



Agilent 1200 Infinity II Series Refractive Index Detector

User Manual



Agilent Technologies

Notices

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Manual Part Number

G7162-90000

Edition

11/2015

Printed in Germany

Agilent Technologies
Hewlett-Packard-Strasse 8
76337 Waldbronn

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CAUTION

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

In This Guide...

This manual covers the

- G7162A Agilent 1260 Infinity II Refractive Index Detector
- G7162B Agilent 1290 Infinity II Refractive Index Detector (Micro)

1 Introduction to the Refractive Index Detector

This chapter gives an introduction to the Refractive Index Detector.

2 Site Requirements and Specifications

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

3 Using the Module

This chapter explains the essential operational parameters of the module.

4 Preparing the Module

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

5 Optimizing the Detector

This chapter provides information on how to optimize the detector.

6 Troubleshooting and Diagnostics

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

7 Error Information

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

8 Test Functions

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

9 Maintenance and Repair

This chapter provides general information on maintenance and repair of the detector.

10 Parts for Maintenance

This chapter provides information on parts for maintenance.

11 Identifying Cables

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

12 Hardware Information

This chapter describes the module in more detail on hardware and electronics.

13 LAN Configuration

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

14 Appendix

This chapter provides safety and other general information.

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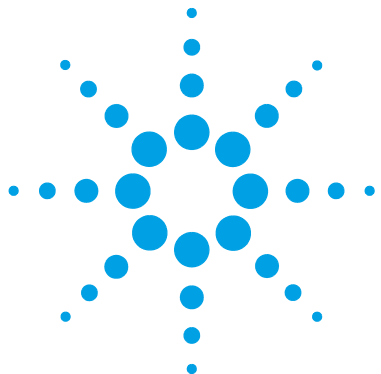
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This chapter gives an introduction to the Refractive Index Detector.



Introduction to the Refractive Index Detector

The Standard Optical (G7162A) and Micro Optical (G7162B) detectors are designed for highest optical performance, GLP compliance, and easy maintenance. They include 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 40000 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 32.

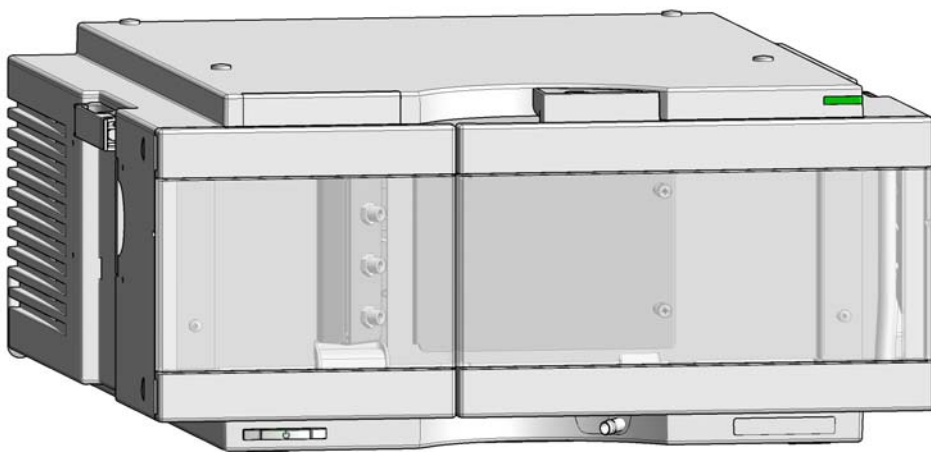


Figure 1 The Agilent 1200 Infinity Series Refractive Index Detector

G7162A Refractive Index Detector

This detector is equipped with the standard optical unit and is used for all standard applications.

It comprises the following features:

- inlet port to sample cell 62 μL ,
- inlet port to outlet port 590 μL ,
- maximum data rate up to 74 Hz.

G7162B Refractive Index Detector Micro

This detector is equipped with the micro optical unit and is used for all low volume applications.

It comprises the following features:

- inlet port to sample cell 10 μL ,
- inlet port to outlet port 265 μL ,
- maximum data rate up to 148 Hz,
- LED illumination.

How the Detector Operates

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.

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

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

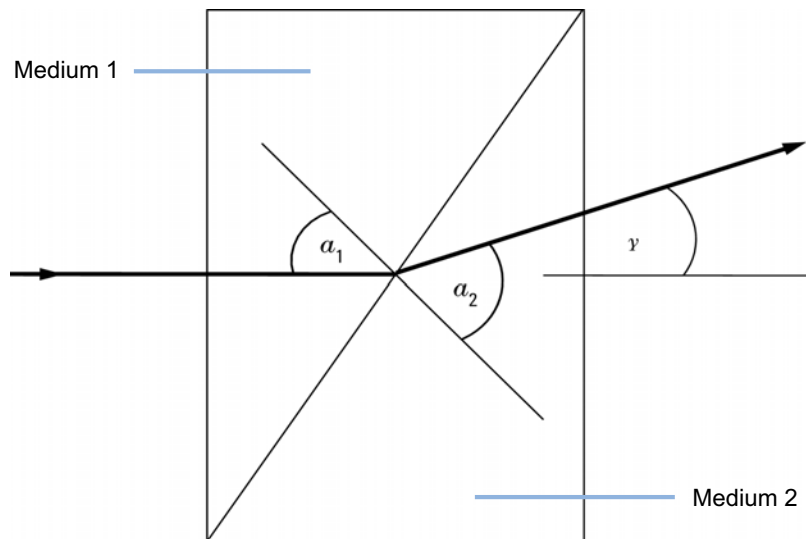


Figure 2 Light Refraction

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
- n_2 = Refractive index of medium 2
- n_1 = Refractive index of medium 1

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 Infinity II 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](#) on page 14).

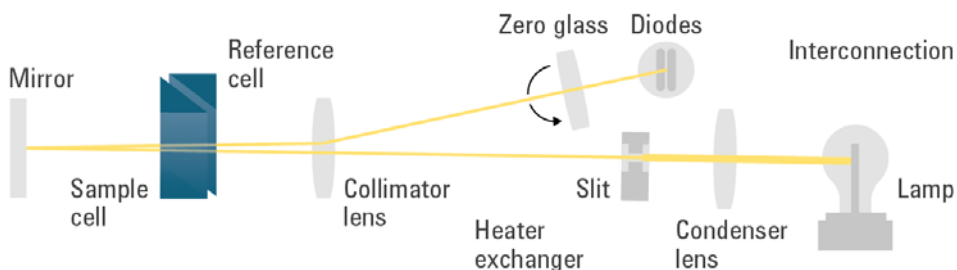


Figure 3 Light path

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.

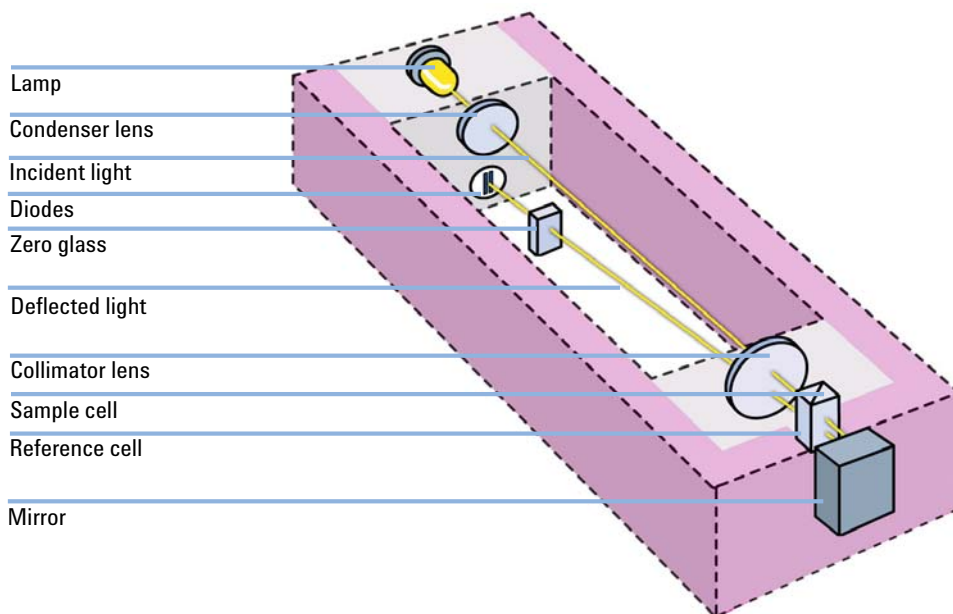


Figure 4 Optical Path

Flow Path

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 °CC 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.

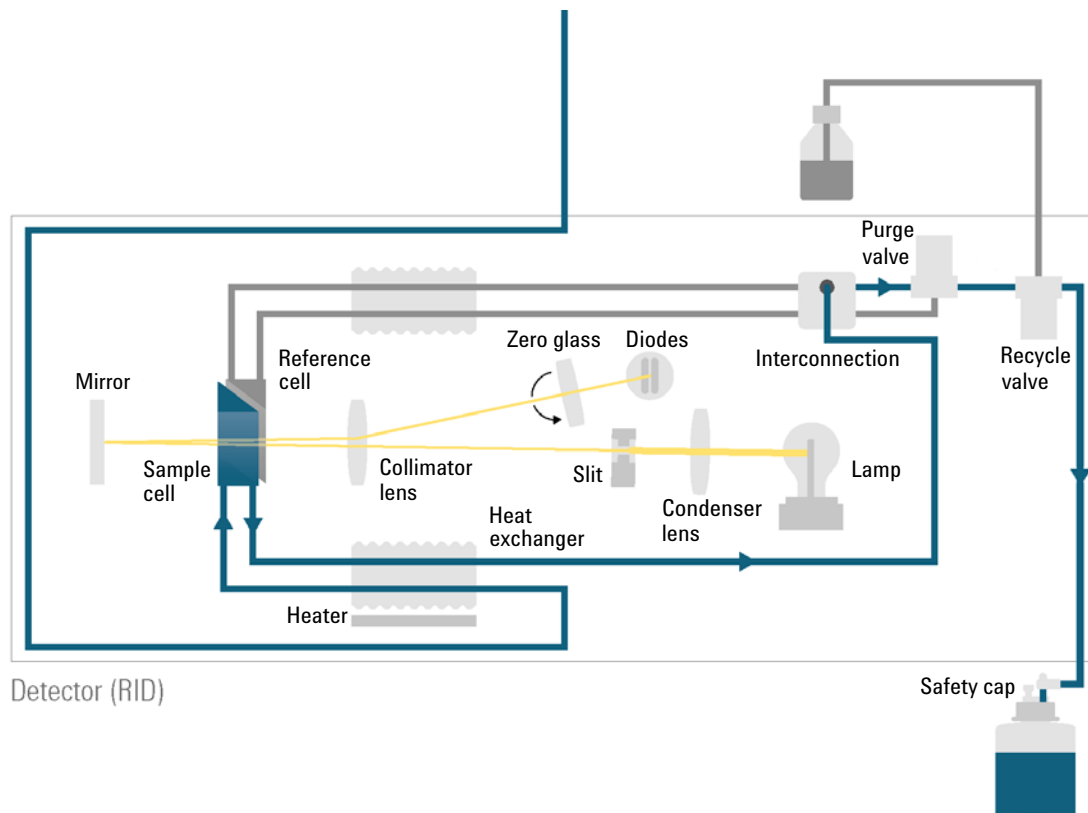
If the purge valve is in the *on* position the eluent cannot pass immediately to the recycle valve but will instead flow via a second heat exchanger through the reference cell and then into the recycle valve. Periodically switching the purge valve to the *on* position while only mobile phase is flowing 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.

The different flow paths depend on the status of the Purge Valve and Recycle Valve.

Normal Flow Mode

Purge Valve = OFF, Recycle Valve = OFF



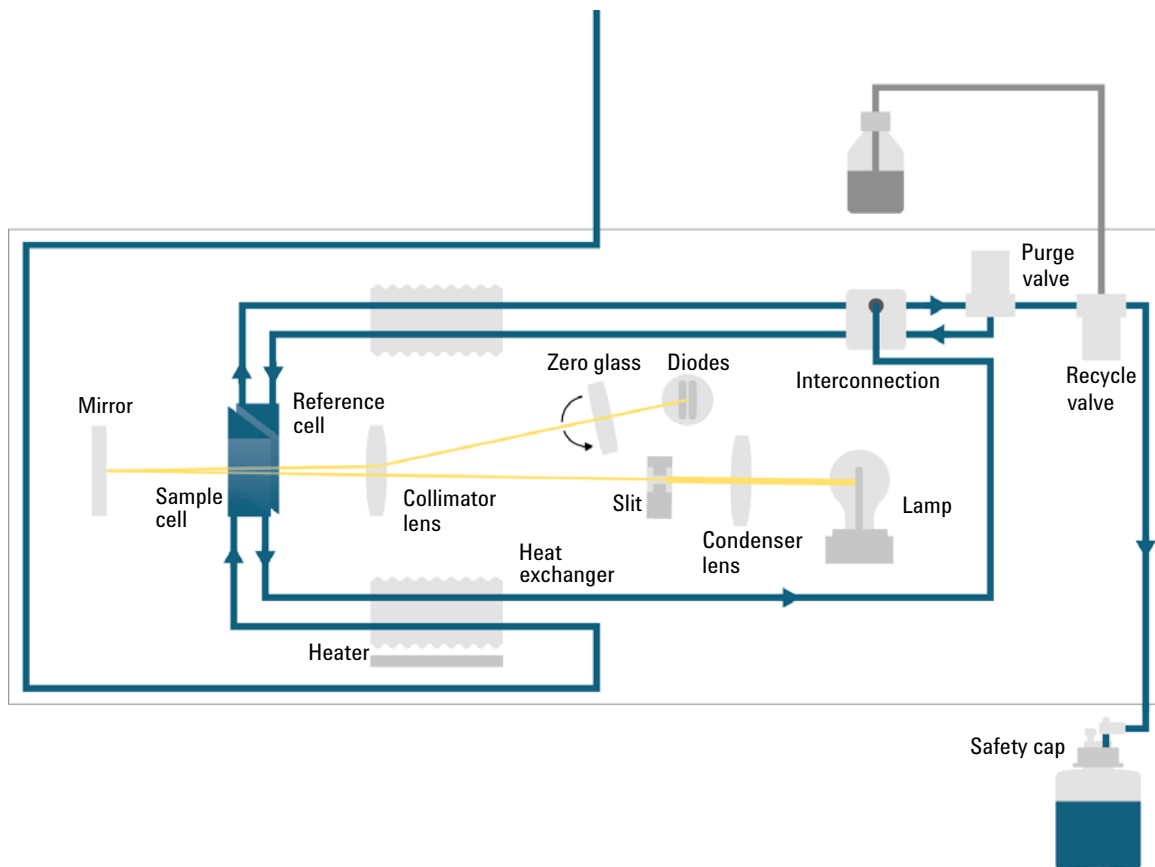
1 Introduction to the Refractive Index Detector

Flow Path

Purge Mode

This mode is used for flushing the complete detector inclusive the reference side of the flow cell.

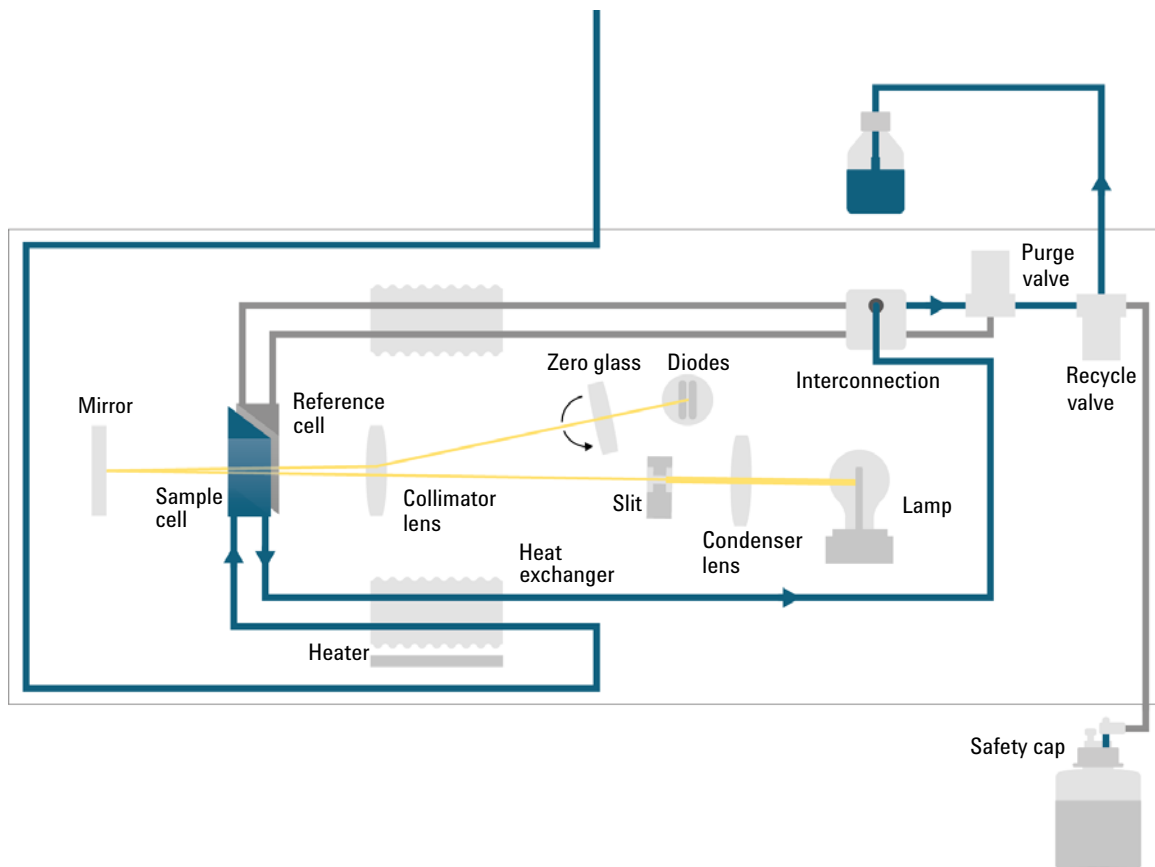
Purge Valve = ON, Recycle Valve = OFF



Recycle Mode

This mode is used for saving solvent during periods where no sample is running through.

Purge Valve = OFF, Recycle Valve = ON



COM = COMMON
NO = NORMALLY OPEN
NC = NORMALLY CLOSED

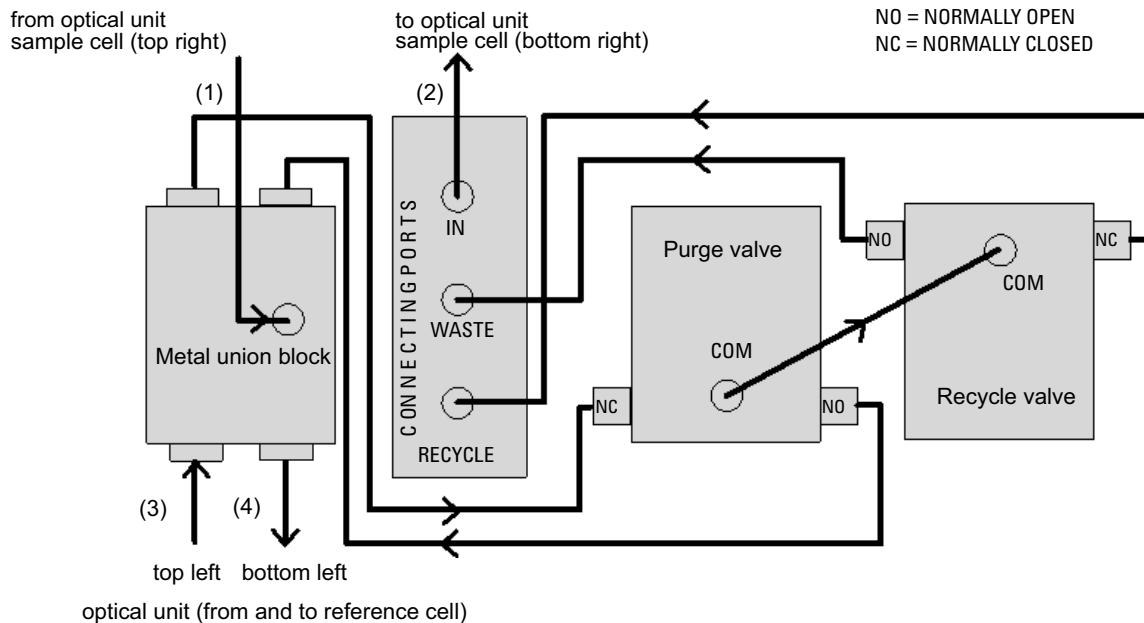


Figure 5 Physical Plumbing Connections

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 PTFE (available as Tubing kit (G1362-68709)).

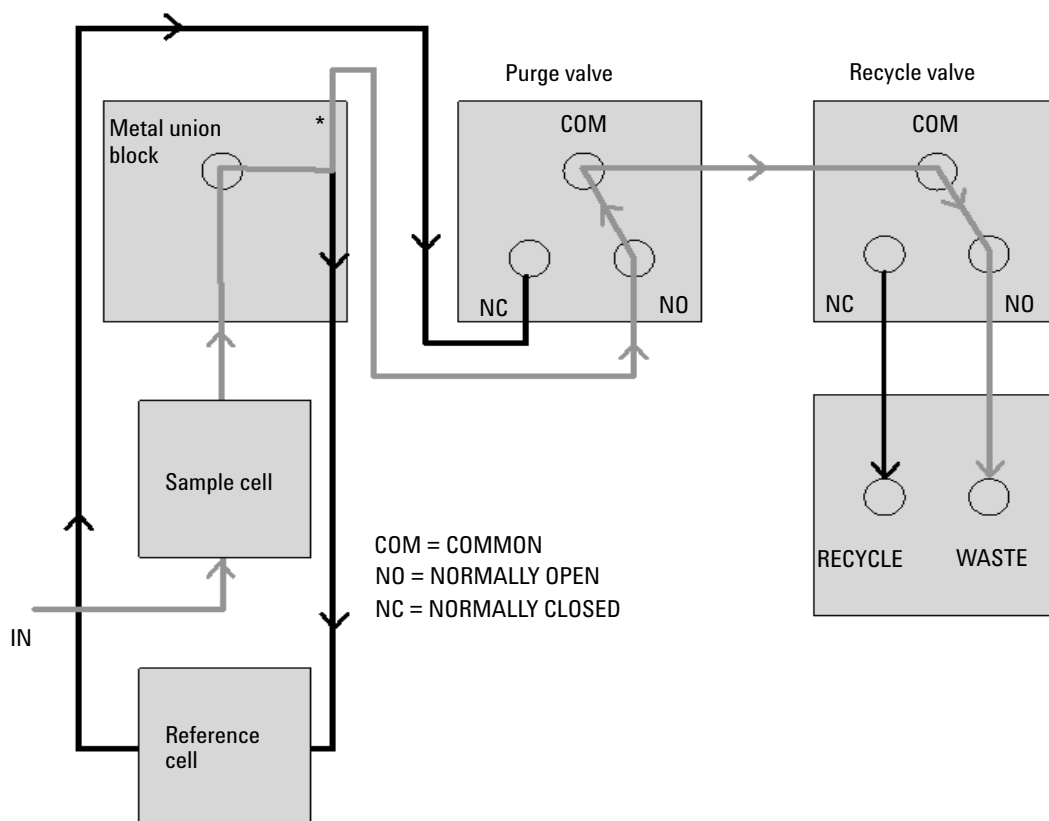


Figure 6 Flow path with the Purge- and Recycle-Valves = OFF

Grey lines = flowing path
Black lines = immobilized mobile phase

*The T-connection in the metal union block results in both sides of the flow cell (sample and reference) always being exposed to the same pressure

1 Introduction to the Refractive Index Detector

Flow Path

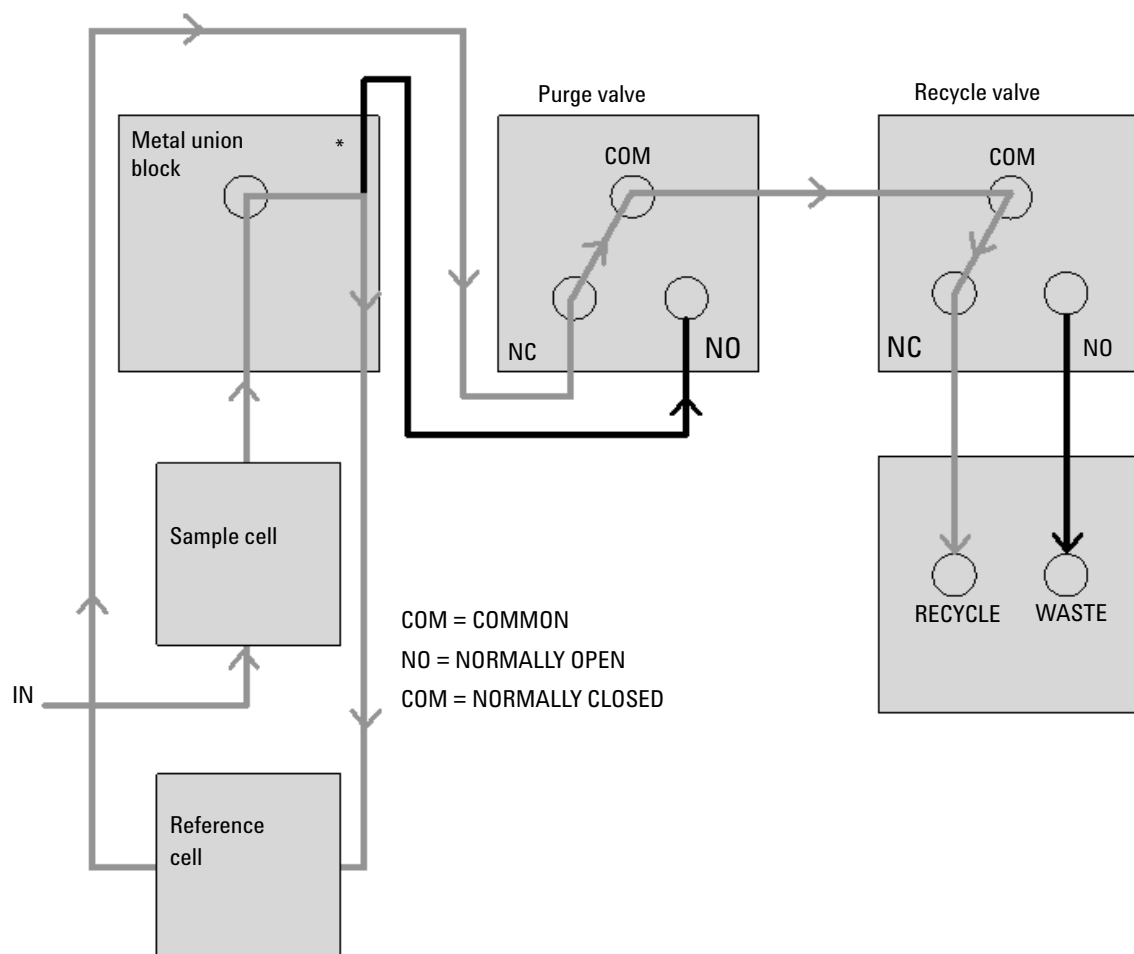


Figure 7 Flow path with the Purge- and Recycle-Valves = ON

Grey lines = flowing path
Black lines = immobilized mobile phase

*The T-connection in the metal union block results in both sides of the flow cell (sample and reference) always being exposed to the same pressure

Leak and Waste Handling

The 1290 Infinity II Series has been designed for safe leak and waste handling. It is important that all security concepts are understood and instructions are carefully followed.

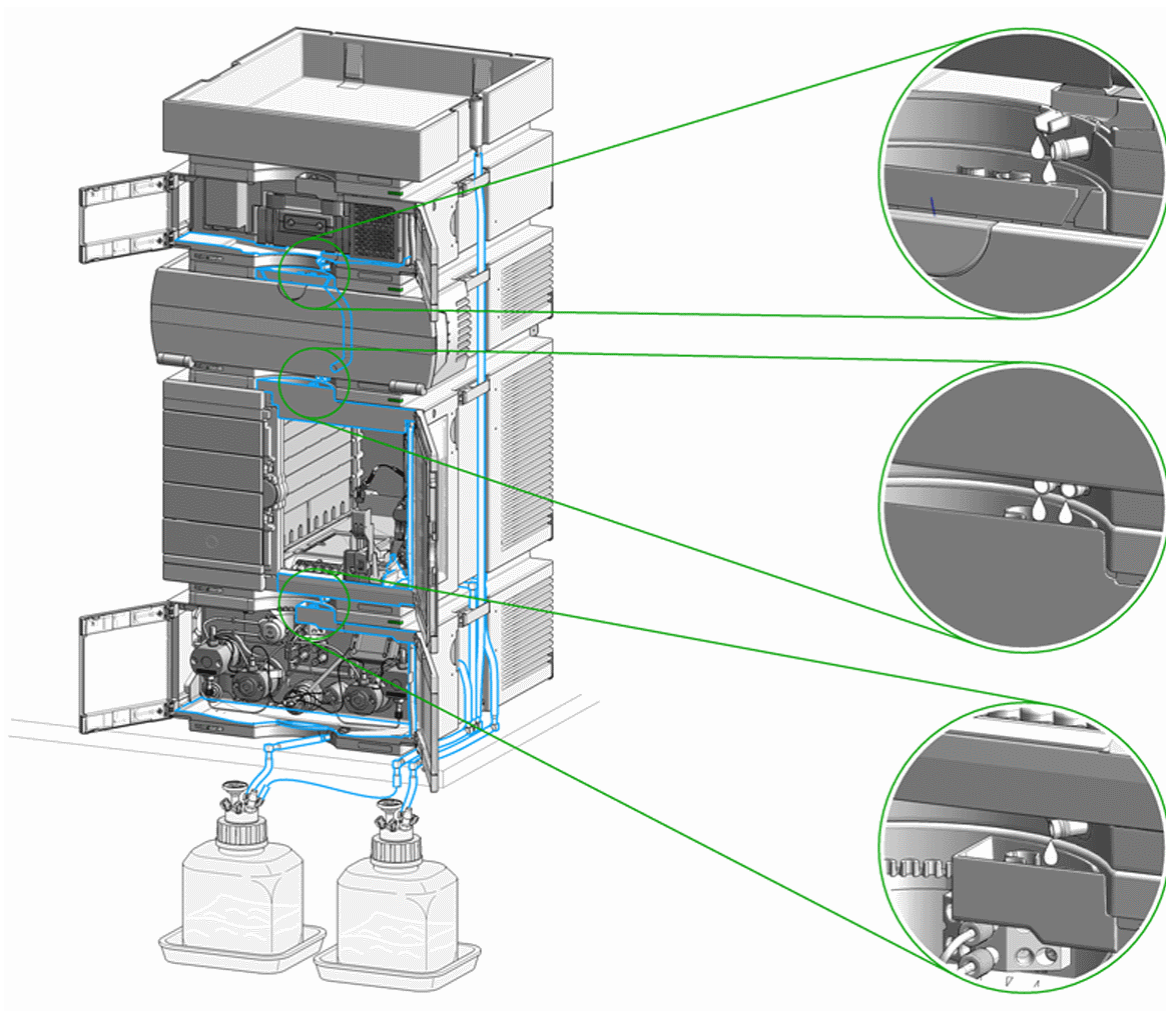


Figure 8 Leak and waste handling concept (overview - typical stack configuration as an example)

1 Introduction to the Refractive Index Detector

Leak and Waste Handling

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

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

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

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

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

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

NOTE

Do not install the waste tubings into the central waste connectors.

Waste Guidance

NOTE

The waste drainage must go straight into the waste containers. The waste flow must not be restricted at bends or joints.

Waste Concept

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

**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.

1 Introduction to the Refractive Index Detector

Leak and Waste Handling



2

Site Requirements and Specifications

Site Requirements 28

Physical Specifications 31

Performance Specifications 32

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



Site Requirements

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

Power Considerations

The module power supply has wide ranging capability. It accepts any line voltage in the range described in [Table 1](#) on page 31. Consequently there is no voltage selector in the rear of the module. There are also no externally accessible fuses, because automatic electronic fuses are implemented in the power supply.

WARNING

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

→ Connect your instrument to the specified line voltage only.

WARNING

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

Repair work at the module can lead to personal injuries, e.g. electrical shock, when the cover is opened and the module is connected to power.

→ Always unplug the power cable before opening the cover.

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

WARNING

Inaccessible power plug.

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

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

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

Power Cords

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

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

WARNING

Absence of ground connection

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

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

WARNING

Unintended use of supplied power cords

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

- Never use a power cord other than the one that Agilent shipped with this instrument.
 - Never use the power cords that Agilent Technologies supplies with this instrument for any other equipment.
 - Never use cables other than the ones supplied by Agilent Technologies to ensure proper functionality and compliance with safety or EMC regulations.
-

WARNING

Power cords

Solvents may damage electrical cables.

- Prevent electrical cables from getting in contact with solvents.
 - Exchange electrical cables after contact with solvents.
-

Bench Space

The module dimensions and weight (see [Table 1](#) on page 31) allow you to place the module on almost any desk or laboratory bench. It needs an additional 2.5 cm (1.0 inches) of space on either side and approximately 8 cm (3.1 inches) in the rear for air circulation and electric connections.

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

The module should be operated in a horizontal position.

NOTE

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

Environment

Your module will work within the specifications at ambient temperatures and relative humidity described in [Table 1](#) on page 31.

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 32) 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

Condensation within the module

Condensation can damage the system electronics.

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

NOTE

This module is designed to operate in a typical electromagnetic environment, i.e. where RF transmitters such as mobile telephones may not be used in close proximity.

Physical Specifications

Table 1 Physical Specifications

Type	Specification	Comments
Weight	15 kg (33 lbs)	
Dimensions (height × width × depth)	180 x 396 x 436 mm (7.1 x 15.6 x 17.2 inches)	
Line voltage	100 – 240 V~, ± 10 %	Wide-ranging capability
Line frequency	50 or 60 Hz, ± 5 %	
Power consumption	70 W / 80 VA	
Ambient operating temperature	4–55 °C (39–131 °F)	
Ambient non-operating temperature	-40 – 70 °C (-40 – 158 °F)	
Humidity	< 95 % r.h. at 40 °C (104 °F)	Non-condensing
Operating altitude	Up to 3000 m (9842 ft)	
Non-operating altitude	Up to 4600 m (15092 ft)	For storing the module
Safety standards: IEC, EN, CSA, UL	Installation category II, Pollution degree 2	For indoor use only.
ISM Classification	ISM Group 1 Class B	According to CISPR 11

Performance Specifications

Table 2 Agilent 1260 Infinity II Refractive Index Detector (G7162A) Performance Specifications

Type	Specification	Comments
Detection type	Refractive Index	
Refractive index range	1.00 – 1.75 RIU, calibrated	
Measurement range	$\pm 600 \cdot 10^{-6}$ RIU	
Optical zeroing		via set screw
Optics temperature control	5 °C above ambient to 55 °C	
Sample cell	Volume: 8 μ L Maximum pressure: 5 bar (0.5 MPa) Maximum flow rate: 5 mL/min	
Valves	Automatic purge and automatic solvent recycle	
Volumes	Inlet port to sample cell 62 μ L, inlet port to outlet port 590 μ L	
Liquid contact materials	316 stainless steel, PTFE and quartz glass	
pH range	2.3 – 9.5	
Performance specifications	Short term noise: $< \pm 1.25 \cdot 10^{-9}$ RIU Drift: $< 200 \cdot 10^{-9}$ RIU/hr	see note below this table
Time programmable parameters	polarity, peak width	
Maximum data rate	74 Hz	
Detector zero	automatic zero before analysis	
Control and data evaluation	Parameter entry, signal display, on-line help and diagnostics with the Agilent 1260 Infinity Control Module.	

Table 2 Agilent 1260 Infinity II Refractive Index Detector (G7162A) Performance Specifications

Type	Specification	Comments
Analog outputs	Recorder/integrator: 100 mV or 1 V, output range selectable, one output	
Communications	LAN, controller-area network (CAN), ERI: 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.	

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 on-line degasser (e.g. G4225A), pump and thermostatted column compartment. Instrument equilibrated for 2 hours.

Performance Specifications

Table 3 Agilent 1290 Infinity II Refractive Index Detector (G7162B) Performance Specifications

Type	Specification	Comments
Detection type	Refractive Index	
Refractive index range	1.00 – 1.75 RIU, calibrated	
Measurement range	$\pm 600 \cdot 10^{-6}$ RIU	
Optical zeroing		via set screw
Optics temperature control	5 °C above ambient to 55 °C	
Sample cell	Volume: 2.5 μ L Maximum pressure: 5 bar (0.5 MPa) Maximum flow rate: 1 mL/min (100 % water)	
Valves	Automatic purge and automatic solvent recycle	
Volumes	Inlet port to sample cell 2.5 μ L, inlet port to outlet port 265 μ L	
Liquid contact materials	316 stainless steel, PTFE and quartz glass	
pH range	2.3 – 9.5	
Performance specifications	Short term noise: $< \pm 1.75 \cdot 10^{-9}$ RIU Drift: $< 200 \cdot 10^{-9}$ RIU/hr	see note below this table
Time programmable parameters	polarity, peak width	
Maximum data rate	148 Hz	
Detector zero	automatic zero before analysis	
Control and data evaluation	Parameter entry, signal display, on-line help and diagnostics with the Agilent 1260 Infinity Control Module.	
Analog outputs	Recorder/integrator: 100 mV or 1 V, output range selectable, one output	

Table 3 Agilent 1290 Infinity II Refractive Index Detector (G7162B) Performance Specifications

Type	Specification	Comments
Communications	LAN, controller-area network (CAN), ERI: 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.	

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 on-line degasser (e.g. G4225A), pump and thermostatted column compartment. Instrument equilibrated for 2 hours.

2 Site Requirements and Specifications

Performance Specifications



3 Using the Module

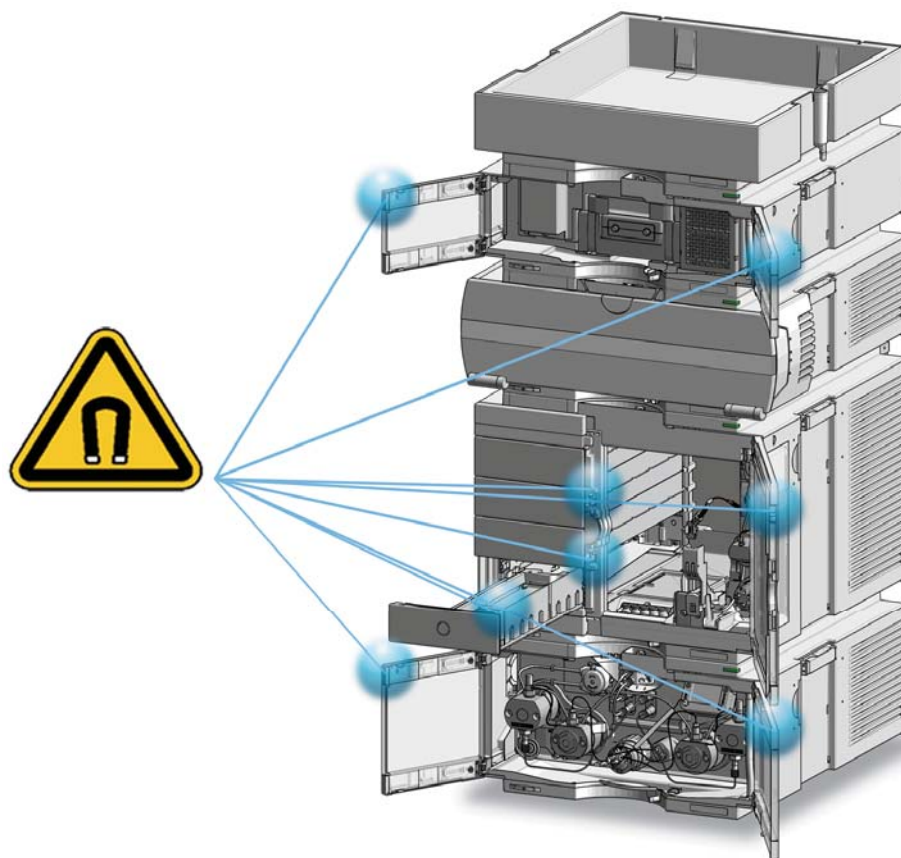
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The Detector User Interface	44
Detector Control Settings	47
Method Parameter Settings	49

This chapter explains the essential operational parameters of the module.

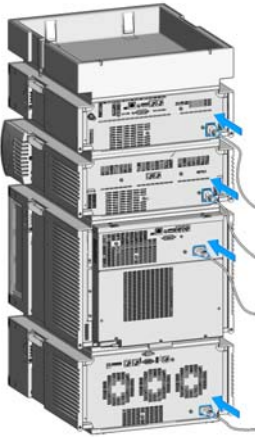
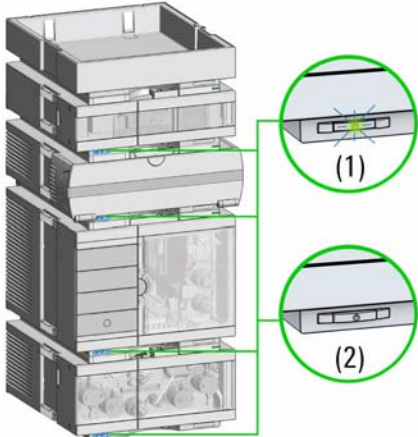
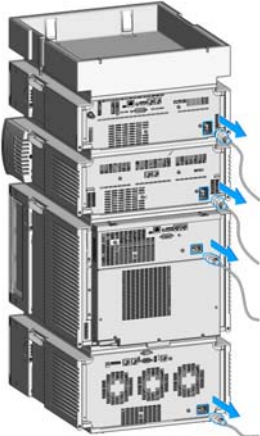


Magnets

- 1 This stack exemplarily shows the magnets' positions in the modules.

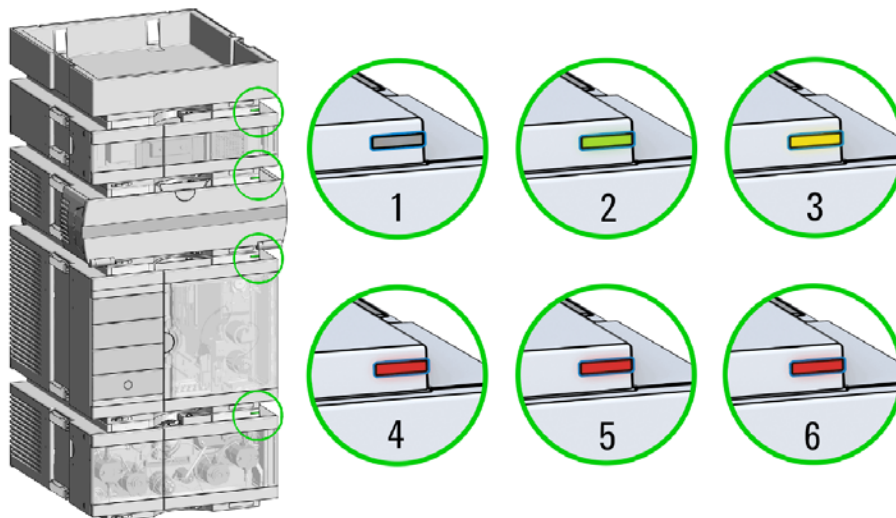


Turn on/off

<div>1</div> <div></div>	<div>2</div> <div></div> <div>Power switch</div> <div>(1) On</div> <div>(2) Off</div>
<div>3</div> <div></div>	

Status Indicators

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



Status indicators

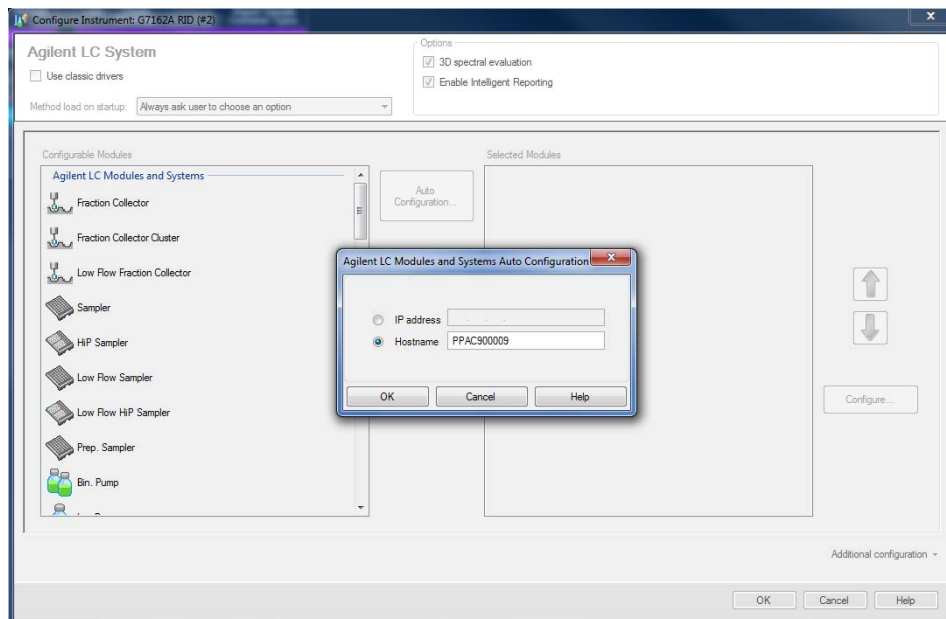
1. Idle
2. Run mode
3. Not-ready. Waiting for a specific pre-run condition to be reached or completed.
4. Error mode - interrupts the analysis and requires attention (for example a leak or defective internal components).
5. Resident mode (blinking) - for example during update of main firmware.
6. Bootloader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

Instrument Configuration

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



- 2 Enter the setup information (MAC / IP address and/or Instrument Name).
 - a Agilent OpenLAB ChemStation (Configure Instrument):



3 Using the Module

Instrument Configuration

b Lab Advisor (Instrument Overview - Add Instrument):

System Name: G7162A

Instruments

Instrument Name: G7162A

Instrument Address: PPAC900009

Instrument Type: Agilent LC/CE

Add Instrument

OK Cancel

Set up the Detector with Agilent Open Lab ChemStation

The setup of the detector is shown with the Agilent OpenLab ChemStation C.01.07 and LC and CE Drivers A.02.13.

NOTE

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

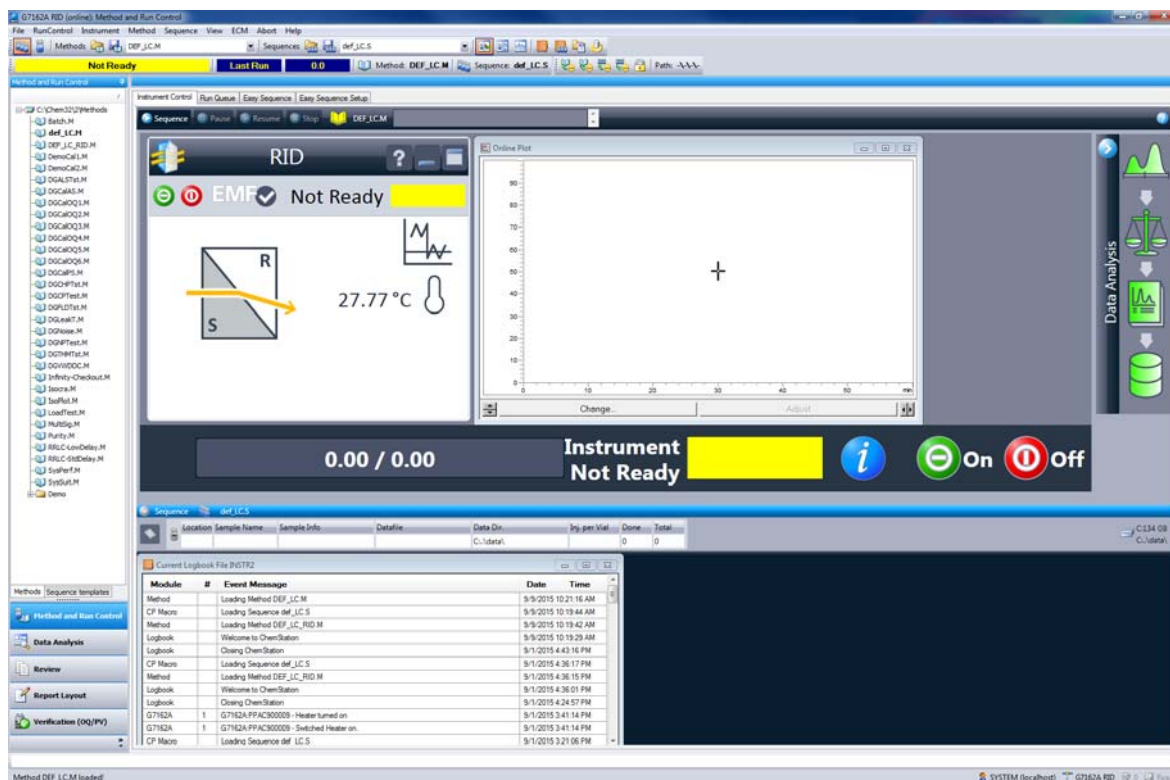
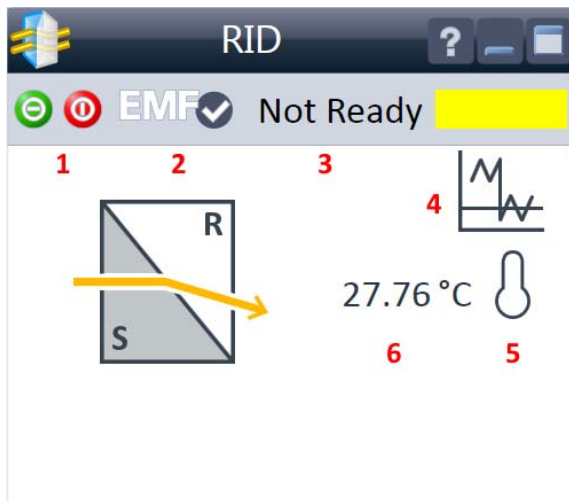


Figure 9 ChemStation Method and Run Control (just detector is shown)

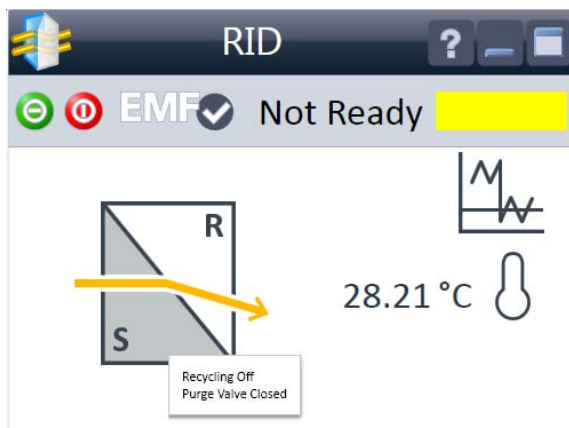
After successful load of the OpenLab ChemStation, you should see the module as an active item in the graphical user interface (GUI).

The Detector User Interface



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

- 1 Make device ready or turn off
- 2 EMF status
- 3 Detector status
- 4 Balance
- 5 Heater status (on/off)
- 6 Heater temperature



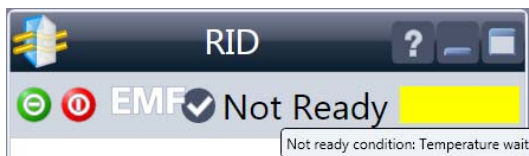
The Purge Valve status (closed/open) and the Recycle Valve status (off/on) is shown when the cursor moves across the flow cell icon.



EMF Status shows Run / Ready / Error state and “Not Ready text” or “Error text”

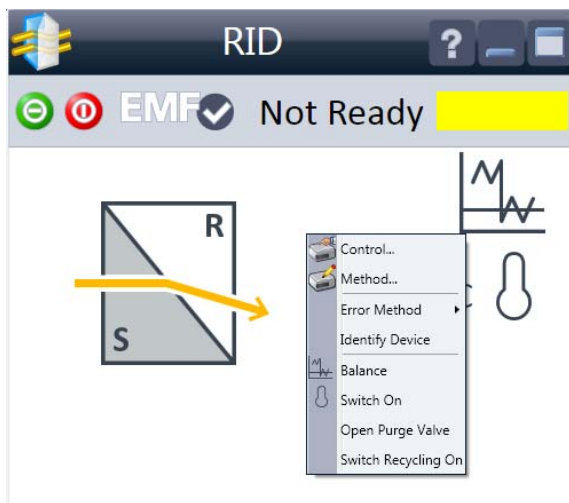
- Offline (gray)
- Ok. No Maintenance required (green)
- EMF warning. Maintenance might be required (yellow)
- EMF warning. Maintenance required (red)

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



Module Status shows Run / Ready / Error state and “Not Ready text” or “Error text”

- Error (red)
- Not ready (yellow)
- Ready (green)
- Pre run, Post run (purple)
- Run (blue)
- Idle (green)
- Offline (dark gray)
- Standby (light gray)

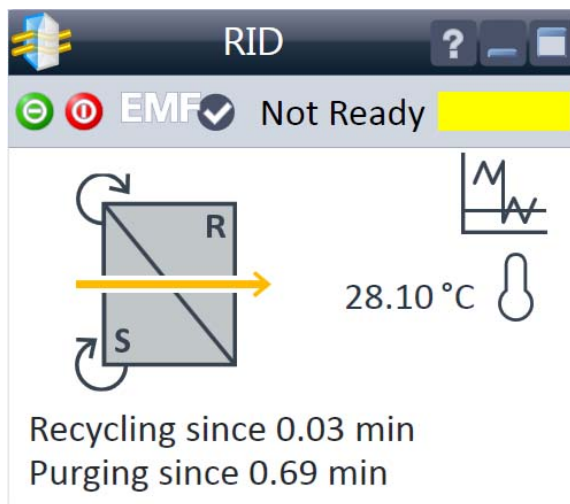


A right-click into the Active Area will open a menu to

- Show the **Control** Interface (special module settings)
- Show the **Method** interface (similar as via menu **Instrument > Setup Instrument Method**)
- Set **Error Method**
- Identify Module (Status LED will blink)
- Perform a **Balance**
- Switch the Heater on/off (same as click on button **Make Device Ready/Turn device off (standby)**)
- Open/close Purge Valve
- Recycle Valve on/off

3 Using the Module

The Detector User Interface



If the Purge Valve or Recycle Valve has been turned on, the on-time is displayed below the flow cell icon.

Detector Control Settings

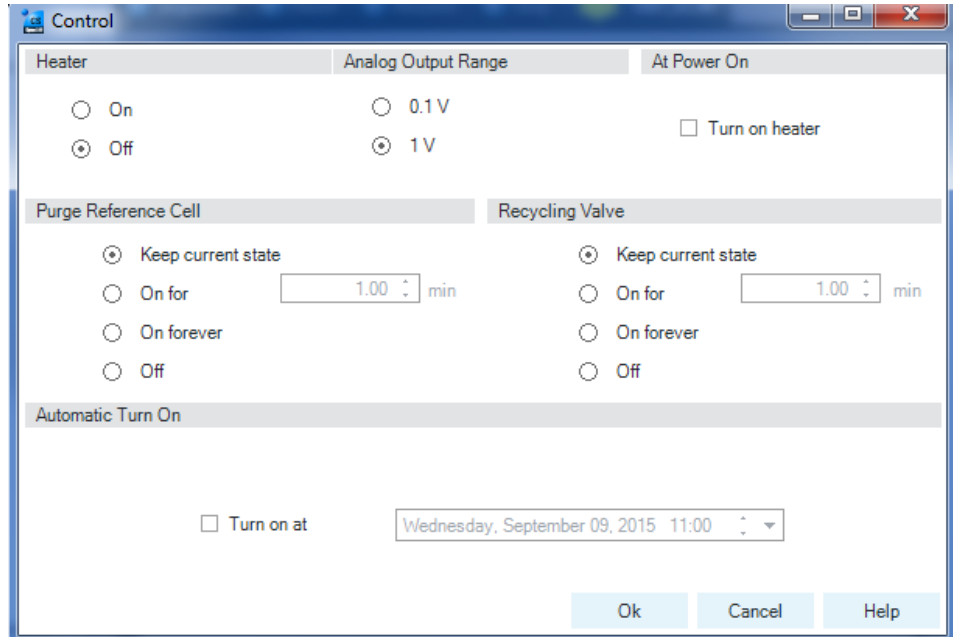


Figure 10 Control settings

The figure shows the default settings.

- **Heater:** Select the **On** option to switch the RID heater on. This parameter requires setting the Optical Unit Temperature. Select the **Off** option to switch the optical unit heater off.
- **Analog Output Range:** can be set to either 100 mV or 1 V full scale, for additional settings see Analog Output (under “[Method Parameter Settings](#)” on page 49).
- **At Power On:** When activated, the optical unit heater is turned on automatically when the RID is switched on. For shortest equilibration times, Agilent recommends to leave this function always on.

3 Using the Module

Detector Control Settings

- **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. This will be started immediately if you click **OK** on this window. Allow additional time for baseline stabilization after purging.
- **Recycling Valve:** Select the **On** option to switch the recycling of the eluent on. The **Off** option diverts the flow of the RID to the waste bottle.
- **Automatic Turn On:** This function allows you to turn on the optical unit heater at a specified date and time. It requires that the **At Power On** function is turned off. Select **Turn Heater on at:** to activate the date and time fields, and enter the date and time in the appropriate fields in the specified format.

Method Parameter Settings

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

Setup Method

RID Instrument Curves

RID (G7162A)

Optical Unit Temperature

☐ Not controlled

☒ 35.00 °C

Signal

Acquire

Signal: ☒

Peakwidth: > 0.2 min (4 s response time) (2.31 Hz)

Stoptime Posttime

☒ As Pump/Injector ☐ Off

☐ 1.00 min ☐ 1.00 min

Advanced

Analog Output

Zero Offset: 5 %

Attenuation: 500000 nRIU

Signal Polarity

☒ Positive (+)

☐ Negative (-)

Automatic Zero Before Analysis Automatic Recycling After Analysis

☒ On ☐ On

☐ Off ☒ Off

Automatic Purge

☐ Automatic Purge

Purge time: 1.00 min

Wait time: 0.00 min

Timetable (empty)

OK Apply Cancel Help

Figure 11 Method parameter settings

NOTE

For additional help and support: Highlight the desired cell and press **F1**. A help screen will open with additional information and documentation about the topic.

3 Using the Module

Method Parameter Settings

Table 4 Method parameter settings

Optical Unit Temperature	
<input type="radio"/> Not controlled <input checked="" type="radio"/> 35.00 °C	
Signal	
Acquire	
Signal:	<input checked="" type="checkbox"/>
Peakwidth:	> 0.2 min (4 s response time) (2.31 Hz)
Stoptime	<input checked="" type="radio"/> As Pump/Injector <input type="radio"/> [] min
< 0.0025 min (0.031 s response time) (74 Hz) > 0.0025 min (0.063 s response time) (37 Hz) > 0.005 min (0.13 s response time) (37 Hz) > 0.01 min (0.25 s response time) (37 Hz) > 0.025 min (0.5 s response time) (18.5 Hz) > 0.05 min (1 s response time) (9.25 Hz) > 0.1 min (2 s response time) (4.63 Hz) > 0.2 min (4 s response time) (2.31 Hz) > 0.4 min (8 s response time) (1.16 Hz)	
Signal	
Acquire	
Signal:	<input checked="" type="checkbox"/>
Peakwidth:	> 0.2 min (4 s response time) (2.31 Hz)
Stoptime	<input checked="" type="radio"/> As Pump/Injector <input type="radio"/> [] min
< 0.001 min (0.015 s response time) (148 Hz) > 0.001 min (0.031 s response time) (74 Hz) > 0.0025 min (0.063 s response time) (37 Hz) > 0.005 min (0.13 s response time) (37 Hz) > 0.01 min (0.25 s response time) (37 Hz) > 0.025 min (0.5 s response time) (18.5 Hz) > 0.05 min (1 s response time) (9.25 Hz) > 0.1 min (2 s response time) (4.63 Hz) > 0.2 min (4 s response time) (2.31 Hz) > 0.4 min (8 s response time) (1.16 Hz)	
Stoptime	<input checked="" type="radio"/> As Pump/Injector <input type="radio"/> 1.00 min
Posttime	<input checked="" type="radio"/> Off <input type="radio"/> 1.00 min

Optical Unit Temperature:

This item sets the temperature of the optical unit. The optical unit of the Agilent 1260 Infinity 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.

Peakwidth (Response time, Data Rate):

Peakwidth enables you to select the peak width (response time) for your analysis. The peak width is defined as the width of a peak, in minutes, at half the peak height. Set the peak width to the narrowest expected peak in your chromatogram. The peak width sets the optimum response time for your 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.

If **Acquire Signal** check box is not marked, signals are not stored.

NOTE

The 1260 Infinity II RID (G7162A) has a data rate of up to 74 Hz. The 1290 Infinity II RID (G7162B) has a data rate of up to 148 Hz.

Stoptime/Posttime

The **Stoptime** is the time where either the complete system stops (**As Pump/Injector**) or the module (if different from system stop time). The data collection is stopped at this time.

You can set the **Posttime** so that your module 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 or temperature change.

Table 4 Method parameter settings

<p>Analog Output</p> <p>Zero Offset: <input type="text" value="5"/> %</p> <p>Attenuation: <input type="text" value="500000"/> nRIU</p>	<p>Analog Output</p> <p>The range can be set to either 100 mV or 1 V full scale, see “Detector Control Settings” on page 47.</p> <ul style="list-style-type: none"> • Zero Offset: 1 – 99 % in steps of 1 % (5 % equal to 50 mV). • Attenuation: 488 – 1000000 nRIU at discrete values for either 100 mV or 1 V full scale.
<p>Signal Polarity</p> <p><input checked="" type="radio"/> Positive (+)</p> <p><input type="radio"/> Negative (-)</p>	<p>Signal Polarity</p> <p>Use this item to set 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.</p>
<p>Automatic Zero Before Analysis</p> <p><input checked="" type="radio"/> On</p> <p><input type="radio"/> Off</p>	<p>Automatic Zero Before Analysis</p> <p>Use this setting 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.</p>
<p>Automatic Recycling After Analysis</p> <p><input type="radio"/> On</p> <p><input checked="" type="radio"/> Off</p>	<p>Automatic Recycling After Analysis:</p> <p>This parameter can be used to select between automatic recycling of the effluent (On) or directing the effluent to the waste outlet of the RID (Off) after the run.</p>
<p>Automatic Purge</p> <p><input type="checkbox"/> Automatic Purge</p> <p>Purgetime: <input type="text" value="1.00"/> min</p> <p>Waittime: <input type="text" value="0.00"/> min</p>	<p>Automatic Purge</p> <p>This parameter can be used to purge the reference cell and wait additional time for baseline stabilization. It is initiated each time the run is started. This should be used only if the content of the reference cell is expected to degrade during a run. The automatic purge is completed before the autozero is performed and before the injection is done.</p>

3 Using the Module
Method Parameter Settings

Table 4 Method parameter settings

▲ Timetable (1/100 events)

[min]	Function	Parameter
00	Change Polarity	Polarity: Positive (+)

Polarity

☒ Positive

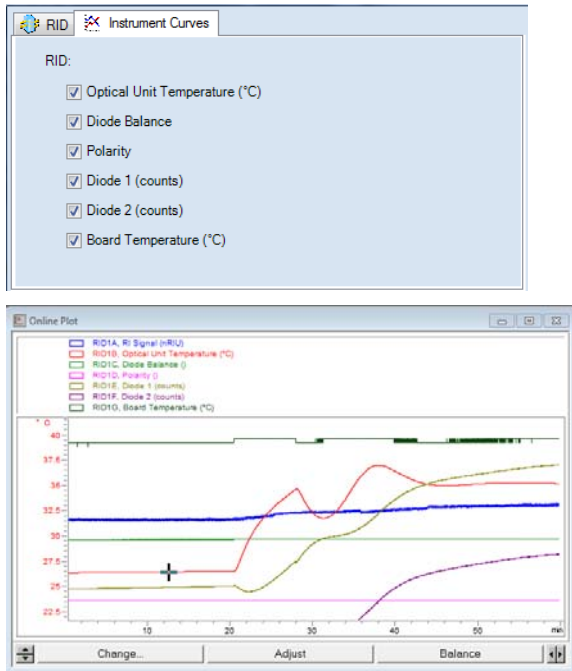
☐ Negative

AddRemoveClear all

CutCopyPaste

Timetable

You may set up time events to change functions with their parameters over the run time. Add lines as required. Time Limits: 0.00 to 99999.00 min in steps of 0.01 min. Via the buttons in the bottom area time table lines can be added, removed, cut copied, pasted or completely cleared. Based on the chosen function, a certain parameter can be selected.



Instrument Curves

The detector has several signals that can be used for diagnosing problems. These signals can be used in addition to the normal baseline signal to determine whether correlation to other signals exists. These signals are available via the Agilent ChemStation Online Plot/Data Signal and/or Agilent Lab Advisor Software.

- **Optical unit temperature**
- **Diode Balance** to diagnose peaks that exceed the dynamic range of the RID, for example in the case of extremely high concentrations/signals.
- **Polarity** monitors of polarity switching during the run.
- **Diode 1 and Diode 2:** 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 and diode 2.
- **Board Temperature**

The temperature around the Leak Sensor (at the power switch electronics) can be used for looking at ambient temperature changes.



4 Preparing the Module

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Waste Concept	55
Setting up an Analysis	56
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Preparing the Detector	60
Preparing the HPLC System	60
Running the Sample and Verifying the Results	62
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This chapter provides information on how to set up the module for an analysis and explains the basic settings.



Leak and Waste Handling

WARNING

Toxic, flammable and hazardous solvents, samples and reagents

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

- When working with these substances observe appropriate safety procedures (for example by wearing goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the vendor, and follow good laboratory practice.
- The volume of substances should be reduced to the minimum required for the analysis.
- Do not operate the instrument in an explosive atmosphere.
- Never exceed the maximal permissible volume of solvents (6 L) in the solvent cabinet.
- Do not use bottles that exceed the maximum permissible volume as specified in the usage guideline for the Agilent 1200 Infinity Series Solvent Cabinets.
- Arrange the bottles as specified in the usage guideline for the solvent cabinet.
- A printed copy of the guideline has been shipped with the solvent cabinet, electronic copies are available on the Internet.
- Ground the waste container.
- The residual free volume in the appropriate waste container must be large enough to collect the waste liquid.
- Check the filling level of the waste container regularly.
- To achieve maximal safety, check the correct installation regularly.
- Do not use solvents with an auto-ignition temperature below 200 °C (392 °F).

NOTE

Recommendations for Solvent Cabinet

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

For correct installation of your system contact your Agilent service representative.

Waste Concept

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



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.

Setting up an Analysis

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

NOTE

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

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

NOTE

Pump for approximately 10minutes before starting your application.

NOTE

Do NOT exceed the flow rate of the 1290 Infinity II RID (Micro) whilst purging pump. Bypass detector when purging >1 mL/min.

Requirements and Conditions

What You Will Need

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

Table 6 What you will need

Agilent 1200 Infinity Series system	Pump (plus degassing)
	Autosampler
	Detector
	Degasser (optional)
	Column Compartment (optional)
	Agilent CDS
	System should be correctly set up for LAN communication with the Agilent ChemStation
Column:	Zorbax Eclipse XDB-C18, 4.6 x 150 mm, 5 µm (993967-902) or an equivalent column
Standard:	Agilent isocratic checkout sample (01080-68704)

Conditions

A single injection of the isocratic test standard is made under the conditions given in [Table 7](#) on page 58:

Table 7 Chromatographic conditions

Mobile phases	30 % water, 70 % acetonitrile
Flow rate	1.5 mL/min
Stroke A	20 µL
Stop time	10 min
Injection volume	20 µL
Column compartment temperature	25 °C
Optical unit Temperature	35 °C
Polarity	Positive
Peak Width (Response time)	0.2 min (4 s, standard)

Typical Chromatogram

A typical chromatogram for this analysis is shown in [Figure 12](#) on page 59. The exact profile of the chromatogram will depend on the chromatographic conditions. Variations in solvent quality, column packing, standard concentration and column temperature will all have a potential effect on peak retention and response.

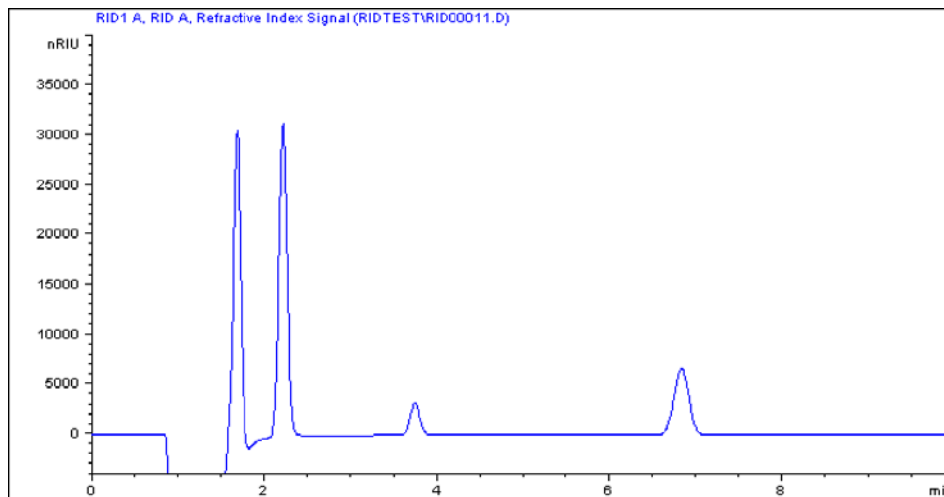


Figure 12 Isocratic standard sample chromatogram

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 four peaks from the checkout sample.

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.

Preparing the Detector

For best performance of the detector

- Let the lamp warm-up and stabilize for at least one hour (initial turn on of the module requires a longer time depending on the environment and the application needs).
- For high sensitivity measurements, a stable environment is required; refer to “[Environment](#)” on page 30. Prevent drafts from air condition systems.
- Do not work with removed/open front panels/doors. When the system includes a G1316 TCC (typically located below the detector) and its front panel is removed while the TCC is set to high temperatures, the up-streaming air could influence the stability of the detector baseline.

Preparing the HPLC System

- 1 Turn on the control software and the monitor.
- 2 Turn on the modules.
- 3 Start the control software. The screen should show all modules and the system status is Not Ready.
- 4 Turn on the modules that require conditioning:
 - a Detector heater (warm-up for at least 60 min to get a stable baseline).
 - b Column compartment (set temperature as required).
 - c Pump (purge).
 - d Purge the detector reference cell for 20 min.
 - e Sampler (prepare the standard isocratic sample into a vial).
 - f Solvents (fill water and Acetonitrile into the solvent bottles).
- 5 Load the default method.
- 6 Pump the water/acetonitrile (30/70 %) mobile phase through the column for 10 min for equilibration.

- 7 Select the menu item **Run Control > Sample Info** and enter information about this application. Click **OK** to leave this screen.

Sample Info: G7162A RID

Operator name:

Data file:

Path: Subdirectory:

Name Pattern

Signal 1:

Isocratic Sample 2015-08-12 11-33-39.D

Sample parameters

Vial/Location: (blank run if no entry)

Sample name: Sample amount:

Multiplier: Dilution: ISTD amount:

Comment:

Figure 13 Sample Info

Running the Sample and Verifying the Results

- 1 To start a run select the menu item **RunControl > Run Method**.
- 2 This will start the modules and the online plot on the Agilent ChemStation will show the resulting chromatogram.

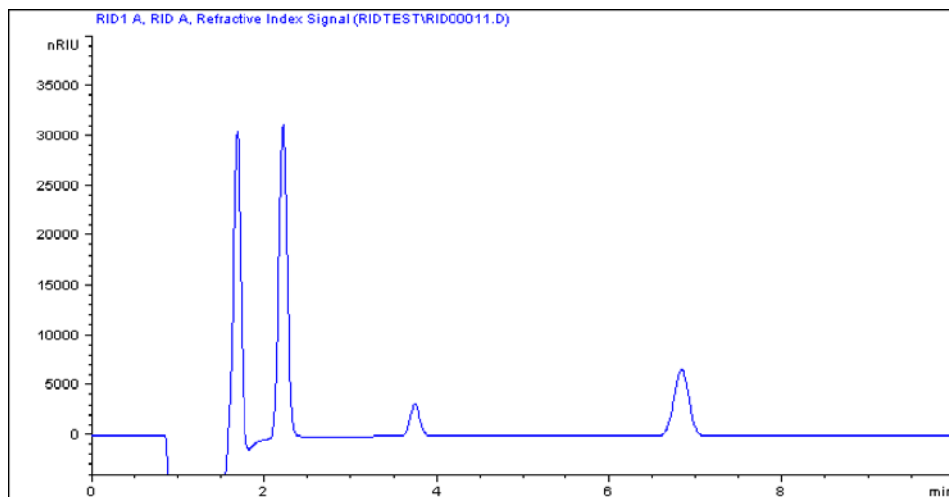


Figure 14 Isocratic standard sample chromatogram

Solvent Information

Observe the following recommendations on the use of solvents.

- Follow recommendations for avoiding the growth of algae, see pump manuals.
- Small particles can permanently block capillaries and valves. Therefore, always filter solvents through 0.4 µm filters.
- Avoid or minimize the use of solvents that may corrode parts in the flow path. Consider specifications for the pH range given for different materials like flow cells, valve materials etc. and recommendations in subsequent sections.

Material Information

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

Disclaimer

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

PEEK

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

It is stable in a pH range between 1 – 12, and inert to many common solvents.

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

Polyimide

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

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

Polyethylene (PE)

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

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

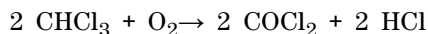
Tantalum (Ta)

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

Stainless Steel (ST)

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

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



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

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

Diamond-Like Carbon (DLC)

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

Fused silica and Quartz (SiO₂)

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

Gold

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

Zirconium Oxide (ZrO₂)

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

Platinum/Iridium

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

Fluorinated polymers (PTFE, PFA, FEP, FFKM)

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

TFE/PDD copolymer tubings, which are used in all Agilent degassers except G1322A, are not compatible with fluorinated solvents like Freon, Fluorinert, or Vertrel. They have limited life time in the presence of Hexafluoroisopropanol (HFIP). To ensure the longest possible life with HFIP, it is best to dedicate a particular chamber to this solvent, not to switch solvents, and not to let dry out the chamber. For optimizing the life of the pressure sensor, do not leave HFIP in the chamber when the unit is off.

Sapphire, Ruby and Al₂O₃-based ceramics

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

4 **Preparing the Module**

Solvent Information



5 Optimizing the Detector

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Potential Causes for Baseline Problems	73
Detector Equilibration	74

This chapter provides information on how to optimize the detector.



Refractive Index Detector Optimization

NOTE

Depending on the detector different inlet tubings are used (from the Accessory Kit):

- G7162A:
 - Interfacing capillary (G1362-87300)
- G7162B:
 - Capillary ST 0.075 mm x 220 mm (5067-4784) (Sampler to TCC/MCT)
 - Capillary ST 0.075 mm x 340 mm (5067-4783) (Column to RID)

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 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 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 PEEK adapter 1/4-28 to 10-32 (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 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, don't switch the pump off after analysis, instead just recycle solvents or at least reduce only the flow. Switch valves and settings only when needed. Don't 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 and Diagnostics

Available Tests vs User Interfaces 76

Agilent Lab Advisor Software 77

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



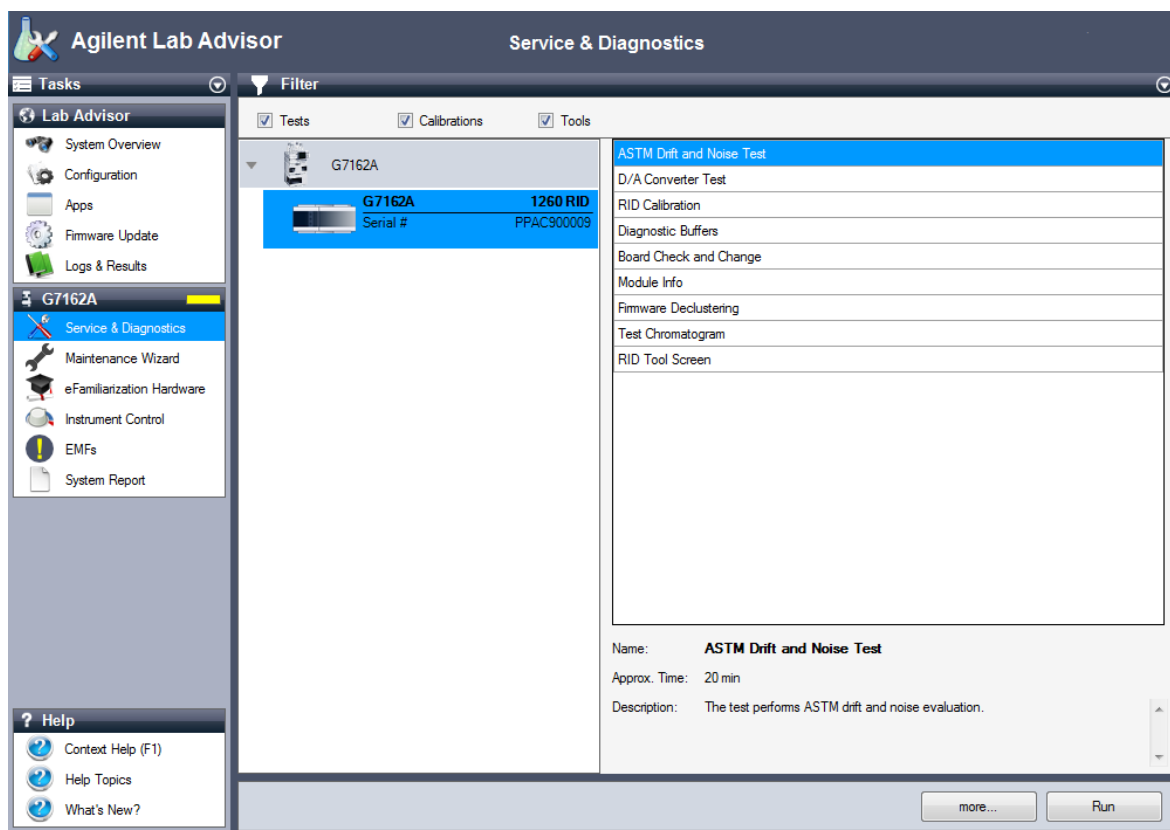
Available Tests vs User Interfaces

NOTE

Depending on the used interface, the available tests and the screens/reports may vary. Preferred tool should be the Agilent Lab Advisor, see [“Agilent Lab Advisor Software”](#) on page 77.

Agilent Lab Advisor B.02.07 SP1 or later is required.

The Instant Pilot supports the G7162A/B with B.02.19 or later. It does not provide any test functions!



Agilent Lab Advisor Software

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

The Agilent Lab Advisor software is available in two versions:

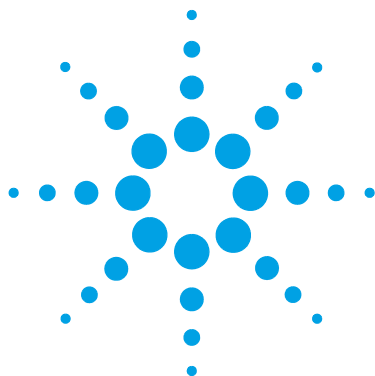
- Lab Advisor Basic
- Lab Advisor Advanced

Lab Advisor Basic is included with every Agilent 1200 Infinity Series and Infinity II Series pump.

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

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

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



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

What Are Error Messages

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

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

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

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

General Error Messages

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

Timeout

Error ID: 0062

The timeout threshold was exceeded.

Probable cause

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

Suggested actions

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

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

Shutdown

Error ID: 0063

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

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

Probable cause	Suggested actions
1 Leak detected in an external instrument with a remote connection to the system.	Fix the leak in the external instrument before restarting the module.
2 Shut-down in an external instrument with a remote connection to the system.	Check external instruments for a shut-down condition.
3 The degasser failed to generate sufficient vacuum for solvent degassing.	Check the vacuum degasser for an error condition. Refer to the <i>Service Manual</i> for the degasser or the pump that has the degasser built-in.

Remote Timeout

Error ID: 0070

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

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

Lost CAN Partner

Error ID: 0071

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

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

Probable cause

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

Suggested actions

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

Leak Sensor Open

Error ID: 0083

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

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

Probable cause

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

Suggested actions

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

Leak Sensor Short

Error ID: 0082

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

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

Probable cause

- 1 Defective leak sensor.
- 2 Leak sensor incorrectly routed, being pinched by a metal component.

Suggested actions

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

Compensation Sensor Open

Error ID: 0081

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

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

Probable cause

- 1 Loose connection between the power switch board and the main board
- 2 Defective power switch assembly

Suggested actions

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

Compensation Sensor Short

Error ID: 0080

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

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

Probable cause

- 1 Defective power switch assembly
- 2 Loose connection between the power switch board and the main board

Suggested actions

Please contact your Agilent service representative.

Please contact your Agilent service representative.

Fan Failed

Error ID: 0068

The cooling fan in the module has failed.

The hall sensor on the fan shaft is used by the main board to monitor the fan speed. If the fan speed falls below a certain limit for a certain length of time, the error message is generated.

This limit is given by 2 revolutions/second for longer than 5 seconds.

Depending on the module, assemblies (e.g. the lamp in the detector) are turned off to assure that the module does not overheat inside.

Probable cause

- 1 Fan cable disconnected.
- 2 Defective fan.
- 3 Defective main board.

Suggested actions

Please contact your Agilent service representative.

Please contact your Agilent service representative.

Please contact your Agilent service representative.

Leak

Error ID: 0064

A leak was detected in the module.

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

Probable cause	Suggested actions
1 Loose fittings.	Ensure all fittings are tight.
2 Broken capillary.	Exchange defective capillaries.
3 Leaking valve.	Exchange valve.
4 Leaking flow cell.	Exchange optical unit.

ERI Messages

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

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

Probable cause	Suggested actions
1 The load on the ERI is too high.	Reduce the load.

Refractive Index Detector Specific Error Messages

Thermal Fuse Open

Error ID: 2680

The thermal fuse of the optical unit heater has failed.

Probable cause

- 1** Heater cable disconnected.
- 2** Defective main board.
- 3** Defective thermal fuse.

Suggested actions

Please contact your Agilent service representative.

Please contact your Agilent service representative.

Please contact your Agilent service representative.

Heater Resistance Too High

Error ID: 2681

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

Probable cause

- 1** Heater cable disconnected.
- 2** Defective main board.
- 3** Defective heater.

Suggested actions

Please contact your Agilent service representative.

Please contact your Agilent service representative.

Please contact your Agilent service representative.

Heater Fuse

Error ID: 2682

The electronic fuse of the heater has been activated.

Probable cause

- 1 Short in heater circuit.
- 2 Defective main board.
- 3 Defective heater.

Suggested actions

- Powercycle the module.
- Please contact your Agilent service representative.
- Please contact your Agilent service representative.

Wrong Temperature Profile

Error ID: 2683

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

Probable cause

- 1 Defective main board.
- 2 Defective heater.

Suggested actions

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

Undecipherable Temperature Signal

Error ID: 2684

Probable cause

- 1** Heater cable disconnected.
- 2** Defective main board.
- 3** Defective heater.

Suggested actions

Please contact your Agilent service representative.

Please contact your Agilent service representative.

Please contact your Agilent service representative.

Maximum Temperature Exceeded

Error ID: 2685

The maximum heater temperature has been exceeded.

Probable cause

- 1** Defective main board.
- 2** Defective heater.

Suggested actions

Please contact your Agilent service representative.

Please contact your Agilent service representative.

Purge Valve Fuse Blown

Error ID: 2686

The electronic fuse on the purge valve has been activated.

Probable cause

- 1 Short in purge valve circuit.
- 2 Defective purge valve.
- 3 Defective main board.

Suggested actions

Power cycle the module.

Please contact your Agilent service representative.

Please contact your Agilent service representative.

Recycle Valve Fuse Blown

Error ID: 2687

The electronic fuse on the recycle valve has been activated.

Probable cause

- 1 Short in recycle valve circuit.
- 2 Defective recycle valve.
- 3 Defective main board.

Suggested actions

Power cycle the module.

Please contact your Agilent service representative.

Please contact your Agilent service representative.

Purge Valve Not Connected

Error ID: 2688

When activated no response was received from the purge valve.

Probable cause

- 1** Purge valve disconnected.
- 2** Defective purge valve.
- 3** Defective main board.

Suggested actions

Please contact your Agilent service representative.

Please contact your Agilent service representative.

Please contact your Agilent service representative.

Recycle Valve Not Connected

Error ID: 2689

When activated no response was received from the recycle valve.

Probable cause

- 1** Recycle valve disconnected.
- 2** Defective recycle valve.
- 3** Defective main board.

Suggested actions

Please contact your Agilent service representative.

Please contact your Agilent service representative.

Please contact your Agilent service representative.

Lamp Voltage too Low

Error ID: 2693

Probable cause

- 1 Defective main board.
- 2 Defective lamp or optics.

Suggested actions

Please contact your Agilent service representative.

Please contact your Agilent service representative.

Lamp Voltage too High

Error ID: 2690

Probable cause

- 1 Contaminated flow cell.
- 2 Defective main board.
- 3 Defective lamp or optics.

Suggested actions

Flush the flow cell.

Please contact your Agilent service representative.

Please contact your Agilent service representative.

Lamp Current too High

Error ID: 2691

Probable cause

- 1 Defective main board.
- 2 Defective lamp or optics.

Suggested actions

Please contact your Agilent service representative.

Please contact your Agilent service representative.

Lamp Current too Low

Error ID: 2694

Probable cause

- 1 Optical unit cable disconnected.
- 2 Defective main board.
- 3 Defective lamp or optics.

Suggested actions

Please contact your Agilent service representative.

Please contact your Agilent service representative.

Please contact your Agilent service representative.

Wait Function Timed Out

Error ID: 2692

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

Probable cause

- 1 Time too short.

Suggested actions

Increase time.

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

Event ID 2600

Probable cause

- 1 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

Event ID 2692

Probable cause

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

Suggested actions

Allow the wait time to elapse.

Unbalanced Diodes

Probable cause

- 1 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 [“The Optical Balance Procedure”](#) on page 108).

Not Enough Light

Probable cause

- 1 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

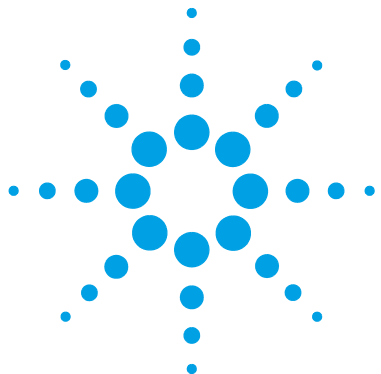
The amount of light falling on the light receiving diodes is too high to generate a refractive index signal.

Probable cause

- 1 The sample cell content is varying too much from the reference cell.

Suggested actions

Purge reference and sample cell.



8 Test Functions

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



Introduction

All tests are described based on the Agilent Lab Advisor Software B.02.07 SP1 [147].

Table 8 Interfaces and available test functions

Interface	Comment	Available Function
Agilent Lab Advisor	For functions see Table 9 on page 99	Available functions depend on Product Level (Basic – Advanced – FSE)
Agilent ChemStation	No tests available Adding of temperature/lamp signals to chromatographic signals possible	Diagnostic Signals <ul style="list-style-type: none"> • Temperature optical unit • Diode 1 & 2 • Balance • Polarity
Agilent Instant Pilot G4208A	No tests available	<ul style="list-style-type: none"> • FW Update • EMF

Table 9 Function Overview Lab Advisor Basic/Advanced

Functions	Product Level	
Tests		
- ASTM Drift and Noise Test	Basic	Advanced
- D/A Converter Test	Basic	Advanced
Calibrations		
- RID Calibration	Basic	Advanced
Tools		
- Diagnostic Buffers	Basic	Advanced
- Module Info	Basic	Advanced
- Test Chromatogram	Basic	Advanced
- RID Tool Screen	Basic	Advanced
Controls		
- Advanced Method Parameters		
- Attenuation Analog Output		Advanced
- Analog Output 1 Offset [% Full Scale]		Advanced
- Polarity		Advanced
- Configuration		
- Remote Pulse Duration [s] *	Basic	Advanced
- Analog Output 1 Range		Advanced
- Control		
- Recycle	Basic	Advanced
- Heater On/Off	Basic	Advanced
- Method Parameters		
- Set Peakwidth		Advanced
- Set Optical temperature [°C]		Advanced

Table 9 Function Overview Lab Advisor Basic/Advanced

Functions	Product Level	
- Module Information		
- Identify Module	Basic	Advanced
- Purge + Prime		
- Start Purge		Advanced
- Set Purge Time [minutes]		Advanced
- Special Commands		
- Detector Reset	Basic	Advanced
- Clear Error	Basic	Advanced
Signals		
- RI Signal [nRIU]		Advanced
- Optical Temperature [°C]		Advanced
- Board Temperature [°C]		Advanced
- Signal Diode 1 [counts]		Advanced
- Signal Diode 2 [counts]		Advanced
- Diode Balance		Advanced
- Polarity		Advanced
EMF Counters		
- Time since last Purge	Basic	Advanced

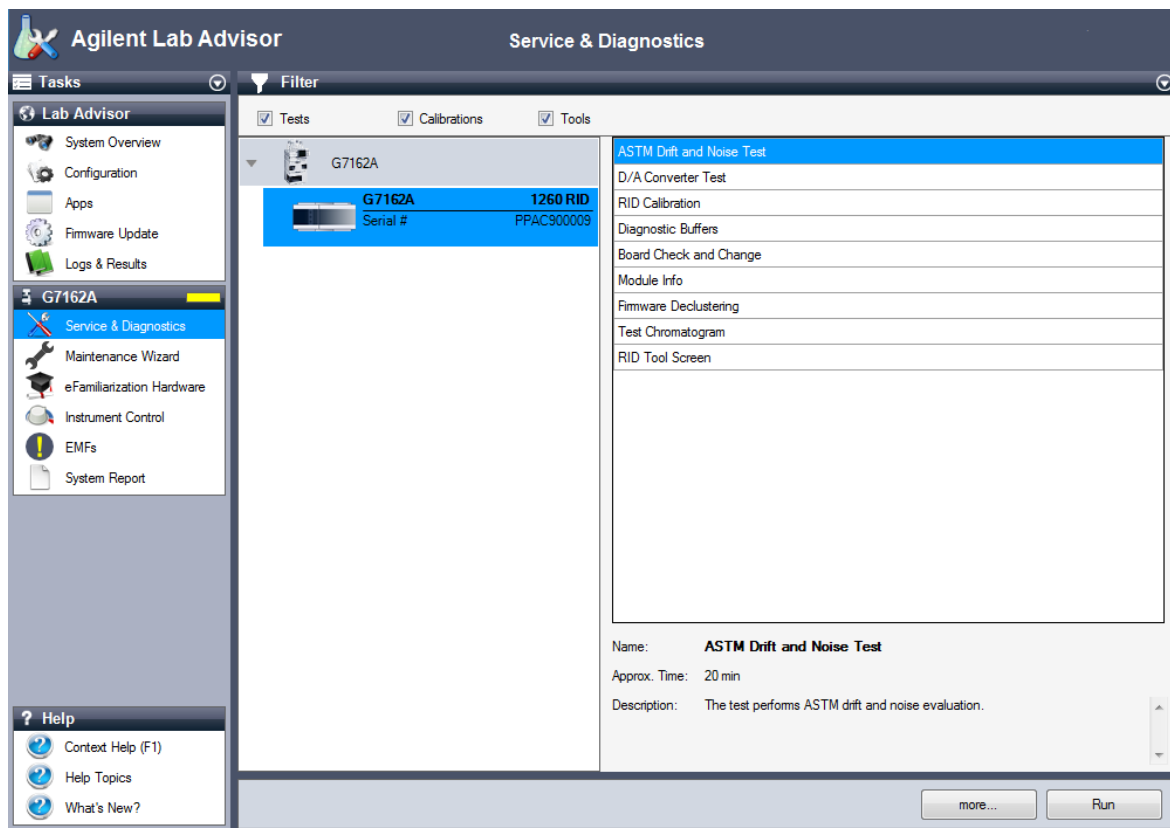


Figure 15 The Lab Advisor shows the available tests

Refractive Index Calibration

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.

Preparing the Calibration

When Recommended after exchange of the optical unit or RIM board.

Tools required **Description**
Laboratory balance

Parts required	#	p/n	Description
	1		DAB/Ph Eur/BP/JP/NF/USP Grade Sucrose
	1	9301-1446	Syringe
	1	9301-0407	Needle
	1	5190-5111	Syringe filter, 0.45 µm, 100/pk
	1	0100-1516	Fitting male PEEK, 2/pk

- 1 Preparation of the sucrose calibration solution.

- a To prepare 25 ml of the calibration solution 87.5 mg of the Sucrose sample is required.
 - b Add the weighed amount of sample into a suitable volumetric flask.
 - c Dispense 10 ml of LC grade water into the flask and shake or stir to dissolve.
 - d 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.
- 2 Preparing the pump.
 - a Fill a suitable solvent bottle with LC grade water.
 - b Connect this bottle to Channel A of the pump, A1 if a binary pump.
 - 3 Flush the degasser and pump.
 - 4 Run the RID Tools Screen with the Agilent Lab Advisor (for further information see Online-Help of user interface). (If an Agilent pump is part of the system, the pump section is active.)

- 5 Purging the sample and reference cells.
 - a The purge valve will automatically switch to the ON position.
 - b Using a syringe or LC pump flush the sample and reference cell with about 20 mL of LC grade water. (If an Agilent pump is part of the system, the pump section is active).
 - c The purge valve will automatically switch to the OFF position when you click **continue**.

- 6** Fill the sample cell with calibration solution.
 - a** Remove the inlet capillary or flushing syringe from the in port.
 - b** Take the syringe and fix the needle to the syringe adapter.
 - c** Suck about 1.5 mL of the calibration sample into the syringe.
 - d** Keep the syringe in a horizontal position.
 - e** Remove the needle.
 - f** Add the filter to the syringe and fit the needle to filter.

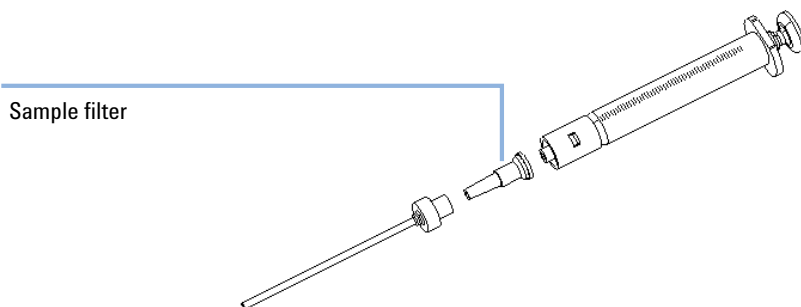


Figure 16 Syringe with Sample Filter

- g** Lift the needle tip and carefully eject approximately 0.5 mL to remove air out of the syringe and to flush the needle.
 - h** Add the PEEK fitting to the needle tip and fix both at the flow cell inlet.

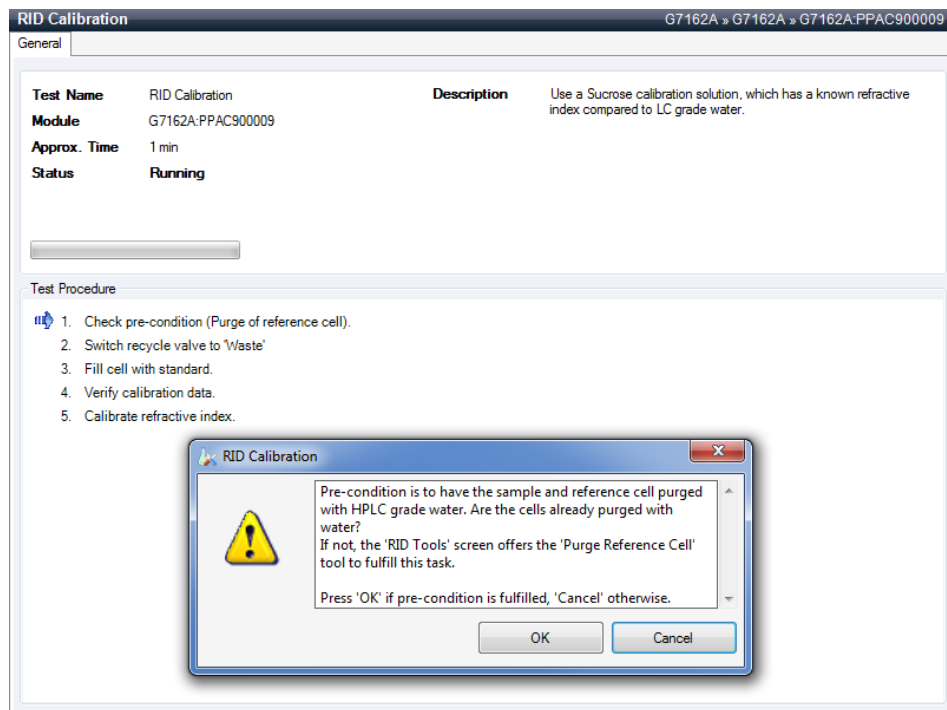
NOTE

Do not inject the calibration solution without the sample filter.

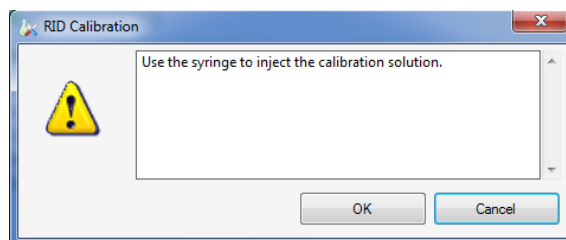
- i** Slowly inject about 1.0 ml and wait for about 10 s to inject another 0.1 mL. This will assure that the cell is filled properly.
- 7** Leave the RID Tools Screen.

Performing the Calibration

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



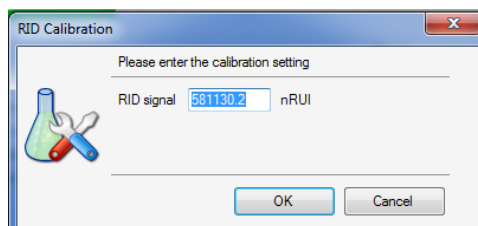
- 2 If the purge of the sample and reference side has been done, start the calibration process with **OK**.
- 3 Inject the calibration sample.



8 Test Functions

Refractive Index Calibration

- 4 If the detector response differs from the theoretical response of $512000 \text{ nRIU} \pm 5000 \text{ nRIU}$ enter the theoretical value (512000) in the dialog box. If the detector response is within the theoretical response click **OK**.



- 5 The calibration was successful.

RID Calibration G7162A » G7162A » G7162A.PPAC900009

General

Test Name	RID Calibration	Description	Use a Sucrose calibration solution, which has a known refractive index compared to LC grade water.
Module	G7162A.PPAC900009 (1260 RID)		
Status	Done		
Start Time	8/14/2015 11:44:55 AM		
Stop Time	8/14/2015 11:45:09 AM		

Test Procedure		Result	
		Name	Value
✓	1. Check pre-condition (Purge of reference cell).	Actual RI Signal	581131.76 nRIU
✓	2. Switch recycle valve to 'Waste'	Calibration setting	500000.00 nRIU
✓	3. Fill cell with standard.		
✓	4. Verify calibration data.		
✓	5. Calibrate refractive index.		

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.

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:

$$\text{diode balance} = \frac{(\text{diode}_1 - \text{diode}_2)}{(\text{diode}_1 + \text{diode}_2)}$$

Where:

- diode_1 = signal proportional to the amount of light falling on diode₁
- diode_2 = signal proportional to the amount of light falling on diode₂

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 When light falling on light receiving diodes is out of balance.

Tools required **Description**
Flat head screwdriver

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.

- 1 Run the RID Tools Screen with the Agilent Lab Advisor (for further information see Online-Help of user interface). (If an Agilent pump is part of the system, the pump section is active.)

The screenshot shows the 'RID Tool Screen' interface. At the top right, the text 'G7162A » G7162A » G7162A:PPAC900009' is visible. The main area is divided into three sections:

- Reference Cell:** Contains a status message 'No pump available'. Below it is a 'Pump' section with a checkbox 'Use Pump' which is unchecked. There are input fields for 'Purge Time [min]' (set to 5), 'Purge Flow [ml/min]' (with a dropdown arrow), and 'Solvent Channel' (with a dropdown arrow). A 'Purge Reference Cell' button is present. Below the button, it says 'Last Purge: 8/11/2015 3:58:12 PM'.
- Recycle Valve:** Contains two radio buttons: 'Waste' (which is selected) and 'Recycle'.
- Optical Balance:** Contains two radio buttons: 'Off' (which is selected) and 'On'. To the right of these is a color-coded scale bar with red, yellow, and green segments, labeled with '-1.000', '0', and '1.000'. Below the scale bar is a 'Diode Balance:' label and an empty input field.

- 2 Purging the sample and reference cells.
 - a Switch the purge valve to the **ON** position.
 - b Purge the sample and reference cells for around 10 min with the solvents to be used.
 - c Switch the purge valve to the **OFF** position
- 3 Select **Optical Balance**.

4 Adjust **Optical Balance**.

- a While monitoring the optical balance use the flat-headed screwdriver to turn the zero glass adjustment screw slowly.
- b When the diode balance value reaches 0.00 (green area), optical balance is restored.

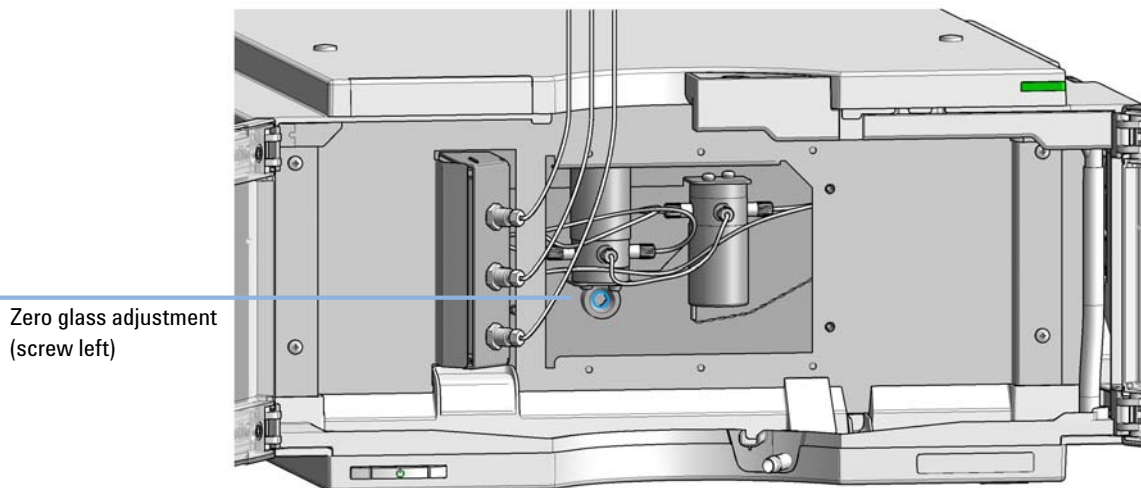


Figure 17 Turning the zero glass adjustment screw

Using the Build-in Test Chromatogram

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

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

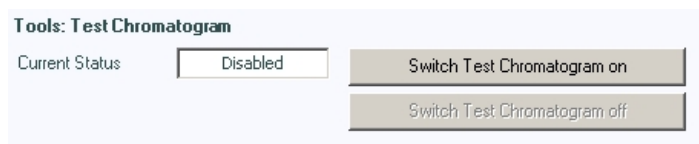
NOTE

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

Procedure Using the Agilent LabAdvisor

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

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



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

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

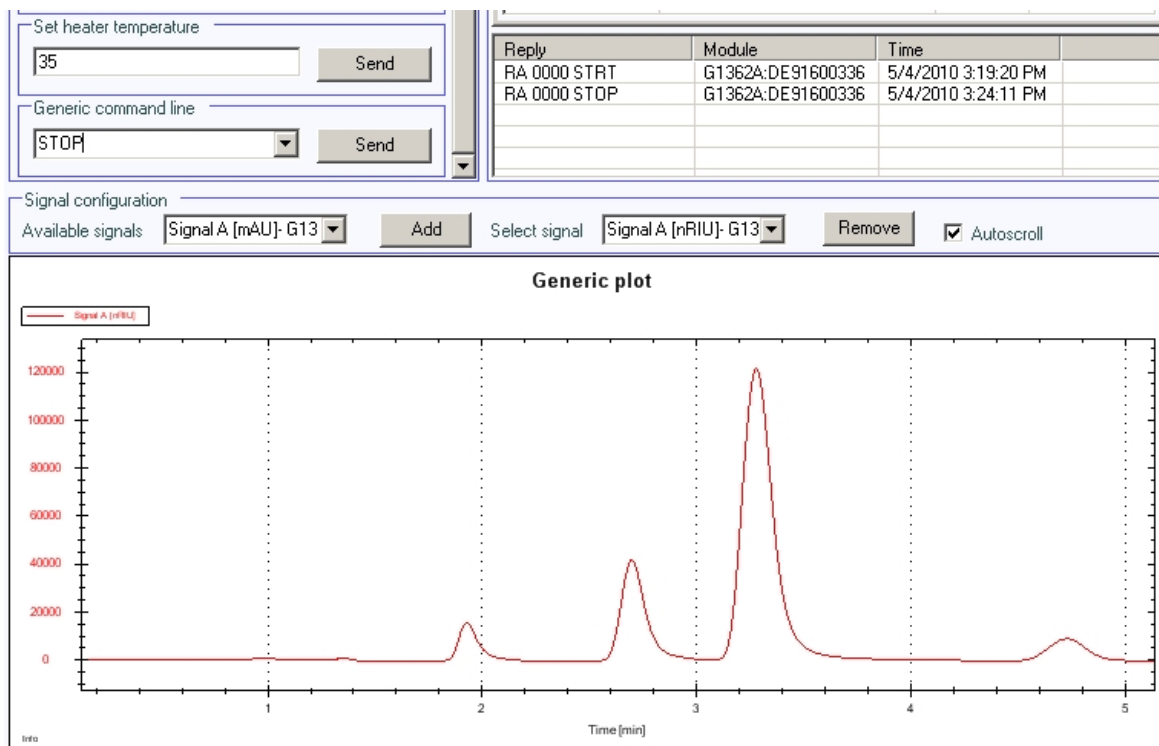


Figure 18 Test Chromatogram with Agilent Lab Advisor

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

NOTE

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

ASTM Drift and Noise Test

Setting the Test Conditions

When If you want to checkout the detector

Tools required **Description**
LC system with G7162A RID

Parts required

#	p/n	Description
1	G1362-87301	Restriction capillary

1 Turn **ON** the detector.

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

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

3 Set up the instrument with the following test conditions.

Table 10 Chromatographic Conditions

Mobile phases	LC grade water
Column	Restriction capillary 2.7 m x 1.7 mm i.d.
Flow rate	1.0 mL/min
Compressibility	46
Stroke	20 µL
Stop time	20 min
Column compartment temperature	35 °C
Optical unit temperature	35 °C
Polarity	Positive
Peak width (response time)	0.2 min (4 s, standard)

4 Set the RID setpoints.

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.

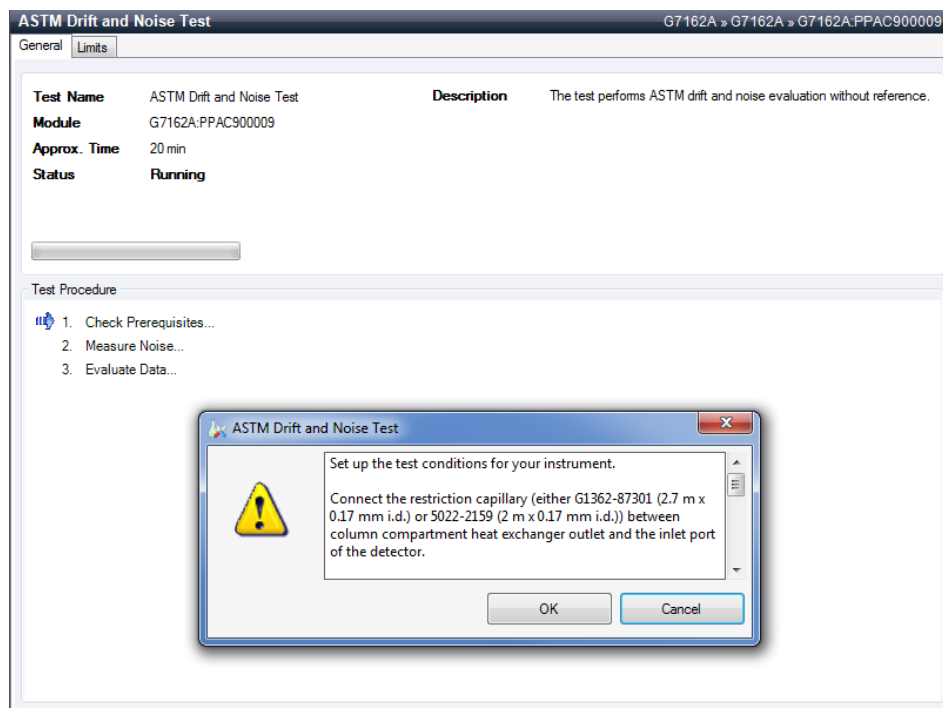
5 Turn the heater **ON** and purge the detector reference cell for 20 min.

6 When purging has finished allow the baseline to stabilize.

NOTE

For optimum performance a stabilization time of 2 hours minimum is recommend.

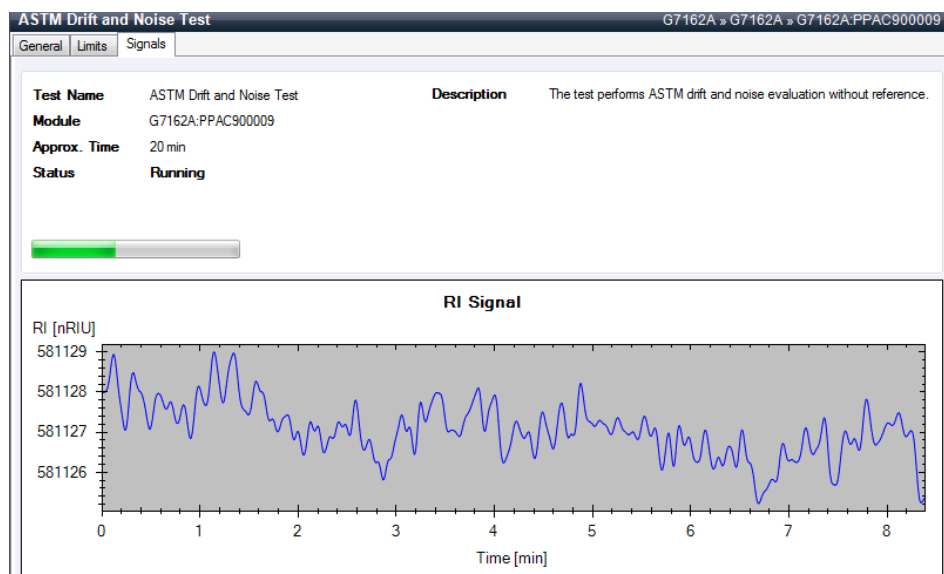
7 Run the ASTM Drift and Noise Test Screen with the Agilent Lab Advisor (for further information see Online-Help of user interface).



8 Test Functions

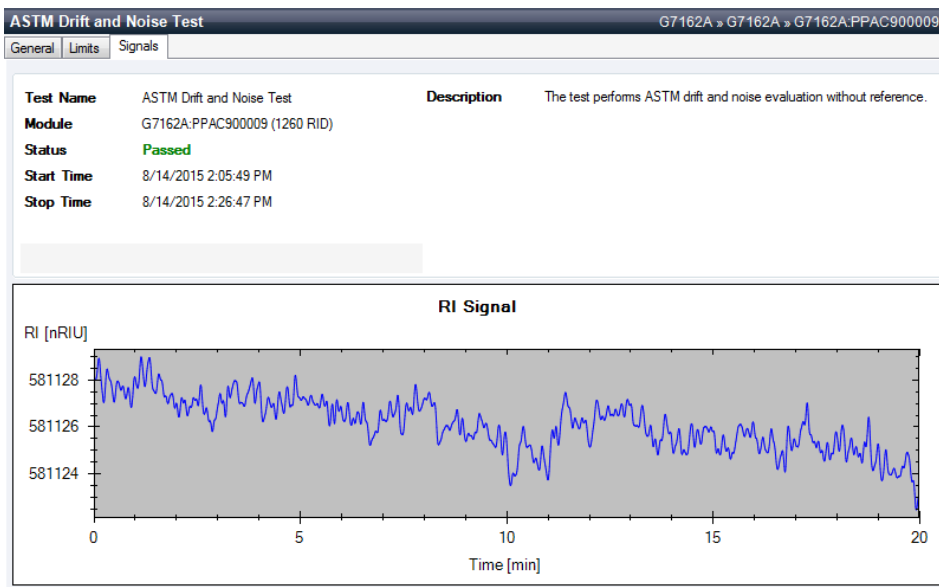
ASTM Drift and Noise Test

8 Click **OK**.



The measurement starts.

The test has completed and shows either PASSED or FAILED.



Evaluation

For the Instant Pilot *Rescale* the plot and measure the baseline noise and drift on the screen. If a printer is configured for the 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.

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

For diagnosing signal problems refer to chapter *"Troubleshooting and Diagnostics"*.

D/A Converter (DAC) Test

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

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

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

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

When If the analog detector signal is noisy or missing.

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

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



Test Evaluation

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

Probable cause

- 1 Bad cable or grounding problem between detector and external device.
- 2 Defective detector main board.

Suggested actions

Check or replace the cable.

Please contact your Agilent service representative.

Other Lab Advisor Functions

EMFs - Early Maintenance Feature

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

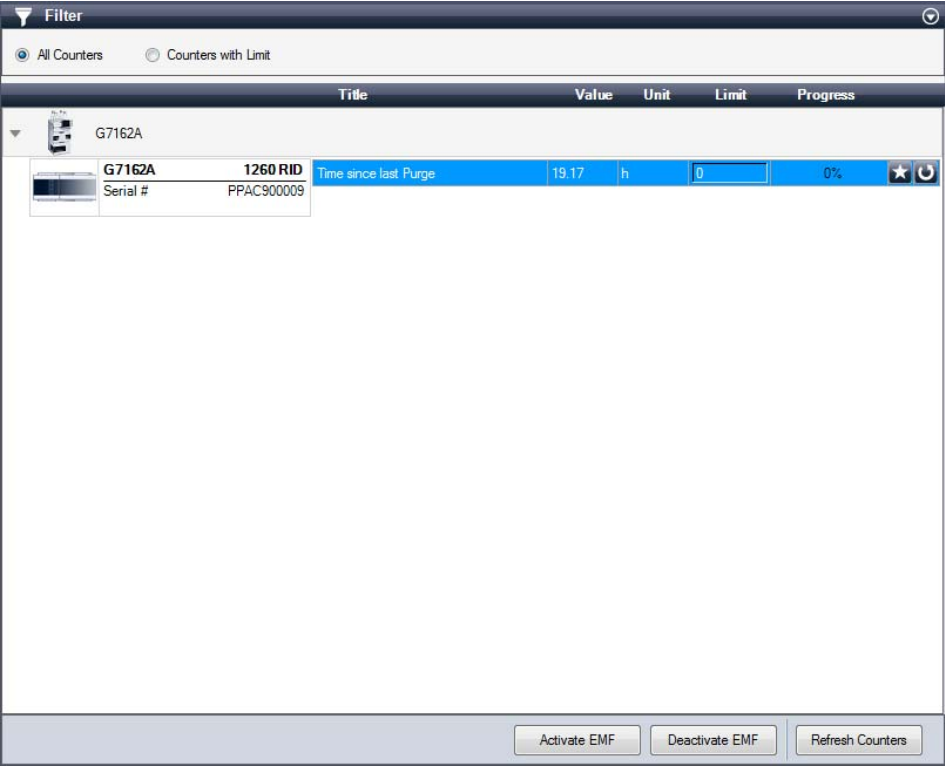


Figure 19 EMFs - Early Maintenance Feature



9 Maintenance and Repair

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Storage of the Detector	124
Remove and Install Doors	125
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This chapter provides general information on maintenance and repair of the detector.



Introduction to Maintenance

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

NOTE

There are no serviceable parts inside.
Do not open the module.

Warnings and Cautions

WARNING

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

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

- Never perform any adjustment, maintenance or repair of the module with the top cover removed and with the power cord plugged in.
 - The security lever at the power input socket prevents that the module cover is taken off when line power is still connected. Never plug the power line back in when cover is removed.
-

WARNING

Sharp metal edges

Sharp-edged parts of the equipment may cause injuries.

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

WARNING

Toxic, flammable and hazardous solvents, samples and reagents

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

- When working with these substances observe appropriate safety procedures (for example by wearing goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the vendor, and follow good laboratory practice.
 - The volume of substances should be reduced to the minimum required for the analysis.
 - Do not operate the instrument in an explosive atmosphere.
-

CAUTION

Electronic boards and components are sensitive to electrostatic discharge (ESD). ESD can damage electronic boards and components.

- Be sure to hold the board by the edges, and do not touch the electrical components. Always use ESD protection (for example, an ESD wrist strap) when handling electronic boards and components.
-

CAUTION

Safety standards for external equipment

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

Overview of Maintenance

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

Table 11 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	If broken or corroded.	Check for leaks.
Replacing the detector's Firmware	If not up to date or corrupted.	

Cleaning the Module

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

WARNING

Liquid dripping into the electronic compartment of your module can cause shock hazard and damage the module

- Do not use an excessively damp cloth during cleaning.
 - Drain all solvent lines before opening any connections in the flow path.
-

Storage of the Detector

NOTE

In case the detector is not used for some time (stored), then fill the flow cell (sample and reference side) with isopropanol.

Remove and Install Doors

Parts required	p/n	Description
	5067-5745	Door Assembly Infinity 180 Left
	5067-5746	Door Assembly Infinity 180 Right

NOTE

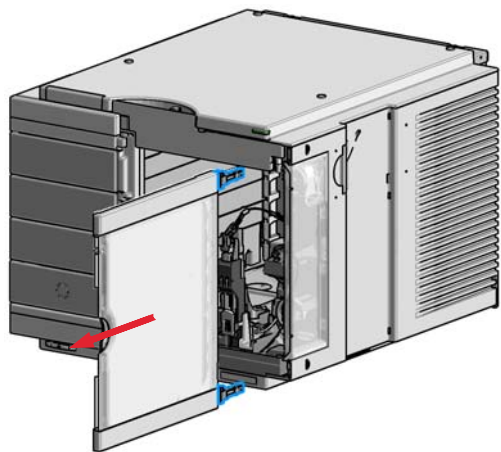
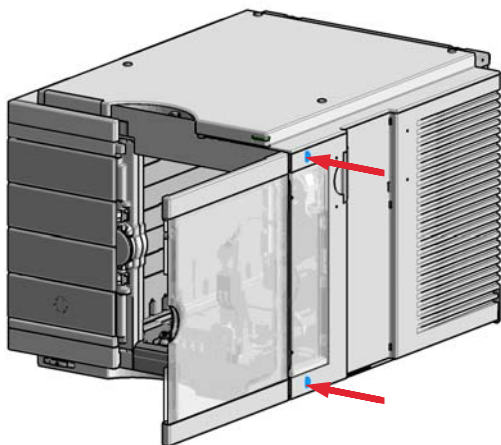
The figures in this procedure show the Infinity II Multisampler module as an example.

The principle of how to remove and/or install doors works in the same way for all Infinity II modules.

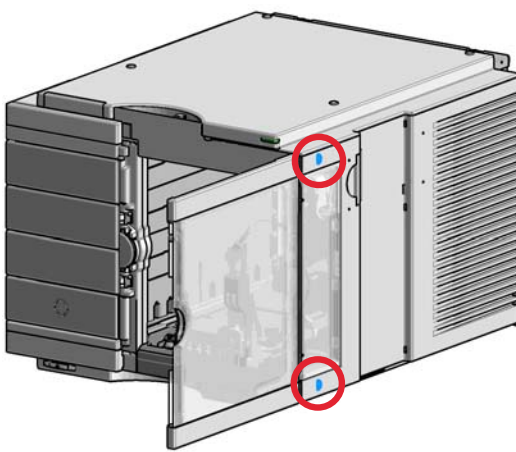
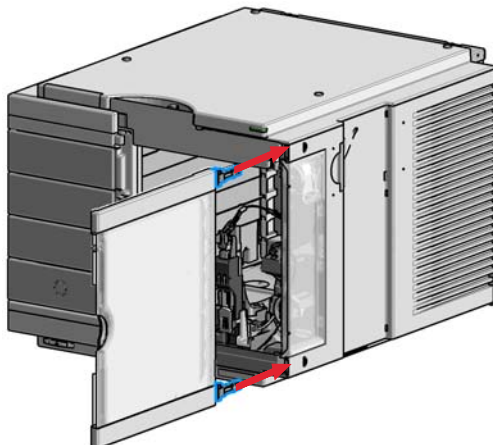
9 Maintenance and Repair

Remove and Install Doors

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



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



Flow Cell Flushing

When If flow cell is contaminated

Tools required

Description
Glass syringe
Adapter

Parts required

#	Description
1	Strong solvent
1	Tubings to waste

WARNING

Dangerous solvents

The strong solvents used in this procedure are toxic and flammable and proper precautions are necessary.

→ Wear protective gloves and goggles.

→ Don't expose yourself to the vapors.

NOTE

Aqueous solvents can build up algae and therefore should do not be left 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.

NOTE

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

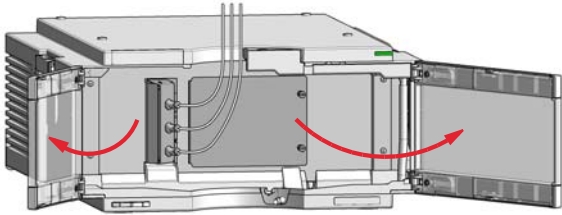
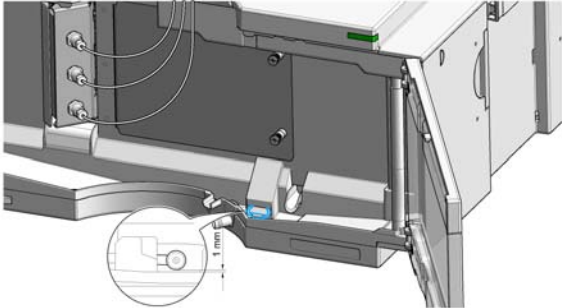
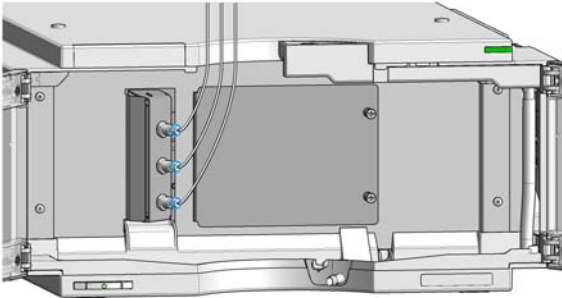
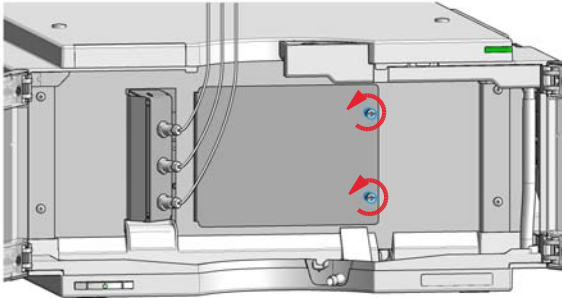
In case the cell is contaminated, follow the procedure below.

- 1 Use the purge mode and flush with the strong solvent.
- 2 Leave this solution in the cell for about one hour.
- 3 Flush with mobile phase.

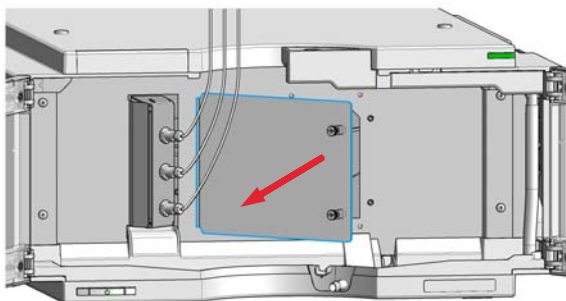
Correct Leaks

When If a leakage has occurred in the valve area or at the capillary connections

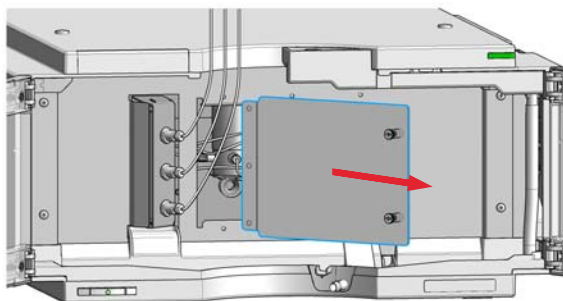
Tools required	Description
	Tissue
	Wrench, 1/4 inch for capillary connections

<p>1 Open the doors.</p> 	<p>2 Observe the leak sensor area for leaks and correct, if required.</p> 
<p>3 Observe the interface ports for leaks and correct, if required.</p> 	<p>4 Unscrew the screws of the Service Door.</p> 

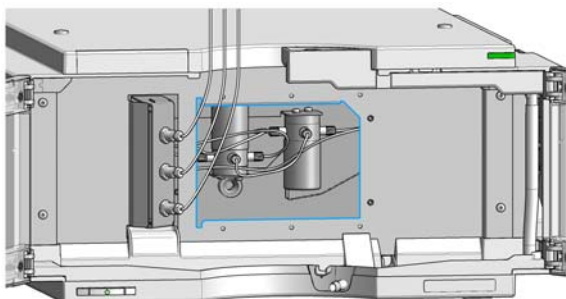
5 Open the Service Door.



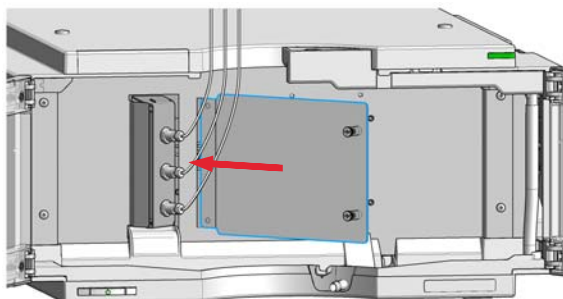
6 Remove the Service Door.



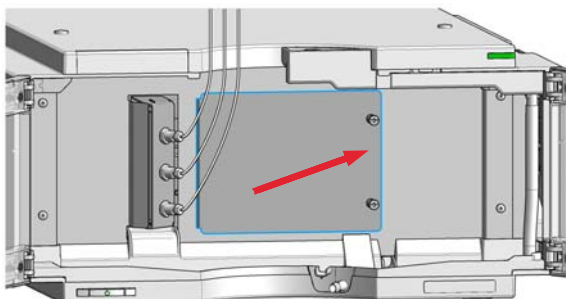
7 Observe the valve area for leaks and correct, if required.



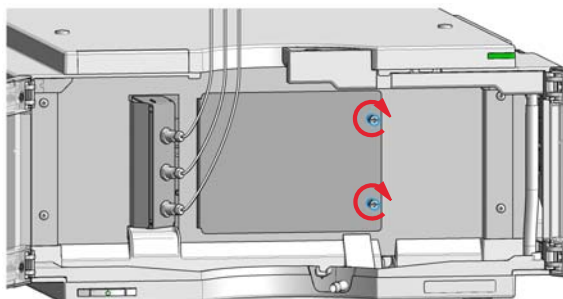
8 Install the Service Door.



9 Close the Service Door.



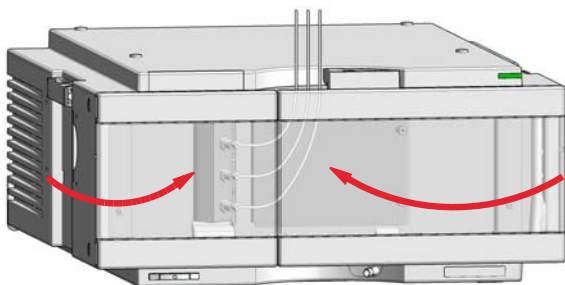
10 Fasten the screws of the Service Door.



9 Maintenance and Repair

Correct Leaks

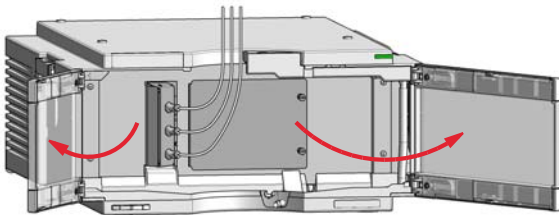
11 Close the doors.



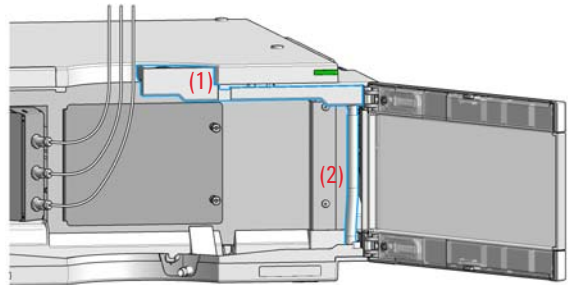
Replace Leak Handling System Parts

Parts required	p/n	Description
	5043-0856	Leak Adapter
	5063-6527	Tubing assembly, i.d. 6 mm, o.d. 9 mm, 1.2 m (to waste) approximately 85 mm required

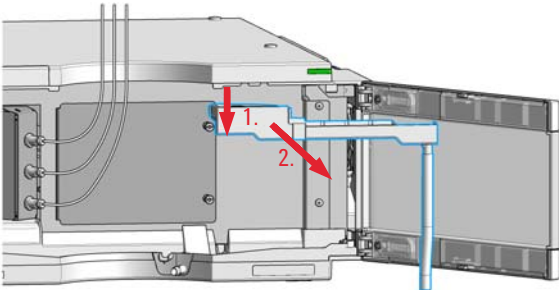
1 Open the doors.



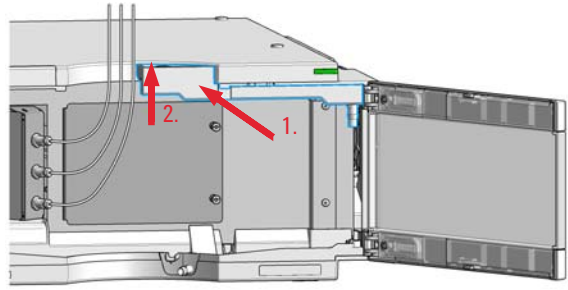
2 Locate the Leak Adapter (1) and Tubing (2).



3 Press the Leak Adapter down and remove it together with the tubing.



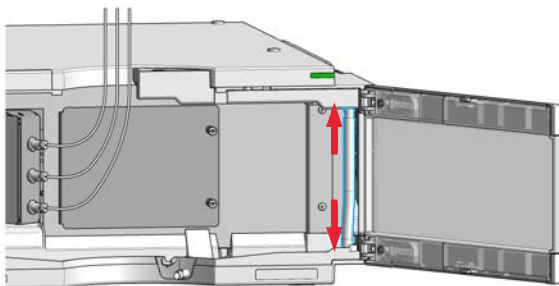
4 Install the Leak Adapter by pressing it into the Main Cover.



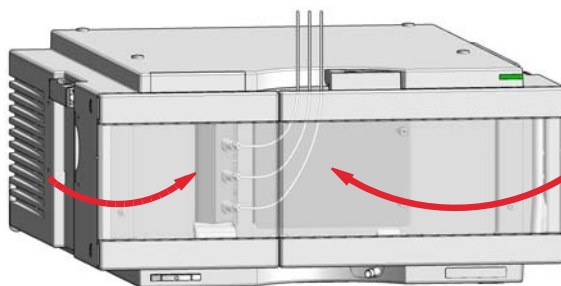
9 Maintenance and Repair

Replace Leak Handling System Parts

- 5** Insert the Tubing (approximately 115 mm required for replacement) between Leak Adapter outlet and Leak Panel.



- 6** Close the doors.



Replace the Module Firmware

When	<p>The installation of newer firmware might be necessary</p> <ul style="list-style-type: none"> • if a newer version solves problems of older versions or • to keep all systems on the same (validated) revision. <p>The installation of older firmware might be necessary</p> <ul style="list-style-type: none"> • to keep all systems on the same (validated) revision or • if a new module with newer firmware is added to a system or • if third party control software requires a special version.
-------------	--

Tools required	Description
	Agilent Lab Advisor software
OR	Instant Pilot G4208A (only if supported by module)

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

Preparations	Read update documentation provided with the Firmware Update Tool.
---------------------	---

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

- 1 Download the required module firmware, the latest FW Update Tool and the documentation from the Agilent web.
http://www.chem.agilent.com/_layouts/agilent/downloadFirmware.aspx?whid=69761
- 2 For loading the firmware into the module follow the instructions in the documentation.

9 **Maintenance and Repair**
Replace the Module Firmware

Module Specific Information

	G7162A/B
Initial firmware	D.06.76
Compatibility with 1100 / 1200 series modules	When using the G7162A/B in a system, all other modules must have firmware from set 6.50 or above (main and resident). Otherwise the communication will not work.
Conversion to / emulation	Not available



10 Parts for Maintenance

Overview of Maintenance Parts [136](#)

Accessory Kit [138](#)

Leak Handling Parts [140](#)

This chapter provides information on parts for maintenance.



Overview of Maintenance Parts

Item	p/n	Description
1	5067-5745	Door Assembly Infinity 180 Left
2	5067-5746	Door Assembly Infinity 180 Right
3	5043-0856	Leak Adapter
4	5063-6527	Tubing assembly, i.d. 6 mm, o.d. 9 mm, 1.2 m (to waste) for Waste and Leak Adapter (ca. 85 mm required)
5	5043-1013	Tubing Clip
	G1362-68706	Interface tubing kit
	G1362-87300	Interfacing capillary
	G1362-87301	Restriction capillary
	G7162-87300	Waste Tube Kit (recycle/waste)

For cables, see “[Cable Overview](#)” on page 144.

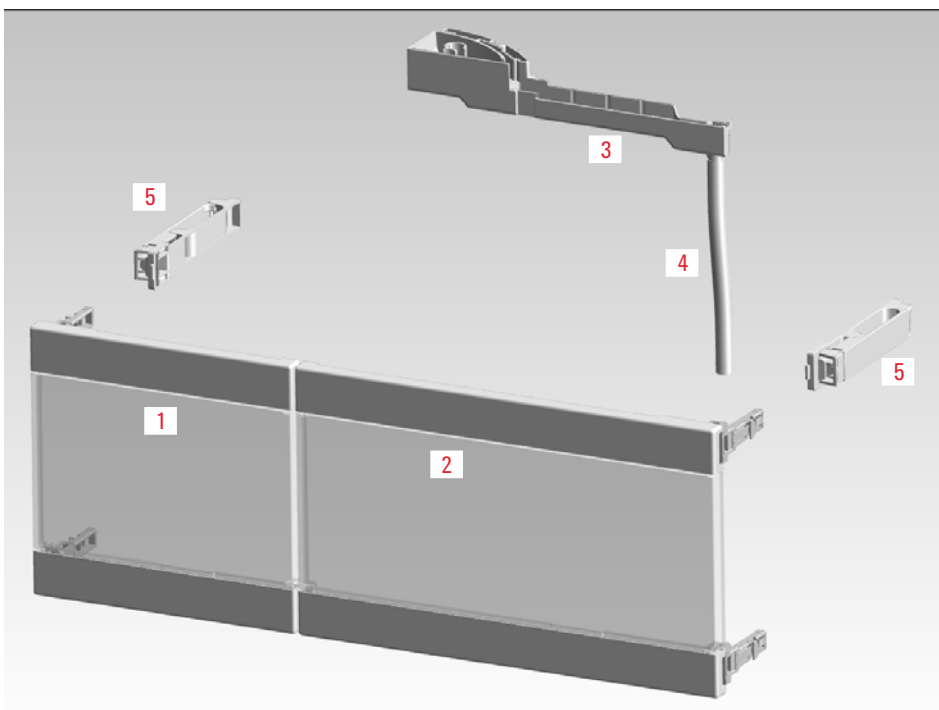


Figure 20 Maintenance Parts

Accessory Kit

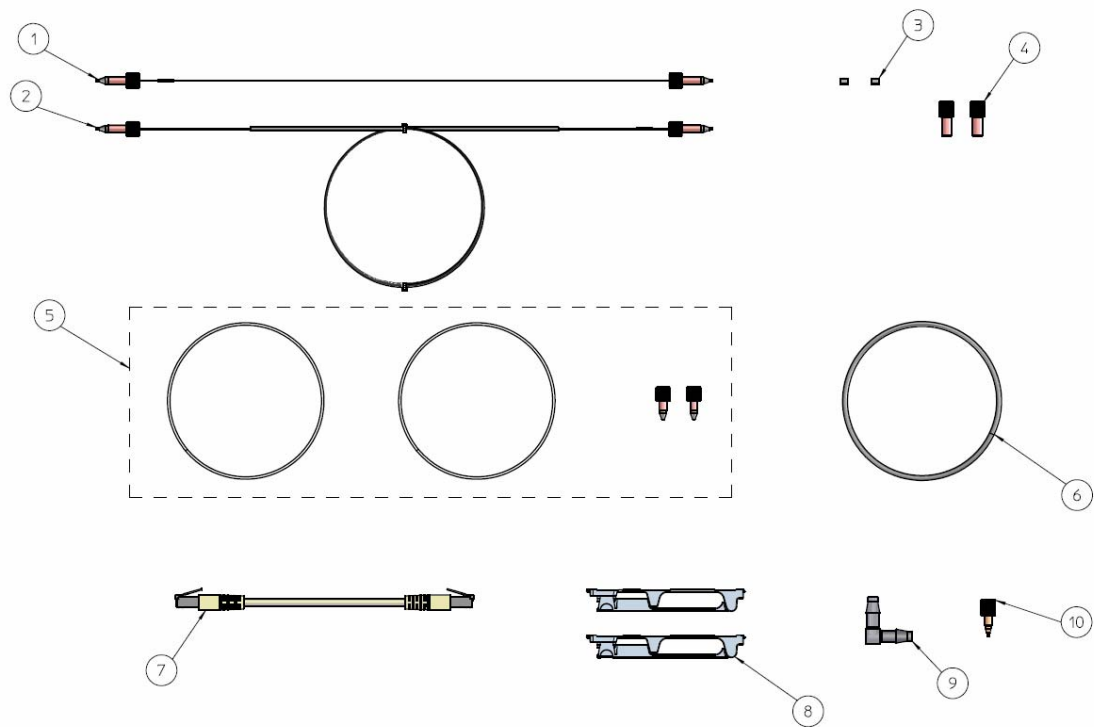


Figure 21 Accessory Kit

Accessory Kit for G7162A

Accessory kit (G7162-68755) contains some accessories needed for the installation of the G7162A RID.

Item	#	p/n	Description
1	1	G1362-87300	Interfacing capillary
2	1	G1362-87301	Restriction capillary
3	2	0100-1700	FERRULE-AY-18IN
4	2	0100-1708	Nut 1/8 PPS
5	1	G7162-87300	Waste Tube Kit (recycle/waste) includes: Fitting, PK (2x), Tubing 2 m (2x)
	1	5042-6449	Flex-Tube OD 1.6 mm
	1	0100-1516	Fitting, PK, 1/16" x 10-32, SH, male nut, 2/pk
6	1	0890-1760	Tubing Flexible 1 ea / 1 meter
	1	5181-1519	CAN cable, Agilent module to module, 1 m
8	2	5043-1013	Tubing Clip
9	1	5500-1155	Tube Connector, 90 degree, ID 6.4
10	1	0100-1847	PEEK adapter 1/4-28 to 10-32 (Adapter AIV to solvent inlet tubes)

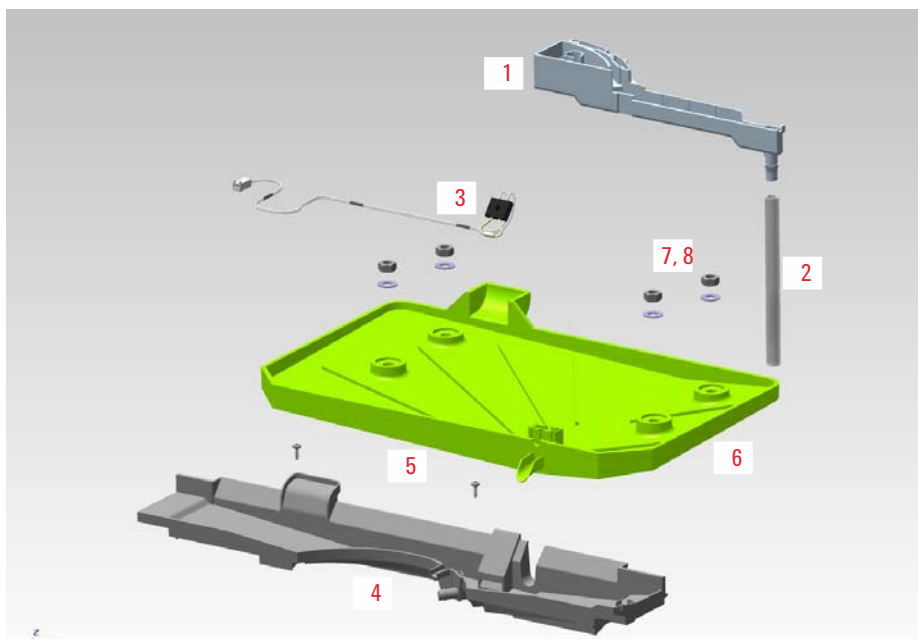
Accessory Kit for G7162B

Accessory kit (G7162-68765) contains some accessories needed for the installation of the G7162B RID.

Item	#	p/n	Description
1	1	5067-4784	Capillary ST 0.075 mm x 220 mm (Sampler to TCC/MCT)
1	1	5067-4783	Capillary ST 0.075 mm x 340 mm (Column to RID)
2	1	G1362-87301	Restriction capillary
3	2	0100-1700	FERRULE-AY-18IN
4	2	0100-1708	Nut 1/8 PPS
5	1	G7162-87300	Waste Tube Kit (recycle/waste) includes: Fitting, PK (2x), Tubing 2 m (2x)
	1	5042-6449	Flex-Tube OD 1.6 mm
	1	0100-1516	Fitting, PK, 1/16" x 10-32, SH, male nut, 2/pk
6	1	0890-1760	Tubing Flexible 1 ea / 1 meter
	1	5181-1519	CAN cable, Agilent module to module, 1 m
8	2	5043-1013	Tubing Clip
9	1	5500-1155	Tube Connector, 90 degree, ID 6.4
10	1	0100-1847	PEEK adapter 1/4-28 to 10-32 (Adapter AIV to solvent inlet tubes)

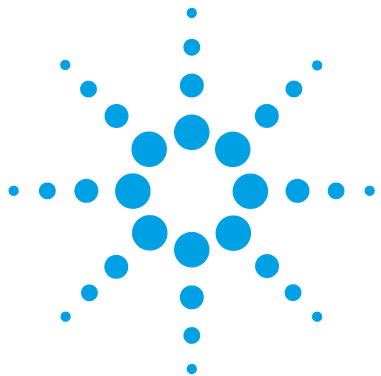
Leak Handling Parts

Item	p/n	Description
1	5043-0856	Leak Adapter
2	5063-6527	Tubing assembly, i.d. 6 mm, o.d. 9 mm, 1.2 m (to waste)
3	5061-3356	Leak sensor
4	G7162-44111	Leak Plane
5	0515-2529	Screw Tapping PAN-HD-TORX T10 3x8 ST-ZN
	5043-1013	Tubing Clip (not shown)
6	G1362-44110	Leak Pan
7	0535-0030	Nut M 14
8	3050-0900	Washer



10 Parts for Maintenance

Leak Handling Parts



11 Identifying Cables

Cable Overview	144
Analog Cables	146
Remote Cables	148
CAN/LAN Cables	152
Agilent Module to PC	153
USB Cables	154

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



Cable Overview

NOTE

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

Analog cables

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

Remote cables

p/n	Description
5188-8029	ERI to general purpose
5188-8044	Remote Cable ERI – ERI
5188-8045	Remote Cable APG – ERI
5061-3378	Remote Cable to 35900 A/D converter
01046-60201	Agilent module to general purpose

CAN cables

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

LAN cables

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

RS-232 cables (not for FUSION board)

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

USB cables

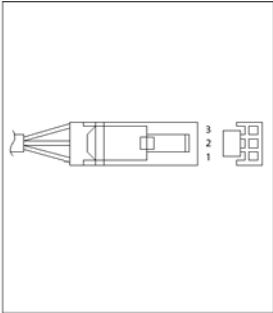
p/n	Description
5188-8050	USB A M-USB Mini B 3 m (PC-Module)
5188-8049	USB A F-USB Mini B M OTG (Module to Flash Drive)

Analog Cables




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

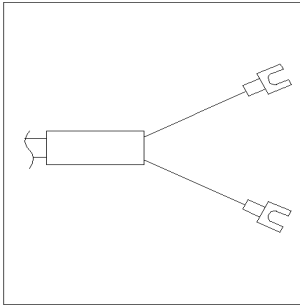
Agilent Module to 35900 A/D converters

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

Agilent Module to BNC Connector

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

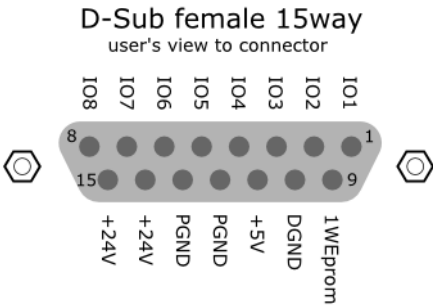
Agilent Module to General Purpose

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

Remote Cables


ERI (Enhanced Remote Interface)

5188-8029 ERI to general purpose


p/n 5188-8029	pin	Color code	Enhanced Remote	Classic Remote	Active (TTL)
	1	white	I01	START REQUEST	Low
	2	brown	I02	STOP	Low
	3	green	I03	READY	High
	4	yellow	I04	POWER ON	High
	5	grey	I05	NOT USED	
	6	pink	I06	SHUT DOWN	Low
	7	blue	I07	START	Low
	8	red	I08	PREPARE	Low
	9	black	1wire DATA		
	10	violet	DGND		
	11	grey-pink	+5V ERI out		
	12	red-blue	PGND		
	13	white-green	PGND		
	14	brown-green	+24V ERI out		
	15	white-yellow	+24V ERI out		
	NC	yellow-brown			

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

Table 12 5188-8044 ERI to ERI

p/n 5188-8044	Pin (ERI)	Signal	Pin (ERI)	Active (TTL)
	10	GND	10	
	1	Start Request	1	Low
	2	Stop	2	Low
	3	Ready	3	High
	5	Power on	5	High
	4	Future	4	
	6	Shut Down	6	Low
	7	Start	7	Low
	8	Prepare	8	Low
	Ground	Cable Shielding	NC	

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

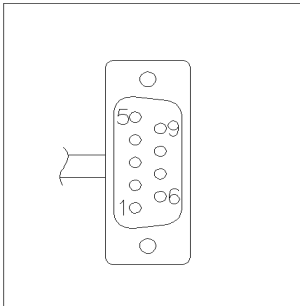
p/n 5188-8045	Pin (ERI)	Signal	Pin (APG)	Active (TTL)
	10	GND	1	
	1	Start Request	9	Low
	2	Stop	8	Low
	3	Ready	7	High
	5	Power on	6	High
	4	Future	5	
	6	Shut Down	4	Low
	7	Start	3	Low
	8	Prepare	2	Low
	Ground	Cable Shielding	NC	

11 Identifying Cables
Remote Cables

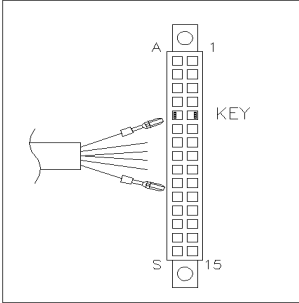


One end of these cables provides a Agilent Technologies APG (Analytical Products Group) remote connector to be connected to Agilent modules. The other end depends on the instrument to be connected to.

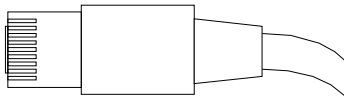
Agilent Module to Agilent 35900 A/D Converters

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

Agilent Module to General Purpose

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

CAN/LAN Cables



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

CAN Cables

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

LAN Cables

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

Agilent Module to PC

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

USB Cables

To connect a USB Flash Drive use a USB OTG cable with Mini-B plug and A socket.

p/n	Description
5188-8050	USB A M-USB Mini B 3 m (PC-Module)
5188-8049	USB A F-USB Mini B M OTG (Module to Flash Drive)



12 Hardware Information

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Setting the 6-bit Configuration Switch	170
Special Settings	172
Instrument Layout	174
Early Maintenance Feedback	175

This chapter describes the module in more detail on hardware and electronics.



Data Flow for Chromatographic Output

The data flow is shown below.

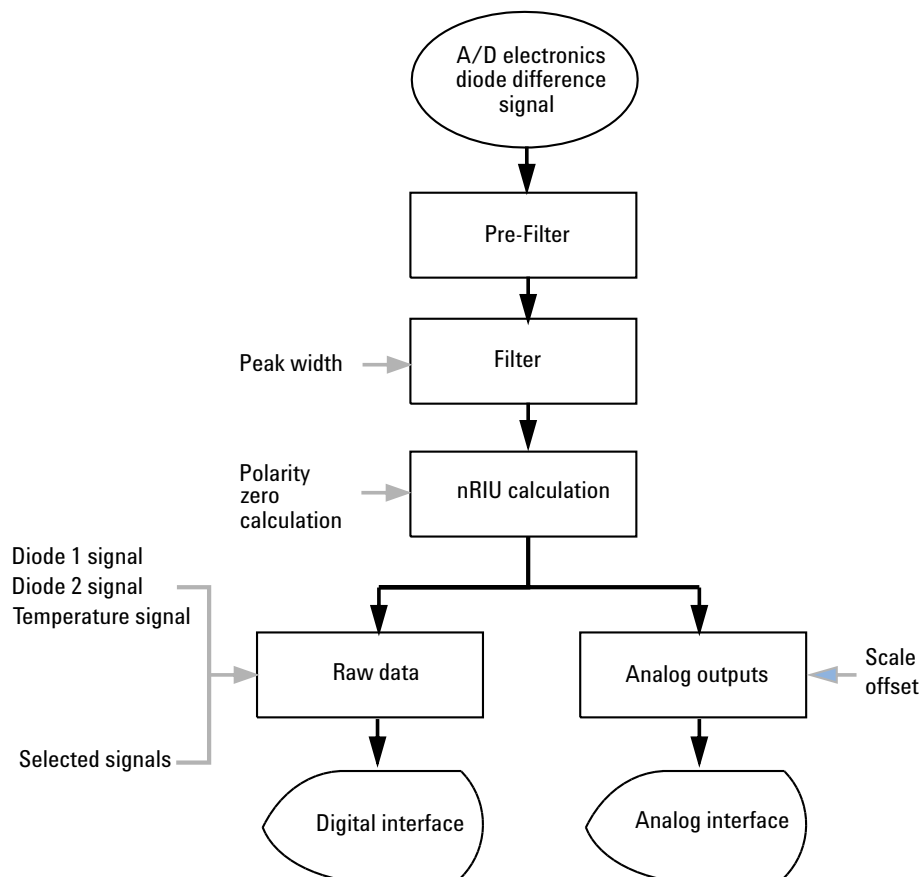


Figure 22 Data flow for chromatographic output

Firmware Description

The firmware of the instrument consists of two independent sections:

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

Resident System

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

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

Main System

Its properties are:

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

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

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

Firmware Updates

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

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

(*) Required tools, firmware and documentation are available from the Agilent web:

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

The file naming conventions are:

PPPP_RVVV_XXX.dlb, where

PPPP is the product number, for example, 1315B for the G1315B DAD,

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

VVV is the revision number, for example 650 is revision 6.50,

XXX is the build number of the firmware.

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

NOTE

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

Main and resident firmware must be from the same set.

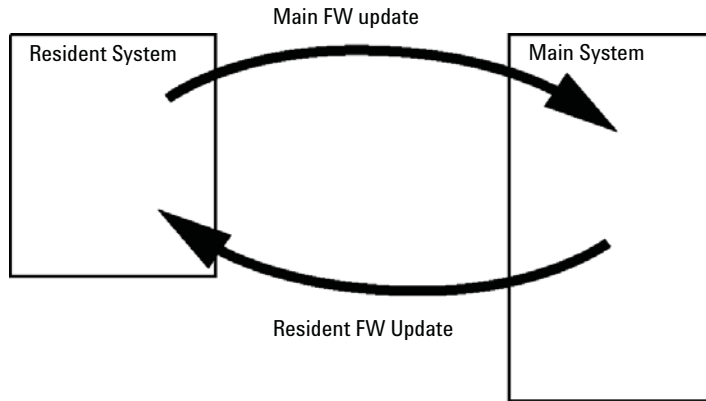


Figure 23 Firmware Update Mechanism

NOTE

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

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

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

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

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

Electrical Connections

- The CAN bus is a serial bus with high-speed data transfer. The two connectors for the CAN bus are used for internal module data transfer and synchronization.
- One analog output provides signals for integrators or data handling systems.
- The ERI/REMOTE connector may be used in combination with other analytical instruments from Agilent Technologies if you want to use features such as start, stop, common shutdown, prepare, and so on.
- With the appropriate software, the LAN connector may be used to control the module from a computer through a LAN connection. This connector is activated and can be configured with the configuration switch.
- With the appropriate software, the USB connector may be used to control the module from a computer through a USB connection.
- The power input socket accepts a line voltage of 100 – 240 VAC \pm 10 % with a line frequency of 50 or 60 Hz. Maximum power consumption varies by module. There is no voltage selector on your module because the power supply has wide-ranging capability. There are no externally accessible fuses because automatic electronic fuses are implemented in the power supply.

NOTE

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

Rear View of the Module

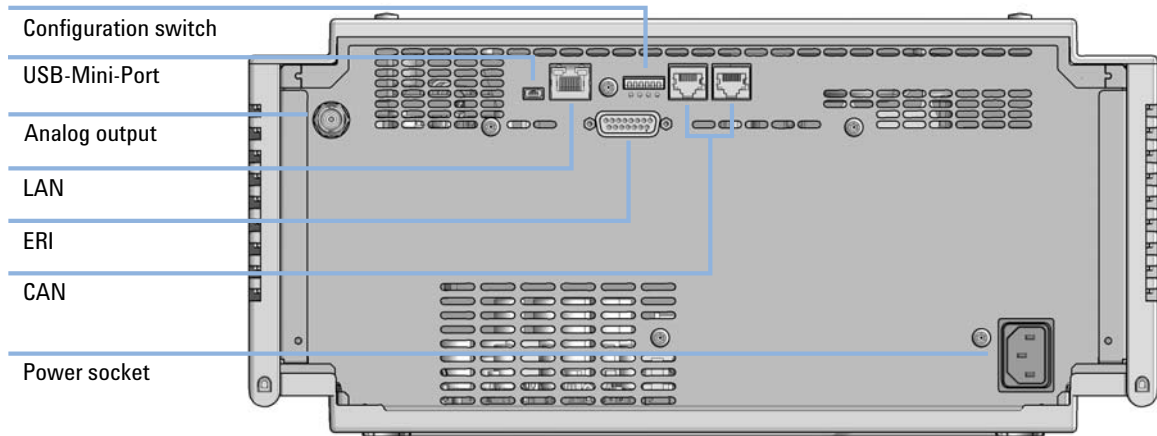


Figure 24 Rear view of the Refractive Index Detector

Information on Instrument Serial Number

Serial Number Information 1200 Series and 1290 Infinity

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

CCYWWSSSSS	Format
CC	country of manufacturing <ul style="list-style-type: none">• DE = Germany• JP = Japan• CN = China
YWW	year and week of last major manufacturing change, e.g. 820 could be week 20 of 1998 or 2008
SSSSS	real serial number

Serial Number Information 1260 Infinity

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

CCXZZ00000	Format
CC	Country of manufacturing <ul style="list-style-type: none">• DE = Germany• JP = Japan• CN = China
X	Alphabetic character A-Z (used by manufacturing)
ZZ	Alpha-numeric code 0-9, A-Z, where each combination unambiguously denotes a module (there can be more than one code for the same module)
00000	Serial number

Interfaces

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

Table 13 Agilent 1200 Infinity II Series Interfaces

Module	CAN	USB	LAN (on-board)	RS-232	Analog	APG (A) / ERI (E)	Special
Pumps							
G7104A Flexible Pump	2	No	Yes	Yes	1	A	
G7120A High Speed Pump	2	No	Yes	Yes	1	A	
Samplers							
G7129A/B ALS	2	Yes	Yes	No	No	E	
G7167A/B Multisampler	2	Yes	Yes	No	No	E	
Detectors							
G7114A/B VWD	2	Yes	Yes	No	1	E	
G7117A/B DAD	2	Yes	Yes	No	1	E	
G7115A/B DAD	2	Yes	Yes	No	1	E	
G7162A/B RID	2	Yes	Yes	No	1	E	
Others							
G7116B MCT	2	No	No	No	No	No	Requires a HOST module via CAN

NOTE

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

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

Overview Interfaces

CAN

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

LAN

The modules have either an interface slot for an LAN card (e.g. Agilent G1369B/C LAN Interface) or they have an on-board LAN interface (e.g. detectors G1315C/D DAD and G1365C/D MWD). This interface allows the control of the module/system via a PC with the appropriate control software. Some modules have neither on-board LAN nor an interface slot for a LAN card (e.g. G1170A Valve Drive or G4227A Flex Cube). These are hosted modules and require a Host module with firmware B.06.40 or later or with additional G1369C LAN Card.

NOTE

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

USB

The USB interface replaces the RS-232 Serial interface in new FUSION generation modules. For details on USB refer to “[USB \(Universal Serial Bus\)](#)” on page 169.

Analog Signal Output

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

Remote (ERI)

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

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

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

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

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

NOTE

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

Table 14 ERI signal distribution

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

Special Interfaces

There is no special interface for this module.

ERI (Enhanced Remote Interface)

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

ERI Description

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

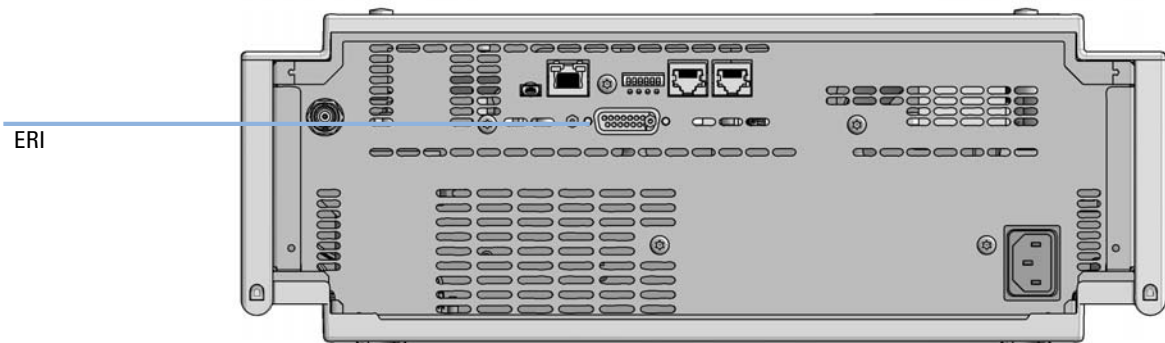
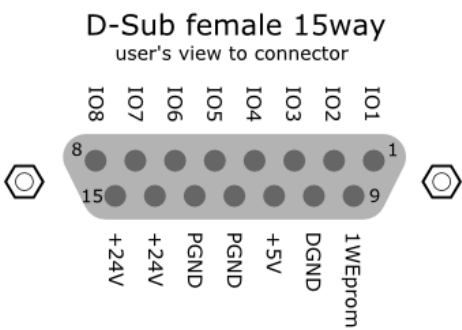


Figure 25 Location of the ERI interface (example shows a G7114A/B VWD)

	Pin	Enhanced Remote
 <p>D-Sub female 15way user's view to connector</p>	1	IO 1 (START REQUEST)
	2	IO 2 (STOP)
	3	IO 3 (READY)
	4	IO 4 (POWER ON)
	5	IO 5 (NOT USED)
	6	IO 6 (SHUT DOWN)
	7	IO 7 (START)
	8	IO 8 (PREPARE)
	9	1 wire DATA
	10	DGND
	11	+5 V ERI out
	12	PGND
	13	PGND
	14	+24 V ERI out
	15	+24 V ERI out

IO (Input/Output) Lines

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

1-Wire Data (Future Use)

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

5V Distribution (Future Use)

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

24V Distribution (Future Use)

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

USB (Universal Serial Bus)

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

- a PC with control software (for example Agilent Lab Advisor)
- USB Flash Disk

Setting the 6-bit Configuration Switch

The 6-bit configuration switch is located at the rear of the module with FUSION electronics. Switch settings provide configuration parameters for LAN and instrument specific initialization procedures.

All modules with FUSION electronics:

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

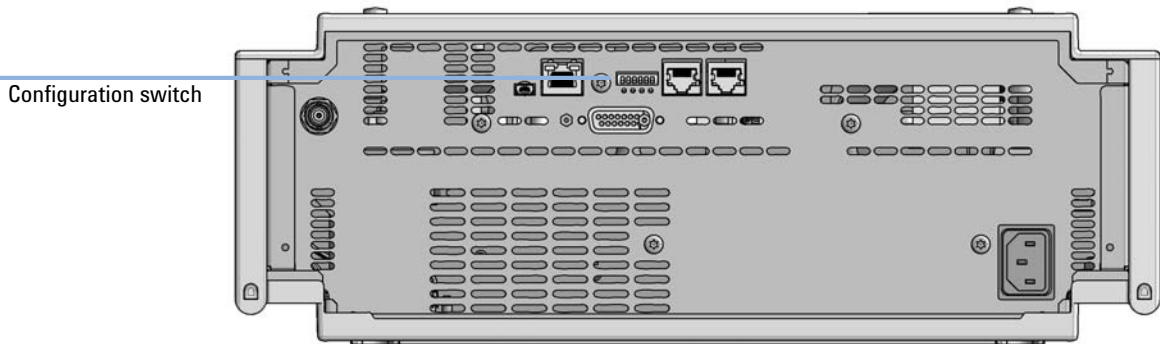


Figure 26 Location of Configuration switch (example shows a G7114A/B VWD)

Table 15 6-bit Configuration Switch

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

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

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

³ Default IP Address is 192.168.254.11

⁴ Host Name will be the MAC address.

Special Settings

Boot-Resident/Main

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

If you use the following switch settings and power the instrument up again, the instrument firmware stays in the resident/main mode. In resident mode, it is not operable as a module. It only uses basic functions of the operating system for example, for communication. In this mode the main firmware can be loaded (using update utilities).

Forced Cold Start

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

- Boot Main System / Revert to Default Data

The instrument will boot to main mode and changes to the module's default parameter. May be also required to load resident firmware into the module.

- Boot Resident System / Revert to Default Data

The instrument will boot to resident mode and changes to the module's default parameter. May be also required to load main firmware into the module.

CAUTION

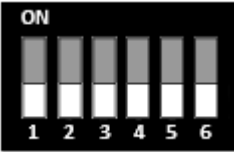
Loss of data

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

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

If you use the following switch settings and power the instrument up again, it will start as described above.

Table 16 Boot Resident / Forced Coldstart

	SW1	SW2	SW3	SW4	SW5	SW6	Init Mode
	1	0	0	0	0	0	Boot Main System / Keep Data
	1	1	0	0	0	0	Boot Resident System / Keep Data
	1	0	0	0	0	1	Boot Main System / Revert to Default Data
	1	1	0	0	0	1	Boot Resident System / Revert to Default Data
Note: The setting '0' (down) is essential.							

Instrument Layout

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

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

Early Maintenance Feedback

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

EMF Counters

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

Using the EMF Counters

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

Setting the EMF Limits

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

12 Hardware Information

Early Maintenance Feedback



13 LAN Configuration

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



What You Have to Do First

The module has an on- board LAN communication interface.

NOTE

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

- 1 Note the MAC (Media Access Control) address for further reference. The MAC or hardware address of the LAN interfaces is a world wide unique identifier. No other network device will have the same hardware address. The MAC address can be found on a label at the rear of the module underneath the configuration switch (see [Figure 28](#) on page 178).

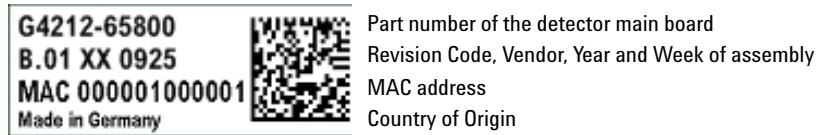


Figure 27 MAC-Label

- 2 Connect the instrument's LAN interface (see [Figure 28](#) on page 178) to
 - the PC network card using a crossover network cable (point-to-point) or
 - a hub or switch using a standard LAN cable.

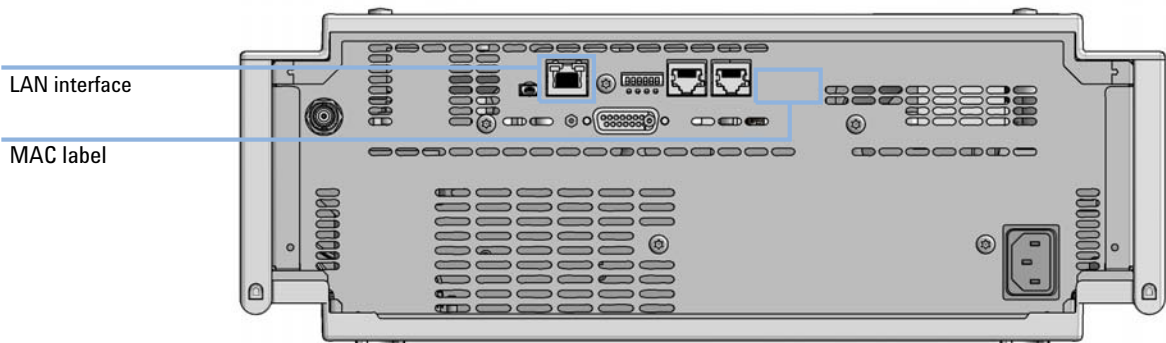


Figure 28 Location of LAN interfaces and MAC label

TCP/IP parameter configuration

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

- IP address
- Subnet Mask
- Default Gateway

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

- by automatically requesting the parameters from a network-based BOOTP Server (using the so-called Bootstrap Protocol)
- by automatically requesting the parameters from a network-based DHCP Server (using the so-called Dynamic Host Configuration Protocol). This mode requires a LAN-onboard Module or a G1369C LAN Interface card, see “[Setup \(DHCP\)](#)” on page 186
- by manually setting the parameters using Telnet
- by manually setting the parameters using the Instant Pilot (G4208A)

The LAN interface differentiates between several initialization modes. The initialization mode (short form ‘init mode’) defines how to determine the active TCP/IP parameters after power-on. The parameters may be derived from a Bootp cycle, non-volatile memory or initialized with known default values. The initialization mode is selected by the configuration switch, see [Table 18](#) on page 181.

Configuration Switches

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

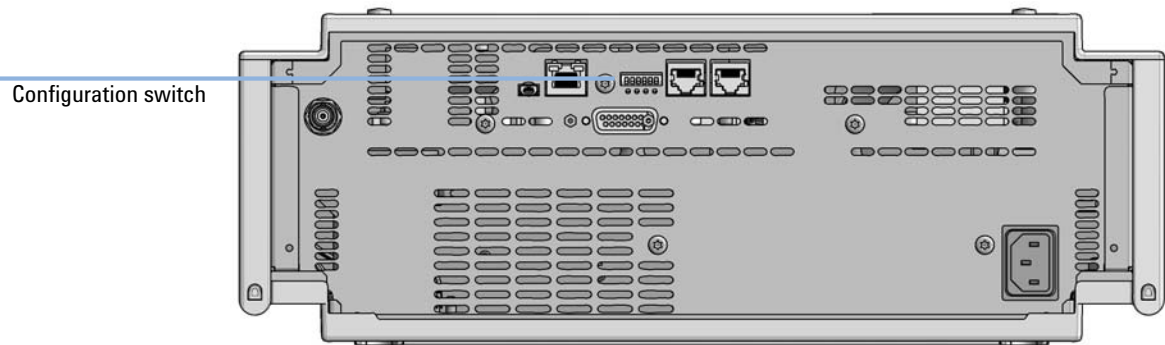


Figure 29 Location of Configuration switch (example shows a G7114A/B VWD)

The module is shipped with all switches set to OFF, as shown above.

NOTE

To perform any LAN configuration, SW1 and SW2 must be set to OFF.


Table 17 Factory Default Settings

Initialization ('Init') Mode	Bootp, all switches down. For details see "Initialization Mode Selection" on page 181
------------------------------	---

Initialization Mode Selection

The following initialization (init) modes are selectable:

Table 18 Initialization Mode Switches

	SW1	SW2	SW3	SW4	SW5	SW6	Init Mode
	0	0	0	0	0	0	Use Default IP Address
	0	0	0	0	1	0	Use Stored IP Address
	0	0	0	1	0	0	Use DHCP

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

Default IP address for LAN is 192.168.254.11.

DHCP address is the module's LAN MAC address.

Bootp

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

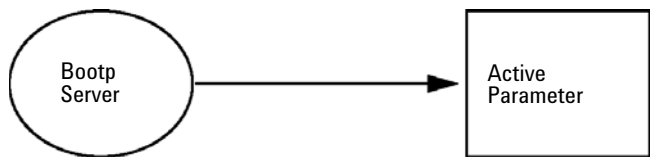


Figure 30 Bootp (Principle)

Bootp & Store

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

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

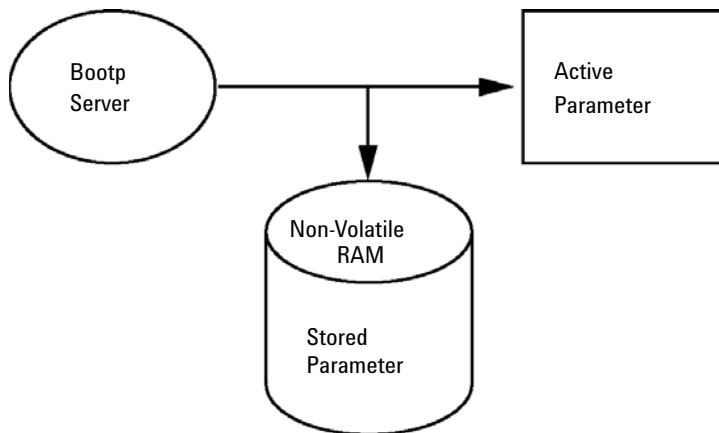


Figure 31 Bootp & Store (Principle)

NOTE

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

Using Stored

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

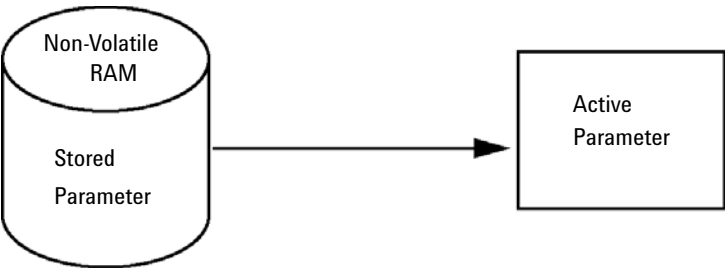


Figure 32 Using Stored (Principle)

Using Default

When **Using Default** is selected, the factory default parameters are taken instead. These parameters enable a TCP/IP connection to the LAN interface without further configuration, see [Table 19](#) on page 183.

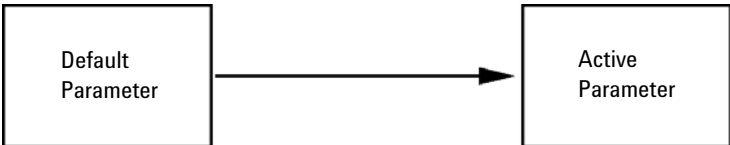


Figure 33 Using Default (Principle)

NOTE

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

Table 19 Using Default Parameters

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

13 LAN Configuration

Initialization Mode Selection

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

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

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

NOTE

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

Dynamic Host Configuration Protocol (DHCP)

General Information (DHCP)

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

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

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



Figure 34 DHCP (Principle)

NOTE

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

13 LAN Configuration

Dynamic Host Configuration Protocol (DHCP)

Setup (DHCP)

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

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

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

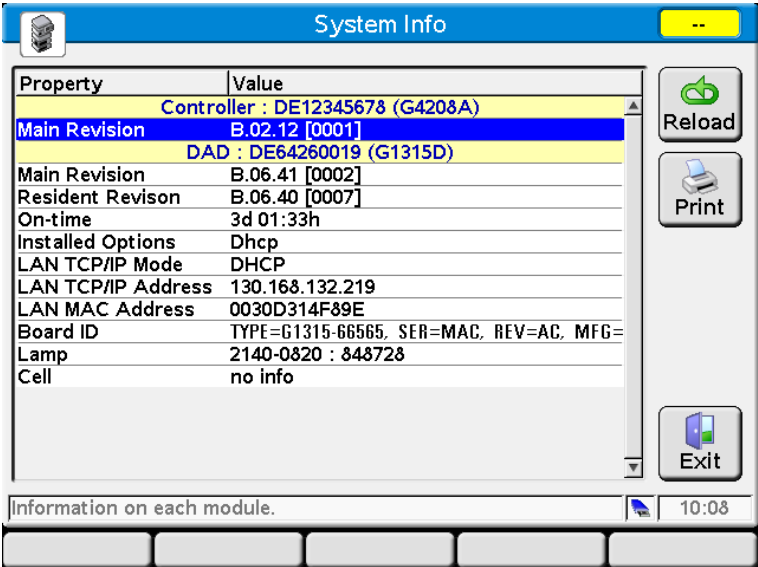


Figure 35 LAN Setting on Instant Pilot

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

Table 20 G1369C LAN Interface Card (configuration switch on the card)

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

Table 21 LC Modules inclusive 1120/1220 (configuration switch at rear of the instrument)

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

- 3** Turn on the module that hosts the LAN interface.
- 4** Configure your Control Software (e.g. Agilent ChemStation, Lab Advisor, Firmware Update Tool) and use MAC address as host name, e.g. *0030d3177321*.

The LC system should become visible in the control software (see Note in section “[General Information \(DHCP\)](#)” on page 185).

Manual Configuration

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

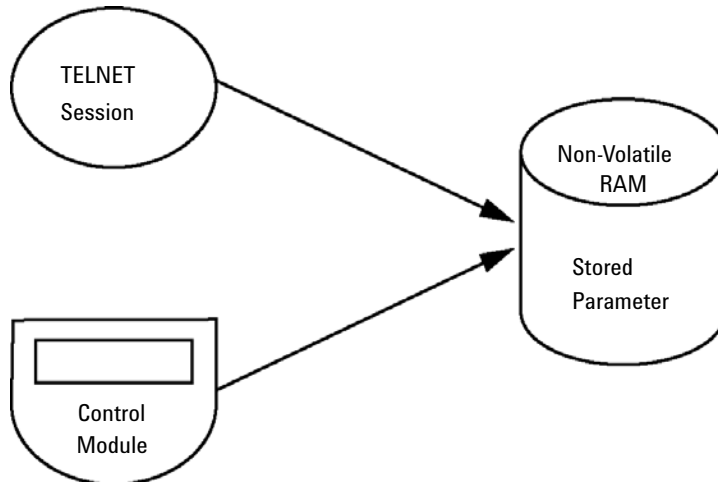


Figure 36 Manual Configuration (Principle)

With Telnet

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

- 1 Open the system (DOS) prompt window by clicking on Windows **START** button and select **"Run..."**. Type "cmd" and press OK.
- 2 Type the following at the system (DOS) prompt:
 - `c:\>telnet <IP address>` or
 - `c:\>telnet <host name>`

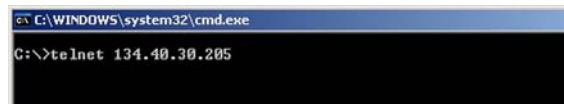


Figure 37 Telnet - Starting a session

where <IP address> may be the assigned address from a Bootp cycle, a configuration session with the Handheld Controller, or the default IP address (see ["Configuration Switches"](#) on page 180).

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

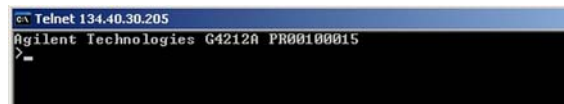


Figure 38 A connection to the module is made

- 3 Type
? and press enter to see the available commands.

```
cs Telnet 134.40.30.205
Agilent Technologies G4212A PR00100015
>?
command syntax      description
-----
?                    display help info
/                    display current LAN settings
ip <x.x.x.x>          set IP Address
sm <x.x.x.x>          set Subnet Mask
gw <x.x.x.x>          set Default Gateway
exit                exit shell
>
```

Figure 39 Telnet Commands

Table 22 Telnet Commands

Value	Description
?	displays syntax and descriptions of commands
/	displays current LAN settings
ip <x.x.x.x>	sets new ip address
sm <x.x.x.x>	sets new subnet mask
gw <x.x.x.x>	sets new default gateway
exit	exits shell and saves all changes

- 4 To change a parameter follows the style:
- parameter value, for example:
ip 134.40.28.56
- Then press [Enter], where parameter refers to the configuration parameter you are defining, and value refers to the definitions you are assigning to that parameter. Each parameter entry is followed by a carriage return.

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

```

c> Telnet 134.40.30.205
>/
LAN Status Page
-----
MAC Address   : 0030D317521C
Init Mode     : Using Stored
TCP/IP Properties
- active -
IP Address    : 134.40.30.205
Subnet Mask   : 255.255.248.0
Def. Gateway  : 134.40.24.1
TCP/IP Status : Ready
Controllers   : no connections
>_

```

Figure 40 Telnet - Current settings in "Using Stored" mode

information about the LAN interface
MAC address, initialization mode
Initialization mode is Using Stored
active TCP/IP settings

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

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

```

c> Telnet 134.40.30.205
>ip 192.168.254.12
>/
LAN Status Page
-----
MAC Address   : 0030D317521C
Init Mode     : Using Stored
TCP/IP Properties
- active -
IP Address    : 134.40.30.205
Subnet Mask   : 255.255.248.0
Def. Gateway  : 134.40.24.1
- stored -
IP Address    : 192.168.254.12
Subnet Mask   : 255.255.248.0
Def. Gateway  : 134.40.24.1
TCP/IP Status : Ready
Controllers   : no connections
>_

```

Figure 41 Telnet - Change IP settings

change of IP setting to
Initialization mode is Using Stored
active TCP/IP settings

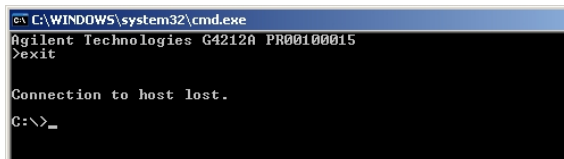
stored TCP/IP settings in non-volatile memory

connected to PC with controller software (e.g. Agilent
ChemStation), here not connected

13 LAN Configuration

Manual Configuration

- 7 When you have finished typing the configuration parameters, type **exit** and press **Enter** to exit with storing parameters.



```
C:\WINDOWS\system32\cmd.exe
Agilent Technologies G4212A PR00100015
>exit

Connection to host lost.
C:\>_
```

Figure 42 Closing the Telnet Session

NOTE

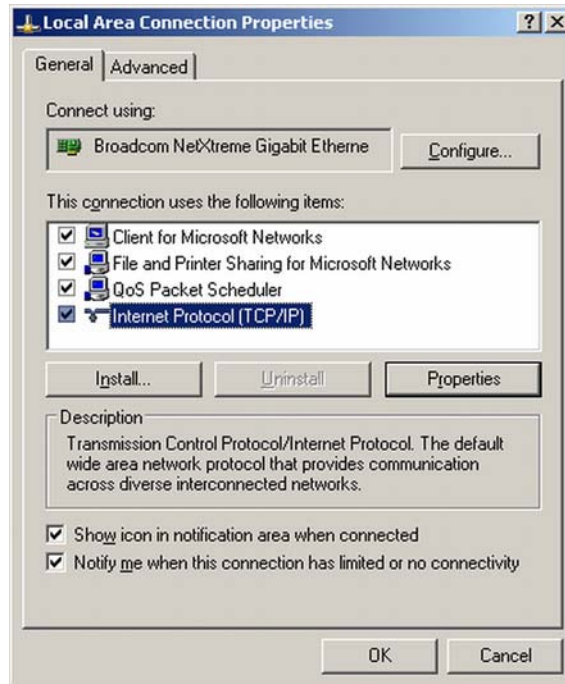
If the Initialization Mode Switch is changed now to “Using Stored” mode, the instrument will take the stored settings when the module is re-booted. In the example above it would be 192.168.254.12.

PC and Agilent ChemStation Setup

PC Setup for Local Configuration

This procedure describes the change of the TCP/IP settings on your PC to match the module's default parameters in a local configuration (see Table 19 on page 183).

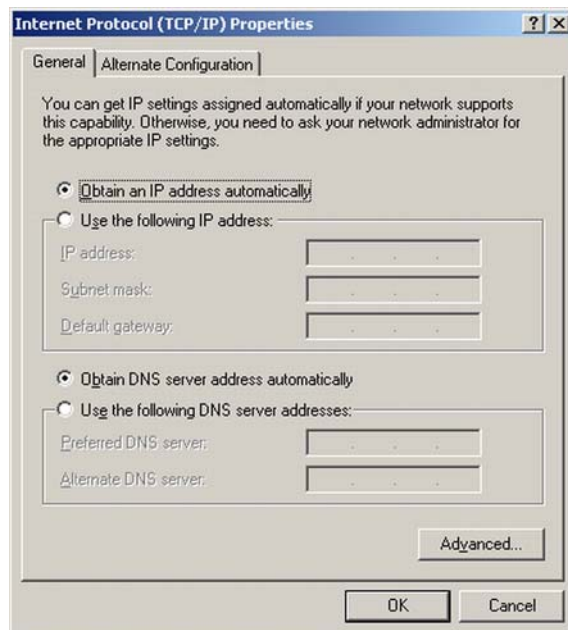
- 1 Open the Local Area Connection Properties and select **Internet Protocol (TCP/IP)**. Then click on **Properties**.



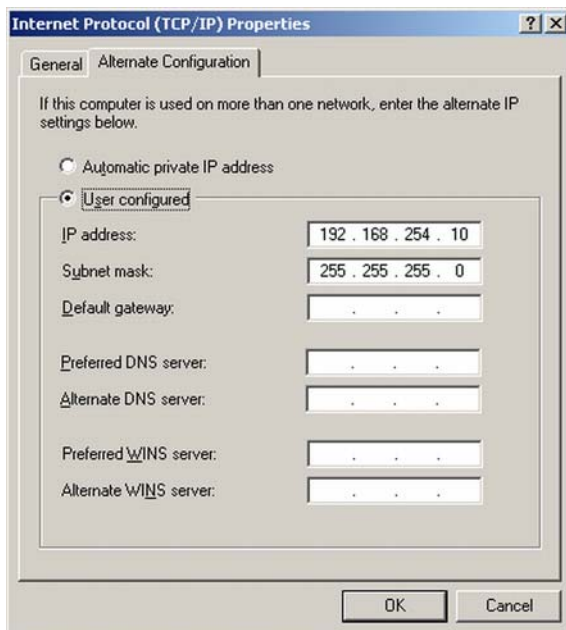
13 LAN Configuration

PC and Agilent ChemStation Setup

- 2 You may enter here the fixed IP address of the module or use the **Alternate Configuration**.



- 3 We will use the direct LAN access via Cross-over LAN cable with the module's IP address.



- 4 Click on **OK** to save the configuration.

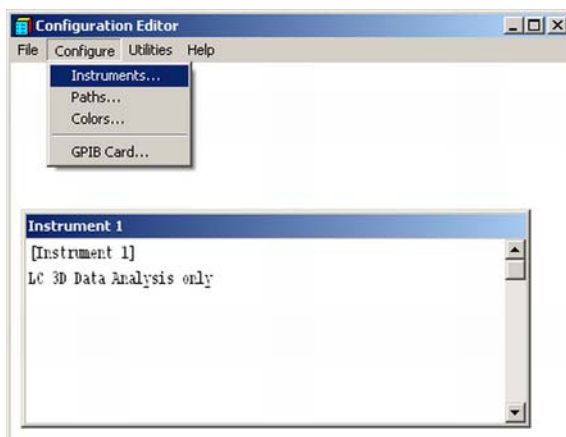
Agilent ChemStation Setup

This procedure describes the Agilent ChemStation B.04.02 setup for the 1290 Infinity system using the 1290 Infinity DAD (G4212A) as the interfacing module. The setup works in the same way for all other systems.

NOTE

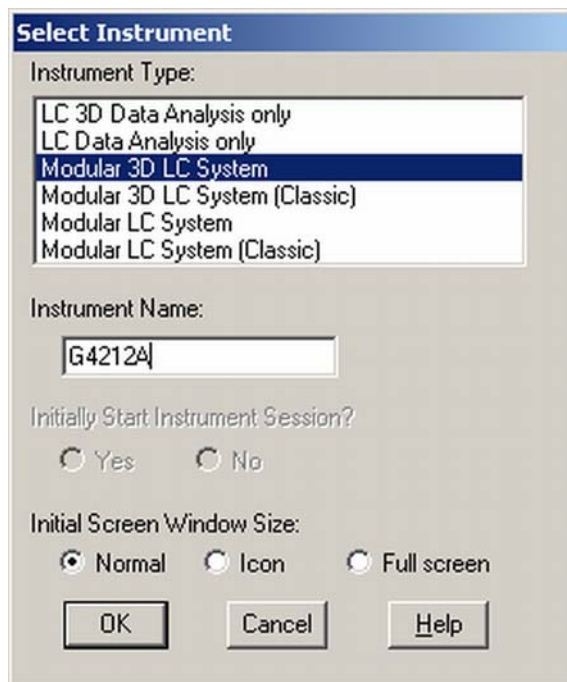
The LAN must be connected to detector due to high data load on communication to Control Software.

- 1 Open the ChemStation Configuration Editor.



- 2 Select from the menu **Configure - Instruments**.
- 3 Select **Modular 3D LC System**.
- 4 Give the Instrument a name.

- 5 Click on **OK**.



Select Instrument

Instrument Type:

- LC 3D Data Analysis only
- LC Data Analysis only
- Modular 3D LC System**
- Modular 3D LC System (Classic)
- Modular LC System
- Modular LC System (Classic)

Instrument Name:

G4212A

Initially Start Instrument Session?

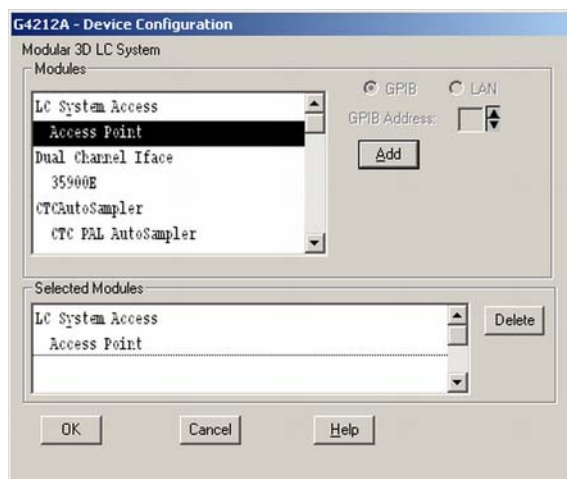
☐ Yes ☐ No

Initial Screen Window Size:

☒ Normal ☐ Icon ☐ Full screen

OK Cancel Help

- 6 Select **LC System Access — Access Point** and click on **Add**.



G4212A - Device Configuration

Modular 3D LC System

Modules

- LC System Access
- Access Point**
- Dual Channel Iface
- 35900E
- CTCAutoSampler
- CTC PAL AutoSampler

☒ GPIB ☐ LAN

GPIB Address:

Add

Selected Modules

- LC System Access
- Access Point

Delete

OK Cancel Help

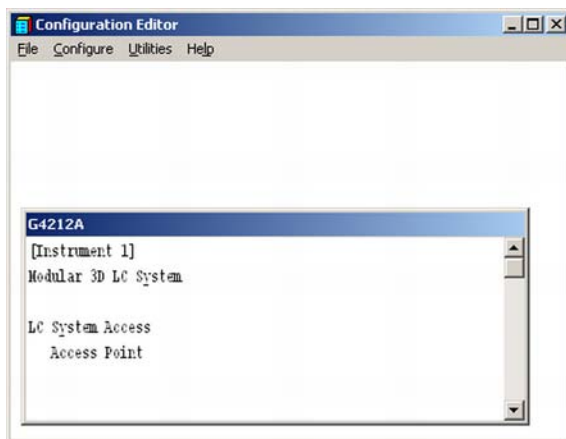
13 LAN Configuration

PC and Agilent ChemStation Setup

- 7 Click on **OK**.

The Configuration Editor shows now the new instrument.

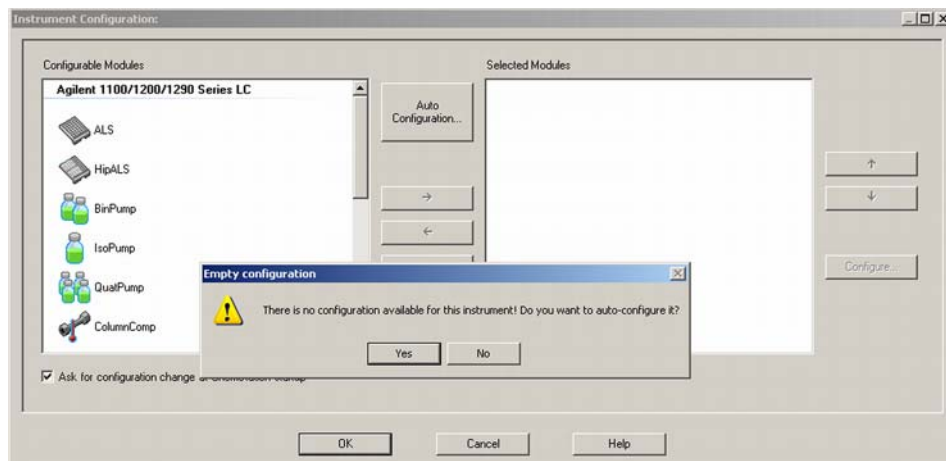
- 8 If required, change under **Configure – Path** the folder locations.
- 9 Save the current configuration via **File – Save**.



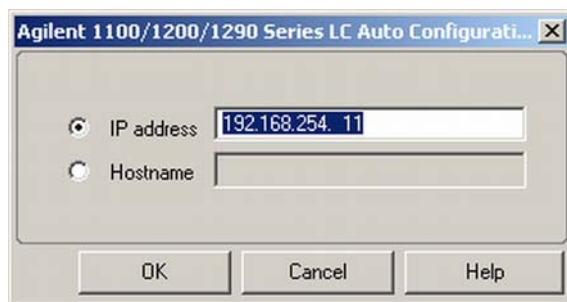
- 10 Exit the Configuration Editor.
- 11 Start the Agilent ChemStation.

During first startup or when the system configuration has changed, a notification shows up.

- 12** The left column shows the modules that could be configured. You may select the module manually from the list. We use the Auto Configuration mode. Click on **Yes**.



- 13** Enter the IP address or the Hostname of the module with the LAN-access.



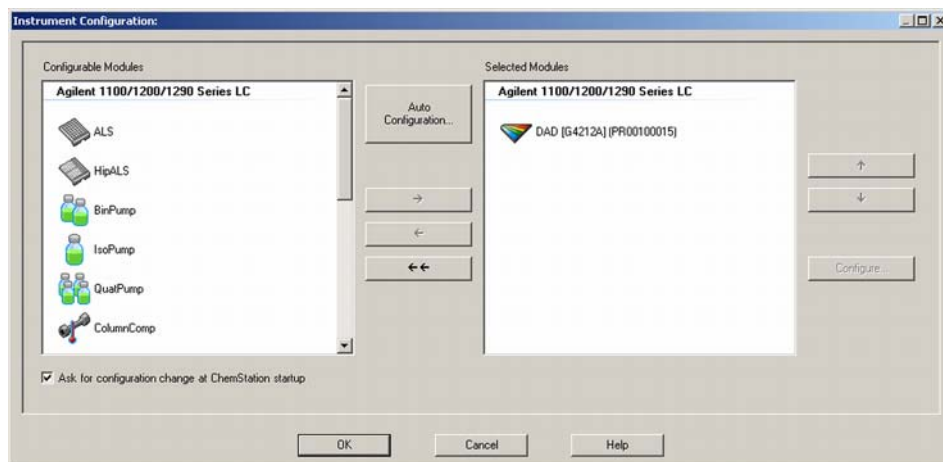
- 14** Click on **OK**.

The selected module is shown now in the right window (with serial number). In addition all other modules connected via CAN to the detector are shown as well.

13 LAN Configuration

PC and Agilent ChemStation Setup

15 Click on **OK** to continue the ChemStation loading.



16 You may see the details of the module by **selecting the module** and clicking on **Configure**.



Under **Connection Settings** you may change the IP/Hostname of the module (may require a re-start of the ChemStation).

After successful load of the ChemStation, you should see the module(s) as active item in the graphical user interface (GUI).

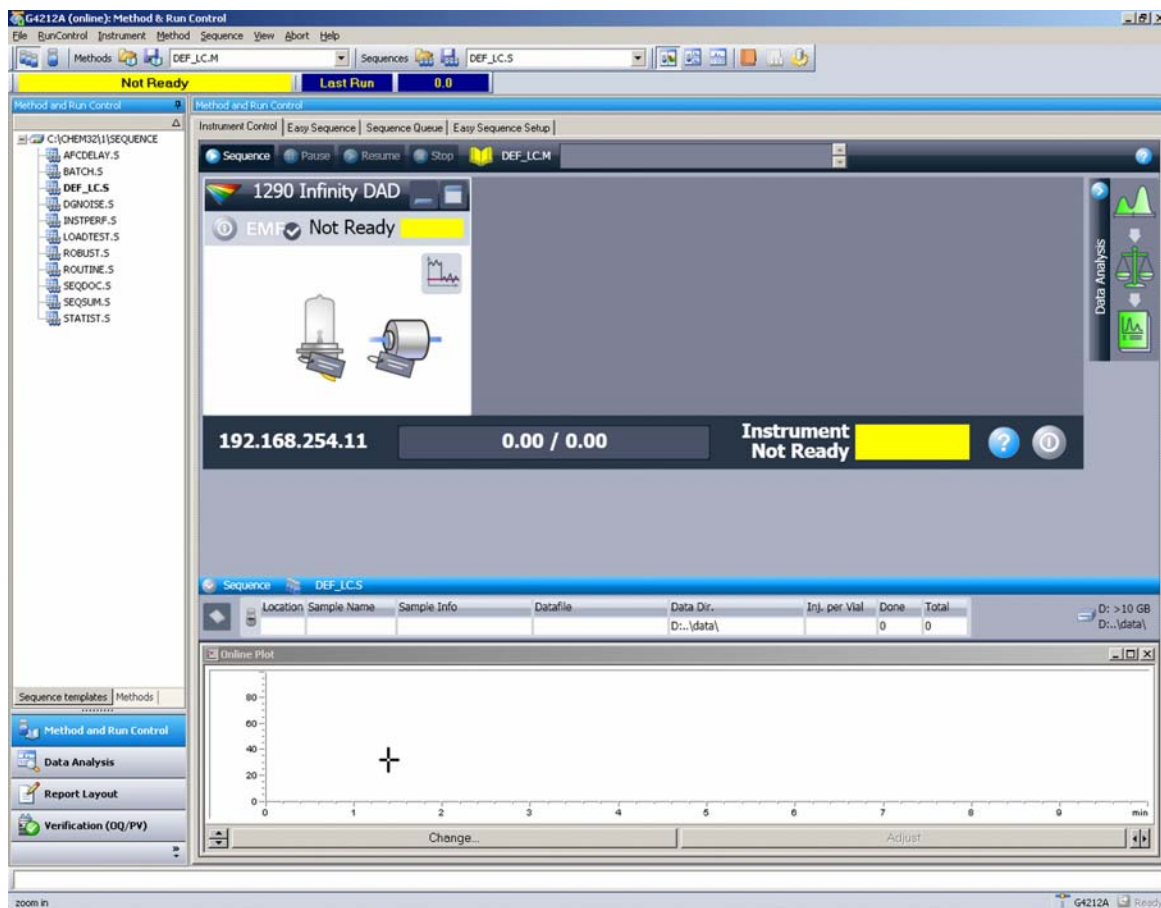


Figure 43 Screen After Successful Load of ChemStation

13 LAN Configuration

PC and Agilent ChemStation Setup



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This chapter provides safety and other general information.



General Safety Information

General Safety Information

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

WARNING

Ensure the proper usage of the equipment.

The protection provided by the equipment may be impaired.

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

Safety Standards

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

General

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

Before Applying Power

WARNING

Wrong voltage range, frequency or cabling

Personal injury or damage to the instrument

- Verify that the voltage range and frequency of your power distribution matches to the power specification of the individual instrument.
 - Never use cables other than the ones supplied by Agilent Technologies to ensure proper functionality and compliance with safety or EMC regulations.
 - Make all connections to the unit before applying power.
-

NOTE

Note the instrument's external markings described under “[Safety Symbols](#)” on page 208.

Ground the Instrument

WARNING

Missing electrical ground

Electrical shock

- If your product is provided with a grounding type power plug, the instrument chassis and cover must be connected to an electrical ground to minimize shock hazard.
 - The ground pin must be firmly connected to an electrical ground (safety ground) terminal at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.
-

Do Not Operate in an Explosive Atmosphere

WARNING

Presence of flammable gases or fumes

Explosion hazard

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

Do Not Remove the Instrument Cover

WARNING

Instrument covers removed

Electrical shock

- Do Not Remove the Instrument Cover
 - Only Agilent authorized personnel are allowed to remove instrument covers. Always disconnect the power cables and any external circuits before removing the instrument cover.
-

Do Not Modify the Instrument

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

In Case of Damage

WARNING

Damage to the module

Personal injury (for example electrical shock, intoxication)

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

Solvents

WARNING

Toxic, flammable and hazardous solvents, samples and reagents

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

- When working with these substances observe appropriate safety procedures (for example by wearing goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the vendor, and follow good laboratory practice.
 - The volume of substances should be reduced to the minimum required for the analysis.
 - Do not operate the instrument in an explosive atmosphere.
 - Never exceed the maximal permissible volume of solvents (6 L) in the solvent cabinet.
 - Do not use bottles that exceed the maximum permissible volume as specified in the usage guideline for the Agilent 1200 Infinity Series Solvent Cabinets.
 - Arrange the bottles as specified in the usage guideline for the solvent cabinet.
 - A printed copy of the guideline has been shipped with the solvent cabinet, electronic copies are available on the Internet.
 - Ground the waste container.
 - The residual free volume in the appropriate waste container must be large enough to collect the waste liquid.
 - Check the filling level of the waste container regularly.
 - To achieve maximal safety, check the correct installation regularly.
 - Do not use solvents with an auto-ignition temperature below 200 °C (392 °F).
-

Safety Symbols

Table 23 Symbols













	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.
	The apparatus is marked with this symbol when hot surfaces are available and the user should not touch it when heated up.
	Cooling unit is designed as vapor-compression refrigeration system. Contains fluorinated greenhouse gas (refrigerant) according to the Kyoto protocol. For specifications of refrigerant, charge capacity, carbon dioxide equivalent (CDE), and global warming potential (GWP) see instrument label.
	Confirms that a manufactured product complies with all applicable European Community directives. The European Declaration of Conformity is available at: http://regulations.corporate.agilent.com/DoC/search.htm
	Manufacturing date.
	Power symbol indicates On/Off. The apparatus is not completely disconnected from the mains supply when the power switch is in the Off position
	Pacemaker Magnets could affect the functioning of pacemakers and implanted heart defibrillators. A pacemaker could switch into test mode and cause illness. A heart defibrillator may stop working. If you wear these devices keep at least 55 mm distance to magnets. Warn others who wear these devices from getting too close to magnets.

Table 23 Symbols

	<p>Magnetic field</p> <p>Magnets produce a far-reaching, strong magnetic field. They could damage TVs and laptops, computer hard drives, credit and ATM cards, data storage media, mechanical watches, hearing aids and speakers. Keep magnets at least 25 mm away from devices and objects that could be damaged by strong magnetic fields.</p>
	<p>Indicates a pinching or crushing hazard</p>
	<p>Indicates a piercing or cutting hazard.</p>

WARNING

A WARNING

alerts you to situations that could cause physical injury or death.

- Do not proceed beyond a warning until you have fully understood and met the indicated conditions.

CAUTION

A CAUTION

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

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

Waste Electrical and Electronic Equipment (WEEE) Directive

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 starting with 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.



NOTE

Do not dispose of in domestic household waste

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

Radio Interference

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

Test and Measurement

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

Sound Emission

Manufacturer's Declaration

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

This product has a sound pressure emission (at the operator position) < 70 dB.

- Sound Pressure $L_p < 70$ dB (A)
- At Operator Position
- Normal Operation
- According to ISO 7779:1988/EN 27779/1991 (Type Test)

Solvent Information

Flow Cell

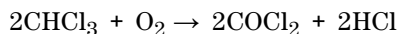
To protect optimal functionality of your flow-cell:

- Avoid the use of alkaline solutions (pH > 9.5) which can attack quartz and thus impair the optical properties of the flow cell.

Use of Solvents

Observe the following recommendations on the use of solvents.

- Brown glass ware can avoid growth of algae.
- Small particles can permanently block capillaries and valves. Therefore always filter solvents through 0.4 µm filters.
- Avoid the use of the following steel-corrosive solvents:
 - Solutions of alkali halides and their respective acids (for example, lithium iodide, potassium chloride, and so on),
 - High concentrations of inorganic acids like sulfuric acid and nitric acid, especially at higher temperatures (if your chromatography method allows, replace by phosphoric acid or phosphate buffer which are less corrosive against stainless steel),
 - Halogenated solvents or mixtures which form radicals and/or acids, for example:



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

- Chromatographic grade ethers, which can contain peroxides (for example, THF, dioxane, di-isopropyl ether) such ethers should be filtered through dry aluminium oxide which adsorbs the peroxides,
- Solvents containing strong complexing agents (e.g. EDTA),
- Mixtures of carbon tetrachloride with 2-propanol or THF.

Agilent Technologies on Internet

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<http://www.agilent.com>

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- introduction,
- specifications,
- configuration,
- optimizing,
- troubleshooting and diagnostics,
- maintenance,
- parts identification,
- hardware information,
- safety and related information.

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Printed in Germany
11/2015



G7162-90000



Agilent Technologies