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present. Do not replace components with power cable connected.

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

Do not install substitute parts or make any unauthorized modification to the instrument.

Capacitors inside the instrument may still be charged, even though the instrument has been disconnected from its source of supply. Dangerous voltages, capable of causing serious personal injury, are present in this instrument. Use extreme caution when handling, testing and adjusting.

When working with solvents please observe appropriate safety procedures (e.g. goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet by the solvent vendor, especially when toxic or hazardous solvents are used.

## Safety Symbols

Table 51 shows safety symbols used on the instrument and in the manuals.

**Table 51** Safety Symbols

Symbol	Description
	The apparatus is marked with this symbol when the user should refer to the instruction manual in order to protect the apparatus against damage.
	Indicates dangerous voltages.
	Indicates a protected ground terminal.
	Indicates eye damage may result from directly viewing the light produced by the deuterium lamp used in this product.

### WARNING

**A warning alerts you to situations that could cause physical injury or damage to the equipment. Do not proceed beyond a warning until you have fully understood and met the indicated conditions.**

### CAUTION

**A caution alerts you to situations that could cause a possible loss of data. Do not proceed beyond a caution until you have fully understood and met the indicated conditions.**

## Lithium Batteries Information

**WARNING**

Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the equipment manufacturer. Lithium batteries may not be disposed-off into the domestic waste.

Transportation of discharged Lithium batteries through carriers regulated by IATA/ICAO, ADR, RID, IMDG is not allowed. Discharged Lithium batteries shall be disposed off locally according to national waste disposal regulations for batteries.

---

**WARNING**

Lithiumbatteri - Eksplosionsfare ved fejlagtig håndtering. Udskiftning må kun ske med batteri af samme fabrikat og type. Lever det brugte batteri tilbage til leverandøren.

---

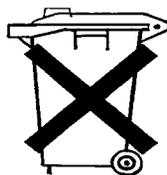
**WARNING**

Lithiumbatteri - Eksplosionsfare. Ved udskiftning benyttes kun batteri som anbefalt av apparatfabrikanten. Brukt batteri returneres apparatleverandøren.

---

**NOTE**

Bij dit apparaat zijn batterijen geleverd. Wanneer deze leeg zijn, moet u ze niet weggooien maar inleveren als KCA.



## **Disposal of Mercury from Deuterium Lamp**

The long-life deuterium lamp (part number 5181-1528) includes a timer, which contains mercury. The timer has to be disposed of locally according to national waste disposal regulations.

## Radio Interference

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

### **Test and Measurement**

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

## Sound Emission

### **Manufacturer's Declaration**

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

This product has a sound pressure emission (at the operator position) < 70 dB.

- Sound Pressure  $L_p < 70$  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 52** UV-Radiation Limits

Exposure/day	Effective Irradiance
8 hours	0.1 $\mu\text{W}/\text{cm}^2$
10 minutes	5.0 $\mu\text{W}/\text{cm}^2$

Typically the radiation values are much smaller than these limits:

**Table 53** UV-Radiation Typical Values

Position	Effective Irradiance
Lamp installed, 50 cm distance	Average 0.016 $\mu\text{W}/\text{cm}^2$
Lamp installed, 50 cm distance	Maximum 0.14 $\mu\text{W}/\text{cm}^2$

## Solvent Information

Observe the following recommendations on the use of solvents.

### 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.

Prevent any crystallization of buffer solutions. This will lead into a blockage/damage of the flow cell.

If the flow cell is transported while temperatures are below 5 degree C, it must be assured that the cell is filled with alcohol.

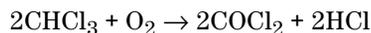
Aqueous solvents in the flow cell can build up algae. Therefore do not leave aqueous solvents sitting in the flow cell. Add small % of organic solvents (e.g. Acetonitrile or Methanol ~5%).

### Solvents

Brown glass ware can avoid growth of algae.

Always filter solvents, small particles can permanently block the capillaries. 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 nitric acid, sulfuric acid especially at higher temperatures (replace, if your chromatography method allows, by phosphoric acid or phosphate buffer which are less corrosive against stainless steel).
- Halogenated solvents or mixtures which form radicals and/or acids, for example:



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

- Chromatographic grade ethers, which can contain peroxides (for example, THF, dioxane, 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.

## Declaration of Conformity for HOX2 Filter

We herewith inform you that the holmium oxide glass filter (type Hoya HY-1)  
(Part No. 79880-22711)

meets the following specification of absorbance maxima positions:

361.0 nm - 418.9 nm - 453.7 nm - 536.7 nm (spectral bandwidth: 2 nm).

Agilent Technologies guarantees the traceability of the specified absorbance maxima to a National Institute of Standards & Technology (NIST) holmium oxide solution standard with a lot-to-lot tolerance of  $\pm 0.3$ nm.

The wavelength calibration filter built into the Agilent Technologies UV-visible detectors

**Table 54**

			<b>Wavelength Accuracy</b>
Product No.	79880A	HP 1090 system	$\pm 1$ nm
	79883A	HP 1090 system	$\pm 1$ nm
	79854A	HP 1050 series	$\pm 1$ nm
	1306A	HP 1050 series	$\pm 1$ nm
	G1315A/B	Agilent 1100 series	$\pm 1$ nm
	G1365A/B	Agilent 1100 series	$\pm 1$ nm
	G1600A		$\pm 1$ nm

is made of this material and meets these specifications. It is, therefore, suitable for wavelength calibration of these detectors within the specified wavelength accuracy of the respective detector over its wavelength range.

\_\_\_ March 20, 2000 \_\_\_  
Date



Engineering Manager



Quality Manager

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Select “Products” - “Chemical Analysis”

It will provide also the latest firmware of the Agilent 1100 series modules for download.

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## **In This Book**

This manual contains technical reference information about the Agilent 1100 Series diode array detectors.

The manual describes the following:

- installing the detector,
- introduction to the diode array detector and its optimization,
- diagnostics and troubleshooting,
- repairing the detector,
- parts and materials,
- theory of operation, and
- screens of the local control module.

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