Agilent 1200 Series Refractive Index Detector

Service Manual

Agilent Technologies

Notices

Manual Part Number

G1362-90110

Edition

02/06

Printed in Germany

Agilent Technologies
Hewlett-Packard-Strasse 8
76337 Waldbronn, Germany

Manual Structure

The **Service Manual G1362-90110** (English) contains the complete information about the Agilent 1200 Series Refractive Index Detector. It is available as Adobe Reader file (PDF) only.

The **User Manual G1362-90010** (English) and its localized versions contain a subset of the Service Manual and is shipped with the detector in printed matter.

Latest versions of the manuals can be obtained from the Agilent web.

Software Revision

This guide is valid for B.01.xx revisions of the Agilent 1200 Series ChemStation Software, where xx refers to minor revisions of the software that do not affect the technical accuracy of this guide.

Warranty

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

Technology Licenses

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

Restricted Rights Legend

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

Safety Notices

CAUTION

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

WARNING

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

In This Guide...

This manual covers the 1200 Series G1362A RID.

Contents

1
Introduction to the Refractive Index Detector

This chapter gives an introduction to the Refractive Index Detector.

Introduction to the Refractive Index Detector

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

- advanced temperature controlled detector optics ready to use within two hours of installation
- automatic zero and automatic purge combined with a recycle valve for automatic solvent recycling allow uninterrupted operation
- durable tungsten lamp with a life expectancy of 40,000 hours
- automatic light intensity control circuit to ensure the optimum performance of the optics
- integrated diagnostics for efficient troubleshooting
- built-in refractive index calibration
- front access to valves and capillaries for easy maintenance

For specifications, see “Performance Specifications” on page 35.

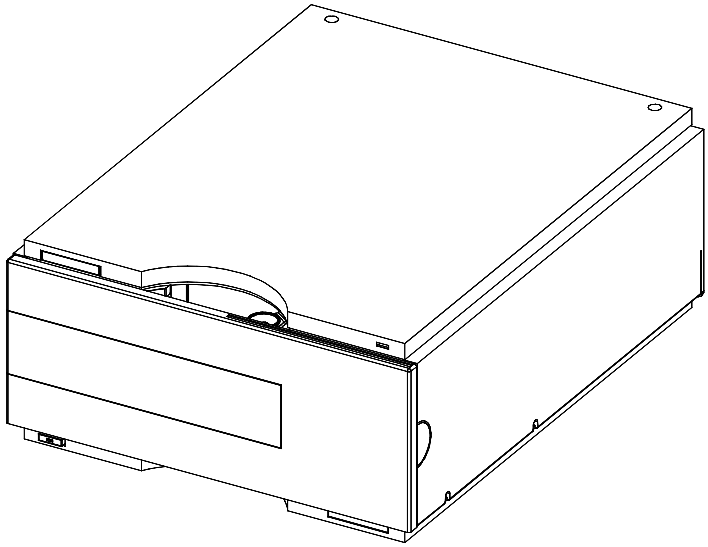


Figure 1 The Agilent 1200 Series Refractive Index Detector

How the Detector Operates

Refractive Index Detection

Refractive index

When a beam of light passes from one medium into another, the wave velocity and direction changes. The change in direction is called refraction. The relationship between the angle of incidence and the angle of refraction is expressed in Snell's Law of refraction.

Snells's Law

$$n = \frac{n_2}{n_1} = \frac{\sin\alpha_1}{\sin\alpha_2}$$

Where:

n = Refractive index of medium 1 relative to medium 2

n_2 = Refractive index of medium 2

n_1 = Refractive index of medium 1

α_1 = angle of incident light in medium 1

α_2 =angle of refraction in medium 2

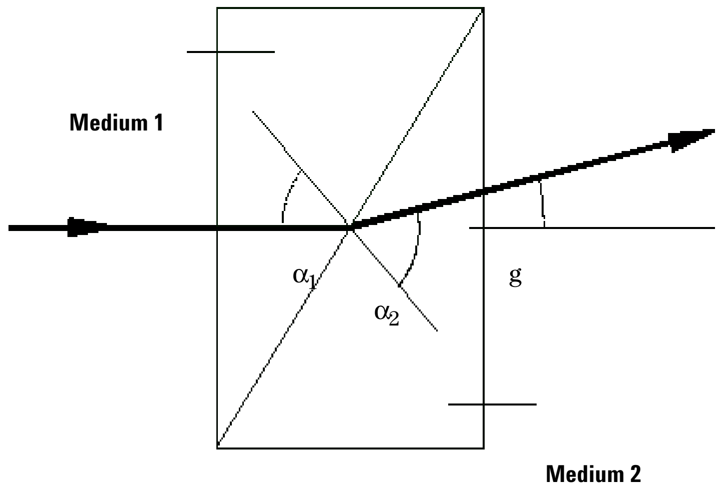


Figure 2 Light Refraction

According to the formula below small angles of external deflection are proportional to the difference between the refractive indices of medium 1 and medium 2.

$$\tan\gamma = \frac{n_1 - n_2}{n_1}$$

Where:

γ = angle of external deflection

Factors that Affect Refractive Index

The refractive index of a medium is affected by a number of factors;

1 Wavelength

The refractive index varies with changes in the wavelength of the incident light beam.

2 Density

As the density of the medium changes the refractive index changes. At a fixed wavelength of incident light the changes in refractive index are generally linear in relation to the changes in medium density.

The density of a medium will be affected by the following factors:

- Composition (if not a pure substance)
- Temperature
- Pressure

Detection Principle

Detector Design

The Agilent 1200 Series refractive index detector is a differential refractometer that measures the deflection of a light beam due to the difference in refractive index between the liquids in the sample and reference cells of a single flow cell.

A beam of light from the lamp passes through a flow cell which is separated diagonally into sample and reference cells. At the rear of the flow cell a mirror reflects the light back through the flow cell and via a zero glass, which affects the path of the light beam, to the light receiver. The light receiver has two diodes each of which produces an electrical current proportional to the amount of light that falls upon it (see Figure 3).

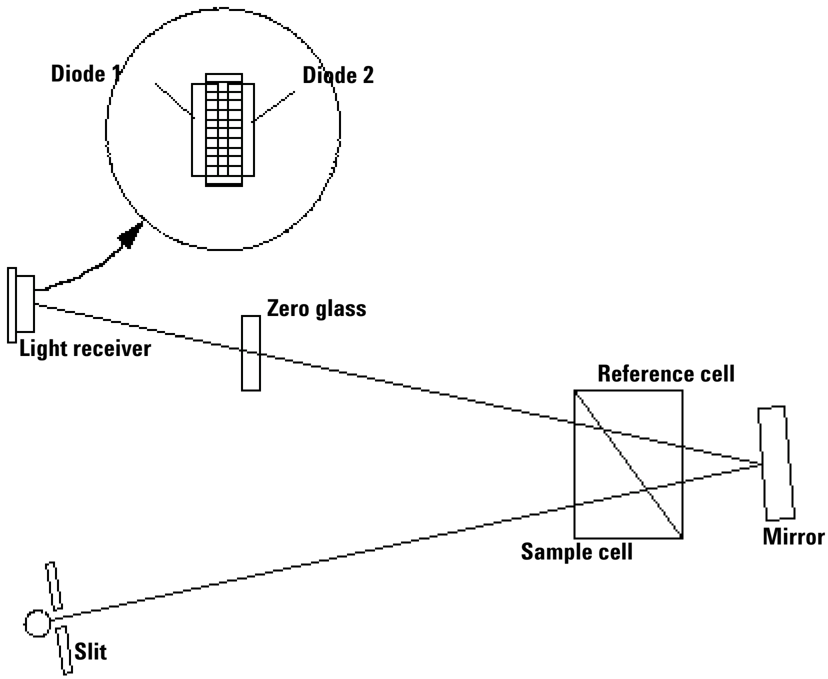


Figure 3 Detection Principle

Measurements

Initially both sample and reference cell are flushed with mobile phase. The reference cell is then closed and solvent flows only through the sample cell. The refractive index of the mobile phase in both cells is the same and the position of the zero glass can be adjusted so that the detector is in optical balance with an equal amount of light falls on each diode.

When sample elutes from the column into the sample cell the refractive index of the cell contents changes. The change in refractive index deflects the light beam as it passes through the flow cell resulting in an unequal amount of light falling on each diode. The change in current from the diodes that this causes is amplified and used to produce the calibrated detector signal. This signal expressed, as nano Refractive Index Units (nRIU), corresponds to the difference between the refractive index of sample in the sample cell and the mobile phase in the reference cell.

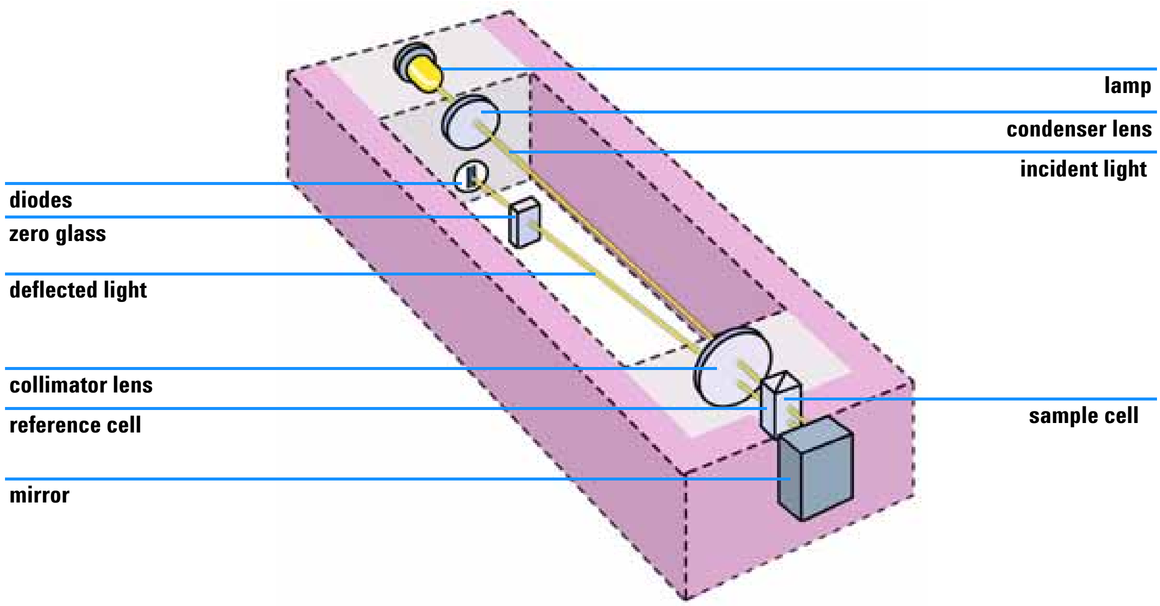


Figure 4 Optical Path

Flow Path

Flow Path

The column eluent enters the optical unit through the in port and passes through a heat exchanger. The combination of the heat exchanger and control of the optical unit temperature in the range of 5 °C above ambient to 55 °C minimizes changes in refractive index due to temperature variations. The eluent flows through the sample cell and via the same heat exchanger to the purge valve. With the purge valve in the OFF position the eluent passes to the recycle valve. If the recycle valve is also in the OFF/WASTE position the eluent will flow via the waste port into the waste container.

If the recycle valve is in the ON/BOTTLE position the eluent will flow via the recycle port back to the solvent bottle. The recycle valve can be manually set to the ON or OFF position or the **Automatic recycling after analysis** mode can be enabled. In this mode the recycle valve will automatically switch to the ON position after each analysis has been completed and return to the OFF position before the next analysis starts. Using this mode provides the benefits of uninterrupted flow through the detector without the problems of excessive solvent usage or the contamination of mobile phase with recycled sample compounds.

If the purge valve is in the *on* position the eluent cannot pass immediately to the recycle valve but will instead flow via a second heat exchanger through the reference cell and then into the recycle valve (see Figure 5). Periodically switching the purge valve to the *on* position while only mobile phase is flowing will ensure that the liquid in the reference cell is as similar as possible to the flowing solvent. The purge valve can be manually set to the *on* position for a defined time or the **Automatic purge** mode can be enabled. In this mode the purge valve will automatically switch to the ON position for a defined **purgetime** prior to the start of each analysis. If a **purgetime** is set then a **waittime** must also be set to allow the detector baseline to stabilize after the switching of the purge valve position.

After both the purgetime and waittime have been completed the analysis will start. If the **Automatic zero before analysis** mode is enabled the detector output will be set to zero immediately before the analysis begins.

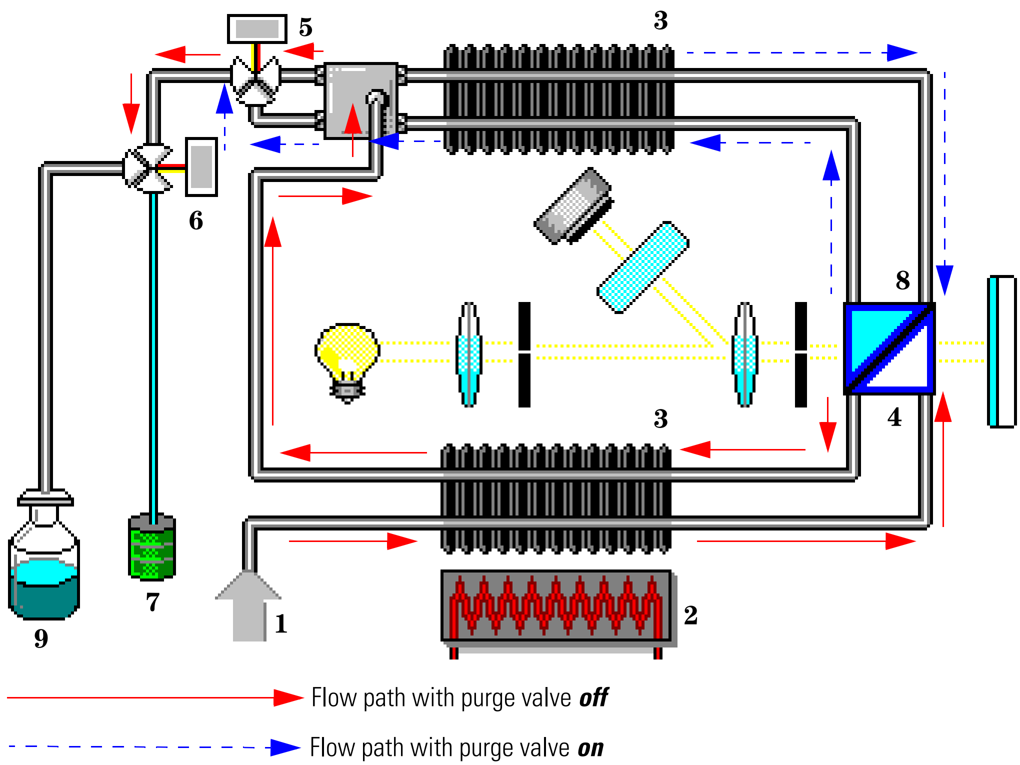
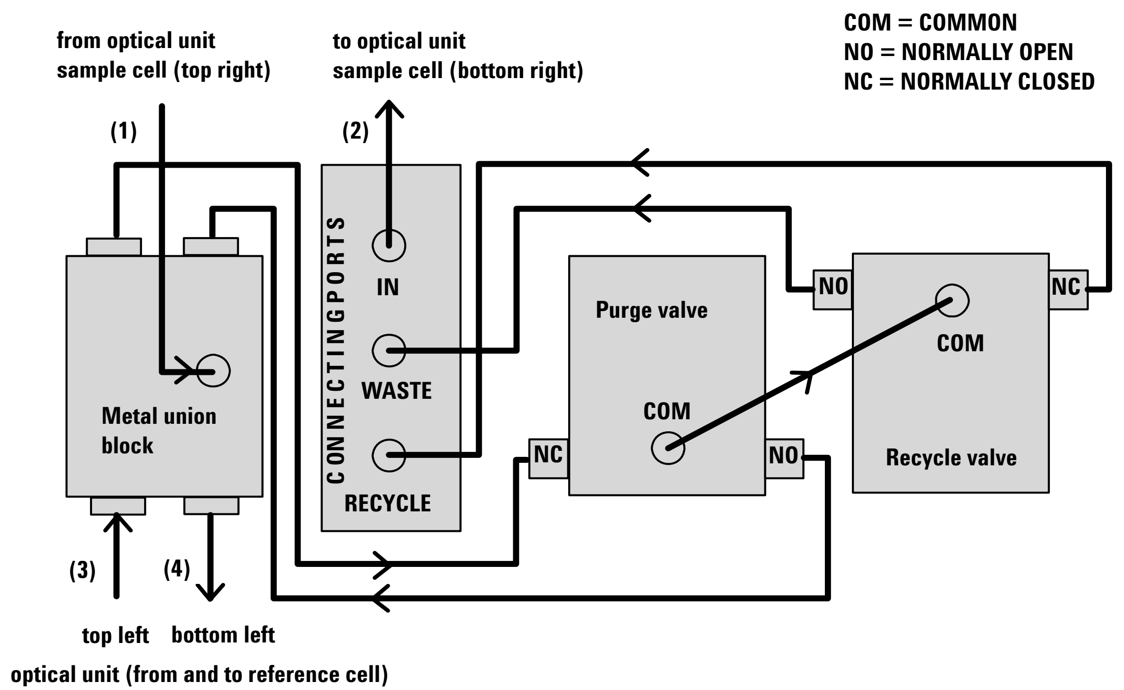


Figure 5 Flow Path

1 Flow in
2 Heater
3 Heat exchanger
4 Sample cell
5 Purge valve
6 Recycle valve
7 Waste container
8 Reference cell
9 Solvent bottle



Capillaries (1) to (4) are part of the optical unit assembly. They are made of SST with an ID of 1.0 mm, except for (2), which has an ID of 0.2 mm. All other tubings (to and from the purge and the reference valve) are made of Teflon and are available as a kit (PN G1362-68709)

Figure 6 G1362A Physical Plumbing Connections

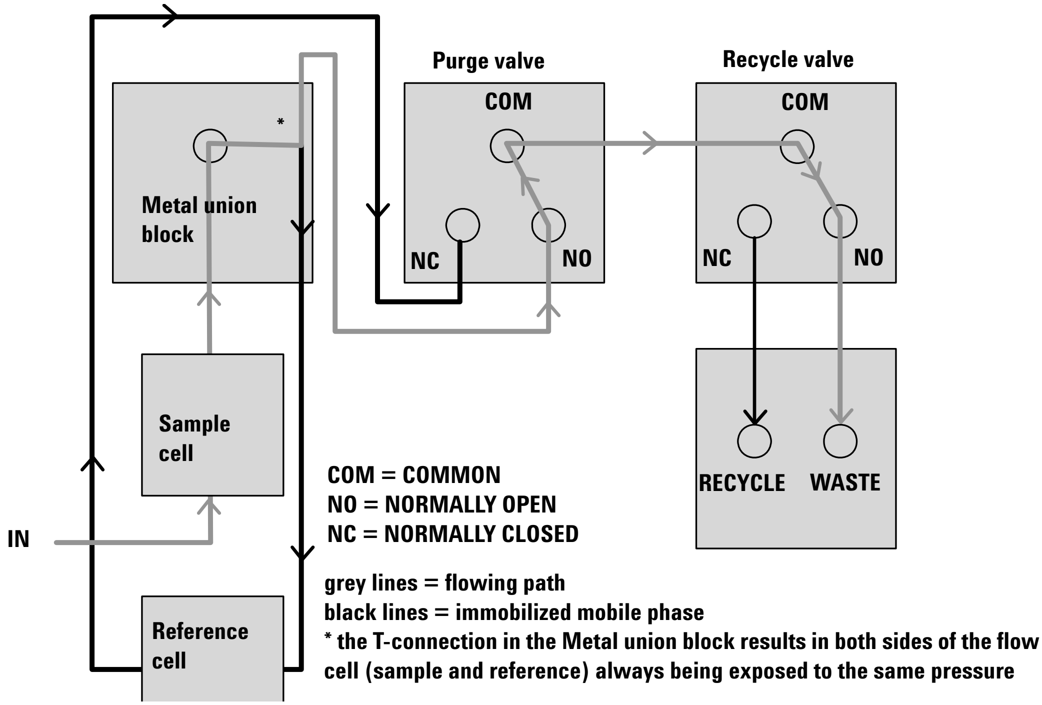


Figure 7 Flow path with the Purge- and Recycle-Valves = OFF

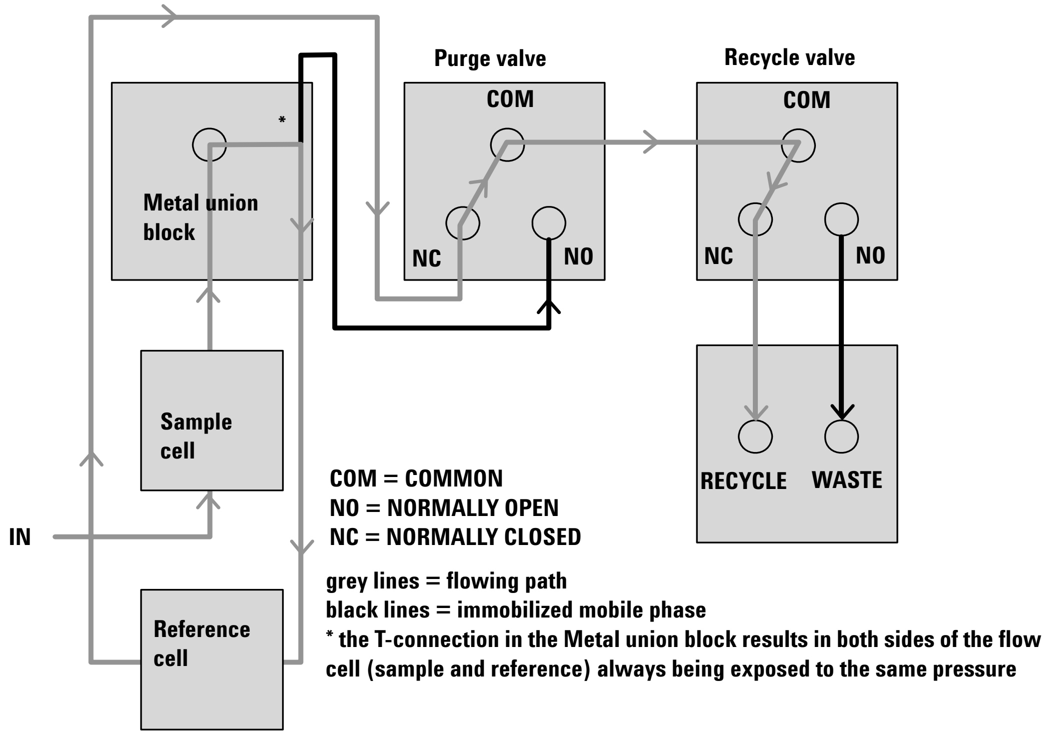


Figure 8 Flow path with the Purge- and Recycle-Valves = ON

Electrical Connections

- The GPIB connector is used to connect the detector to the 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 (Table 24 on page 224 or "Setting the 8-bit Configuration Switch" on page 228) and 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 1200 Series module data transfer and synchronization.
- One analog output provides 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 Agilent Technologies if you want to use features such as start, stop, common shut down, prepare, and so on.
- With the appropriate software, the RS-232C connector may be used to control the module from a computer through a RS-232C connection. This connector is activated and can be configured with the configuration switch next to the GPIB connector (see "Communication Settings for RS-232C Communication" on page 230). See your software documentation for further information.
- The power input socket accepts a line voltage of 100–120 or 220–240 volts AC ± 10% with a line frequency of 50 or 60 Hz. Maximum power consumption is 160 VA. There is no voltage selector on your module because the power supply has wide-ranging capability. There are no externally accessible fuses, because automatic electronic fuses are implemented in the power supply. The security lever at the power input socket prevents the module cover from being taken off when line power is still connected.

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

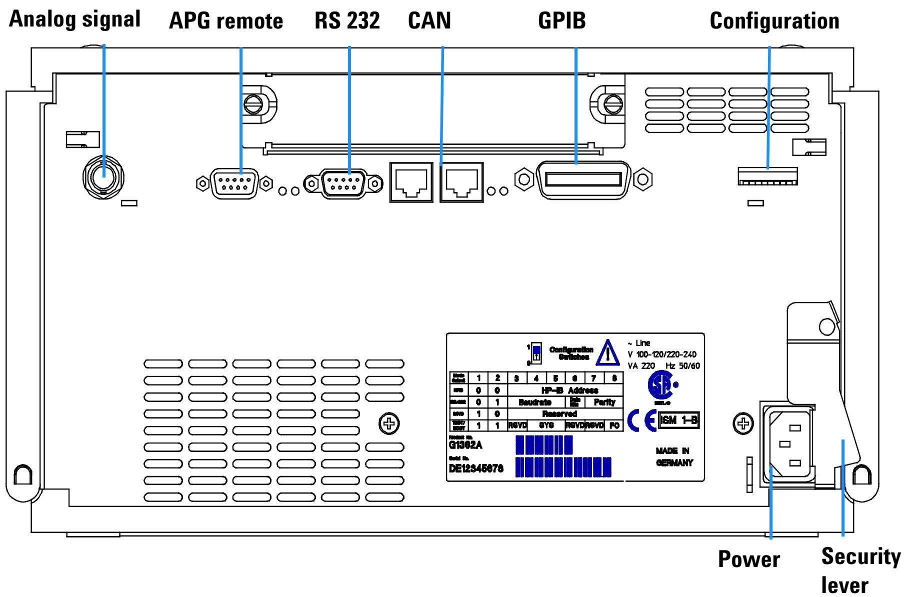


Figure 9 Electrical Connections

Instrument Layout

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

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

Early Maintenance Feedback (EMF)

Maintenance requires the exchange of components which are subject to wear or stress. Ideally, the frequency at which components are exchanged should be based on the intensity of usage of the 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 one EMF counters for the reference liquid age. The counters increment with the time that liquid remains in the reference cell, and can be assigned a maximum limit which provides visual feedback in the user interface when the limit is exceeded. The counters are reset to zero after the reference cell is purged.

Using the EMF Counters

The user-selectable EMF limits for the EMF counters enable the early maintenance feedback to be adapted to specific user requirements. The useful counter time since last purge is dependent on the requirements for the analysis, 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 reference liquid age counters. Enter this values (or a value slightly less than the displayed values) as an EMF limit, and then reset the EMF counter to zero. The next time the EMF counter exceed the new EMF limit, the EMF flag will be displayed, providing a reminder that maintenance needs to be scheduled.

2
Site Requirements and Specifications

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

Site Requirements

Power Consideration

The detector power supply has wide ranging capabilities and accepts any line voltage in the range mentioned in Table 1 on page 34. 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 device is 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 on page 34) allow 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 an Agilent 1200 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 on page 34.

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 35) 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.

NOTE The G1362A RID is designed to operate in a typical electromagnetic environment (EN61326-1) where RF transmitters, such as mobile phones, should not be used in close proximity.

Physical Specifications

Table 1 Physical Specifications

Type	Specification	Comments
Weight	17 kg (38 lbs)	
Dimensions (width × depth × height)	345 × 435 × 180 mm (13.5 × 17 × 7 inches)	
Line voltage	100 – 240 VAC, ± 10 %	Wide-ranging capability
Line frequency	50 or 60 Hz ± 5 %	
Power consumption	160 VA	Maximum
Ambient operating temperature	0 – 55 °C (32 – 131 °F)	
Ambient non-operating temperature	-40 – 70 °C (-4 – 158 °F)	
Rel. 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	For indoors use only!

Performance Specifications

Table 2 Performance Specifications Agilent 1200 Series Refractive Index Detector

Type	Specification	Comments
Detection type	Refractive Index	
Refractive index range	1.00 - 1.75 RIU, calibrated	
Measurement range	+/- 600 x 10^{-6} RIU	
Optical zeroing		via set screw
Optics temperature control	5 ° C above ambient to 55 ° C	
Sample cell	volume 8uL maximum pressure 5 bar (0.5Mpa) maximum flow rate 5mL/minute	
Valves	Automatic purge and automatic solvent recycle	
Volumes	Inlet port to sample cell 62uL, inlet port to outlet port 590uL	
Liquid contact materials	316 stainless steel, teflon and quartz glass	
pH range	2.3 - 9.5	
Performance specifications	Short term noise < +/- 2.5 x 10^{-9} RIU Drift < 200 x 10^{-9} RIU/hour	see note below this table
Time programmable parameters	polarity, peak width	
Detector zero	automatic zero before analysis	

Table 2 Performance Specifications Agilent 1200 Series Refractive Index Detector (continued)

Type	Specification	Comments
Control and data evaluation	Parameter entry, signal display, on-line help and diagnostics with the Agilent 1200 Series Control Module. Optional PCMCIA card for method, sequence and logbook storage and transfer. Agilent ChemStation for LC PC based software for control and data evaluation.	
Analog outputs	Recorder/integrator: 100 mV or 1 V, output range selectable, one output	
Communications	Controller-area network (CAN), GPIB, RS-232C, LAN, APG Remote: ready, start, stop and shut-down signals	
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 with user-selectable limits and feedback messages. Electronic records of maintenance and errors. Automated operational qualification/performance verification (OQ/PV).	
Housing	All materials recyclable.	

Table 2 Performance Specifications Agilent 1200 Series Refractive Index Detector (continued)

Type	Specification	Comments
Environment:	0 to 55 ° C constant temperature at <95% humidity (non-condensing)	
Dimensions:	180 mm x 345 mm x 435 mm (7 x 13.5 x 17 inches) (height x width x depth)	
Weight	17 kg (38 lbs)	

NOTE

Based on ASTM method E-1303-95 "Practice for Refractive Index Detectors used in Liquid Chromatography".Reference conditions; optics temperature 35 ° C, response time 4 s, flow 1.0 mL/min LC-grade Water, restriction capillary, column compartment temperature 35 ° C, Agilent 1200 Series on-line vacuum degasser, pump and thermostatted column compartment. Instrument equilibrated for 2 hours.

3
Installing the Refractive Index Detector

This chapter provides information on unpacking, checking on completeness, stack considerations and installation of the detector.

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 3 Detector Checklist

Description	Quantity
Detector	1
Power cable	1
User Manual	1
Accessory kit (see Table 4)	1

Detector Accessory Kit Contents

Table 4 Accessory Kit Contents (Part Number G1362-68705)

Description	Part Number	Quantity
Interface tubing kit includes:	G1362-68706	1
• Ferrule 1/8”	0100-1700	2
• Nut 1/8” PPS	0100-1708	2
• 2 m Tubing flexible	0890-1760	2
Interfacing capillary, 400mm lg, 0.17mm i.d. includes:	G1362-87300	1
• Hand tight fitting (reorder pack with 10 pcs.)	5062-8541	2
Restriction capillary, 3700mm lg, 0.17mm i.d. includes:	G1362-87301	1
• Hand tight fitting (reorder pack with 10 pcs.)	5062-8541	2
CAN cable	5181-1516	1
PEEK adapter to pump’s active inlet valve	0100-1847	1

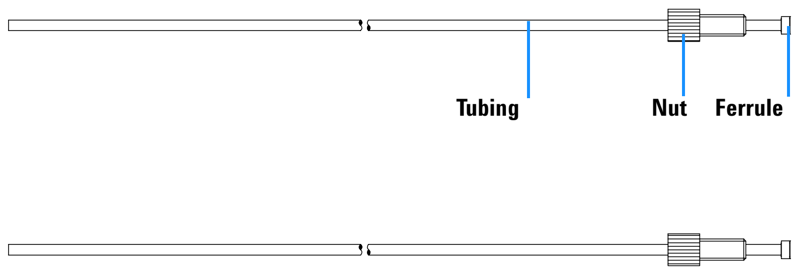


Figure 10 Interface tubing kit Parts

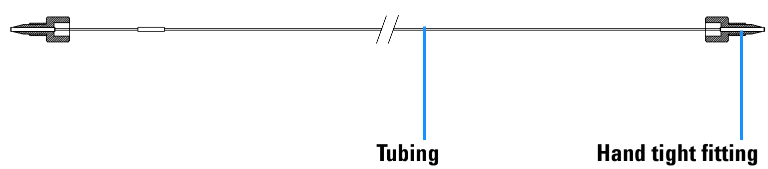


Figure 11 Interfacing Capillary Parts

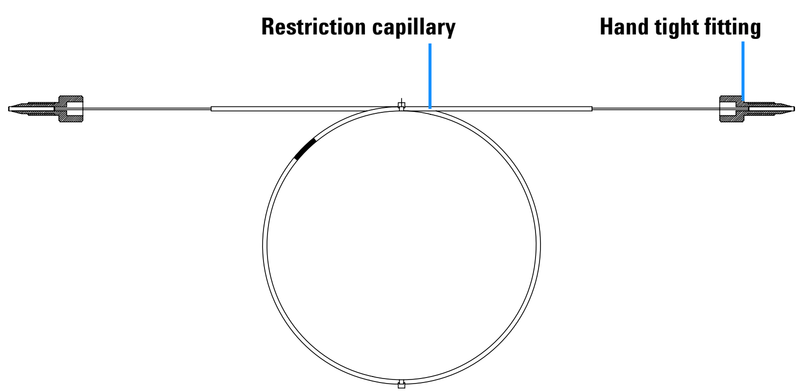


Figure 12 Restriction Capillary Parts

Optimizing the Stack Configuration

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

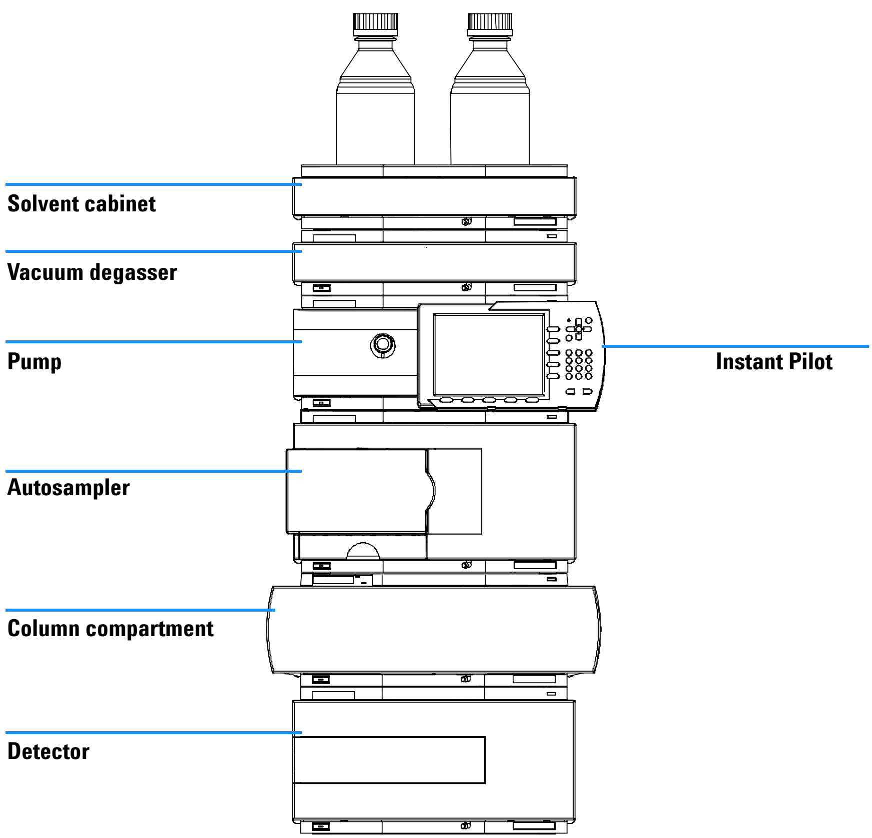


Figure 13 Recommended Stack Configuration (Front View)

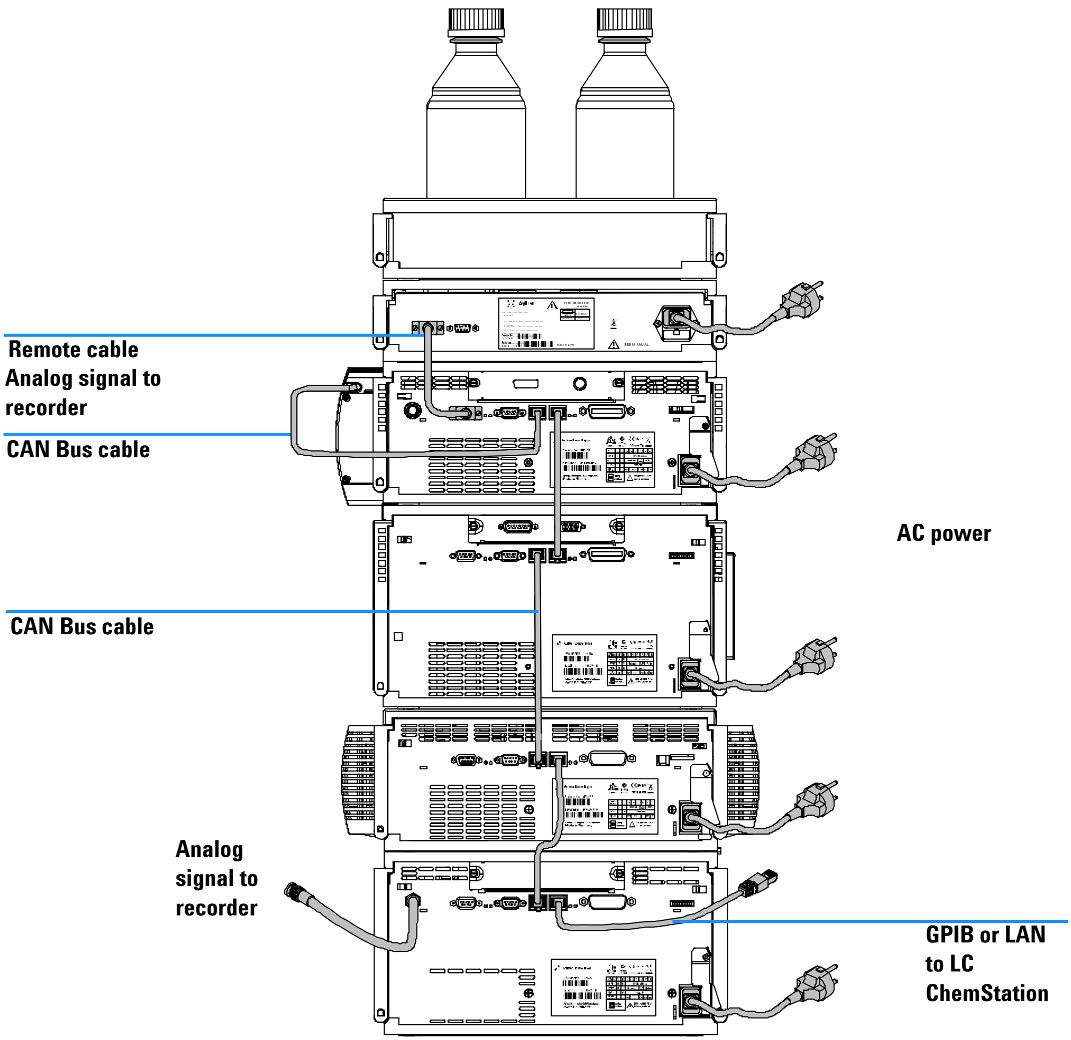


Figure 14 Recommended Stack Configuration (Rear View)

Installing the Detector

Preparations	Locate bench space Provide power connections Unpack the detector
Parts required	Detector Power cord, for other cables see below and "Cable Overview" on page 196.

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.

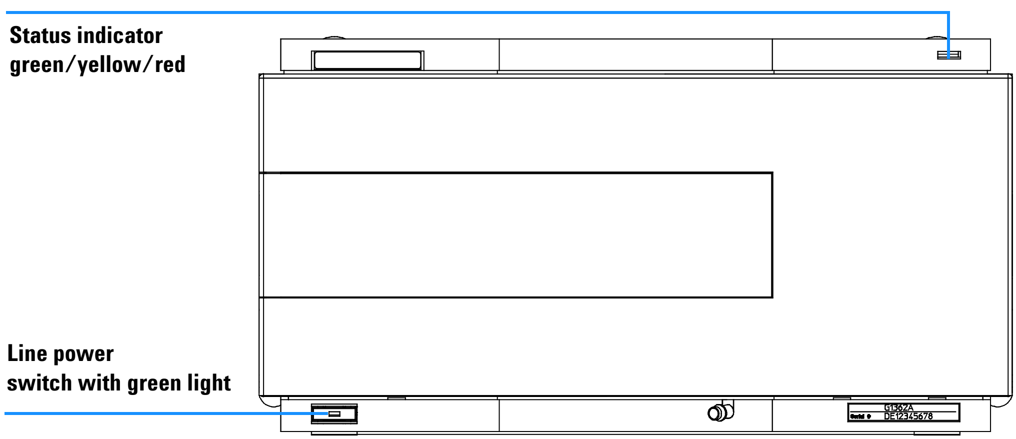


Figure 15 Front View of Detector

4 Connect the power cable to the power connector at the rear of the detector.

5 Connect the CAN cable to other Agilent 1200 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.

7 Connect the analog cable (optional) for a chart recorder, integrator or other data collection device.

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

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

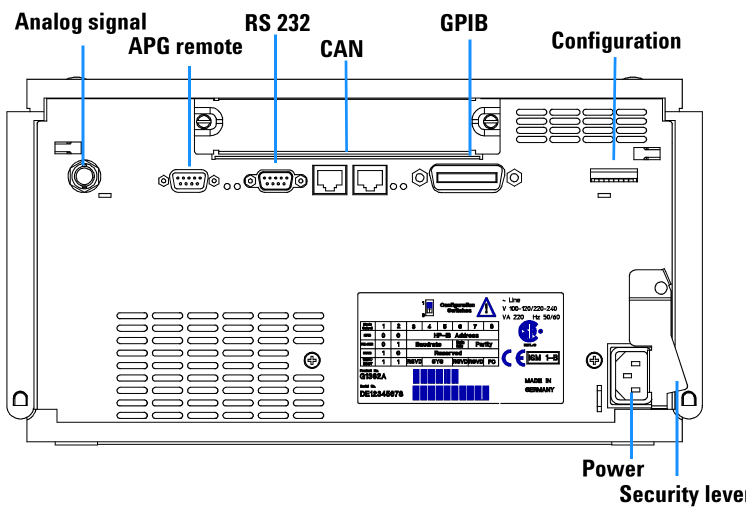


Figure 16 Rear View of Detector

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 228.

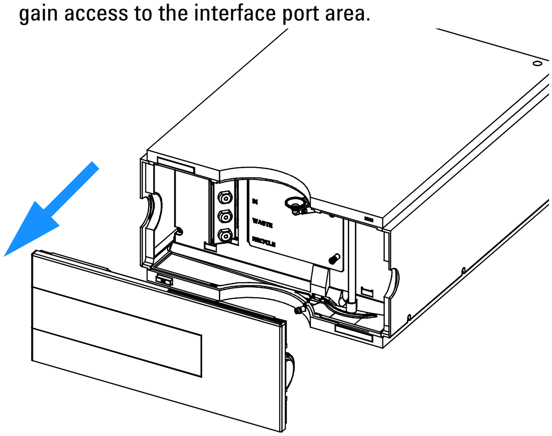
Flow Connections to the Detector

Preparations	Detector is installed in the LC system.
Parts required	Other modules Interface tubing kit G1362-68706 Interfacing capillary G1362-87300 see "Detector Accessory Kit Contents" on page 41 1/4" wrench.

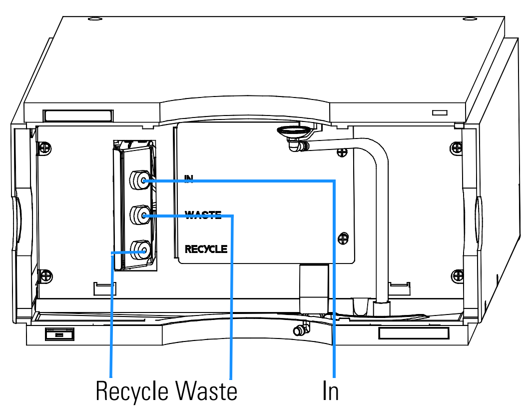
WARNING **When working with solvents please observe appropriate safety procedures (for example, goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the solvent vendor, especially when toxic or hazardous solvents are used.**

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.

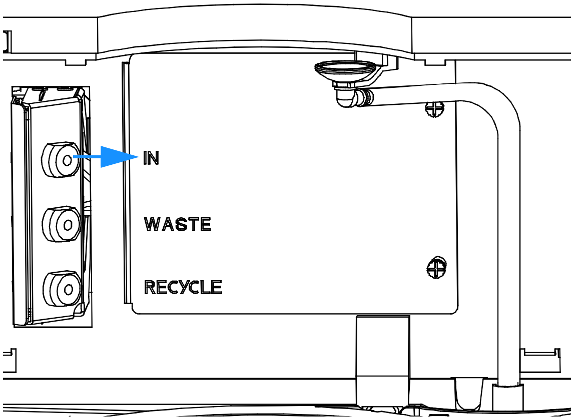
1 Press the release buttons and remove the front cover to gain access to the interface port area.



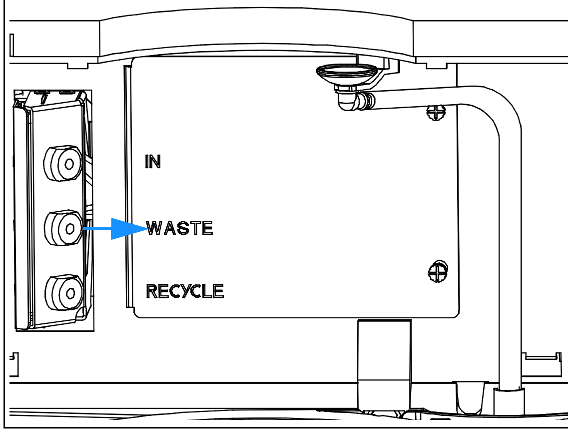
2 Locate the in, waste and recycle ports.



3 Remove the blanking plug and connect the interfacing capillary to the in port.



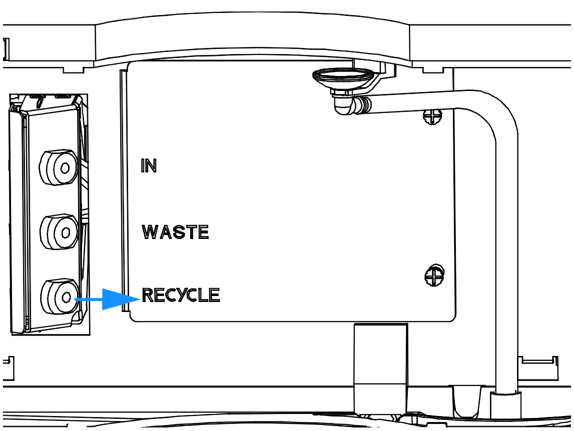
4 Remove the blanking plug and connect one of the tubes from the interface tubing kit to the waste port.



NOTE

The back pressure rating of the refractive index flow cell is 5 bar. Therefore the RI detector must be the last module in the flow path. If an additional detector is to be installed it must be connected upstream of the refractive index detector in order to avoid damage to the RID flow cell due to overpressure.

5 Remove the blanking plug and connect the other tube from the interface tubing kit to the recycle port.



NOTE

Remove all blanking plugs from all outlet ports (waste & recycle) of the detector to avoid potential damage to the flow cell, if the recycle valve is accidentally switched to one of these ports, while flow is applied to the detector.

6 Direct the waste tube into a suitable waste container. Make sure that there is no restriction of this tube.

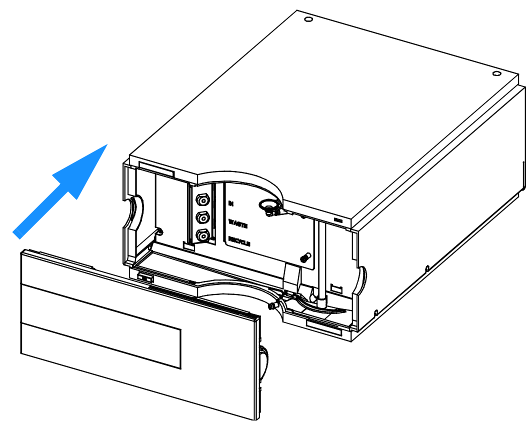
7 If solvent recycling is to be used direct the recycle tube into the solvent bottle. Make sure that there is no restriction of this tube.

NOTE

To optimize detector performance the waste container and solvent bottle should be positioned above the level of the refractive index detector and solvent pump (e.g. in the solvent compartment). This will maintain a *slight* pressure in the sample cell. Route the tubing behind the front covers of the Agilent 1200 Series modules in the stack.

8 Establish flow and observe if leaks occur.

9 Replace the front cover.



The installation of the detector is now complete.

4
Using the Refractive Index Detector

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

Operation of the Refractive Index Detector

This chapter can be used for

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

Before Using the System

Solvent Information

Observe recommendations on the use of solvents in chapter "Solvents" in the pump's reference manual.

Priming and Purging the System

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

Table 5 **Choice of Priming Solvents for Different Purposes**

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

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

Pump for approximately 30 minutes before starting your application (for some solvents an even longer flush and equilibration time might be needed).

Refractive Index Detector Control

The following operating instructions were generated using the Agilent B.01.03 ChemStation as operating software.

How To Get There:

The Agilent 1200 RID Control dialog box is displayed when you select **More RID...** from the Instrument menu (**More RID...** is available in **Full Menus** only) and select **Control**... from the **More RID...** submenu.

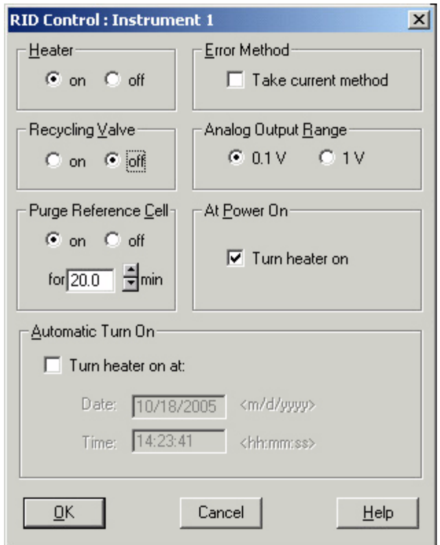


Figure 17 Refractive Index Detector Control

- **Heater:** Select the On option to switch the RID heater on. This parameter requires to set the Optical Unit Temperature.
  Select the Off option to switch the optical unit heater off.
- **Error Method:** The Error Method group enables you to select the method that is run when an error occurs. It ensures that the instrument shuts down in a controlled manner if the ChemStation control is discontinued for any reason. When Take Current Method is checked the current method is copied to the module and stored; if an error occurs, the module will run the stored method.
- **Recycling Valve:** Select the On option to switch the recycling of the eluent on. The Off option diverts the flow of the Agilent 1200 RID to the waste bottle.
- **Analog Output Range:** The Analog Output Range group allows you to select the voltage ranges of the analog output of the refractive index detector.
  Select 0.1 V to set the full-scale output to 0.1 volts.
  Select 1 V to set the full-scale output to 1 volt.

- **Purge Reference Cell:** This parameter is used to exchange the content of the reference cell in the case of solvent change or reference cell contamination. Enter a time interval (minutes) to purge the reference cell of the Agilent 1200 RID. This will be started immediately if you click OK on this window. Allow additional time for baseline stabilization after purging.
- **At Power On:** The At Power On group allows you to select to turn on the Agilent 1200 RID temperature controller when the Agilent 1200 RID is switched on.
- **Automatic Turn On:** You can set a date and time at which the temperature controller is switched on automatically.
  Select Turn Agilent 1200 RID on at: to activate the date and time fields, and enter the date and time in the appropriate fields in the specified format.

Refractive Index Detector Settings

The following operating instructions were generated using the Agilent B.01.03 ChemStation as operating software.

How To Get There:

The Agilent 1200 RID Signal dialog box is displayed when you select **Setup RID Signal** from the **Instrument menu**.

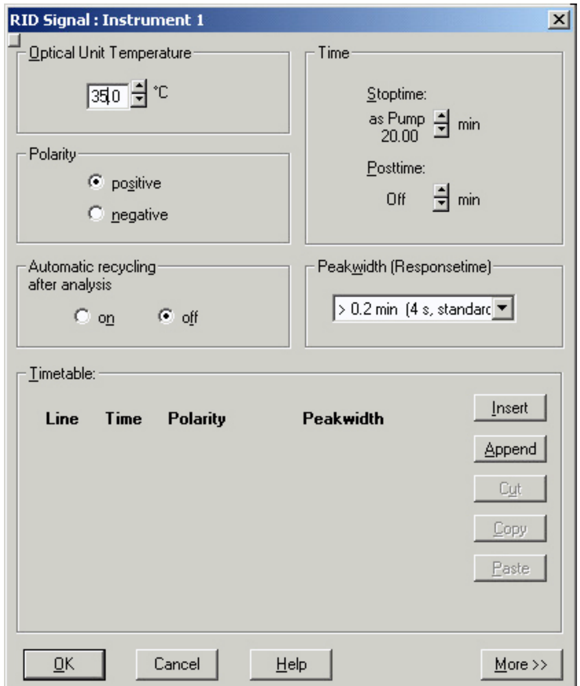


Figure 18 Refractive Index Detector Settings

- **Optical Unit Temperature:** This item sets the temperature of the optical unit. The optical unit of the Agilent 1200 RID can be operated between 5°C above ambient and 55°C. The recommended setting is 5°C above ambient. This will improve baseline stability.
- **Polarity:** This item sets the polarity of the RID signal. Because of the nature of analytes and eluents refractive index detectors can show negative and positive peaks, even within a run. Select the Signal Polarity you expect from your data from Negative or Positive.
- **Automatic Recycling:** This parameter can be used to select between automatic recycling of the eluent (on) or directing the eluent to the waste outlet of the RID (off) after the run.

- **Time:**
  Stoptime
  Stoptime enables you to set a time at which the RID stops an analysis. If the RID is used with other Agilent 1200 Series modules, the RID stoptime stops the RID only and does not stop any other modules.
  Limits: 0.00 to 99999.00 minutes, asPump (the stoptime of the pump when an Agilent pump is configured), asInj (the stoptime of the injector if an Agilent 1200 injector but no Agilent pump is configured) or noLimit (an infinite run time).
  The stoptime setting depends on the configured pump. If you have an Agilent pump with an Agilent injector, then the pump is the stoptime master (asPump). If you have a non-Agilent pump and an Agilent 1200 injector then the injector is the stoptime master (asInj).

  Posttime
  You can set the Posttime so that your RID remains in the not ready state during the Posttime to delay the start of the next analysis. A Posttime period can be used to allow your column to equilibrate after changes in solvent composition.
  Limits: 0 to 99999.00 minutes or Off. Off sets the posttime to 0.0 min.
- **Peakwidth:** Peakwidth enables you to select the peak width (response time) for your analysis. The peak width is defined as the width of a peak, in minutes, at half the peak height. Set the peak width to the narrowest expected peak in your chromatogram. The peak width sets the optimum response time for your RID.
  Limits: When you set the peak width (in minutes), the corresponding response time is set automatically and the appropriate data rate for signal acquisition is selected (please refer to the ChemStation's Online help for more details).

Refractive Index Detector More Settings

The following operating instructions were generated using the Agilent B.01.03 ChemStation as operating software.

How To Get There:

The Agilent 1200 RID Signal dialog box is displayed when you select **Setup RID signal** from the **Instrument menu**. The **More Button** displays additional Menus.

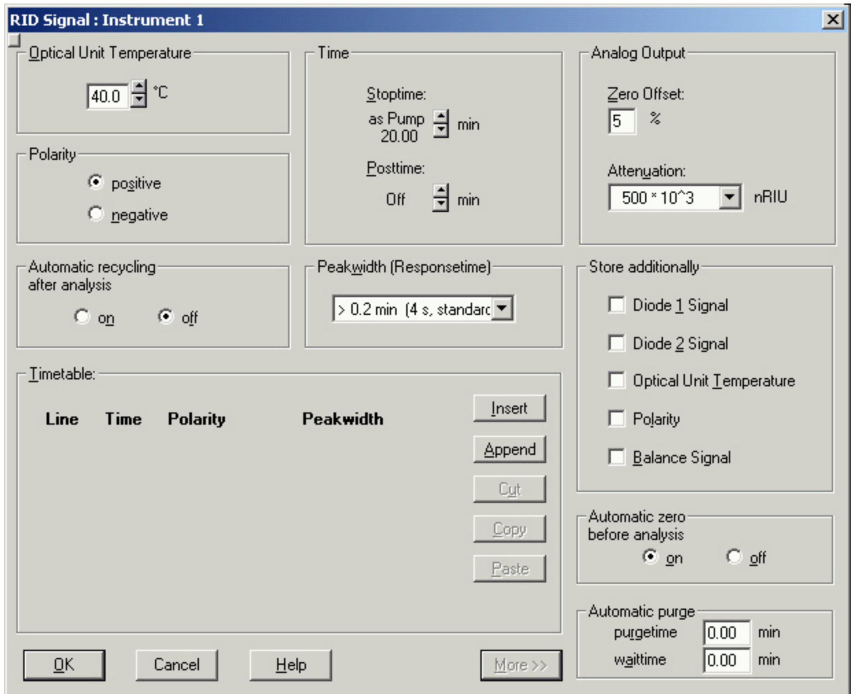


Figure 19 More RID Settings

- **Analog Output:** If the Analog Output is used a zero offset (limits between 1 and 99%) can be selected to enable the display of negative peaks. The attenuation settings helps to keep all peaks on scale. Choose the appropriate setting from the list.

- **Store Additionally:** Here you can choose to store additional signal that may help during method development and diagnosis with the Agilent 1200 RID. The following parameters can be selected:

  Diode 1 signal
  The RID signal is based on the ratio of the light level that is measured by two photodiodes. The RID signal is zero if the two diodes show the same light level. This parameter allows you to store individually the signal measured by the diode 1.

  Diode 2 signal
  The RID signal is based on the ratio of the light level that is measured by two photodiodes. The RID signal is zero if the two diodes show the same light level. This parameter allows you to store individually the signal measured by the diode 2.

  Optical unit temperature
  This parameter activates the storage of the optical unit temperature signal.

  Polarity
  This parameter activates the storage of polarity switching during the run.

  Balance signal
  This parameter activates storage of the diode balance signal during a run. This helps to diagnose peaks that exceed the dynamic range of the RID, for example in the case of extremely high concentrations/signals.

- **Automatic Zero:** This setting allows you to activate an automatic zeroing of the signal before the run is started. If automatic purge is selected, the purge will be performed before the automatic zero.
- **Automatic Purge:** This parameter can be used to do a purge of the reference cell and wait additional time for baseline stabilization. It will be initiated each time when the run is started. This should only be used if the content of the reference cell is expected to degrade during a run. The automatic purge will be finished before the autozero is performed and before the injection is done.

Running a Checkout Sample

This chapter describes the check out of the Agilent 1200 Series refractive index detector using the Agilent isocratic checkout sample.

When required	If you want to checkout the detector
Hardware required	LC system with G1362A RID
Parts required	Zorbax Eclipse XDB C18, 150mm x 4.6mm i.d. (Part number 993967-902) Agilent isocratic checkout sample (Part number 01080-68704)

Starting Your Detector

1 Turn **ON** the detector.

2 You are now ready to change the settings of your detector.

Setting the Chromatographic Conditions

1 Set up the instrument with the following chromatographic conditions.

Table 6 Chromatographic Conditions

Mobile phases	30% Water, 70% Acetonitrile
Column	Zorbax Eclipse XDB C18, 150mm x 4.6mm i.d.
Sample	Isocratic standard sample
Flow rate	1.5 ml/min
Stroke A	20 µl
Stop time	10 minutes
Injection volume	20 µl
Column compartment temperature	25 ° C
Optical unit Temperature	35 ° C
Polarity	Positive
Peak Width (Response time)	0.2 minutes (4 seconds, standard)

2 Set the RID setpoints according to Figure 20.

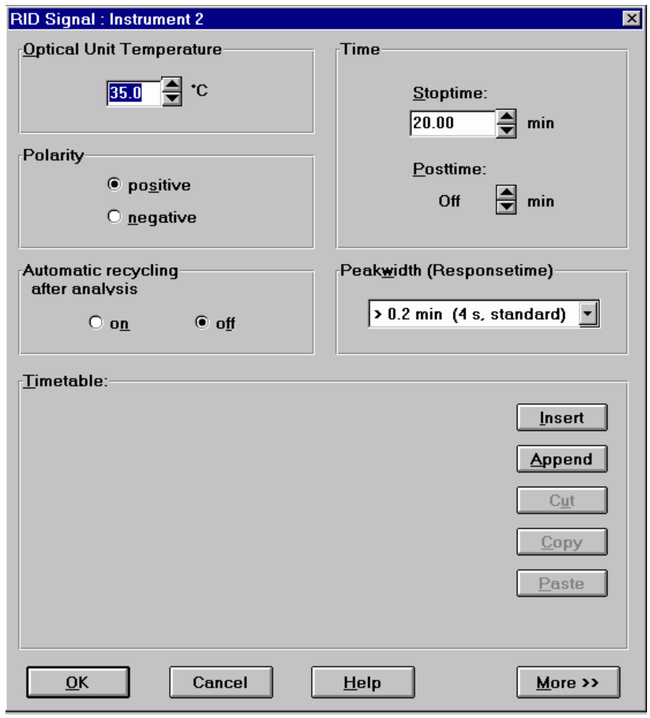


Figure 20 RID Check Out Sample Parameters

3 Turn the heater **ON** and purge the detector reference cell for 20 minutes as shown in Figure 21:

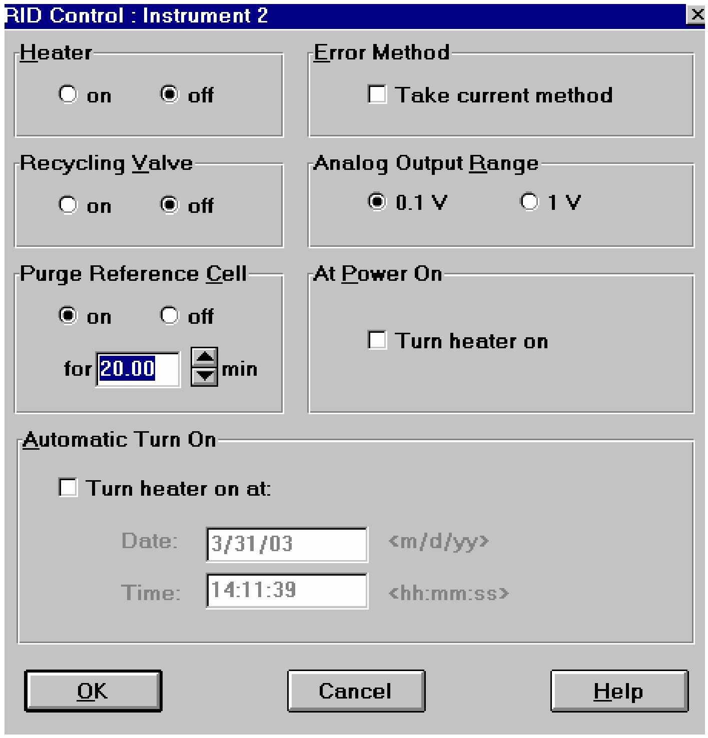


Figure 21 RID Check Out Sample Control

4 When purging has finished allow the baseline to stabilize and start the analysis.

5 If you are using the Control Module in place of the Agilent ChemStation enter the **Plot** function and select **Ref.Index**, set a **time range** of 10 minutes and the **RID signal** from -4000 to 40000 nRIU.

NOTE

The resulting chromatogram should only be seen as a qualitative example, the checkout procedure is not meant as a quantitative procedure. Its intent is only to verify the presence of the for peaks from the checkout sample - nothing more.

Please be aware of the large negative air / solvent peak from the injection (cut out from the bottom of the following figure) prior to the first peak of interest. This is to be expected in a regular chromatogram, especially if a non-degassed sample is injected into degassed solvent and the sample solvent properties don't perfectly match with the mobile phase properties. Only similar zooming factors in the display of a chromatogram will lead to similar looking results.

The resulting chromatogram is shown in Figure 22:

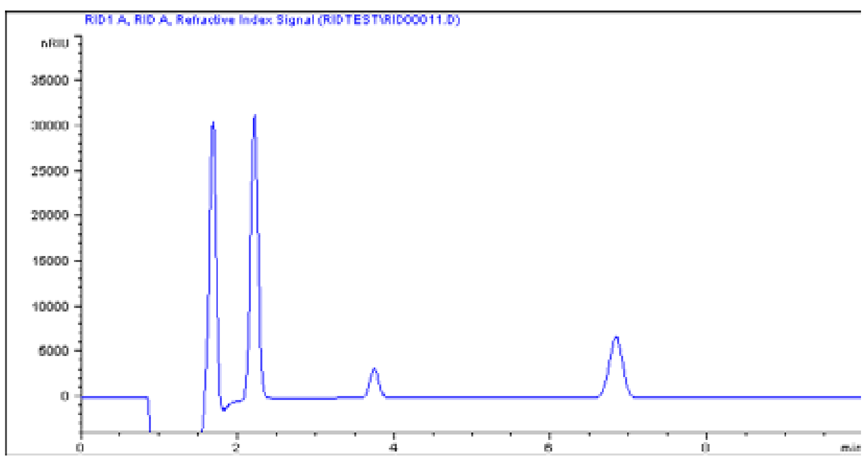


Figure 22 Isocratic Standard Sample Chromatogram

Checking Baseline Noise and Drift

This chapter describes checking the baseline noise and drift for the Agilent 1200 Series refractive index detector.

When required	If you want to checkout the detector
Hardware required	LC system with G1362A RID
Parts required	Restriction capillary (Part number G1362-87301)

Starting Your Detector

1 Turn **ON** the detector.

2 You are now ready to change the settings of your detector.

Setting the Test Conditions

1 Connect the restriction capillary directly between the column compartment heat exchanger outlet and the in port of the detector.

2 .Set up the instrument with the following test conditions.

Table 7 Chromatographic Conditions

Mobile phases	LC grade water
Column	Restriction capillary 2.7m x 0.17mm i.d.
Flow rate	1.0 ml/min
Compressibility	46
Stroke	20 µl
Stop time	20 minutes
Column compartment temperature	40 ° C
Optical unit Temperature	40 ° C
Polarity	Positive
Peak Width (Response time)	0.2 minutes (4 seconds, standard)

3 Set the RID setpoints according to Figure 23.

NOTE

The optical unit temperature must be set at least 5 ° C above ambient conditions. Therefore if ambient temperature is above 30 ° C higher values for Optical unit Temperature and Column compartment temperature must be set.

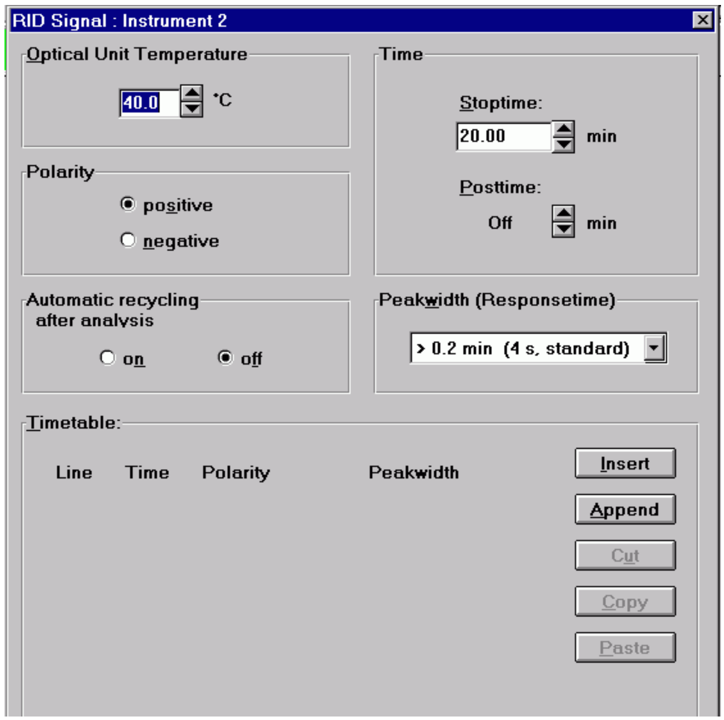


Figure 23 RID Baseline Check Parameters

NOTE The Agilent ChemStation can automatically calculate the baseline short term noise, long term noise (wander) and drift. Follow steps 4 to 9.

NOTE If you are not using the Agilent ChemStation go to step 10.

4 Edit the Agilent ChemStation method (**Method and Run Control- Method Edit Entire Method**).

5 Specify the report style Performance + Noise as shown in Figure 24

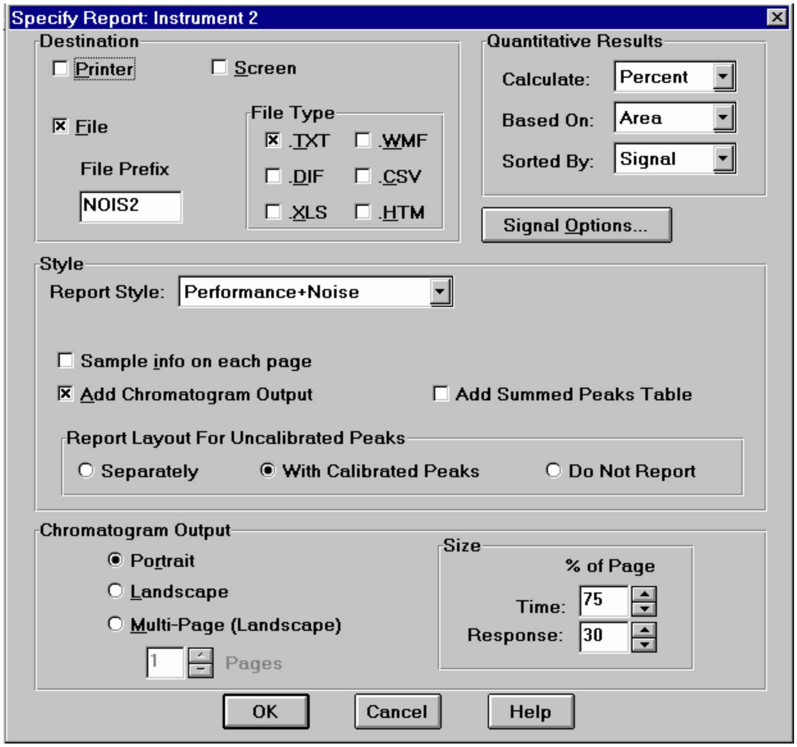


Figure 24 RID Baseline Check Out Report

6 Set the noise determination time range to 0 - 20 minutes as shown in Figure 25:

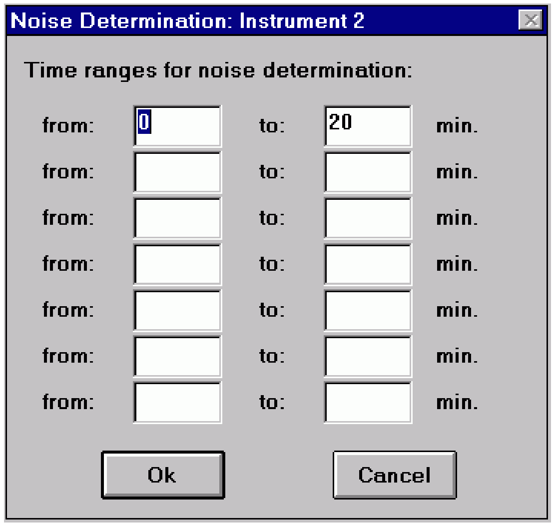


Figure 25 RID Baseline Check Out Noise Ranges

7 **Save** the Agilent ChemStation method.

8 Turn the heater **ON** and purge the detector reference cell for 20 minutes as shown in Figure 26:

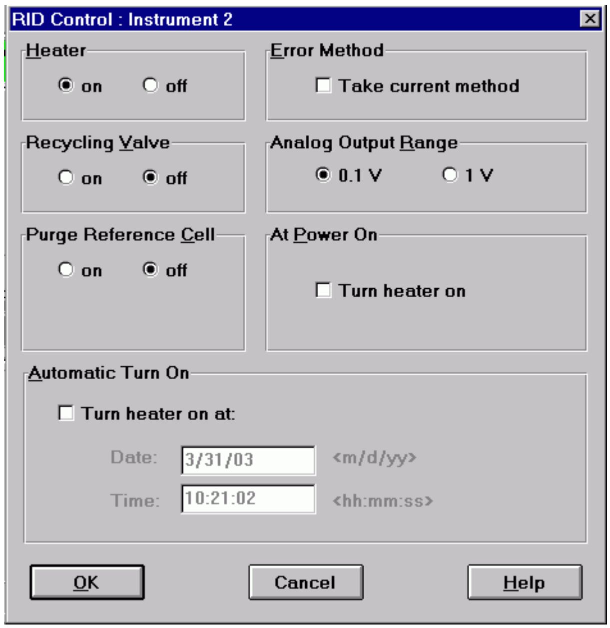
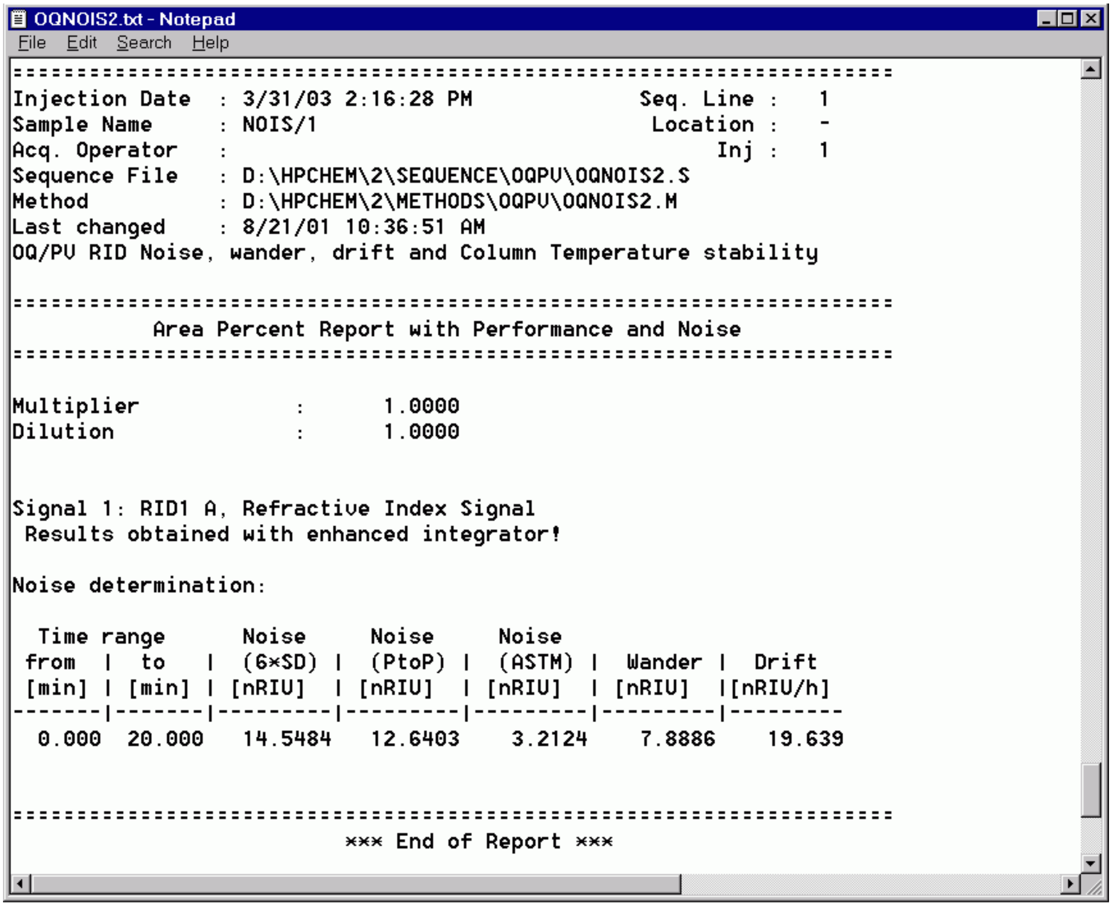


Figure 26 RID Baseline Check Control

9 When purging has finished allow the baseline to stabilize and start the sequence (blank run - no injection).

10 If you are using the Control Module in place of the Agilent ChemStation enter the **Plot** function and select **Ref.Index**, set a **time range** of 20 minutes and the **RID signal** from -200 to 200 nRIU.

11 The Agilent ChemStation report in shown in Figure 27:



OQNOIS2.txt - Notepad

File Edit Search Help

```
======================================================================
Injection Date  : 3/31/03 2:16:28 PM            Seq. Line :   1
Sample Name     : NOIS/1                         Location :   -
Acq. Operator   :                                     Inj :   1
Sequence File   : D:\HPCHEM\2\SEQUENCE\OQPV\OQNOIS2.S
Method          : D:\HPCHEM\2\METHODS\OQPV\OQNOIS2.M
Last changed    : 8/21/01 10:36:51 AM
OQ/PV RID Noise, wander, drift and Column Temperature stability

======================================================================
           Area Percent Report with Performance and Noise
======================================================================

Multiplier              :      1.0000
Dilution                :      1.0000


Signal 1: RID1 A, Refractive Index Signal
 Results obtained with enhanced integrator!

Noise determination:

  Time range      Noise     Noise     Noise
 from  |  to    | (6*SD) |  (PtoP) |  (ASTM) |  Wander |  Drift
 [min] | [min] | [nRIU]  | [nRIU]  | [nRIU]  | [nRIU]  |[nRIU/h]
-------|-------|---------|---------|---------|---------|---------
  0.000  20.000   14.5484   12.6403    3.2124    7.8886    19.639


======================================================================
                          *** End of Report ***
```

Figure 27 Baseline Check Out Results

Evaluation

For the Control Module *Rescale* the plot and measure the baseline noise and drift on the screen. If a printer is configured for the Agilent 1200 Series instrument the plot can be printed by pressing the **m** key and selecting **Print Plot**.

The following values are calculated automatically by the Agilent ChemStation.

- *Noise (ASTM):* The short term noise in nRIU based on ASTM method E-1303-95 “Practice for Refractive Index Detectors used in Liquid Chromatography” using 0.5 minute segments.
- *Wander:* The long term noise in nRIU based on ASTM method E-1303-95 “Practice for Refractive Index Detectors used in Liquid Chromatography” using 0.5 minute segments.
- *Drift:* The drift in nRIU/hour based on ASTM method E-1303-95 “Practice for Refractive Index Detectors used in Liquid Chromatography” measured over 20 minutes.

NOTE Factors that will affect the baseline stability include;

- Variations in the optics or eluent temperature
- Pressure fluctuations in the sample cell
- The quality of the water used
- Air bubbles in the flow cell

See “Refractive Index Detector Control” on page 53.

5
Optimizing the Refractive Index Detector

This chapter provides information on how to optimize the detector.

Refractive Index Detector Optimization

Follow these thirteen points to optimize the performance of your refractive index detector.

1 Position the solvent and waste reservoirs correctly

Position the solvent and waste reservoirs above the level of the refractive index detector and solvent pump. This maintains a slight pressure in the sample cell and will improve the performance of the detector.

2 Do not overpressurize the flow cell

Be aware to not exceed a 5 bar pressure drop after the flow cell when hooking up additional devices like other detectors or a fraction collector. If an additional detector is installed place upstream in the flow path it before the G1362A refractive index detector.

3 Use the correct solvents

To minimize baseline noise and drift solvents must be LC grade and filtered prior to use.

4 Check for leaks

Leaks within the LC instrument that the refractive index detector is connected to will cause problems with baseline long term noise or drift. Confirm that the instrument is free from leaks by performing the Agilent 1200 Series diagnostic pressure test (for the high pressure parts of the system between pump and column). Ensure that the connections from the on-line vacuum degasser to the pump and the detector inlet, waste and recycle connections are air tight.

5 Verify frit, filter and fitting quality

Partially blocked frits, filters and fittings can cause baseline long term noise. Verify that the pressure drop across all such parts is within expected limits.

6 Control the optical unit temperature

Always control the optical unit temperature (heater = ON) for maximum detector sensitivity or with samples that could precipitate in the sample cell at room temperature and set an elevated optical unit temperature at least 5 °C above ambient conditions.

7 Use an appropriate response time

For most applications a setting of 4 seconds is adequate. Only for high speed analyses (short columns at high flow rates) a lower setting is recommended. Bear in mind that even if the response time setting is too high fast peaks will appear a little smaller and broader but retention time and peak areas are still correct and reproducible.

8 Recycle mobile phase

Use the recycle valve to allow automatic recycling of mobile phase delivered when no analysis is running. The pump flow can therefore continue uninterrupted until the next analysis without wasting mobile phase solvents. In addition the refractive index detector is always stabilized and ready for immediate use.

9 Consider using a degasser
For many solvents you can achieve better baseline stability, when using a degasser. For some solvents a degasser might not lead to a better baseline quality.

10 Flush the degasser

If flow is stopped and mobile phase remains inside the on-line vacuum degasser the solvent composition will change. When re-starting the flow or when using new mobile phase flush each degasser channel used for 10 minutes at the maximum flow rate of the pump (with the purge valve of the pump open to avoid a potential over-pressure in the RI detector’s flow cell).

11 Use pre-mixed solvents, only
Don’t use a pump for mixing solvents. When operating the RI detector together with a quaternary pump, bypass the MCGV in the quaternary pump. You have to virtually convert the quaternary pump into an isocratic one, by directly connecting the solvent inlet tubing from degasser or solvent bottle to the active inlet valve of the pump (use adapter 0100-1847, which is delivered with the accessory kit of the detector).

12 Consider solvent changes with time

Baseline drift can be caused by the tendency of certain solvents to change over time. For example the acetonitrile content of acetonitrile/water mixtures will decrease, tetrahydrofuran will form peroxides, the amount of water in hygroscopic organic solvents will increase and solvents such as tetrahydrofuran held in the reference cell may begin to regas.

13 Eliminate mobile phase/column combination problems

Certain mobile phases in combination with specific columns can generate long term baseline noise. For example acetonitrile/water mobile phases with certain aminopropyl bonded phase columns. To eliminate the combination of mobile phase and column as a cause of long term noise replace the column with the restriction capillary (G1362-87301) and re-evaluate the detector performance.

Potential Causes for Baseline Problems

Noise (short term)

Typically the sources for short term noise are either electronic (check the settings for the peak widths, check for ambient sources of electronic noise) or they are related to the solvents, their composition and flow (in order to verify this, turn off the pump, consider degassing your solvents, use only premixed solvents).

Wander (long term noise)

Excessive wander is an indication for a general system or environmental instability (system or laboratory might not be thermally stable, control instrument and laboratory temperature). Verify that the solvent properties are constant over time (flush out contamination, use only stabilized and premixed solvents). Clean the parts in the flow path and allow the system to be flushed out and equilibrated.

Drift

Excessive drift is an indication for a general system or environmental instability (system or laboratory might not be thermally stable, control instrument and laboratory temperature). Verify that the solvent properties are constant over time (flush out of contamination, use only stabilized solvents). Clean parts in the flow path and allow the system to be flushed out and equilibrated.

Detector Equilibration

The Refractive Index (RI) is a function of temperature, pressure and a property of the used solvent (it changes with solvent composition, degassing level and due to any trace of contamination). Therefore the Refractive Index Detector will detect any change in any of these parameters as a change in its signal and a variation of its baseline. Therefore the detector will trace down any instabilities in the system and the environment as well. It may sometimes appear, as if the detector itself was unstable or generating an unstable baseline, where in fact, the detector is simply displaying the instabilities of the environment and the rest of the system. By this the detector is often - without justification - blamed for instabilities, which it does not generate itself, but only detect. The fact that this detector is a universal detector makes it also sensitive to instabilities introduced to it from outside the detector.

This makes it very important to have a very stable environment and system for achieving best possible baseline stability. The baseline will get the better, the longer the system is used under identical and stable conditions. Keep the temperature in your laboratory and system constant and controlled. Ideally a system with an RID should be used always with the same type of analysis (stable solvent composition, temperature, flow rates, do not switch the pump off after analysis, instead just recycle solvents or at least reduce only the flow. Switch valves and settings only when needed. Do not expose the detector to draft of air or to vibrations). A change of any of these parameters may require a considerable amount of time for re-equilibration.

6
Troubleshooting Overview

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

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 ready, not-ready, run, and error states) of the detector. The status indicators provide a quick visual check of the operation of the detector (see "Status Indicators" on page 81).

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 84).

Not-Ready Messages

During the wait for a specific condition to be reached or completed the detector will generate a not-ready message. For each message a short description is provided (see "Not-Ready Messages" on page 112).

Refractive Index Calibration

Refractive index calibration is recommended after exchange of the optical unit to ensure correct operation of the detector. The procedure uses a solution of known refractive index compared to LC grade water (see "Refractive Index Calibration" on page 120).

Optical Balance

Optical balance allows the balance of light falling on the light receiving diodes to be restored. The sample and reference cells must both be fully purged before the procedure is started, see "Optical Balance" on page 125).

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.

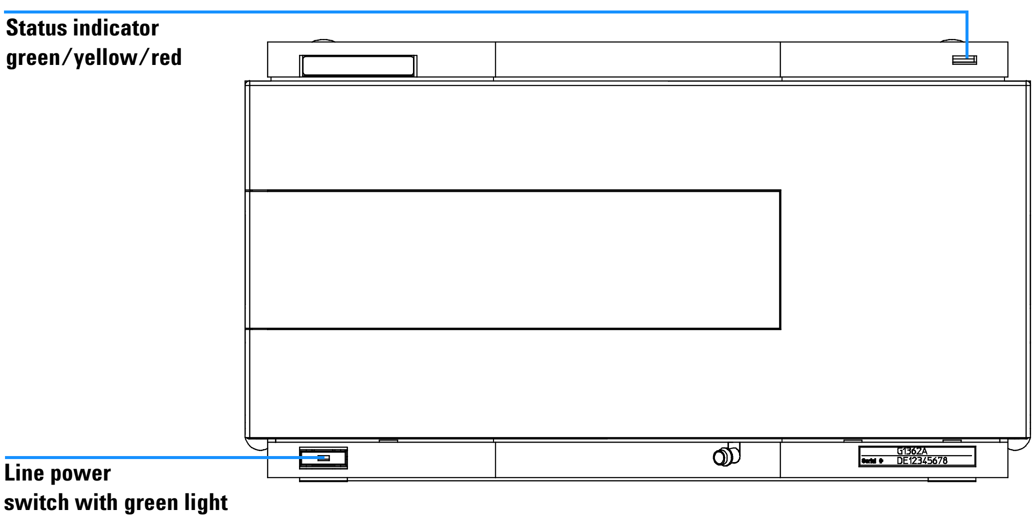


Figure 28 Location of Status Indicators

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:

- 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 operating in a running analysis.
- 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.
- 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.

7
Troubleshooting and Error Messages

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

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.

The error messages are divided into "General Error messages" on page 85 and following pages which are generic for all 1200 series modules and the "Refractive Index Detector Specific Error Messages" on page 92 and following pages.

General Error messages

Time-out

The timeout threshold was exceeded (set in sequence parameter on the Agilent ChemStation or Configure-LC system).

Probable Causes

- The analysis was completed successfully, and the time-out 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 time-out 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 Agilent 1200 Series vacuum degasser.

Remote Time-out

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 RIM board.

Probable Causes

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

Suggested Actions

✔ Ensure all fittings are tight.

✔ Exchange defective capillaries.

✔ Exchange valve.

✔ Exchange optical unit.

NOTE Make sure the leak sensor area is dry before restarting the instrument.

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 RIM 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.

Refractive Index Detector Specific Error Messages

Compensation Sensor Open

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

The resistance across the temperature compensation sensor (NTC) on the RIM 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 RIM board.

Suggested Actions

✔ Exchange the RIM board.

Compensation Sensor Short

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

The resistance across the temperature compensation sensor (NTC) on the RIM 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 RIM board.

Suggested Actions

✔ Exchange the RIM board.

Fan Failed

The cooling fan in the detector has failed.

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

Suggested Actions

✔ Ensure the fan is connected correctly.

✔ Exchange fan.

✔ Exchange the RIM 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.

Thermal Fuse Open

The thermal fuse of the optical unit heater has failed.

Probable Causes

- Heater cable disconnected.
- Defective RIM board.
- Defective thermal fuse.

Suggested Actions

✔ Ensure the heater cable is connected correctly.

✔ Exchange the RIM board.

✔ Exchange optical unit.

Heater Resistance Too High

The resistance of the heater foil is above the set limit.

Probable Causes

- Heater cable disconnected.
- Defective RIM board.
- Defective heater.

Suggested Actions

✔ Ensure the heater cable is connected correctly.

✔ Exchange the RIM board.

✔ Exchange optical unit.

Heater Fuse

The electronic fuse of the heater has been activated.

Probable Causes

- Short in heater circuit.
- Defective RIM board.
- Defective heater.

Suggested Actions

✔ Powercycle the detector.

✔ Exchange the RIM board.

✔ Exchange optical unit.

Wrong Temperature Profile

After turning ON the optical unit heat control, the temperature does not increase at a sufficiently fast rate to reach the set point.

Probable Causes

- Defective RIM board.
- Defective heater.

Suggested Actions

✔ Exchange optical unit.

✔ Exchange the RIM board.

Undecipherable Temperature Signal

Probable Causes

- Heater cable disconnected.
- Defective RIM board.
- Defective heater.

Suggested Actions

✔ Ensure the heater cable is connected correctly.

✔ Exchange the RIM board.

✔ Exchange optical unit.

Maximum Temperature Exceeded

The maximum heater temperature has been exceeded.

Probable Causes

- Defective RIM board.
- Defective heater.

Suggested Actions

✔ Exchange the RIM board.

✔ Exchange optical unit.

Purge Valve Fuse Blown

The electronic fuse on the purge valve has been activated.

Probable Causes

- Short in purge valve circuit.
- Defective purge valve.
- Defective RIM board.

Suggested Actions

✔ Power cycle the module.

✔ Replace purge valve.

✔ Exchange the RIM board.

Recycle Valve Fuse Blown

The electronic fuse on the recycle valve has been activated.

Probable Causes

- Short in recycle valve circuit.
- Defective recycle valve.
- Defective RIM board.

Suggested Actions

✔ Power cycle the module.

✔ Replace recycle valve.

✔ Exchange the RIM board.

Purge Valve Not Connected

When activated no response was received from the purge valve.

Probable Causes

- Purge valve disconnected.
- Defective purge valve.
- Defective RIM board.

Suggested Actions

✔ Connect purge valve.

✔ Replace purge valve.

✔ Exchange the RIM board.

Recycle Valve Missing

When activated no response was received from the recycle valve.

Probable Causes

- Recycle valve disconnected.
- Defective recycle valve.
- Defective RIM board.

Suggested Actions

✔ Connect recycle Valve.

✔ Replace recycle valve.

✔ Exchange the RIM board.

Lamp Voltage too High

Probable Causes

- Contaminated flow cell.
- Defective RIM board.
- Defective lamp or optics.

Suggested Actions

✔ Flush the flow cell.

✔ Exchange the RIM board.

✔ Exchange optical unit.

Lamp Current too High

Probable Causes

- Defective RIM board.
- Defective lamp or optics.

Suggested Actions

✔ Exchange the RIM board.

✔ Exchange optical unit.

Lamp Voltage too Low

Probable Causes

- Defective RIM board.
- Defective lamp or optics.

Suggested Actions

✔ Exchange the RIM board.

✔ Exchange optical unit.

Lamp Current too Low

Probable Causes

- Optical unit cable disconnected.
- Defective RIM board.
- Defective lamp or optics.

Suggested Actions

✔ Connect optical unit cable.

✔ Exchange the RIM board.

✔ Exchange optical unit.

Wait Function Timed Out

Wait for temperature or wait for defined signal has not been fulfilled within the specified time frame.

Not-Ready Messages

Not-ready messages are displayed during the wait for a specific condition to be reached or completed or while a self-test procedure is running. In the event of such a failure, the yellow status indicator at the front of the detector is switched ON.

This section describes the meaning of detector **not-ready** messages.

Purge Time Running

Meaning

- The purge valve is open, liquid is flowing through both sample and reference cell.

Suggested Actions

✔ Allow the reference purge time to elapse.

Wait for Purge

Meaning

- The detector is waiting after the automatic purge of the reference cell.

Suggested Actions

✔ Allow the wait time to elapse.

Unbalanced Diodes

Meaning

- The diode balance value is outside the pre-set range -0.5 to + 0.5, an unequal amount of light is falling on the two light receiving diodes.

Suggested Actions

✔ Flush the reference cell with the mobile phase being used.

✔ Perform the RID Optical Balance procedure (see “Optical Balance” on page 125).

Not Enough Light

Meaning

- There is insufficient light falling on the light receiving diodes to generate a refractive index signal.

Suggested Actions

✔ Flush the flow cell with the mobile phase being used to ensure that it is free of air bubbles or other contamination.

Too Much Light

Meaning

- The amount of light falling on the light receiving diodes is too high to generate a refractive index signal.

8
Troubleshooting, Test Functions and Test Signals

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

Refractive Index Calibration

The refractive index calibration is based on a Sucrose calibration solution, which has a known refractive index compared to LC grade water. After both the sample and reference cells have been purged with LC grade water the Sucrose solution is introduced into the flow cell and then the built-in refractive index calibration functionality is used.

Filling the sample cell with the Sucrose calibration solution will give a theoretical detector response of 512,000 nRIU +/- 5,000 nRIU. The calibration algorithm will allow the actual detector response, if different, to be changed to the theoretical value.

NOTE Refractive index calibration is only required after exchange of the optical unit or the main (RIM) - board.

The Refractive Index Calibration Procedure

When required	Recommended after exchange of the optical unit or RIM board.
Tools required	Laboratory balance
Parts required	DAB/Ph Eur/BP/JP/NF/USP Grade Sucrose Syringe 9301-1446 Syringe needle 9301-0407 Sample filter 5061-3367 PEEK fitting 0100-1516

Steps

1 Preparation of the Sucrose calibration solution.

2 Preparing the pump.

3 Start Refractive Index Calibration.

4 Flushing the degasser and pump.

5 Purging the sample and reference cells.

6 Fill the sample cell with calibration solution.

7 Calibrate Refractive Index.

Preparation of the Sucrose sucrose Calibration Solution

1 To prepare 25 ml of the calibration solution 87.5 mg of the Sucrose sample is required.

2 Add the weighed amount of sample into a suitable volumetric flask.

3 Dispense 10 ml of LC grade water into the flask and shake or stir to dissolve.

4 Dilute the contents of the flask to volume with LC grade water.

Wait five minutes and shake again. The solution is now ready for use.

Preparation of the Pump

1 Fill a suitable solvent bottle with LC grade water.

2 Connect this bottle to Channel A of the pump, A1 if a binary pump.

Start Refractive Index Calibration

1 From the user interface start the RID Calibration (see Figure 29).
Agilent ChemStation: **Diagnosis > Maintenance > RID Calibration**
Control Module: **System - Tests - RID - Calibrate**.

2 Follow the instructions with reference to the steps below.

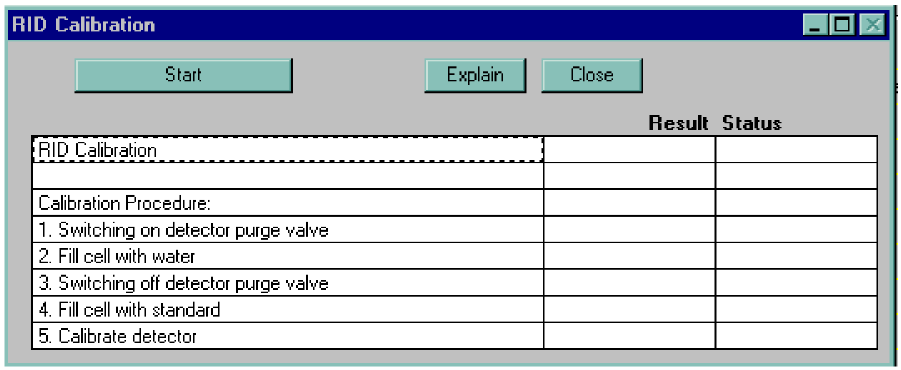


Figure 29 Start Refractive Index Calibration

Purging the Sample and Reference Cells

1 The purge valve will automatically switch to the **ON** position.

2 Using a syringe or LC pump flush the sample and reference cell with about 20 ml of LC grade water.

3 The purge valve will automatically switch to the OFF position when you click **continue**.

Fill the Sample Cell with Calibration Solution

1 Remove the inlet capillary or flushing syringe from the in port.

2 Take the syringe and fix the needle to the syringe adapter.

3 Suck about 1.5 ml of the calibration sample into the syringe.

4 Keep the syringe in a horizontal position.

5 Remove the needle.

6 Add the filter to the syringe and fit the needle to filter.

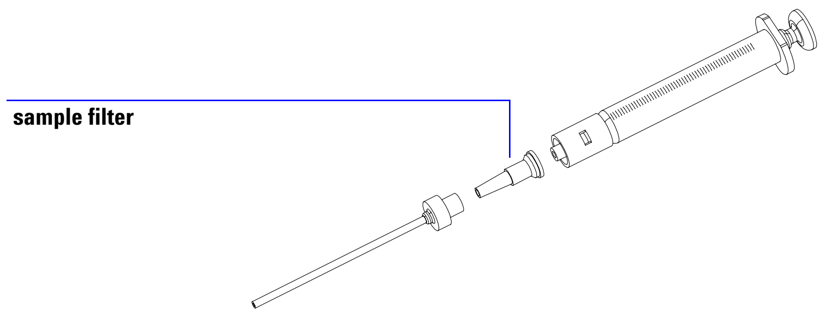


Figure 30 Syringe with Sample Filter

7 Lift the needle tip and carefully eject approximately 0.5 ml to remove air out of the syringe and to flush the needle.

8 Add the PEEK fitting to the needle tip and fix both at the flow cell inlet.

NOTE

Do not inject the calibration solution without the sample filter.

9 Slowly inject about 1.0 ml and wait for about 10 seconds to inject another 0.1 ml. This will assure that the cell is filled properly.

Calibrate Refractive Index

1 If the detector response differs from the theoretical response of 512,000 nRIU +/- 5,000 nRIU enter the theoretical value (512,000) in the dialog box. If the detector response is within the theoretical response click **OK** (see Figure 31).

NOTE Rinse the sample cell with pure water at a minimum of 1.5 ml/min to flush the Sucrose from the cell and the capillaries. When organic solvent is sequentially applied (without rinsing), a blockage of capillaries may occur.

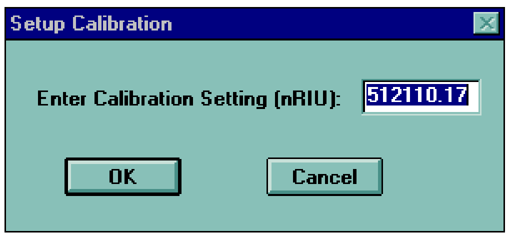


Figure 31 Calibrate Refractive Index

Optical Balance

When the sample and reference cells both contain the same liquids an equal amount of light should fall on each light receiving diode, the diode balance will equal 0. If this balance of light needs to be corrected the optical balance procedure can be used.

Diode balance is calculated as follows;

Diode Balance

$$diodebalance = \frac{(diode1 - diode2)}{(diode1 + diode2)}$$

Where:

diode1 = signal proportional to the amount of light falling on diode 1

diode2 = signal proportional to the amount of light falling on diode 2

Optical balance adjustment is a manual procedure where the position of the light beam falling on the light receiving diode is adjusted using the zero glass adjustment screw.

NOTE The detector will become not-ready when the diode balance value falls outside the range -0.5 to + 0.5.

NOTE Both sample and reference cell must be purged with the same solvent before optical balance is performed. Prior to performing this procedure, the system must be well equilibrated.

The Optical Balance Procedure

When required	When light falling on light receiving diodes is out of balance.
Tools required	Flat-head screwdriver.
Parts required	None.

NOTE This procedure should only be performed to correct a permanent misalignment of the light beam that cannot be eliminated by flushing the sample and the reference cell with the same solvent and by equilibrating the system.

Steps

1 Purging the sample and reference cells.

2 Start optical balance.

3 Adjust optical balance.

Purging the Sample and Reference Cells

1 Switch the purge valve to the **ON** position.

2 Purge the sample and reference cells for around 10 minutes with the solvents to be used.

3 Switch the purge valve to the **OFF** position

Start Optical Balance

1 From the user interface start the RID optical balance (see Figure 32).
Agilent ChemStation: **Diagnosis > Maintenance > RID Optical Balance**
Control Module: **Analysis(RID) > m > Status**

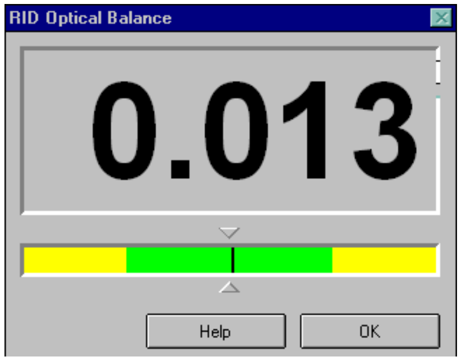


Figure 32 Optical Balance

Adjust Optical Balance

1 While monitoring the optical balance use the flat-headed screwdriver to turn the zero glass adjustment screw slowly (see Figure 33).
2 When the diode balance value reaches 0.00 optical balance is restored.

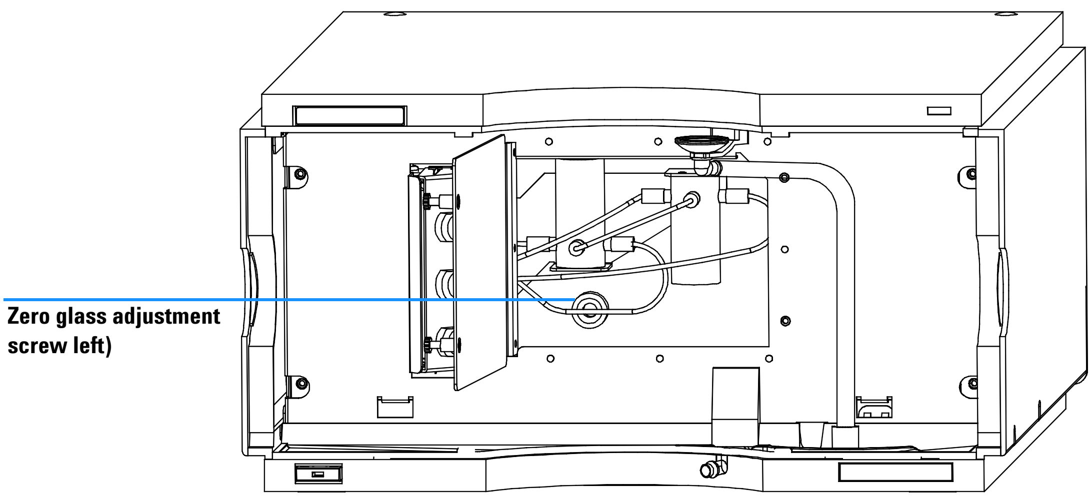


Figure 33 Turning the zero glass adjustment screw

Using the Built-in Test Chromatogram

This function is available from the Agilent ChemStation and the Control Module.

The built-in Test Chromatogram can be used to check the signal path from the detector to the ChemStation and the data analysis or via the analog output to the integrator or data system. An example is shown in Figure 34. The chromatogram is continuously repeated until a stop is executed either by means of a stop time or manually.

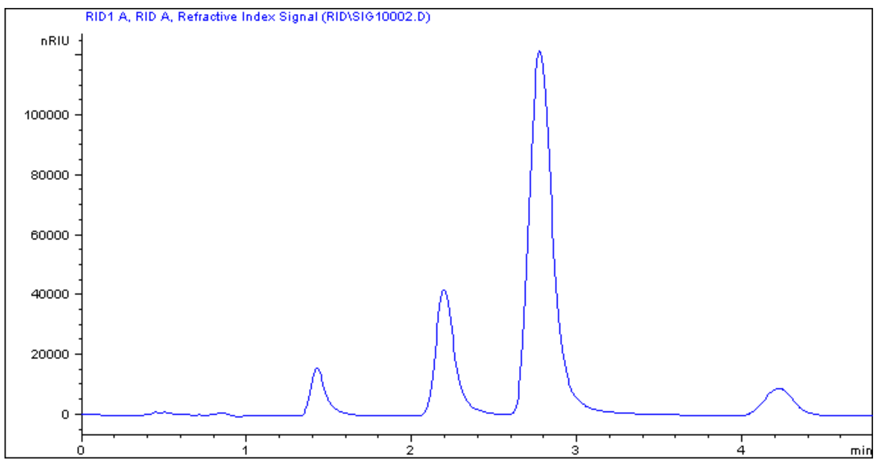


Figure 34 Built-in Test Chromatogram (default settings)

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

Table 8

Peakwidth = >0.05 min (response time = 1 s fast)	Stop time = 1.2 minutes
Peakwidth = >0.20 min (response time = 4 s STD)	Stop time = 4.8 minutes

Procedure using the Agilent ChemStation

1 Load the RID default parameter
   - peakwidth to >0.2 minutes (standard),
   - set stop time to 4.8 minutes.
2 Complete the Sample Information (blank run - no injection).
3 Type into the command line (or as pre-run command):

```
PRINT SENDMODULE$(LRID,"SIMU:DFLT").
```

4 The logbook shows “**Preparing for a simulation**”.
5 Start the run.

The results are processed like a normal chromatogram.

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

Procedure using the Control Module

1 Load the RID default parameter
   - peakwidth to >0.2 minutes (standard),
   - set stop time to 4.8 minutes.
2 Enter **System > Tests - RI Detector**.
3 Select the function **Default test chromatogram** and press **Execute**.

   The logbook shows "**Simulated chromatogram enabled**".
4 Enter the **Plot** function and select **Ref.Index**, set a **time range** of 4.80 minutes and the **RID signal** from -5000 to 125000 nRIU.

NOTE If an Agilent ChemStation is connected, the next step will start the Agilent ChemStation simultaneously and will overwrite the previous used Data File!

5 Start the analysis (blank run - no injection).

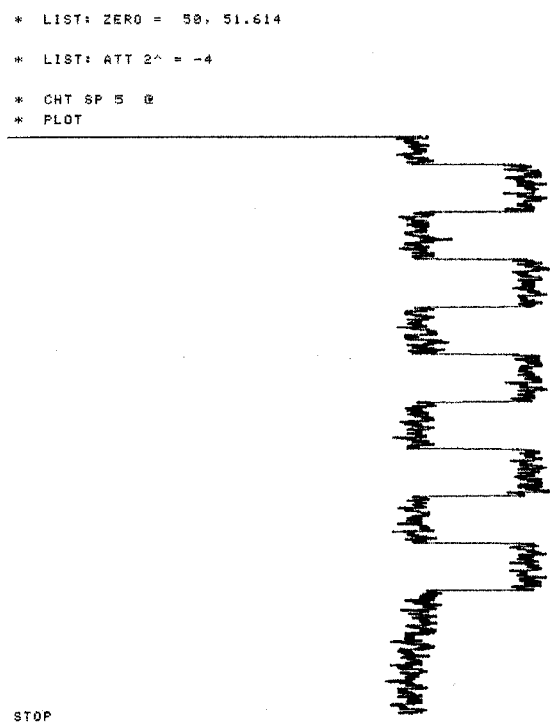
After the run has finished, the plot can be output to a printer connected to the Agilent 1200 Series instrument by pressing **m** and selecting **Print Plot**.

NOTE The test chromatogram is switched OFF automatically at the end of the run.

Using the Built-in DAC Test

This function is available from the Control Module ONLY.

The DAC test provides a test pattern as an analog output. The output voltages (analog 1 and analog 2) should show a constant value corresponding to the ZERO OFFSET value. In addition to the constant voltage is a switched voltage with a duration of 12 seconds and a height of 10 µV, see Figure 35.



Limits:

Noise (p-to-p) < 5 µV

Figure 35 DAC Test (Example)

1 Enable the function (**System > Tests > RID > Enable DAC Test Pattern**).
2 Start the plot mode (e.g. Agilent 3396 with ATTN -4, ZERO=50, CS=5).
3 Stop the plot and disable the TAC Test (**System > Tests > RID > Disable DAC Test Pattern**).
4 Evaluate the noise (should be< 5 µV).

9
Repairing the Refractive Index Detector

This chapter provides general information on repairing the detector.

Introduction to the Repairing the Refractive Index Detector

Maintenance

The detector is designed for easy repair. The most frequent repairs such as flow cell flushing can be done from the front of the detector with the detector in place in the system stack. These repairs are described in “Detector Maintenance Procedures” on page 138.

Exchanging Internal Parts

Some repairs may require exchange of defective internal parts. Exchange of these parts requires the removal of the detector from the stack, removing the covers, and disassembling the detector. The security lever at the power input socket prevents the detector cover from being removed when line power is still connected. These repairs are described in "Exchanging Internal Parts" on page 145.

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 edges.**

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 of another Agilent 1200 Series module) when handling electronic boards and components (see "Using the ESD Strap" on page 136).

CAUTION There is a risk of damaging hardware due to overheating when operating the instrument without covers.

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 of other Agilent 1200 Series modules 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.

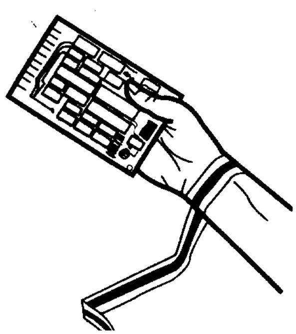


Figure 36 Using the ESD Strap

10
Maintaining the Refractive Index Detector

This chapter describes the maintenance of the detector.

Detector Maintenance Procedures

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

Table 9 Maintenance Procedures

Procedure	Typical Frequency	Notes
Flow cell flushing	If flow cell is contaminated.	
Leak sensor drying	If leak has occurred.	Check for leaks.
Leak handling System replacement	f broken or corroded.	Check for leaks.
Replacing the detector’s Firmware	If not up to date or corrupted.	

Flow Cell Flushing

When required	If flow cell is contaminated
Tools required	Glass syringe, adapter
Parts required	Strong solvent, tubings to waste

NOTE Aqueous solvents in the flow cell can build up algae. Therefore do not leave aqueous solvents in the flow cell for long periods. Add a small percentage of organic solvents (e.g. Acetonitrile or Methanol ~5%).

NOTE The strong solvent should dissolve any potential contaminants in the flow cell. For example water for aqueous mobile phase buffers, chloroform or tetrahydrofuran for not water soluble contaminants.

In case the cell is contaminated, follow the procedure below.

Flushing Procedure

1 Flush with the strong solvent.

2 Leave this solution in the cell for about one hour.

3 Flush with mobile phase.

CAUTION The strong solvent used may be dangerous and proper attention to safety should be given.

NOTE Do not exceed the flow cell pressure limit of 5 bar (0.5 MPa).

Correcting Leaks

When required	If a leakage has occurred in the valve area or at the capillary connections
Tools required	Tissue Two 1/4 inch wrenches for capillary connections
Parts required	None

1 Remove the front cover.
2 Open the service door
3 Use tissue to dry the leak sensor area and the leak pan.
4 Observe the interface ports and the valve area for leaks and correct, if required.
5 Close the service door.
6 Replace the front cover.

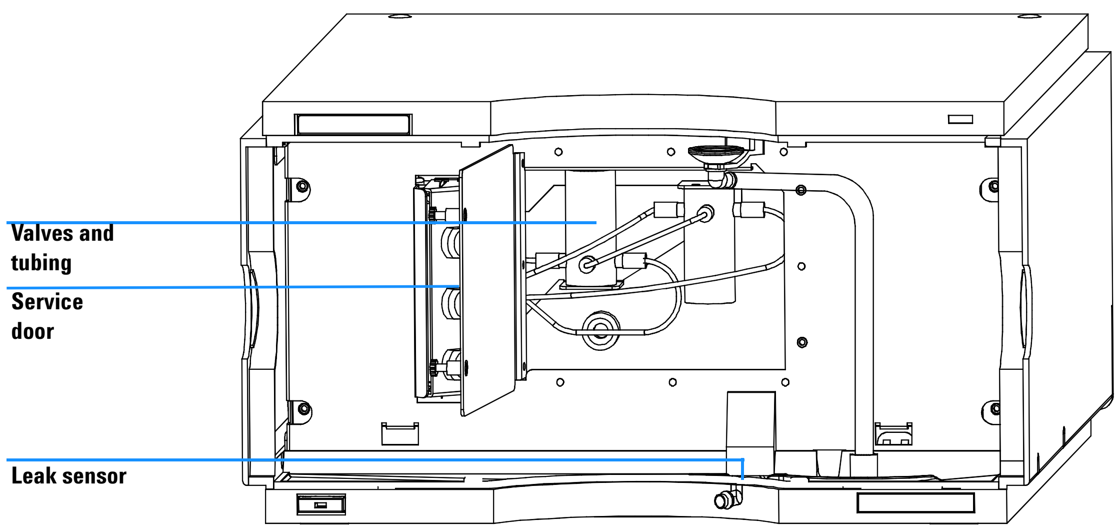


Figure 37 Observing for Leaks

Replacing Leak Handling System Parts

When required	If the parts are corroded or broken
Tools required	None
Parts required	Leak funnel 5061-8388 Leak funnel holder 5041-8389 Leak tubing (120mm) 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.

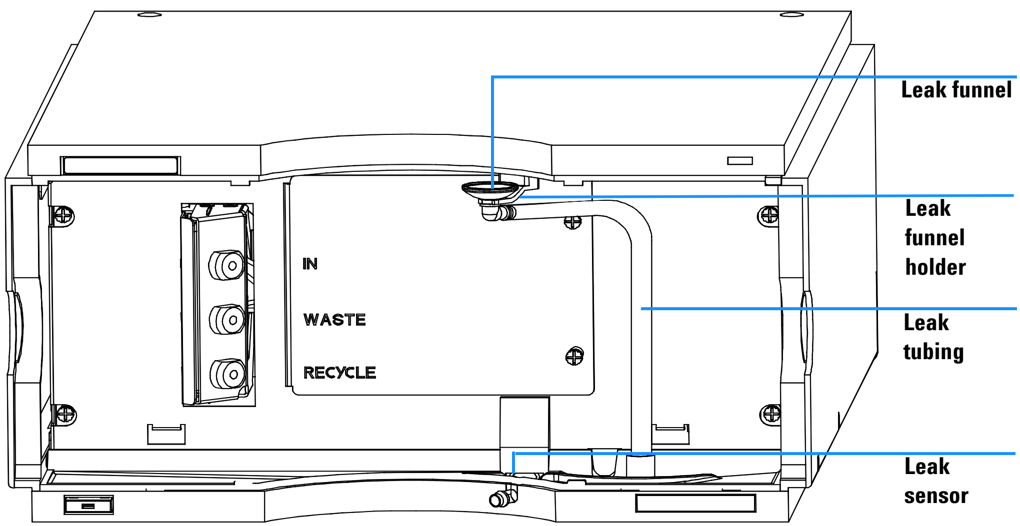


Figure 38 Replacing Leak Handling System Parts

Replacing the Detector’s Firmware

When required	If new version solves problems of currently installed version or after exchange of the detector main board (VWDM) the version on board is older than previous installed one.
Tools required	LAN/RS-232 Firmware Update Tool
Parts required	Firmware, tools and documentation from Agilent web site
Preparations	Read update documentation provided with the Firmware Update Tool.

The installation of *older* firmware might be necessary:

- to keep all systems on the same (validated) revision, or
- if third part control software requires a special version.

To upgrade/downgrade the detector’s firmware the following steps have to be performed:

1 Download the module’s firmware, the LAN/RS-232 FW Update Tool Version 2.00 or above and the documentation from the Agilent web

http://www.chem.agilent.com/scripts/cag_firmware.asp.

2 Load the firmware into the detector as described in the documentation.

3 If the detector main board was replaced, perform a “Refractive Index Calibration” on page 120 to add the recalibration parameters into the board’s memory.

4 If detector main board was replaced, re-enter the serial number information of the module through the user interface.

11
Repairing Internal Parts of the Refractive Index Detector

This chapter describes the repair of internal parts of the detector.

Overview of the Repairing of the Refractive Index Detector

Figure 39 shows the main assemblies and their locations.

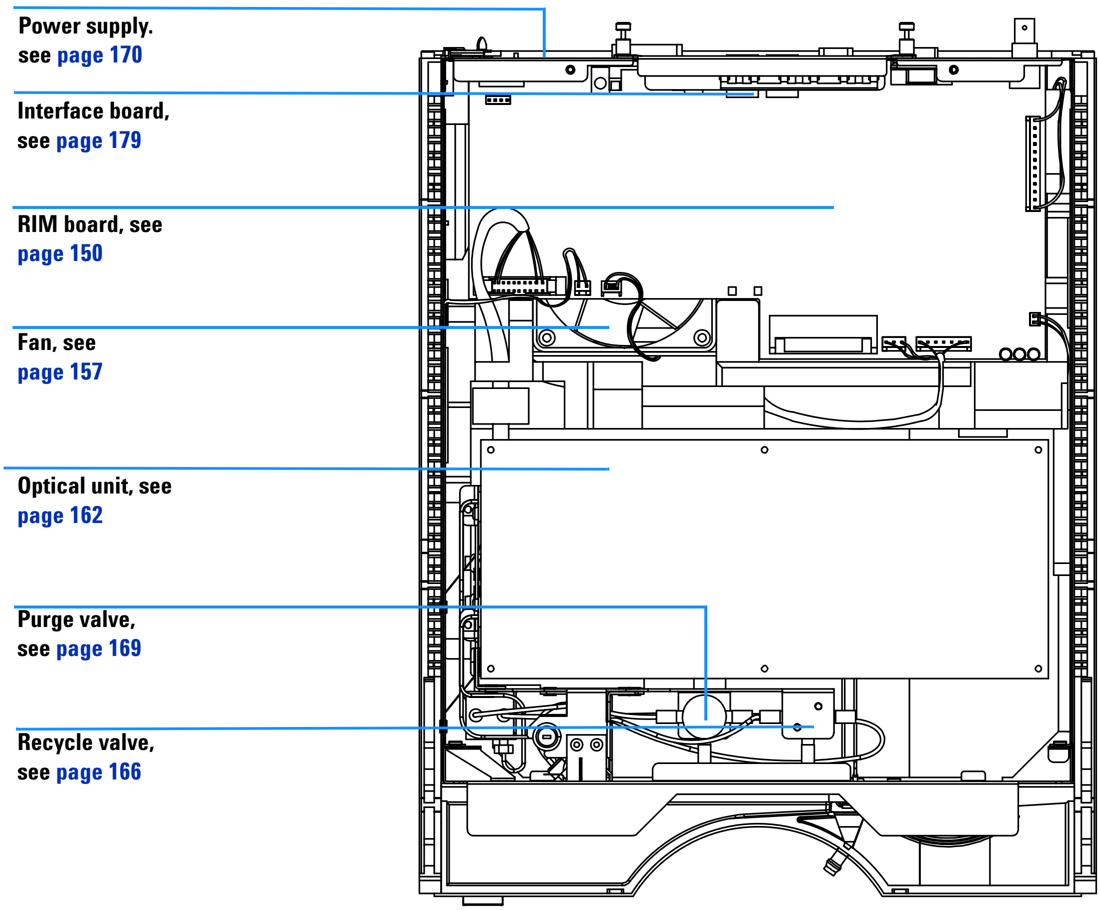


Figure 39 Main Assemblies

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 the detector cover from being removed when line power is still connected.
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.

WARNING

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

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.

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

There will be a risk of damaging hardware due to overheating when operating the instrument without covers.

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 136.

Removing the Covers

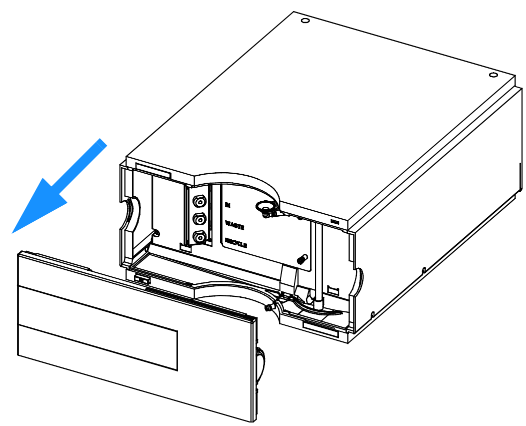
When required	For all repairs inside the detector
Tools required	Screwdriver POZI 1 PT3
Parts required	Depends on the repairs to be done

CAUTION There will be a risk of damaging hardware due to overheating when operating the instrument without covers.

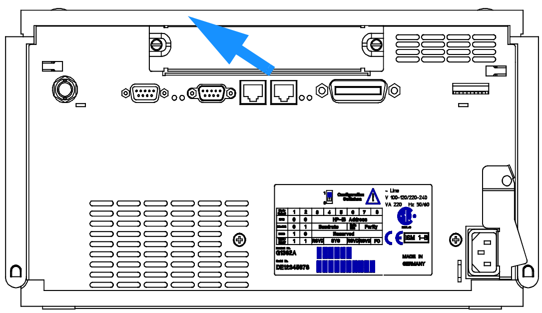
Preparations for this procedure:

- Turn OFF the detector.
- Disconnect the power cable.
- Disconnect the inlet, waste and recycle capillaries.
- Remove detector from stack and place it on the workbench.

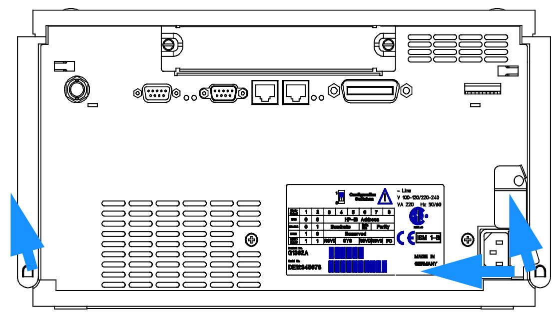
1 Press the release buttons and remove the front cover for access to the interface port area.



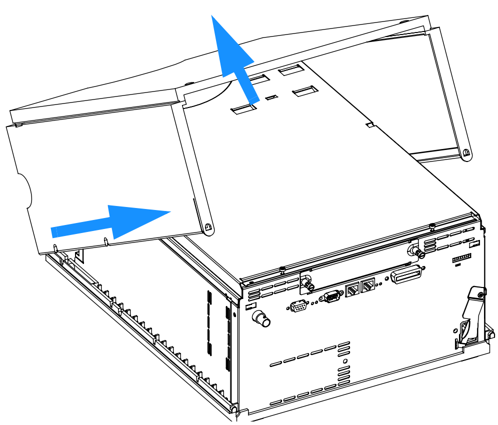
2 If installed, unscrew and remove the interface board. Place the board on the ESD kit.



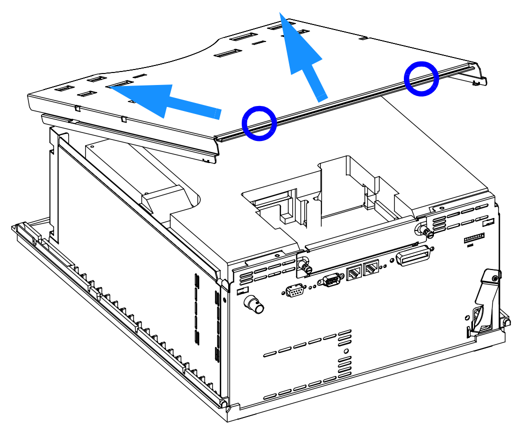
3 Move the power lock across the power inlet and lift the clips on the rear of the cover.



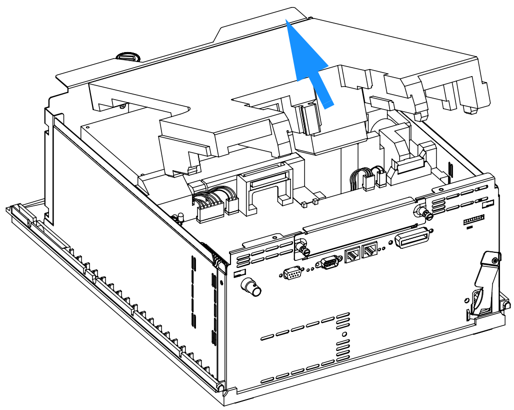
4 Lift the cover up and slide it towards the rear.



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



6 Lift out and remove the top foam.



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

Exchanging the Detector Main Board

When required	If detector main board is defective or for repair on other assemblies
Tools required	Screwdriver POZI 1 PT3 Flat screw driver Hexagonal wrenches 5 mm, 7 mm and 15 mm
Parts required	Detector main board (RIM) G1321-66500 for RID Detector main board (RIM) G1321-69500 for RID (exchange assembly)

1 Switch OFF the module, and disconnect the cables.
2 Remove module from stack and place it on the workbench.

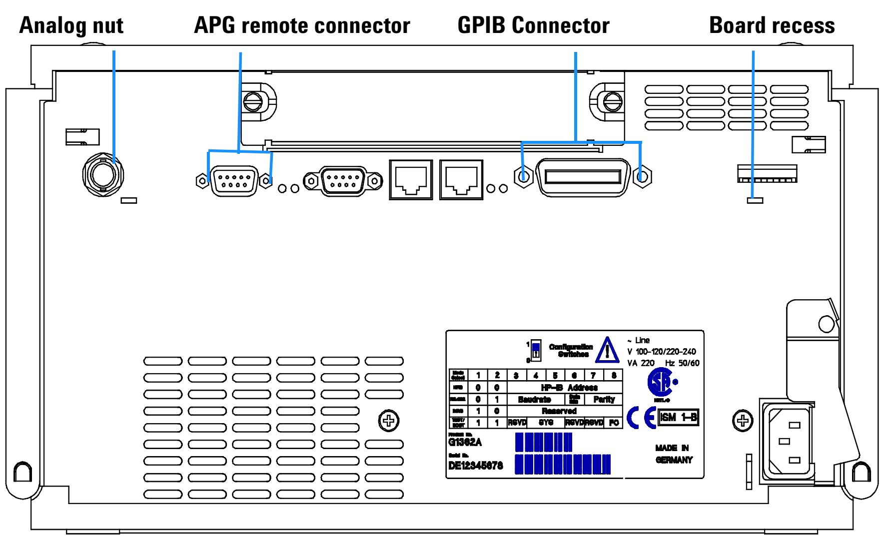


Figure 40 Unscrew Connectors from Board

3 Remove the front cover, top cover and top foam section, see “Removing the Covers” on page 147.
4 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.
5 Disconnect all connectors from the detector main board.

P2 - GPIB
P3/4 - CAN
P5 - RS-232C
P6 - REMOTE
P7 - Analog output
P10 - Power supply
P19 - Optical Unit
P20 - Purge Valve
P21 - Fan
P23 - Leak Sensor
P24 - Interface Board
P25 - Recycle Valve
P26 - Heater
BT - Battery
S1 - Configuration switch

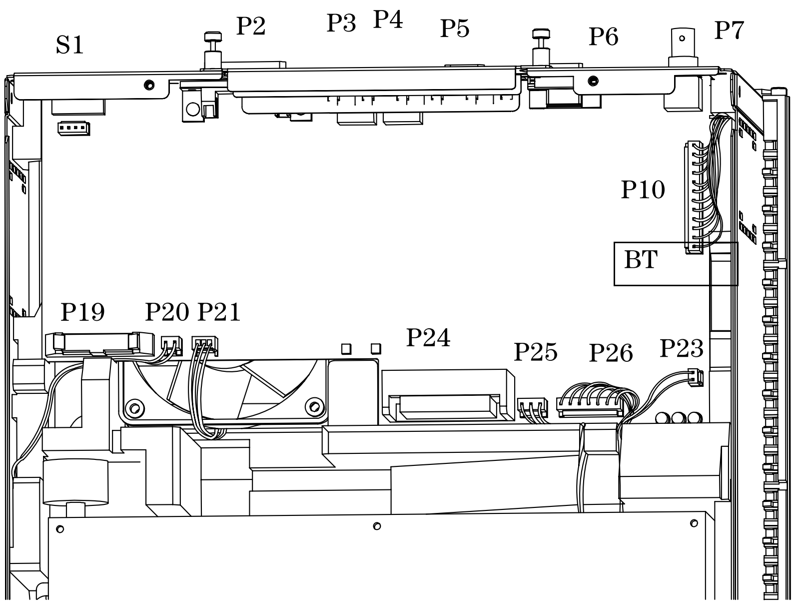


Figure 41 location on RIM board Location of Connectors on RIM Board

6 Remove the detector main board. Place the board on the ESD kit.

7 On the new board check the switch setting of address switch S1, see "Setting the 8-bit Configuration Switch" on page 228.

NOTE

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

8 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.

9 Refit the screws at the REMOTE and GPIB connectors and the nuts of the ANALOG connectors.

10 Reinstall the top foam section, top cover and front cover, see “Replacing the Foams and Covers” on page 176.

11 Replace detector into the stack and reconnect the cables.

12 If a new RIM board is installed performance of the Refractive Index Calibration as described in “Refractive Index Calibration” on page 120 is recommended to check the response of the detector.

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

13 Check the firmware revision of the module. If it is older than the current firmware revision, update the firmware using the standard firmware update procedure, see “Firmware Updates” on page 218.

Changing the Type and Serial Number

When required	If detector main board has been replaced.
Tools required	User interface
Parts required	none
Preparations	• Turn the detector on. • Start the user interface.

When the main board has to be replaced, the new board does not have a serial number. For some modules (e.g. pumps or auto samplers) the type has to be changed (multiple usage boards). Use the information from the serial number plate of your module.

The changes become active after the reboot of the module.

Using the Agilent ChemStation

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

1 To enter a module serial number, type the following command into the command line:

```
print sendmodule$(lrid, "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.

To change the type of the module use the following command:

```
print sendmodule$(lrid, "TYPE XXXXX")
```

Where: XXXXX is the 5-character product number of the module (e.g. G1362A).

WARNING **If you enter the wrong type, your module will not be accessible anymore. In such a case see "Using the Instant Pilot G2408A" on page 154 or "Using the Control Module G1323B" on page 155 for recovering.**

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 **1200 access** screen during the restart of the Agilent ChemStation.

3 After restart, the serial number/type you have just entered can be seen under the **Instrument** menu of the main user interface screen.

Using the Instant Pilot G2408A

1 Connect the Instant Pilot to the detector. Turn ON the detector.

2 On the Instant Pilot's Welcome screen, press **More**, then select **Maintenance**. Using the **up/down arrows**, select the detector where you have to change the product number or serial number.

3 Press **PN/SN**. This will display a screen where you can enter the product number and/or serial number.

4 Make your changes, using the information from the product label of your detector.

WARNING **If you enter the wrong type, your module might not be accessible anymore with the Agilent ChemStation and the Instant Pilot (unsupported module). In such a case follow the "Recover Instructions" on page 155.**

5 Press **OK** to highlight the complete command.

6 Press **Done** to transfer the information into the main board's memory. Press **Cancel** quit the process.

7 Turn the detector OFF then ON again. The Maintenance screen should display the correct serial number for this module.

8 If an Agilent ChemStation is also connected, restart the Agilent ChemStation now as well.

Recover Instructions

1 Turn off the detector.

2 Change the 8-bit Configuration Switch to Resident (see “Stay-Resident Settings” on page 232).

3 Turn the detector on.

4 Re-do steps 2 to 5 of “Using the Instant Pilot G2408A” on page 154 and correct the type information. Enter the product number without “-R”

5 Turn the detector off.

6 Change the 8-bit Configuration Switch back to default settings (see “Setting the 8-bit Configuration Switch” on page 228).

7 Turn the detector ON again. The Maintenance screen should display the correct type for this module.

Using the Control Module G1323B

1 Connect the control module to the detector. Turn ON the detector.

2 On 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**), then **m.** This will display a box which says **Update Enter Serial#**.

4 Press **Enter**. This will display the box labeled **Serial#**.

5 Letters and numbers are created using the up and down arrows. Into 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**).

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.

To change the product number go to the **System** screen.

1 Press **Tests (F3)** and select the detector and press **Enter**.
2 While in the Tests screen, press **m.m** (m dot m).
3 From the box now displayed, select the **Command**, and press **Enter**.
4 Into the box labeled **Nester** (instruction), enter the command **TYPE XXXXX**.

   Letters and numbers are created using the up and down arrows. XXXXX is the 5-character product number of the module being changed. There must be a space between the word TYPE and the product number.

   Examples: **TYPE G1362A** to configure as a RID.

WARNING **If you enter the wrong type, your module might not be accessible anymore with the Agilent ChemStation. In such a case re-enter the TYPE command correctly.**

5 Now, press the **Execute** key. Below the box, a reply line should then say:

   Reply RA 0000 TYPE "XXXXX" (XXXXX is what you just entered)

6 Turn the detector off, then on again. Turn on should be normal. In the **Records** screen, the product# column should indicate the module you just entered. If an Agilent ChemStation is also connected, re-boot it now.

Exchanging the Fan

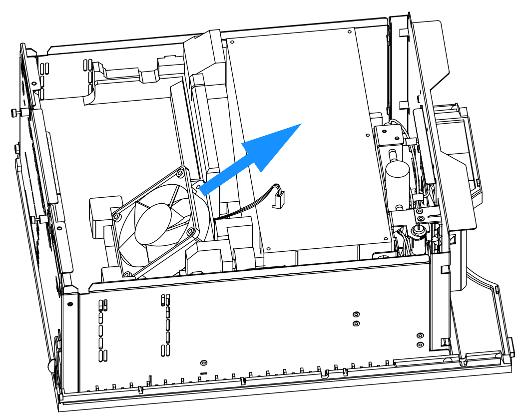
When required	If the fan is defective or noisy
Tools required	Screwdriver POZI 1 PT3
Parts required	Fan assembly 3160-1017

CAUTION The fan must be installed in the correct orientation to ensure optimum cooling and operation of the detector.

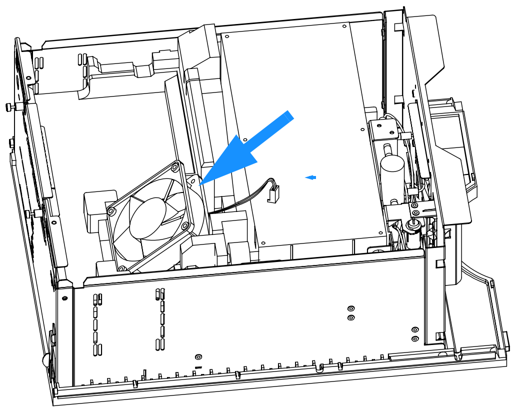
Preparations for this procedure:

- Turn OFF the detector.
- Disconnect the power cable.
- Remove detector from stack and place it on the workbench.
- Remove the covers as described in "Removing the Covers" on page 147.
- Remove the detector main board as described in "Exchanging the Detector Main Board" on page 150.

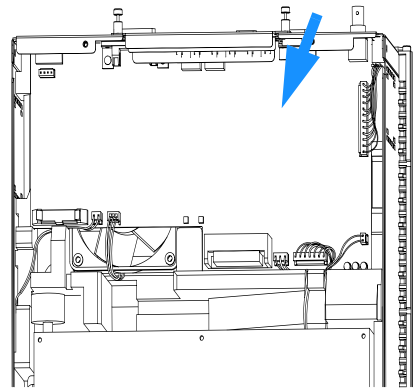
1 Pull the fan up and out of the bottom foam.



2 Insert the fan into the bottom foam. (the air flow must be towards the bottom of the detector).



3 Replace the detector main board as described in “Exchanging the Detector Main Board” on page 150.



Next Steps:

4 Replace the covers as described in “Replacing the Foam and the Top Cover” on page149.

5 Re-install the detector in the stack.

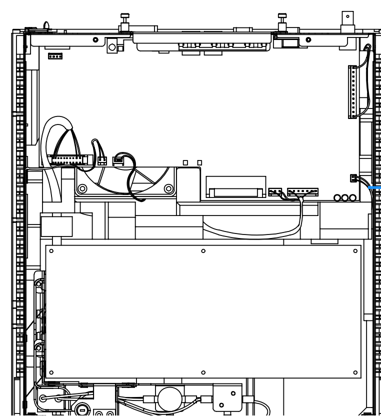
Exchanging the Leak Sensor or Leak Plane

When required	If defective
Tools required	Screwdriver POZI 1 PT3 Flat screwdriver
Parts required	Leak sensor assembly 5061-3356 Leak plane G1362-44111

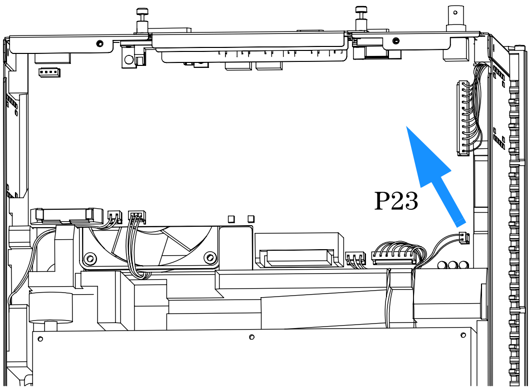
Preparations for this procedure:

- Turn OFF the detector.
- Disconnect the power cable.
- Remove detector from stack and place it on the workbench.
- Remove the covers as described in "Removing the Covers" on page 147.

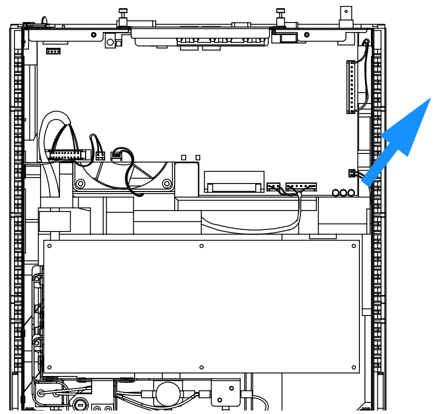
1 Locate the leak sensor cable.



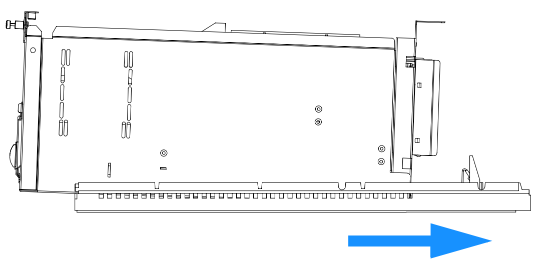
2 Disconnect the leak sensor cable from the detector main board.



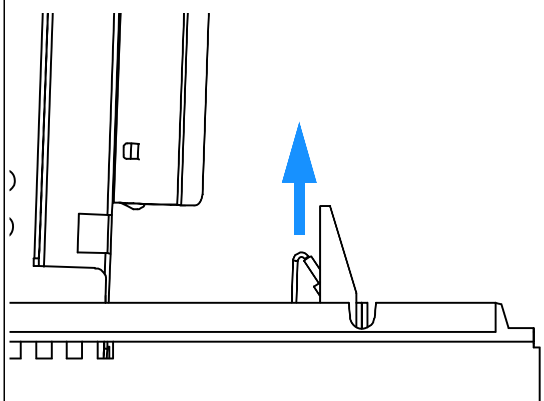
3 Remove the leak sensor cable from the side of the optical unit.



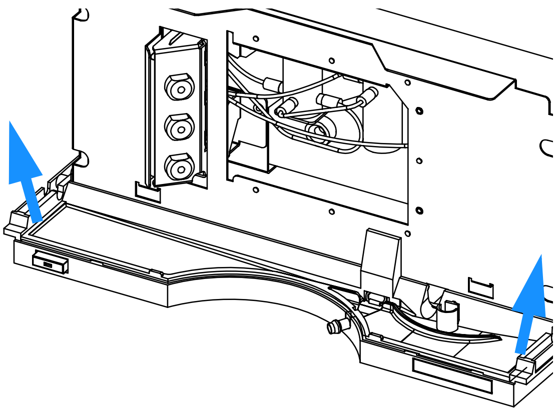
4 Slide the base forward and away from the detector.



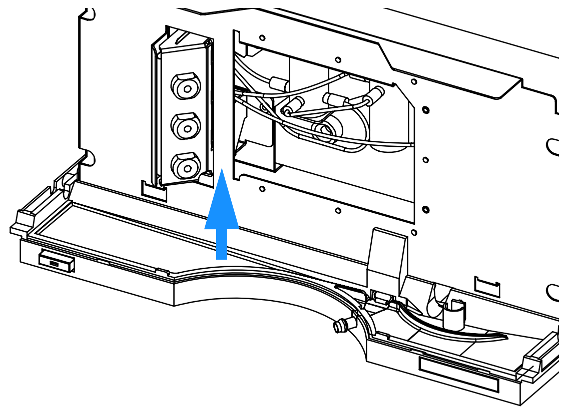
5 Locate the leak sensor and pull it out of the leak plane.



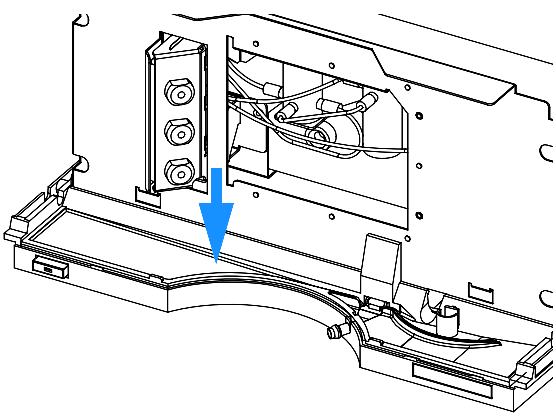
6 (If required) Use a flat screw driver to release the two clasps holding the leak plane in the base.



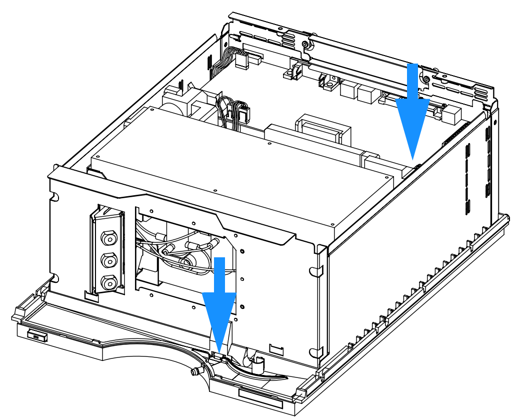
7 (If required) Pull the leak plane up and away from the base.



8 (If required) Press the replacement leak plane down firmly into the base.



9 Replace the leak sensor and reconnect the connector.



Next Steps:

10 Replace the covers as described in "Replacing the Foams and Covers" on page 176.

11 Re-install the detector in the stack.

Removing the Optical Unit

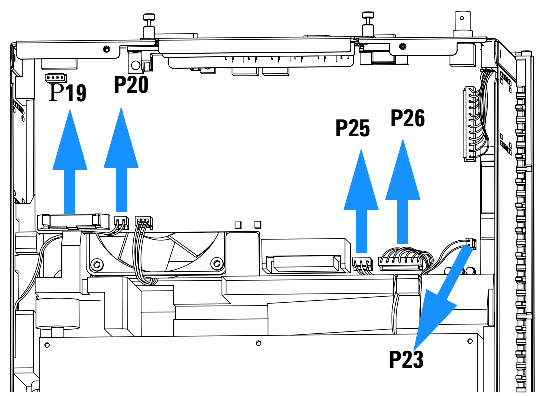
When required	For following repairs: flow cell, lamp, light receiving diodes, heater.
Tools required	Screwdriver POZI 1 PT3
Parts required	Optical unit G1362-69001 (exchange assembly)

CAUTION When working on the optical unit, a clean workbench with ESD protection mat must be available. Otherwise optical components or electronic boards may be damaged

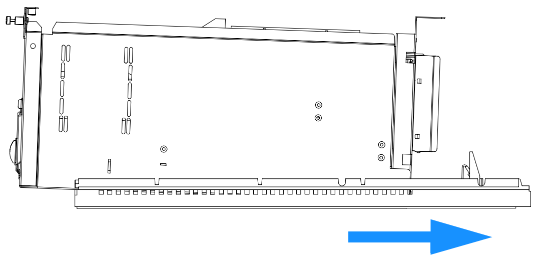
Preparations for this procedure:

- Turn OFF the detector.
- Disconnect the power cable.
- Disconnect capillaries.
- Remove detector from stack and place it on the workbench.
- Remove the covers as described in "Removing the Covers" on page 147.

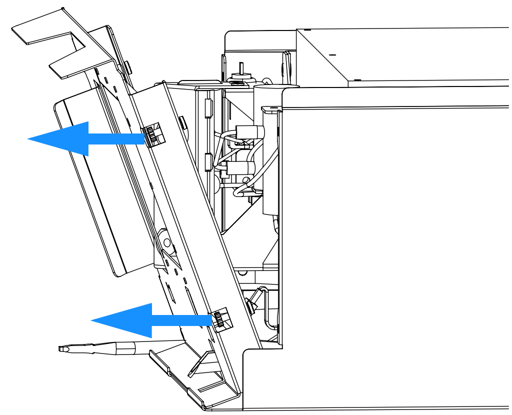
1 Disconnect the optical unit, heater, valves and leak sensor cables from the detector main board.



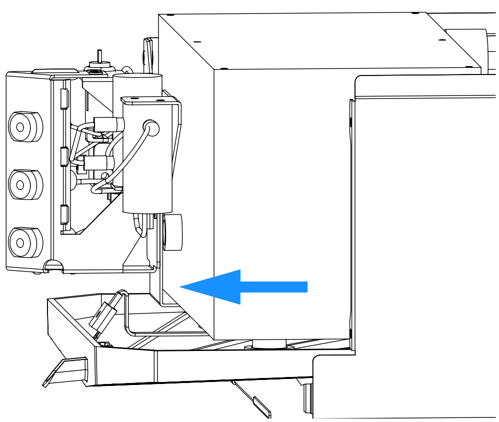
2 Slide the base forward and away from the detector.



3 Unscrew the four screws and remove the Z plane.



4 Slide the optical unit and leak plane forward and away from the detector.



5 Depending on the replacement you want to perform, proceed to the following procedures.

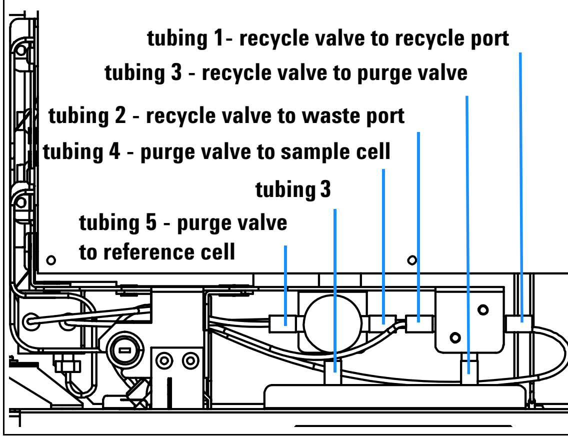
Replacing the Valve Tubing

When required	If defective
Tools required	Screwdriver POZI 1 PT3
Parts required	Tubing kit G1362-68709

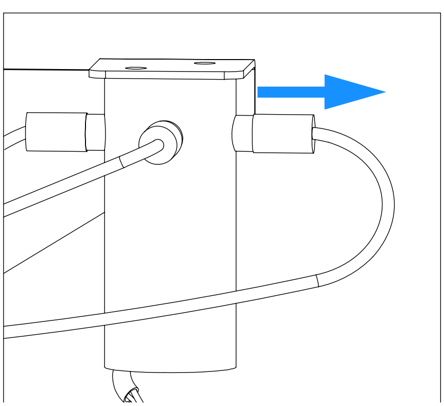
Preparations for this procedure:

- Optical unit has been removed as described in “Removing the Optical Unit” on page 162.

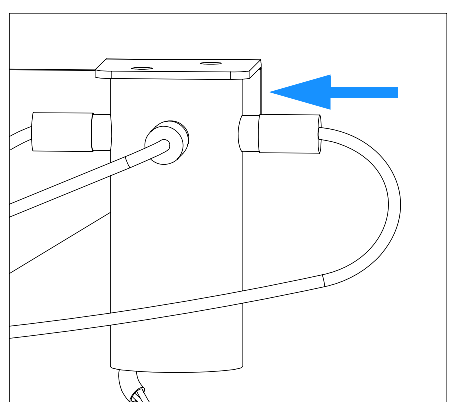
1 Identify the tubing to be changed.



2 Disconnect one of the valve tubes.



3 Carefully reconnect the valve tube.



4 Repeat steps 2 and 3 for the remaining tubes to be replaced.	**5** Ensure that the fittings are tight and check for leaks.

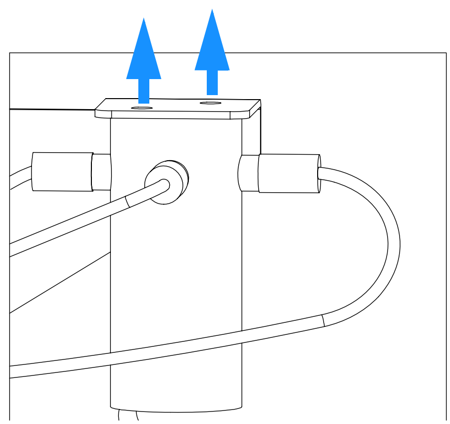
Replacing the Recycle Valve

When required	If defective
Tools required	Screwdriver POZI 1 PT3
Parts required	Recycle valve G1362-27701

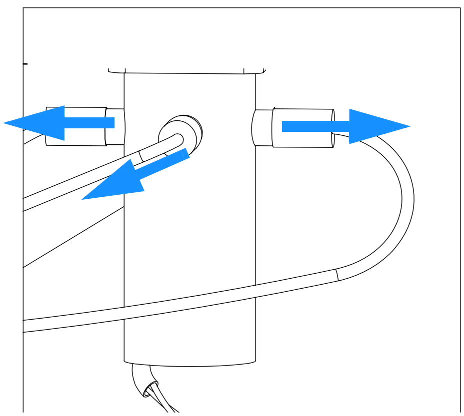
Preparations for this procedure:

- Optical unit has been removed as described in “Removing the Optical Unit” on page 162.

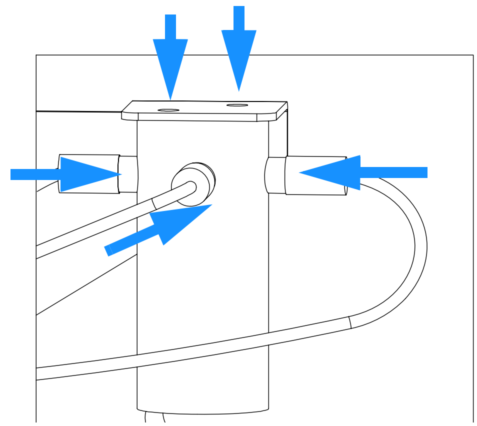
1 Unscrew the two screws and remove the recycle valve from the optical unit.



2 Disconnect the tubing connected to the recycle valve. Note the position of the valve tubes.



3 Attach the new recycle valve and reconnect the tubes. Check for leaks.



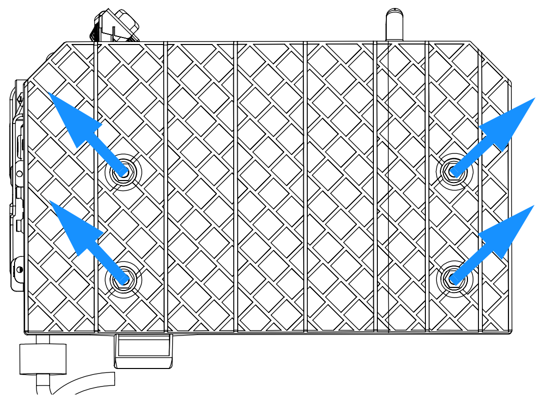
Replacing the Leak Pan

When required	If defective
Tools required	Wrench
Parts required	Leak Pan G1362-44110

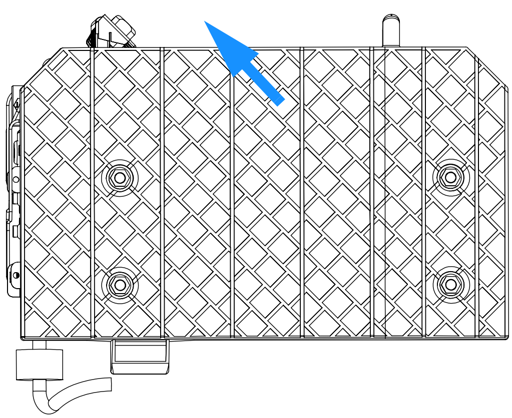
Preparations for this procedure:

- Optical unit has been removed as described in "Removing the Optical Unit" on page 162.

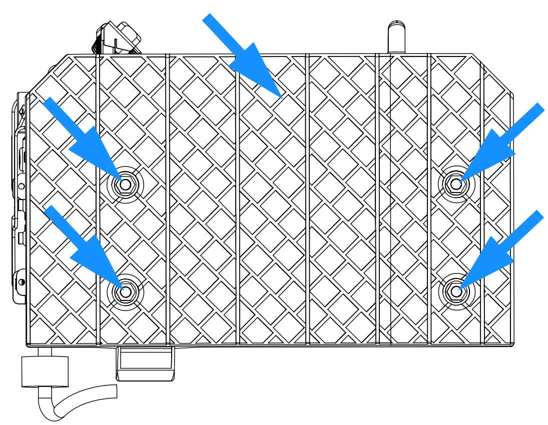
1 Unscrew the four nuts attaching the leak pan to the base of the optical unit.



2 Pull the leak pan away from the optical unit.



3 Attach the new leak pan to the base of the optical unit.



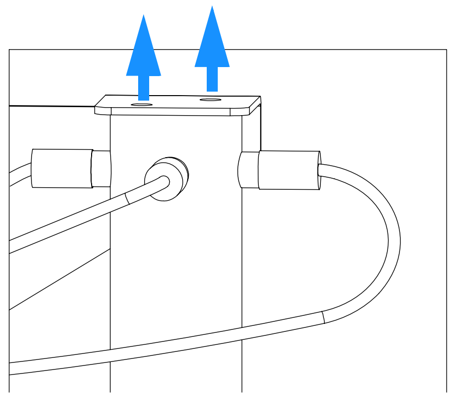
Replacing the Purge Valve

When required	If defective
Tools required	Screwdriver POZI 1 PT3
Parts required	Purge valve G1362-27700

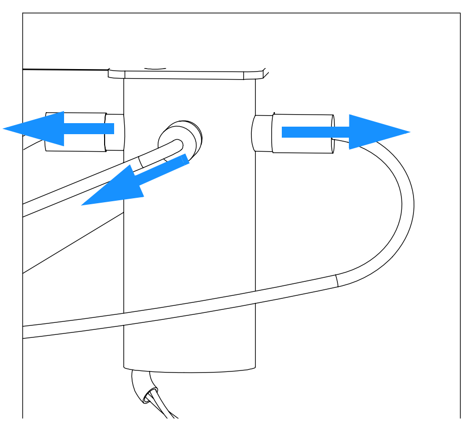
Preparations for this procedure:

- Optical unit has been removed as described in “Removing the Optical Unit” on page 162.
- Leak plane has been removed as described in “Replacing the Leak Pan” on page 168

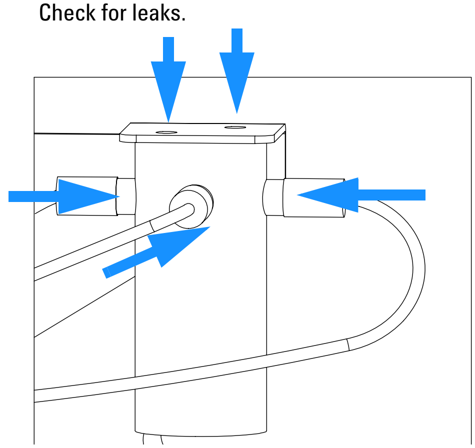
1 Turn the optical unit upside down unscrew the two screws and remove the recycle valve from the optical unit.



2 Disconnect the tubing connected to the recycle valve. Note the position of the valve tubes.



3 Attach the new purge valve and reconnect the capillaries. Check for leaks.



Exchanging the Power Supply

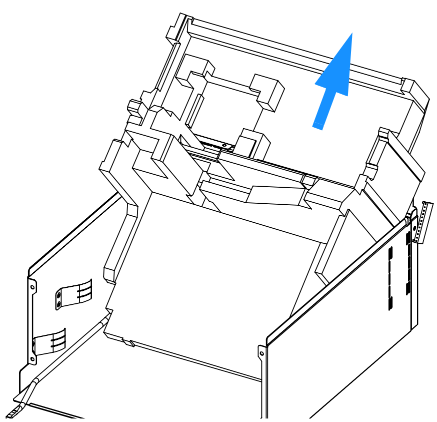
When required	If defective
Tools required	Screwdriver POZI 1 PT3 Wrench 1/4 inch Wrench 5 mm, Wrench 7 mm
Parts required	Power supply 0950-2528

NOTE The repair of the power supply assembly comprises exchanging the complete assembly. No serviceable parts are inside.

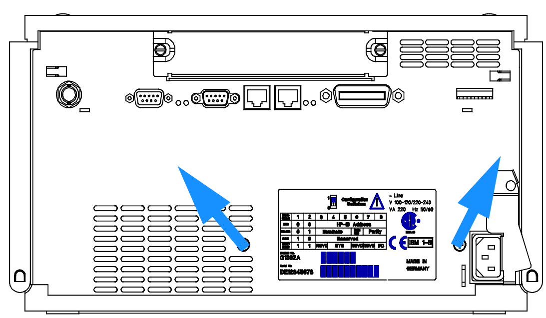
Preparations for this procedure:

- Remove the detector from the stack and place it on the workbench.
- Remove the front cover and top cover, see “Removing the Covers” on page 147.
- Remove the detector main board, see “Exchanging the Detector Main Board” on page 150.
- Remove the fan assembly, see “Exchanging the Fan” on page 157.
- Remove the optical unit, see “Removing the Optical Unit” on page 162.

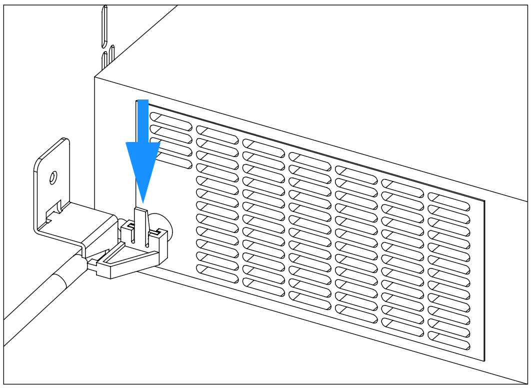
1 Carefully remove the bottom foam piece by sliding it out towards the rear.



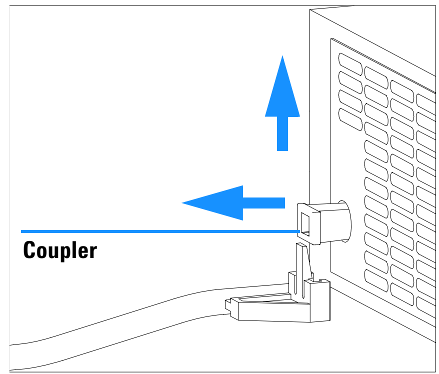
2 Unscrew the power supply at the rear of the module.



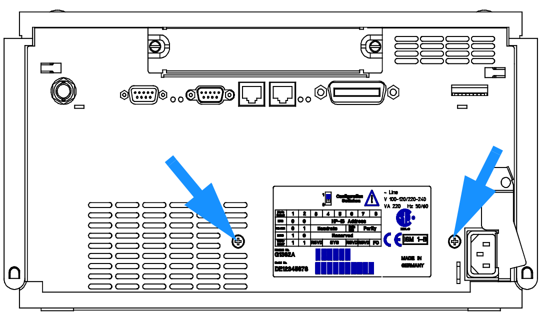
3 Press down the power switch light pipe to remove it from the coupler.



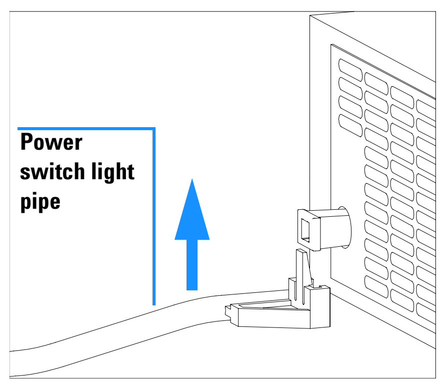
4 Remove the power supply completely.
Re-use the coupler on the new power supply.



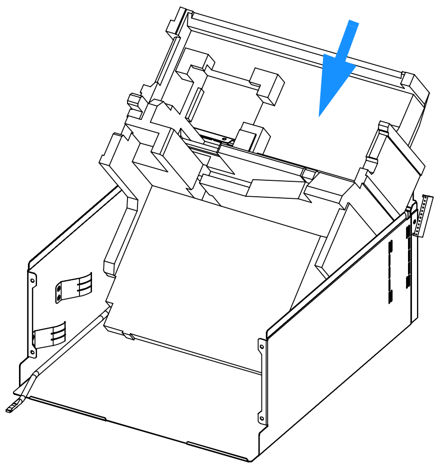
5 Insert the power supply into its location and fix it with the screws at the rear panel.



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



7 Reinstall bottom foam piece.



8 Reinstall the fan assembly, see “Exchanging the Fan” on page 157.

9 Reinstall the detector main board, see “Exchanging the Detector Main Board” on page 150.

10 Reinstall the optical unit, see “Installing the Optical Unit” on page 174.

11 Reinstall the front cover, top cover, see “Replacing the Foams and Covers” on page 176.

12 Replace detector into the stack.

13 Reconnect the power cable and turn ON the detector.

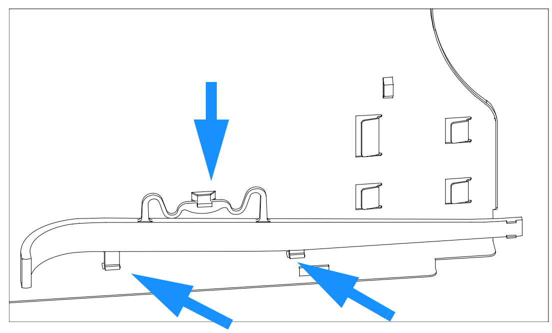
Replacing Status Light Pipe

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

Preparations for this procedure:

- Remove the front cover and top cover, see "Removing the Covers" on page 147.

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



2 Replace the top cover, see "Replacing the Foams and Covers" on page 176.

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

4 Turn ON the detector.

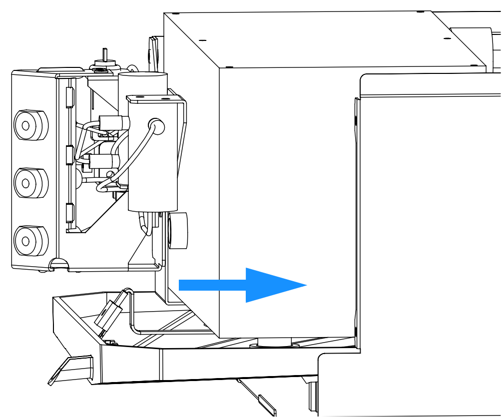
Installing the Optical Unit

When required	When all repairs on the optical unit have been completed or if optical unit replaced
Tools required	Screwdriver POZI 1 PT3 Hexagonal key, 4 mm
Parts Required	Optical Unit G1362-69001

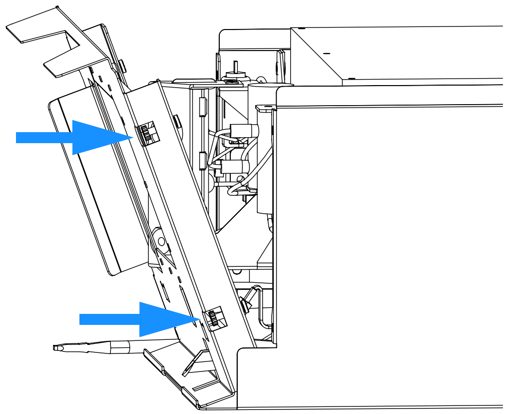
Preparations for this procedure:

- All previous work has been completed.
- Power supply has been installed as described in “Exchanging the Power Supply” on page 170.
- Leak plane has been attached as described in “Replacing the Leak Pan” on page 168.

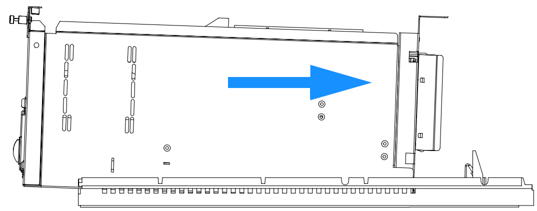
1 Slide the optical unit into the detector.



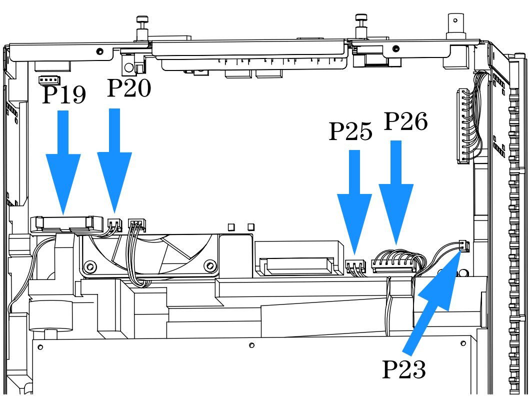
2 Replace the Z plane and tighten the four screws.



3 Slide the detector into the base. Ensure that the power switch light pipe is routed correctly to the power switch.



4 Reconnect the optical unit, heater, valve and leak sensor cables to the detector main board.



Next Steps:

5 Replace the covers as described in “Replacing the Foams and Covers” on page 176.

6 Re-install the detector in the stack.

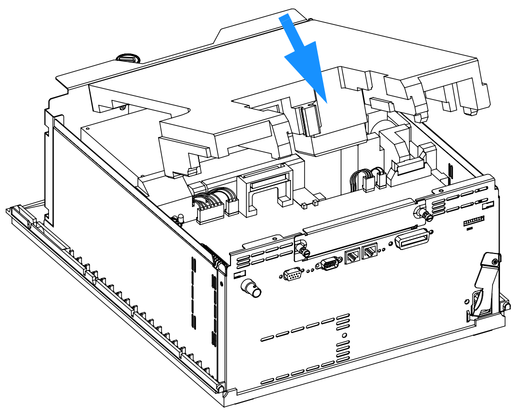
7 If a new optical unit is installed performance of the Refractive Index Calibration as described in “Refractive Index Calibration” on page 120 is recommended to check the response of the detector.

Replacing the Foams and Covers

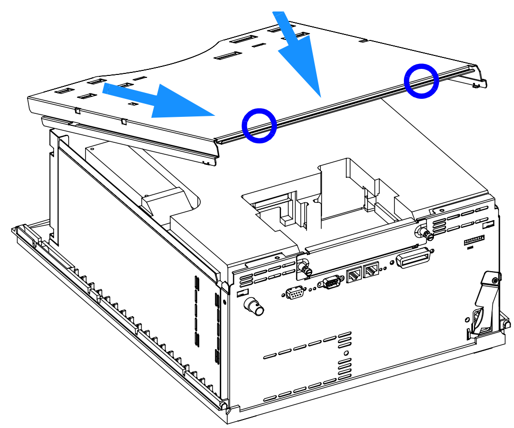
When required	When all repairs have been completed
Tools required	Screwdriver POZI 1 PT3
Prerequisites	The detector is open and other procedures have been carried out

NOTE The front cover (across the optical unit) should only be removed when required during a procedure. This will keep dust away from optical components.

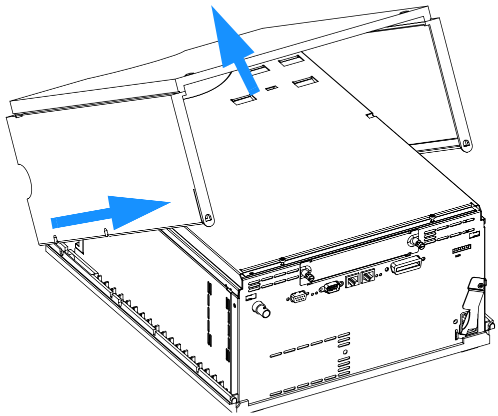
1 Carefully insert the top foam.



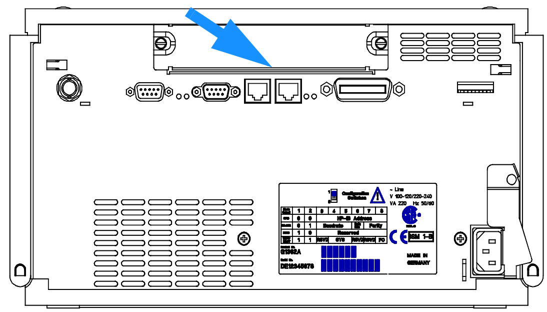
2 Place the top plate on the foam and slide it towards the rear and fix the screws at the rear of the top plate.



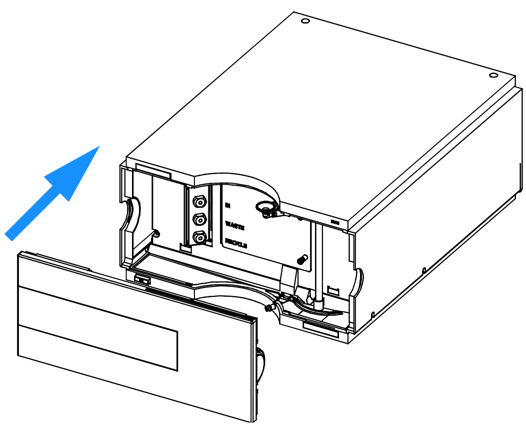
3 Replace the cover.



4 If installed, replace the interface board and fix it with its screws.



5 Replace the front panel.



Next Steps

6 Replace the detector into the stack.

7 Reconnect the power cable and turn ON the detector.

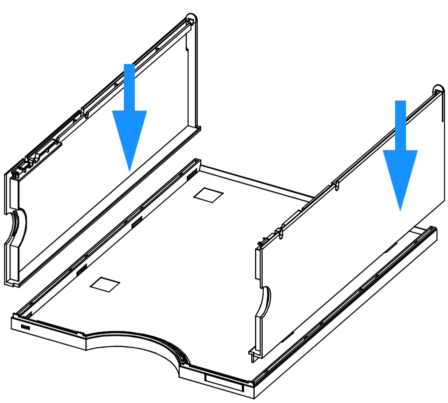
Assembling the Cabinet Kit

When required	If cover is broken
Tools required	None
Parts required	Cabinet kit G1312-68713 (includes base, top, left and right)

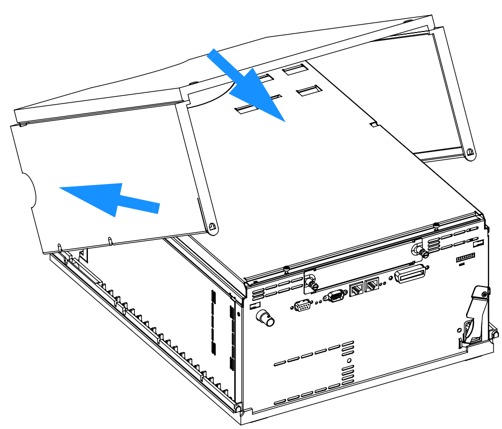
NOTE The cabinet kit contains all parts, but it is not assembled.

WARNING **If you mistakenly insert the left or right side in the opposite position, you may not be able to remove that side from the top part.**

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



2 Replace the cover.



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

4 Turn ON the detector.

Replacing the Interface Board

When required	For all repairs inside the detector or for installation of the board
Part required	Interface board (BCD) G1351-68701 with external contacts and BCD outputs Interface board (LAN) see "LAN Communication Interface Board" on page 222
Tools required	None

To replace the interface board unscrew the two screws, remove the board, slide in the new interface board and fix it with the board's screws.

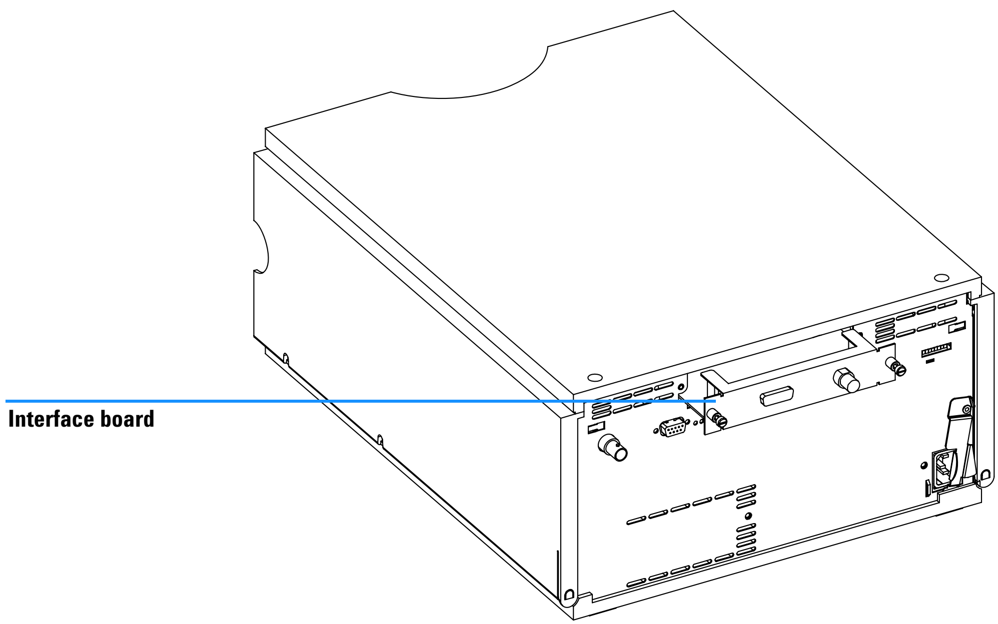


Figure 42 Location of the Interface Board

12
Identifying Parts and Materials

This chapter provides information on parts for repair.

NOTE This chapter contains part numbers for the 1200 series RID.

Overview of Main Assemblies

Figure 43 shows the main assemblies and their locations.

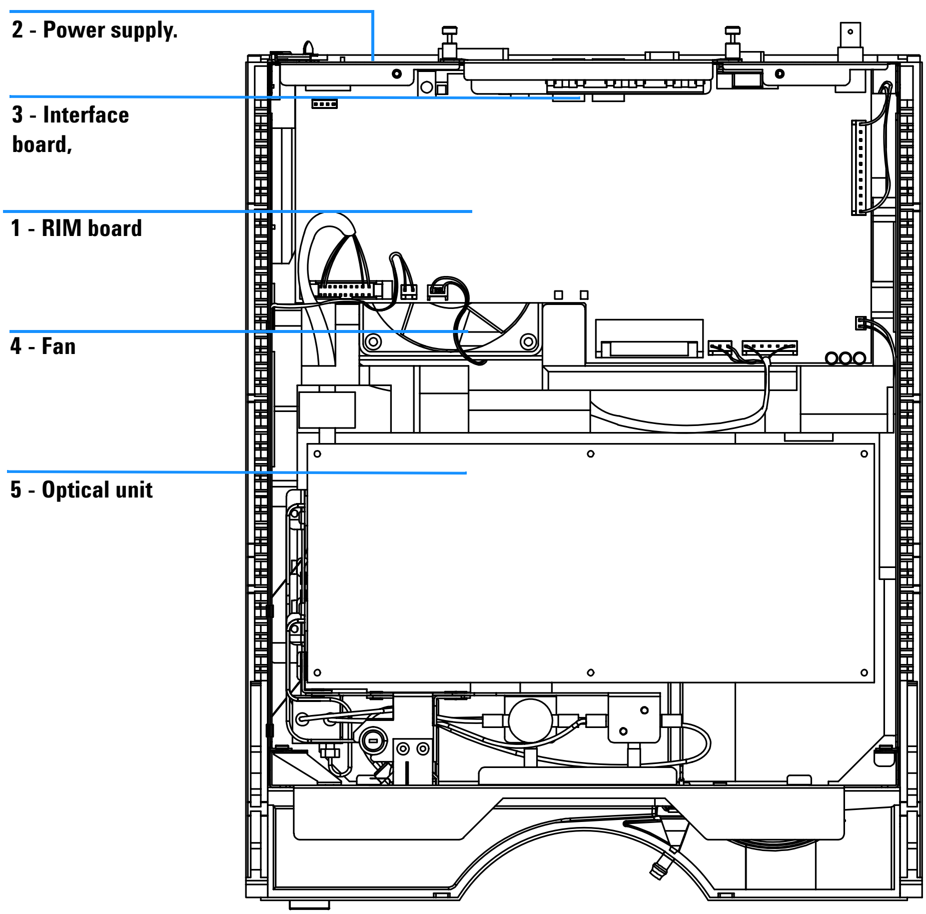


Figure 43 Main Assemblies

Table 10 Main Assemblies

Item	Description	Part Number
1	Detector main board RIM (**exchange assembly, new part has PN G1362-66500**)	G1362-69500
	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 1200 Series modules (0.5 m)	5181-1516
2	Power supply for power and status light parts, see page 190	0950-2528
3	Interface board BCD (BCD/external contacts), optional	G1351-68701
3	Interface board MIO (LAN), optional	see "LAN Communication Interface Board" on page 222
	Fuse for BCD board, 250 mA (total of 4 are on the board)	2110-0004
4	Fan assembly	3160-1017
5	Optical unit (**exchange assembly, new part has PN G1362-60001**)	G1362-69001
6	Leak sensor assembly	5061-3356
	Leak handling parts, see page 191	
	Front cover and cabinet kit, see page 187	
	Sheet metal parts, see page 186	
	Foam parts, see page 188	

Optical Unit Assembly

Table 11 Optical Unit Assembly

Item	Description	Part Number
	Optical unit (**exchange assembly, new part has PN G1362-60001**), includes items 1-3	G1362-69001
1	Purge valve	G1362-27700
2	Recycle valve	G1362-27701
3	Tubing kit, includes:	G1362-68709
4	Tubing 1 300mm recycle valve to recycle port	
5	Tubing 2 200mm recycle valve to waste port	
6	Tubing 3 120mm purge valve to recycle valve	
7	Tubing 4 270mm purge valve to sample cell	
8	Tubing 5 170mm purge valve to reference cell	

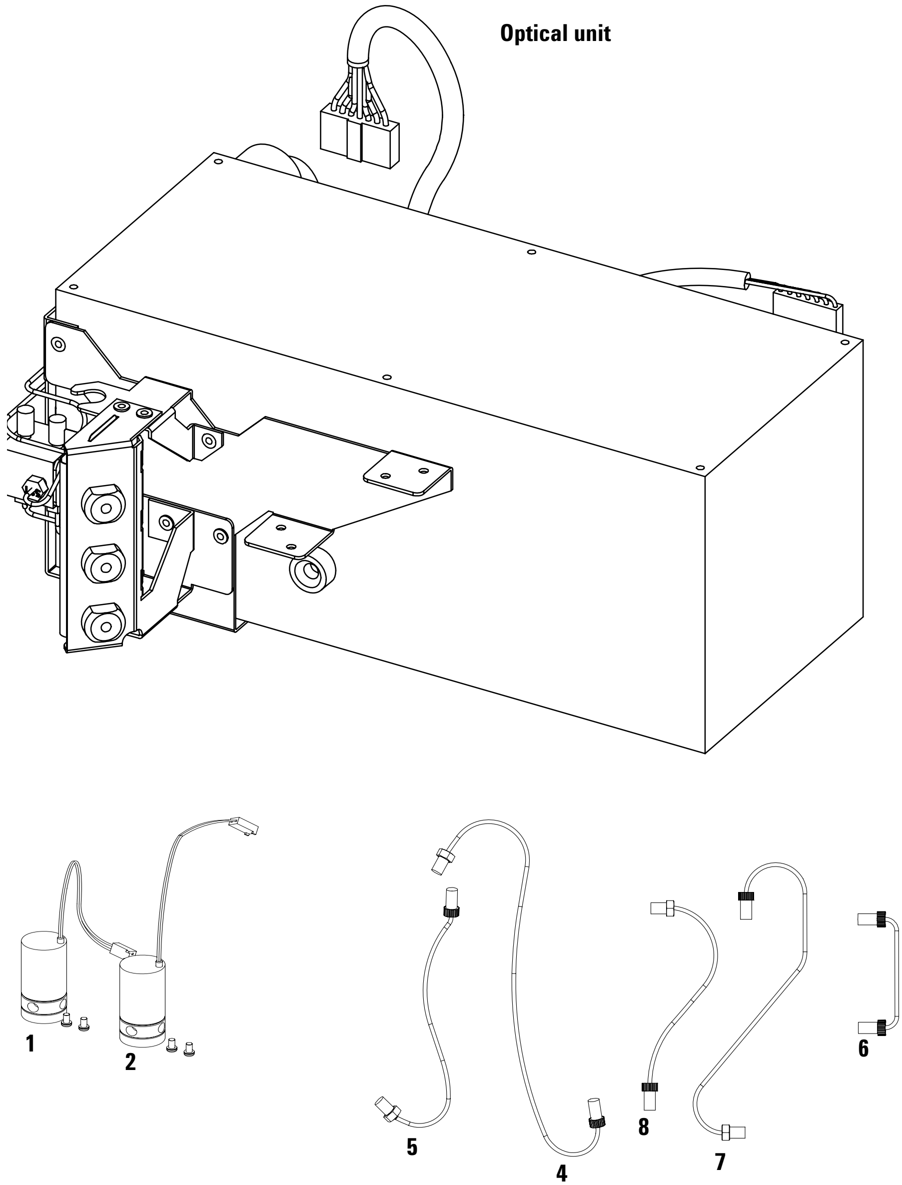


Figure 44 Optical Unit Parts

Sheet Metal Kit

Table 12 Sheet Metal Kit Parts

Item	Description	Part Number
1	Sheet metal kit includes case and top cover	G1362-68701
2	Screws M3 for cover	5022-2112

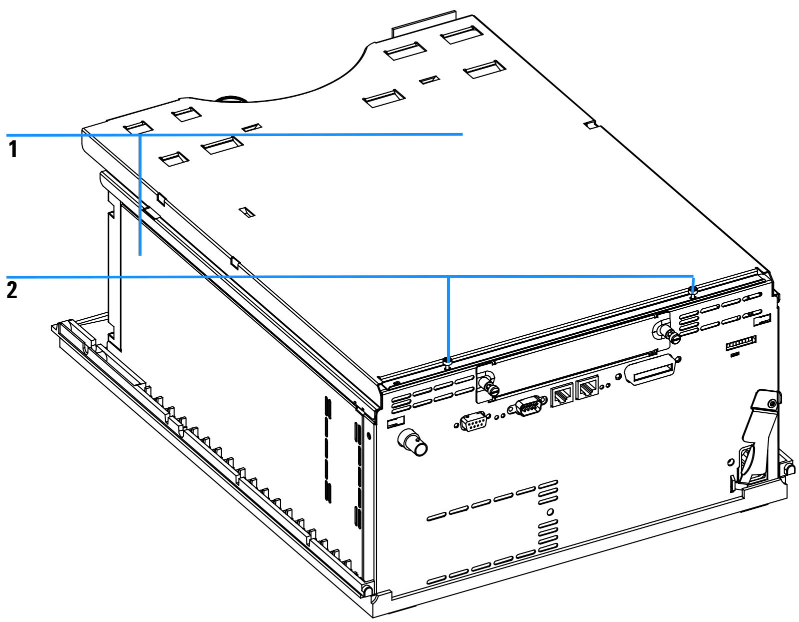


Figure 45 Sheet Metal Kit Parts

Plastic Parts

Table 13 Plastics Parts

Item	Description	Part Number
1	Front cover (1200 Series)	G1362-68710
2	Plastics (1200 Series), includes base, sides and top	G1312-68713
3	Name plate Agilent 1200 Series	5042-8901

NOTE For correct assembling of the top and sides, see "Assembling the Cabinet Kit" on page 178.

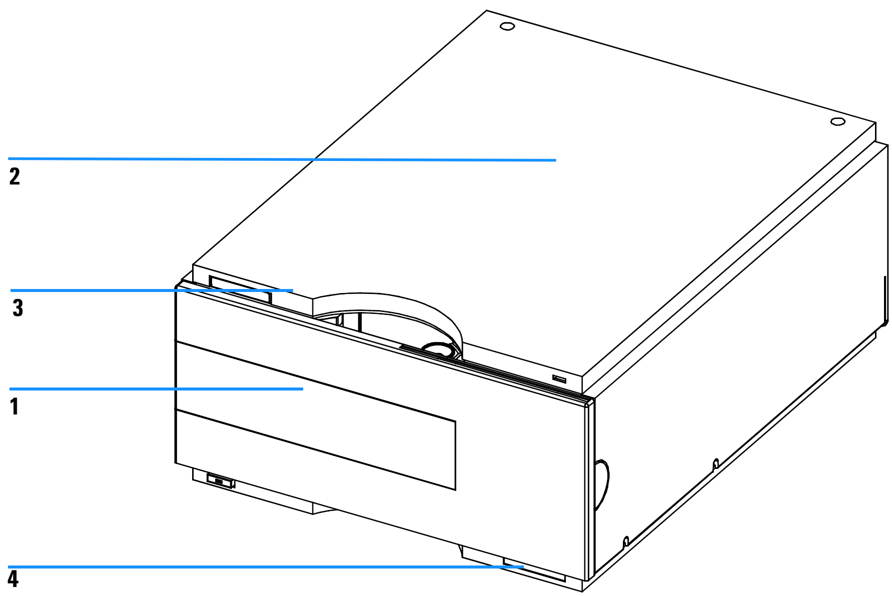


Figure 46 Plastic Parts

Foam Parts

Table 14 Foam Parts

Item	Description	Part Number
1, 2	EPP foam kit, includes top and bottom foam	G1362-68702
3	Guides for interface board	5041-8395

NOTE Do not order the individual part numbers imprinted on the foam.

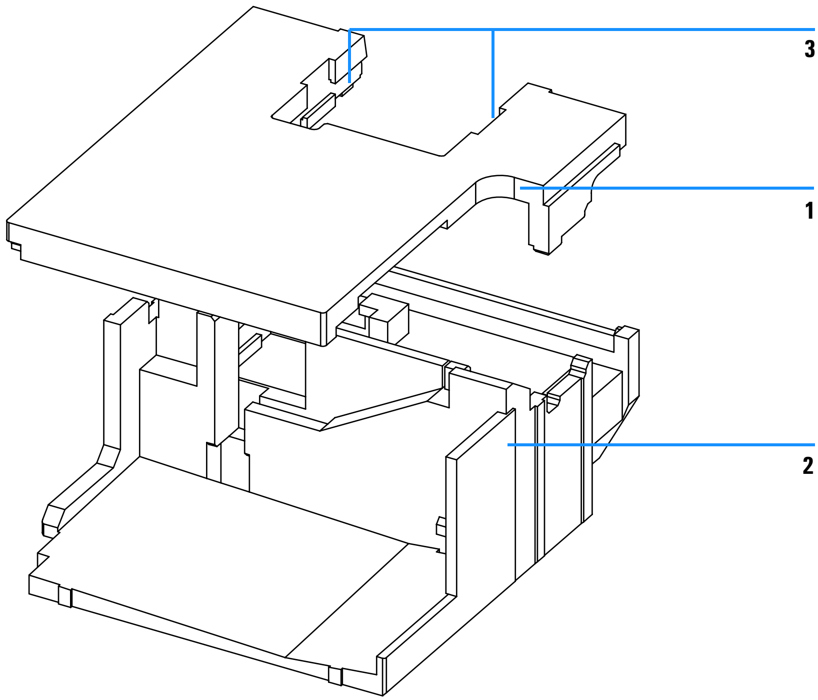


Figure 47 Foam Parts

Power and Status Light Pipes

Table 15 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

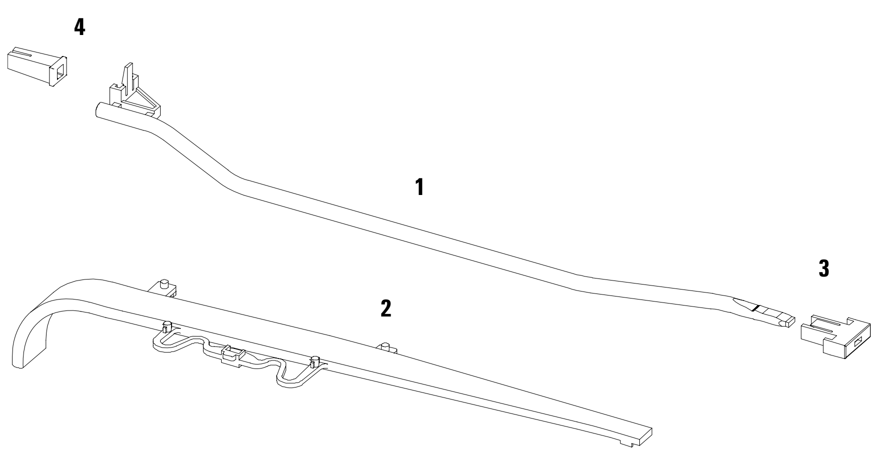


Figure 48 Power and Status Light Pipe

Leak Parts

Table 16 Leak Parts

Item	Description	Part Number
1	Leak sensor assembly	5061-3356
2	Leak plane (1200 series)	G1362-44111
3	Leak pan (1200 series)	G1362-44110
4	Leak funnel	5041-8388
5	Leak funnel holder	5041-8389
6	Clip	5041-8387
7	Leak Tubing 120 mm lg	0890-1711

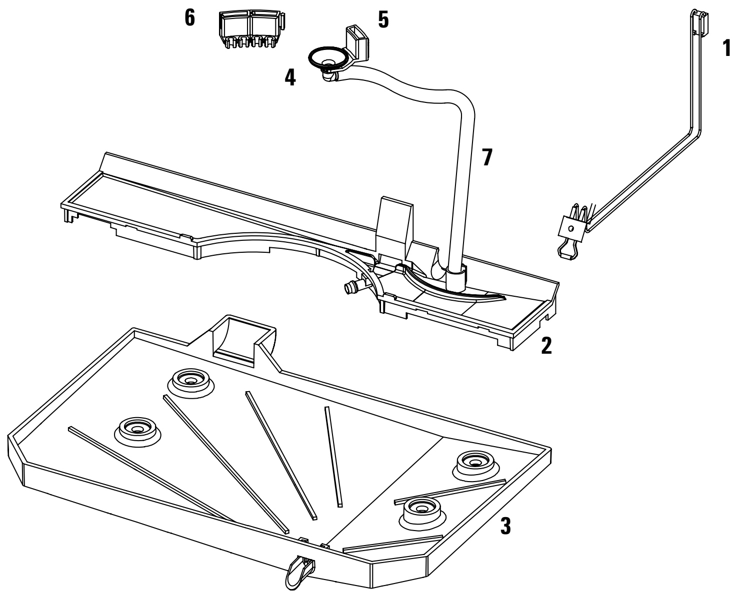


Figure 49 Leak Parts

Accessory Kit

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

8

Table 17 Accessory Kit Parts G1362-68705

Item	Description	Part Number
	Interface tubing kit includes:	G1362-68706
1	• Ferrule 1/8” (2x)	0100-1700
2	• Nut 1/8” PPS (2x)	0100-1708
3	• 2 m Tubing flexible (2x)	0890-1760
4	Interfacing capillary, 400mm lg, 0.17mm i.d. includes:	G1362-87300
5	• Hand tight fitting (2x)	5062-8541 (re-ord. 10 ocs.)
6	Restriction capillary, 3700mm lg, 0.17mm i.d. includes:	G1362-87301
7	• Hand tight fitting (2x)	5062-8541 (re-ord. 10 ocs.)
8	CAN cable	5181-1516
9	PEEK adapter to pump’s active inlet valve	0100-1847

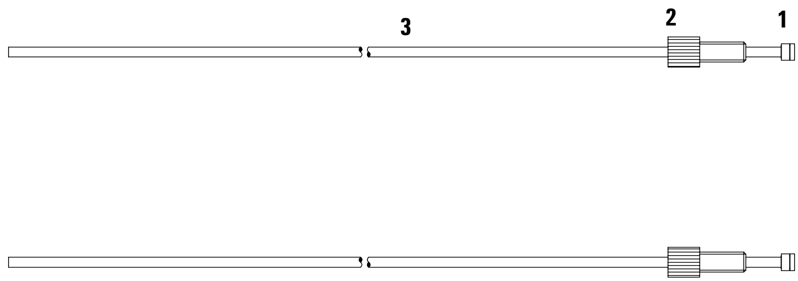


Figure 50 Interface Tubing Kit Parts

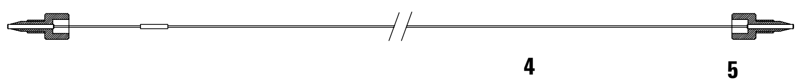


Figure 51 Interfacing Capillary Parts

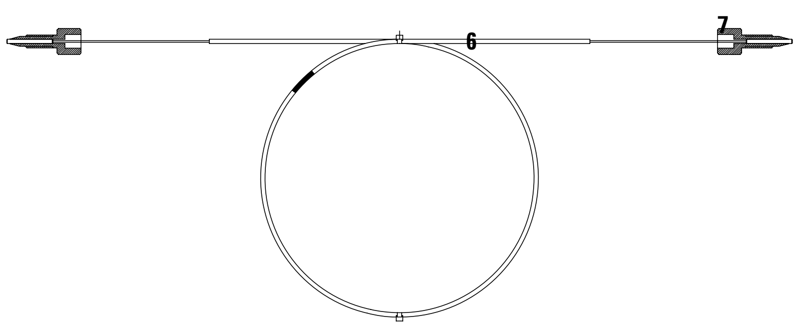


Figure 52 Restriction Capillary Parts

13
Identifying Cables

This chapter provides information on cables used with the 1200 series of HPLC modules.

Cable Overview

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

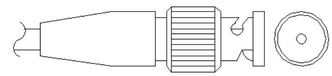
Table 18 Cables Overview

Type	Description	Part Number
Analog cables	3390/2/3 integrators	01040-60101
	3394/6 integrators	35900-60750
	35900A A/D converter	35900-60750
	General purpose (spade lugs)	01046-60105
Remote cables	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 page 203	
	3396 Series III / 3395B integrator	03396-61010
	Agilent 1200 / 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 18 Cables Overview (continued)

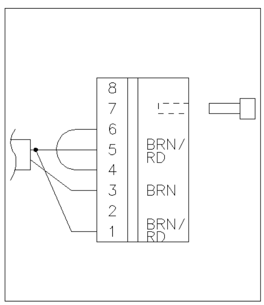
Type	Description	Part Number
BCD cables	3396 integrator	03396-60560
	General purpose (spade Lugs)	G1351-81600
Auxiliary	Agilent 1200 Series vacuum degasser	G1322-61600
CAN cables	Agilent 1200 module to module, 0.5 m	5181-1516
	Agilent 1200 module to module, 1 m	5181-1519
	Agilent 1200 module to control module	G1323-81600
External contacts	Agilent 1200 Series interface board to general purpose	G1103-61611
GPIB cable	Agilent 1200 module to Agilent ChemStation, 1 m	10833A
	Agilent 1200 module to Agilent ChemStation, 2 m	10833B
RS-232 cable	Agilent 1200 module to a computer This kit contains a 9-pin female to 9-pin female Null Modem (printer) cable and one adapter.	34398A
LAN cable	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

Analog Cables

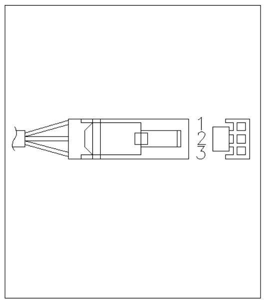


One end of these cables provides a BNC connector to be connected to Agilent 1200 Series modules. The other end depends on the instrument to which connection is being made.

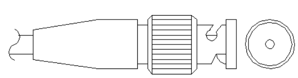
Agilent 1200 to 3390/2/3 Integrators

Connector 01040-60101	Pin 3390/2/3	Pin Agilent 1200	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

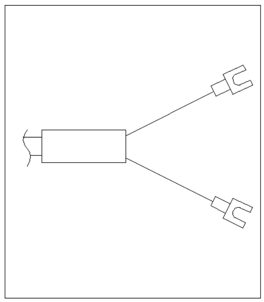
Agilent 1200 to 3394/6 Integrators

Connector 35900-60750	Pin 3394/6	Pin Agilent 1200	Signal Name
	1		Not connected
	2	Shield	Analog -
	3	Center	Analog +

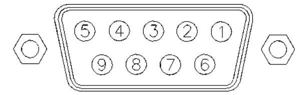
Agilent 1200 to BNC Connector

Connector 8120-1840	Pin BNC	Pin Agilent 1200	Signal Name
	Shield	Shield	Analog -
	Center	Center	Analog +

Agilent 1200 to General Purpose

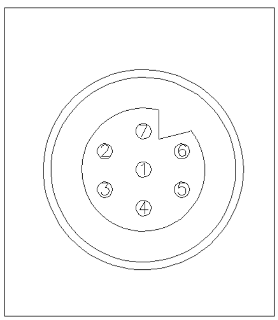
Connector 01046-60105	Pin 3394/6	Pin Agilent 1200	Signal Name
	1		Not connected
	2	Black	Analog -
	3	Red	Analog +

Remote Cables

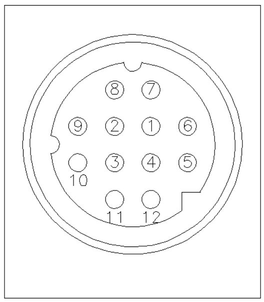


One end of these cables provides a Agilent Technologies APG (Analytical Products Group) remote connector to be connected to Agilent 1200 Series modules. The other end depends on the instrument to be connected to.

Agilent 1200 to 3390 Integrators

Connector 01046-60203	Pin 3390	Pin Agilent 1200	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

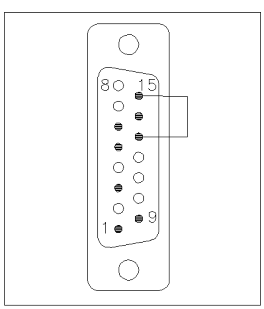
Agilent 1200 to 3392/3 Integrators



4 - Key

Connector 01046-60206	Pin 3392/3	Pin Agilent 1200	Signal Name	Active (TTL)
	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

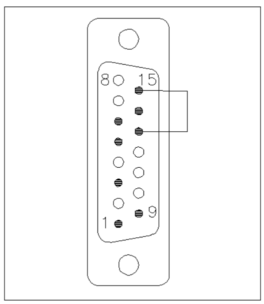
Agilent 1200 to 3394 Integrators



Connector 01046-60210	Pin 3394	Pin Agilent 1200	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.

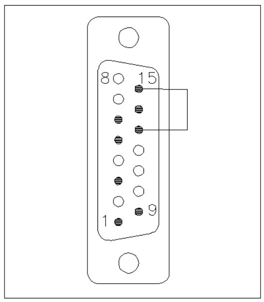
Agilent 1200 to 3396A Integrators

Connector 03394-60600	Pin 3394	Pin Agilent 1200	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 1200 to 3396 Series II / 3395A Integrators

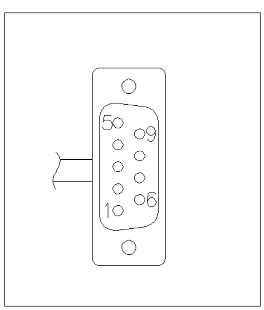
Use the cable 03394-60600 and cut pin #5 on the integrator side. Otherwise the integrator prints START; not ready.

Agilent 1200 to 3396 Series III / 3395B Integrators



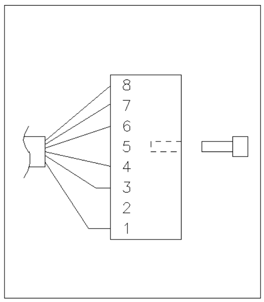
Connector 03396-61010	Pin 33XX	Pin Agilent 1200	Signal Name	Active (TTL)
	9	1 - White	Digital ground	
	NC	2 - Brown	Prepare run	Low
	3	3 - Gray	Start	Low
	NC	4 - Blue	Shut down	Low
	NC	5 - Pink	Not connected	
	NC	6 - Yellow	Power on	High
	14	7 - Red	Ready	High
	4	8 - Green	Stop	Low
	NC	9 - Black	Start request	Low
	13, 15		Not connected	

Agilent 1200 to HP 1050, HP 1046A or Agilent 35900 A/D Converters

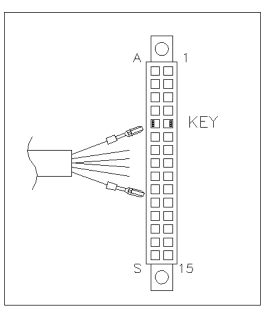


Connector 5061-3378	Pin HP 1050 / ...	Pin Agilent 1200	Signal Name	Active (TTL)
	1 - White	1 - White	Digital ground	
	2 - Brown	2 - Brown	Prepare run	Low
	3 - Gray	3 - Gray	Start	Low
	4 - Blue	4 - Blue	Shut down	Low
	5 - Pink	5 - Pink	Not connected	
	6 - Yellow	6 - Yellow	Power on	High
	7 - Red	7 - Red	Ready	High
	8 - Green	8 - Green	Stop	Low
	9 - Black	9 - Black	Start request	Low

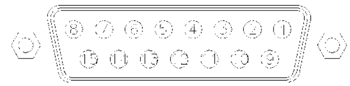
Agilent 1200 to HP 1090 LC or Signal Distribution Module

Connector 01046-60202	Pin HP 1090	Pin Agilent 1200	Signal Name	Active (TTL)
 	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
5 - Key	6	8 - Green	Stop	Low
	NC	9 - Black	Start request	Low

Agilent 1200 to General Purpose

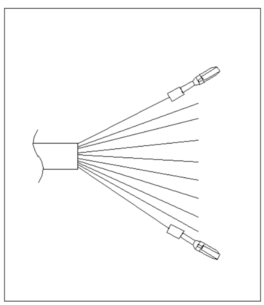
Connector 01046-60201	Pin Universal	Pin Agilent 1200	Signal Name	Active (TTL)
 		1 - White	Digital ground	
		2 - Brown	Prepare run	Low
		3 - Gray	Start	Low
		4 - Blue	Shut down	Low
		5 - Pink	Not connected	
		6 - Yellow	Power on	High
		7 - Red	Ready	High
		8 - Green	Stop	Low
		9 - Black	Start request	Low

BCD Cables

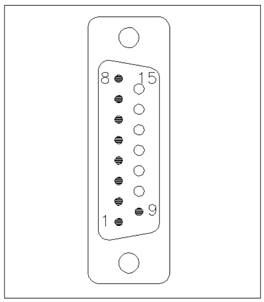


One end of these cables provides a 15-pin BCD connector to be connected to the Agilent 1200 Series modules. The other end depends on the instrument to be connected to

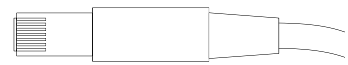
Agilent 1200 to General Purpose

Connector G1351-81600	Wire Color	Pin Agilent 1200	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 1200 to 3396 Integrators

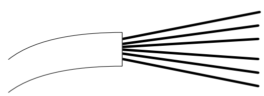
Connector 03396-60560	Pin 3392/3	Pin Agilent 1200	Signal Name	BCD Digit
	1	1	BCD 5	20
	2	2	BCD 7	80
	3	3	BCD 6	40
	4	4	BCD 4	10
	5	5	BCD0	1
	6	6	BCD 3	8
	7	7	BCD 2	4
	8	8	BCD 1	2
	9	9	Digital ground	
	NC	15	+ 5 V	Low

Auxiliary Cable

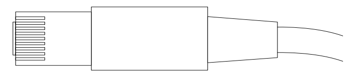


One end of this cable provides a modular plug to be connected to the Agilent 1200 Series vacuum degasser. The other end is for general purpose.

Agilent 1200 Series Degasser to general purposes

Connector G1322-61600	Color	Pin Agilent 1200	Signal Name
	White	1	Ground
	Brown	2	Pressure signal
	Green	3	
	Yellow	4	
	Grey	5	DC + 5 V IN
	Pink	6	Vent

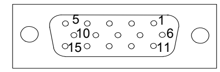
CAN Cable



Both ends of this cable provide a modular plug to be connected to Agilent 1200 Series module's CAN-bus connectors.

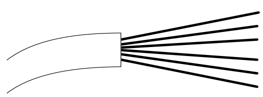
Agilent 1200 module to module, 0.5 m	5181-1516
Agilent 1200 module to module, 1 m	5181-1519
Agilent 1200 module to control module	G1323-81600

External Contact Cable



One end of this cable provides a 15-pin plug to be connected to Agilent 1200 Series module's interface board. The other end is for general purpose.

Agilent 1200 Series Interface Board to general purposes

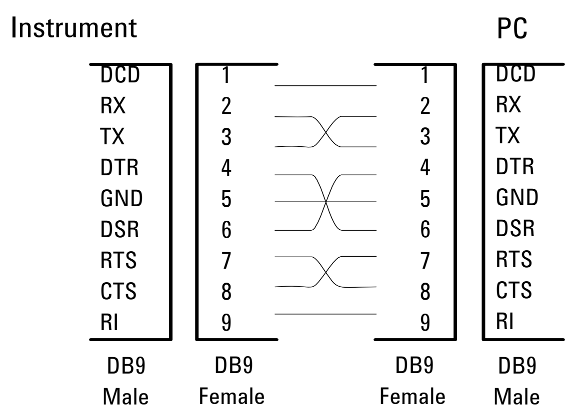
Connector G1103-61611	Color	Pin Agilent 1200	Signal Name
	White	1	EXT 1
	Brown	2	EXT 1
	Green	3	EXT 2
	Yellow	4	EXT 2
	Grey	5	EXT 3
	Pink	6	EXT 3
	Blue	7	EXT 4
	Red	8	EXT 4
	Black	9	Not connected
	Violet	10	Not connected
	Grey/pink	11	Not connected
	Red/blue	12	Not connected
	White/green	13	Not connected
	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 Aligent Technologies instruments with 9-pin male RS-232 connectors to most PCs or printers.

Agilent 1200 module to PC

RS-232 Cable Kit 34398As



LAN Cables

Recommended Cables

Table 19

Description	Part number
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

14
Introduction to the Detector Electronics

This chapter describes the detector electronics in detail.

Electronics

The electronics are comprised of two main components:

- see “Detector Main Board (RIM)” on page 215.
- see “The Main Power Supply Assembly” on page 233.

Optional:

- interface board (BCD/external contacts), see “BCD Board” on page 220.
- interface board (LAN), see “LAN Communication Interface Board” on page 222.

Detector Main Board (RIM)

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

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 "The Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC)" on page 239.

Analog Outputs

There is a single independent analog output (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.

The Analog Output Range can be set to either 1.0V (default) or 0.1V full scale. The baseline Zero value has a default offset of 5% (settable to 0-99%). Attenuation can be set in 12 steps from 488-1000000 nRIU (default is 500000 nRIU).

Valve Drive

There are two identical valve drives for the purge and recycle valves. Each drive comprises an amplifier for the solenoids of the valve.

Heater Drive

This block comprises an amplifier and a filter for the current of the heater foil. This current is measured and routed to the ADC input multiplexer for data acquisition. In addition there are two comparators that, for diagnostics, detect shorts or openings in the thermal fuse and heater foil. The temperature sensor signal is amplified and routed to the ADC input multiplexer for data acquisition.

Lamp Drive

The electronic design of the tungsten lamp provides a regulated, filtered voltage between 2.2 V and 5.5 V. Two amplifiers measure the current and voltage of the lamp. These signals are routed to the ADC input multiplexer for data acquisition.

Diode Signal Measurement

Both diode signals are amplified and routed to the ADC input multiplexer for data acquisition. In addition the electronics analyses the difference and sum of the two diode signals and route these to the ADC input multiplexer.

Electronic Fuse

The valve and heater circuits are protected by electronic fuses. Any error on the board or shortage of the valves will activate the electronic fuses and switch OFF the supply voltage.

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 “Agilent 1200 Series Interfaces” on page 223.

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 in all Agilent 1200 Series modules. Its properties are:

- the complete communication capabilities (GPIB, CAN, LAN and RS-232C),
- memory management, and
- 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, and
- 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 and so on,

or module specific functions like:

- internal events such as lamp control, heater control,
- raw data collection and conversion to absorbance (see “Data flow for chromatographic output” on page 219.

Firmware Updates

Firmware updates can be done using your user interface:

- instant pilot G4208A with files from a USB-memory stick, or
- handheld control module G1323 with files from a PC-card, or
- a PC Firmware Update Tool with files from hard disk or CD-ROM.

The file naming conventions are:

1362A_A601_12.dlb, where

xxxxxis the product number, e.g. 1362A for the G1362A RID), and
vvvvis the revision number, for example A601 is revision A.06.01, and
nnis the build number of the firmware.

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.

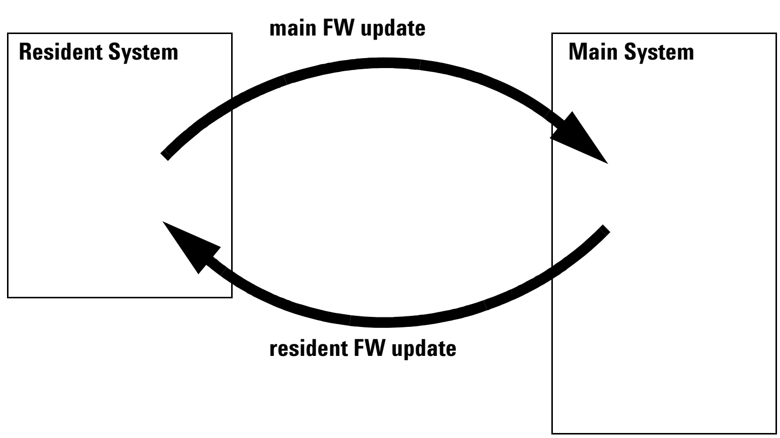


Figure 53 Firmware Update Mechanism

Data flow for chromatographic output

The data flow is shown below.

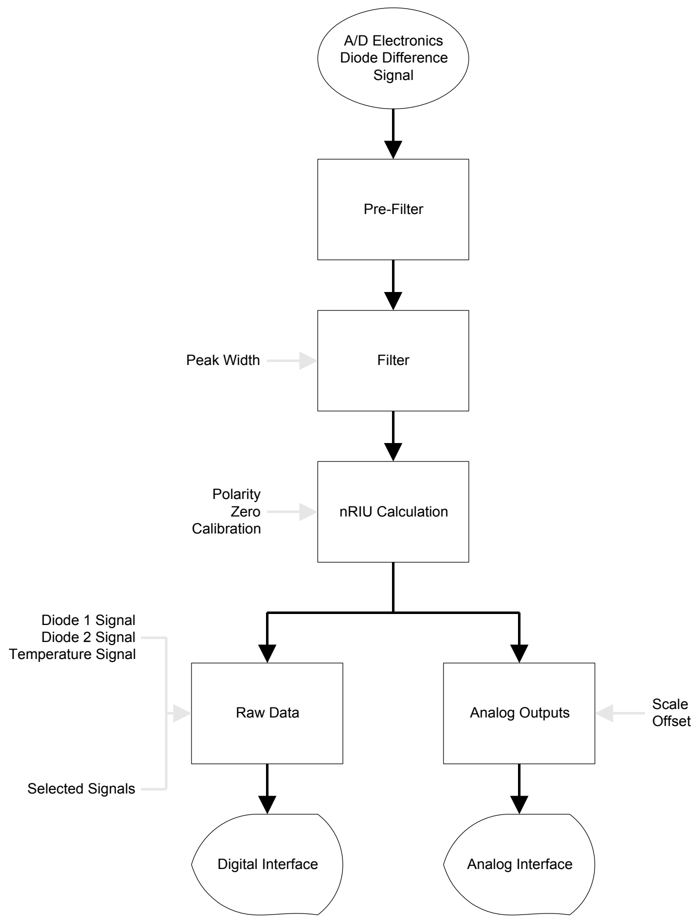


Figure 54 Data flow for chromatographic output

Optional Interface Boards

The Agilent 1200 Series modules have one optional board slot that allows to add an interface board to the modules.

Table 20 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 1200 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).

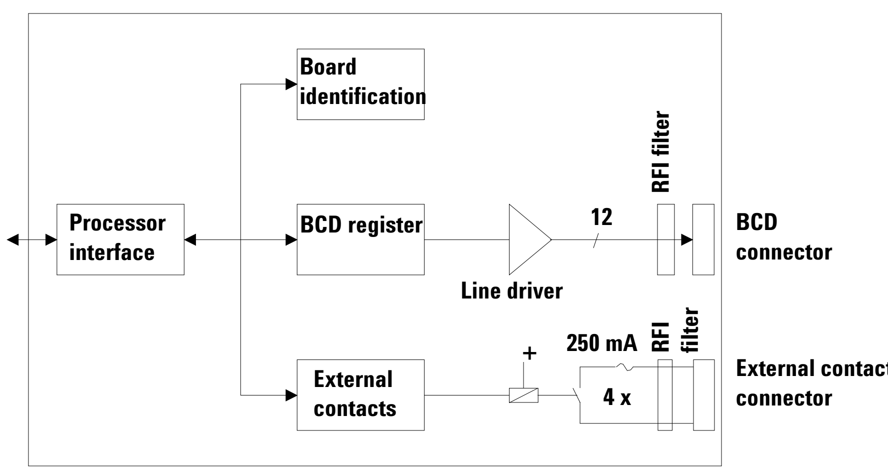


Figure 55 Block Diagram BCD Board

There are general purpose cables available to connect the BCD output, see "BCD Cables" on page 206 and the external outputs, see "External Contact Cable" on page 210 to external devices.

Table 21 Detailed connector layout (1200)

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
15	+5V	Low

LAN Communication Interface Board

NOTE One board is required per Agilent 1200 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 Agilent 1200 Series modules.

a ChemStation software revision A.06.01 or above.

The following cards can be used with the Agilent 1200 Series modules.

Table 22 LAN Boards

Type	Vendor	Supported networks
G1369A G1369-60001	Agilent Technologies	Fast Ethernet, Ethernet/802.3, RJ-45 (10/100Base-TX) **recommended for re-ordering**
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

Agilent 1200 Series Interfaces

The Agilent 1200 Series modules provide the following interfaces:

Table 23 Agilent 1200 Series Interfaces

Interface Type	Pumps	Autosampler	DA Detector MW Detector FL Detector	DA Detector MW Detector (G1315C/G1365C)	VW Detector RI Detector	Thermostatted Column Compartment	Vacuum Degasser
CAN	Yes	Yes	Yes	Yes	Yes	Yes	No
LAN (on-board)	No	No	No	Yes	No	No	No
GPIB	Yes	Yes	Yes	No	Yes	Yes	No
RS-232C	Yes	Yes	Yes	Yes	Yes	Yes	No
Remote	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Analog	Yes	No	2 ×	2 ×	1 ×	No	Yes*
Interface board (LAN/BCD/Ext)	Yes	Yes	Yes	No	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 1200 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, see Figure 16 on page 46.

WARNING **Never use cables other than the ones supplied by Agilent Technologies to ensure proper functionality and compliance with safety or EMC regulations, see “Radio Interference” on page 240.**

Analog Signal Output

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

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 Agilent Technologies.

Table 24 Default Addresses

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

CAN Interface

The CAN is 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 Agilent Technologies if you want to use features as common shut down, prepare, and so on.

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

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

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

Table 25 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

Table 25 Remote Signal Distribution (continued)

Pin	Signal	Description
6	POWER ON	(H) All modules connected to system are switched on. Receiver is any module relying on operation of others.
7	READY	(H) System is ready for next analysis. Receiver is any sequence controller.
8	STOP	(L) Request to reach system ready state as soon as possible (for example, stop run, abort or finish and stop injection). Receiver is any module performing run-time controlled activities.
9	START REQUEST	(L) Request to start injection cycle (for example, by start key on any module). Receiver is the autosampler.

RS-232C

The RS-232C connector is used to control the module from a computer through RS-232C connection, using the appropriate software. This connector can be configured with the configuration switch module 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:

Table 26 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

Table 26 RS-232C Connection Table (continued)

Pin	Direction	Function
9	In	RI

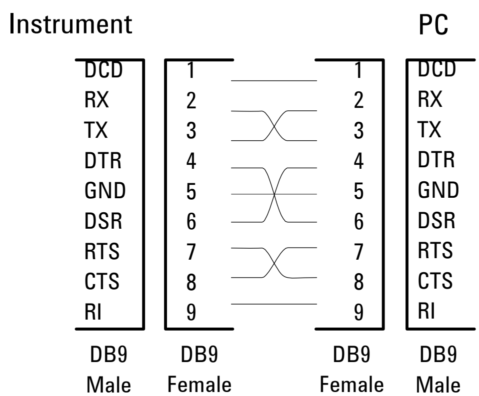


Figure 56 RS-232 Cable

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.

Factory setting is shown for the variable wavelength detector

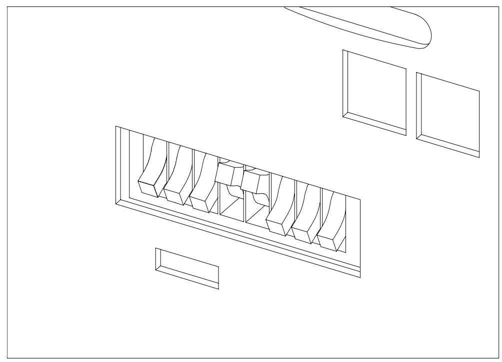


Figure 57 8-bit Configuration Switch

Table 27 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 28 Default Addresses for Agilent Series 1200 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 8453A	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 29 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 30 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 31 Data Bit Settings

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

Table 32 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 33 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 34 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 on-site 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 ± 10% and needs no manual setting.

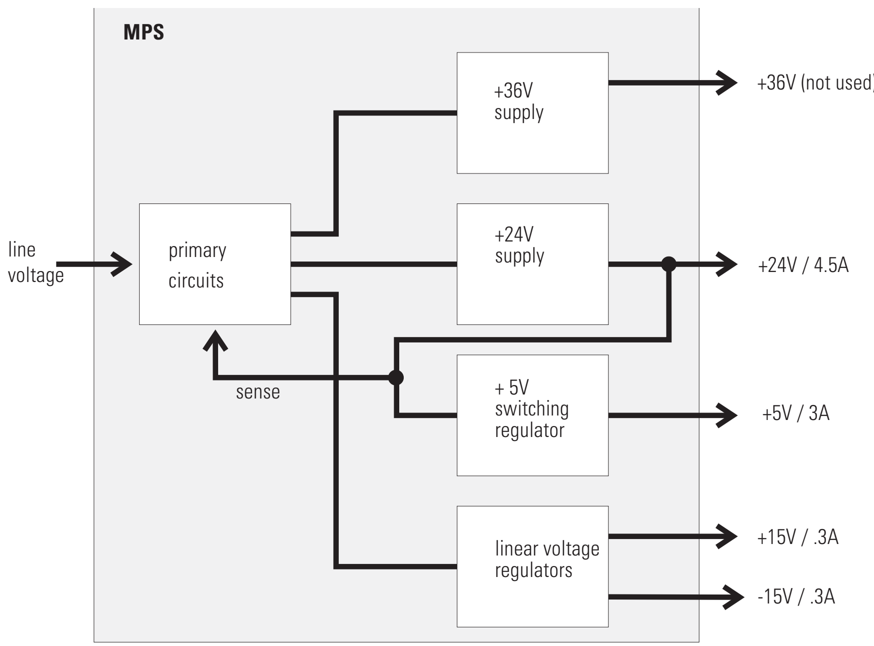


Figure 58 Main Power Supply (MPS) Block diagram

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 35 Main Power Supply Specifications

Maximum power	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	

A
Safety Information

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

General Safety Information

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. 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 fuse holders 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 36 shows safety symbols used on the instrument and in the manuals.

Table 36 Safety Symbols

Symbol	Description
	The apparatus is marked with this symbol when the user should refer to the instruction manual in order to protect risk of harm to the operator and to protect the apparatus against damage.
	Indicates dangerous voltages.
	Indicates a protected ground terminal.
	Indicates eye damage may result from directly viewing the light produced by the deuterium lamp used in this product.

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

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.

The Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC)

Abstract

The Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC), adopted by EU Commission on 13 February 2003, is introducing producer responsibility on all Electric and Electronic appliances from 13 August 2005.

NOTE

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

Product Category:
With reference to the equipment types in the WEEE Directive Annex I, this product is classed as a “Monitoring and Control instrumentation” product.

Do not dispose off in domestic household waste

To return unwanted products, contact your local Agilent office, or see www.agilent.com for more information.

Radio Interference

Never use cables other than the ones supplied by 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 Lp < 70 dB (A)
- At Operator Position
- Normal Operation
- According to ISO 7779:1988/EN 27779/1991 (Type Test)

Solvent Information

Observe the following recommendations on the use of solvents.

Flow Cell

Alkaline solutions (pH > 9.5) dissolve the quartz of a flow cell and should not be left in the system for several days.

Prevent any crystallization of buffer solutions. This will lead into a blockage/damage of the flow cell (maximum allowed pressure on the RID flow-cell is 5.0 bar or 0.5 MPa).

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%). Refer to "Flow Cell Flushing" on page 139.

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:

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

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

- Chromatographic grade ethers, which can contain peroxides (for example, THF, dioxane, di-isopropylether) such ethers should be filtered through dry aluminium oxide which adsorbs the peroxides.
- 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.

Agilent Technologies on Internet

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

http://www.agilent.com

Select “**Life Sciences & Chemical Analysis Solutions**”

It will provide also the latest firmware of the Agilent 1200 Series modules for download.

Index

N

O

P

R

www.agilent.com

In This Book

This manual contains technical service information about the Agilent 1200 Series Refractive Index Detector. The manual describes the following:

- introduction to the RI detector and theory of operation,
- site requirements and specifications,
- installing the RI detector,
- using the RI detector,
- optimizing the RI detector,
- troubleshooting, errors, test functions and signals,
- maintaining and repairing the RI detector,
- identifying parts and materials,
- introduction to the detector electronics.

Printed in Germany
02/06

G1362-90110

Agilent Technologies