# Agilent 1260 Infinity Refractive Index Detector

User Manual

Agilent Technologies

# Notices



## Manual Part Number

G1362-90011 Rev. B

## Edition

05/12

Printed in Germany

Agilent Technologies
Hewlett-Packard-Strasse 8
76337 Waldbronn

**This product may be used as a component of an in vitro diagnostic system if the system is registered with the appropriate authorities and complies with the relevant regulations. Otherwise, it is intended only for general laboratory use.**

## Warranty

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

## Technology Licenses

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

## Restricted Rights Legend

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

## Safety Notices

**CAUTION**

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

**WARNING**

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

# In This Guide...

This manual covers the Agilent 1260 Infinity Refractive Index Detector (G1362A RID).

### 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 Installing the Refractive Index Detector

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

### 4 Using the Refractive Index Detector

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

### 5 Optimizing the Refractive Index 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

This chapter provides general information on maintenance 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 1260 Infinity LC modules.

### 12 Appendix

This chapter provides safetey and other general information.

# Contents

# 1 Introduction to the Refractive Index Detector



This chapter gives an introduction to the Refractive Index Detector.

# Introduction to the Refractive Index Detector

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

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

For specifications, see “Performance Specifications” on page 44.

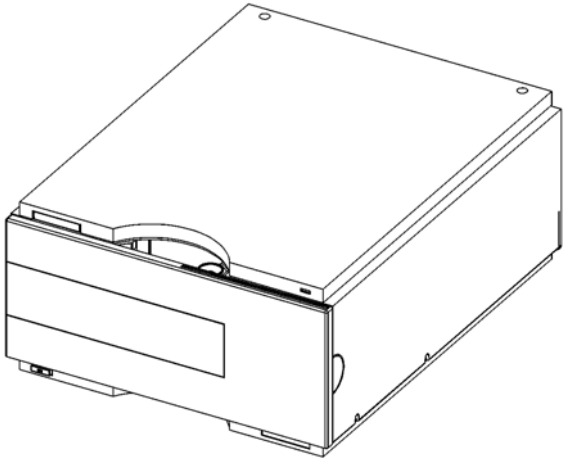


**Figure 1** The Agilent 1260 Infinity Refractive Index Detector

# 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
- $\alpha_1$ = angle of incident light in medium 1
- $\alpha_2$ = angle of refraction in medium 2

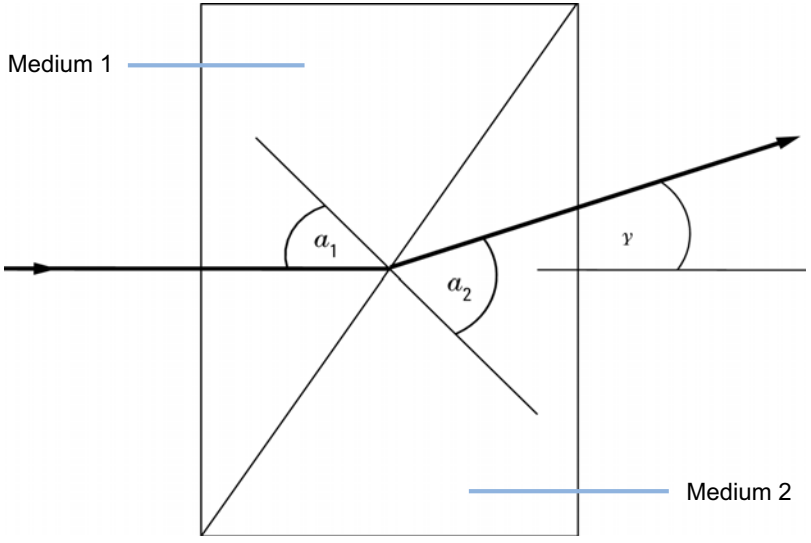



**Figure 2** Light Refraction

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:

- $\gamma$ = 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 1260 Infinity 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).

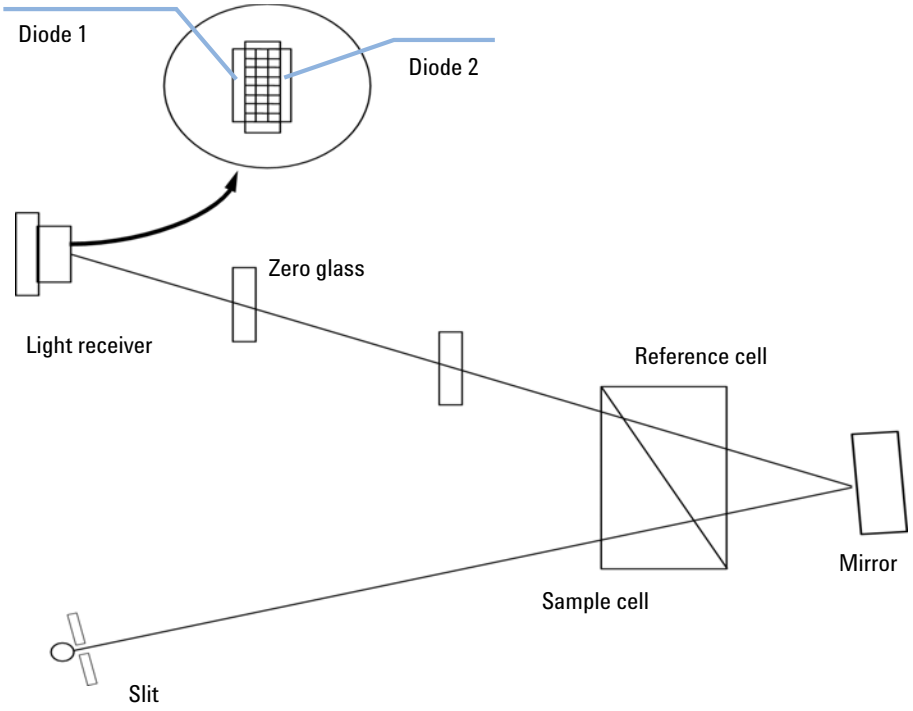



**Figure 3** Detection Principle

## Measurements

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

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

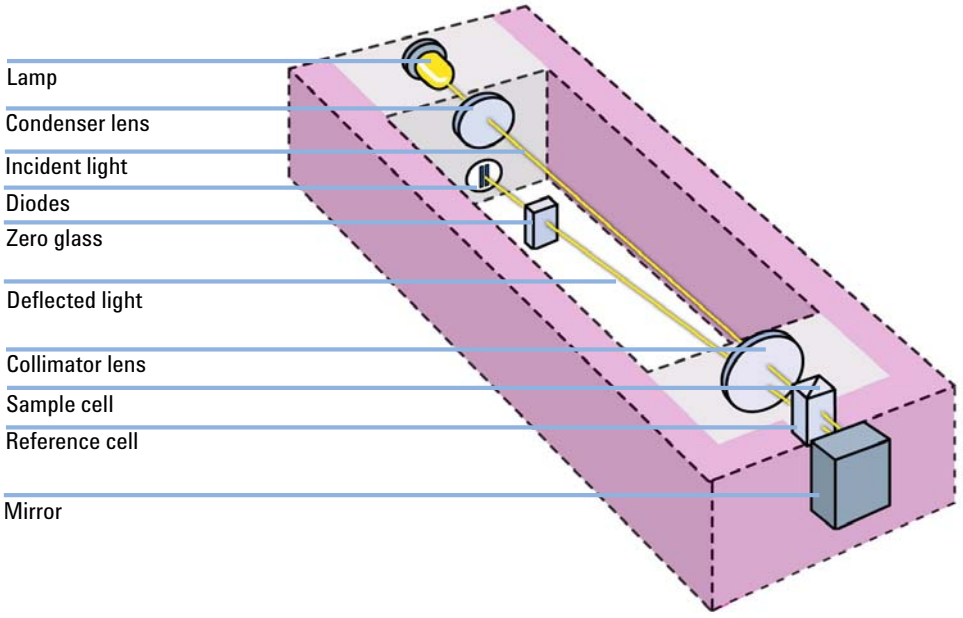



**Figure 4** Optical Path

# Flow Path

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 (see Figure 5 on page 17). Periodically switching the purge valve to the *on* position while only mobile phase is flowing will ensure that the liquid in the reference cell is as similar as possible to the flowing solvent. The purge valve can be manually set to the *on* position for a defined time or the **Automatic purge** mode can be enabled. In this mode the purge valve will automatically switch to the ON position for a defined **purgetime** prior to the start of each analysis. If a **purgetime** is set then a **waittime** must also be set to allow the detector baseline to stabilize after the switching of the purge valve position.

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

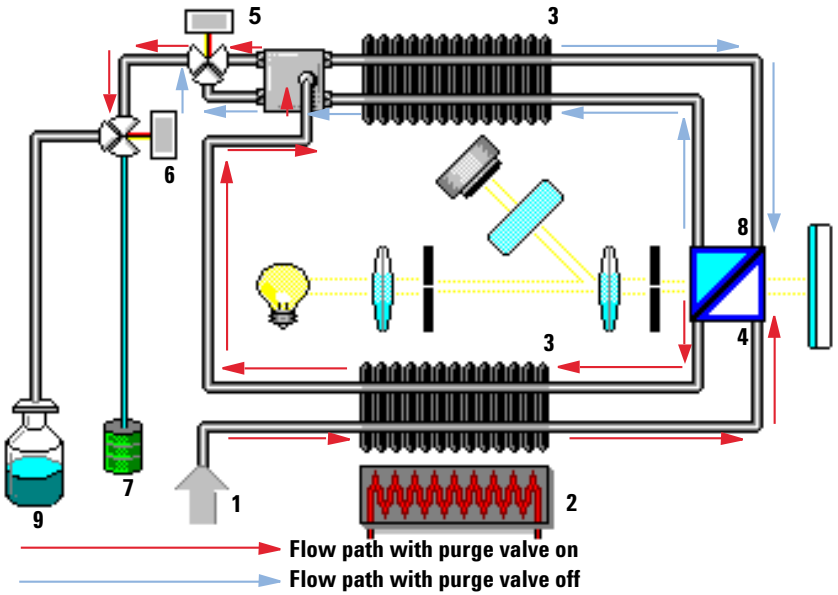



**Figure 5** Flow Path

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

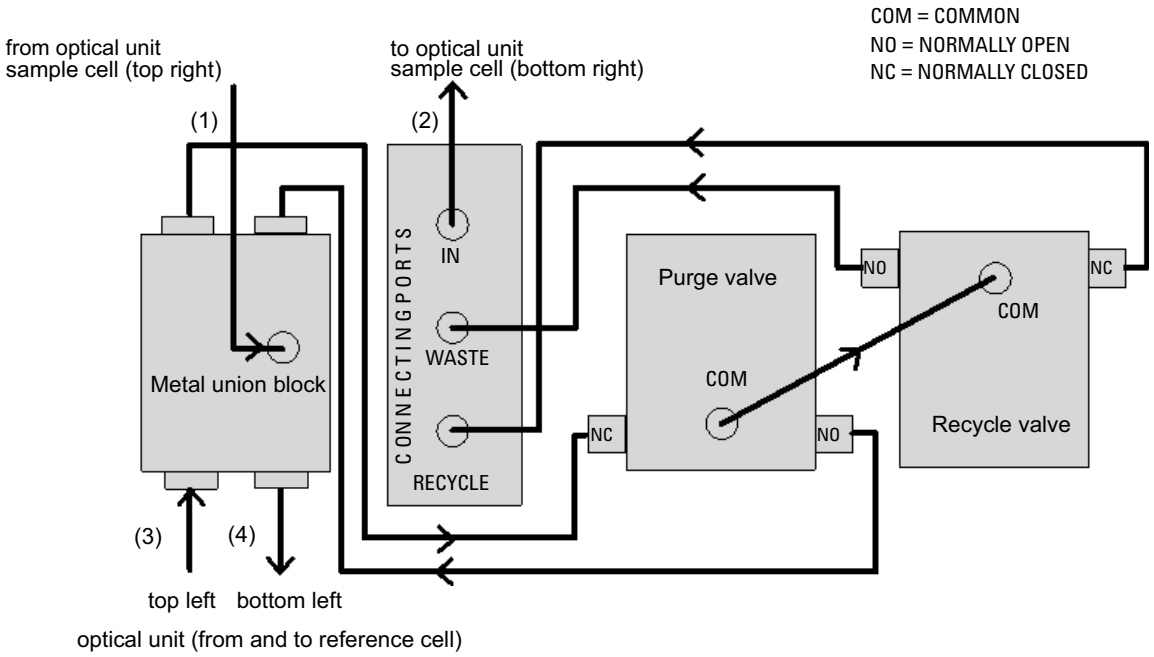



**Figure 6** G1362A Physical Plumbing Connections

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 (p/n G1362-68709).

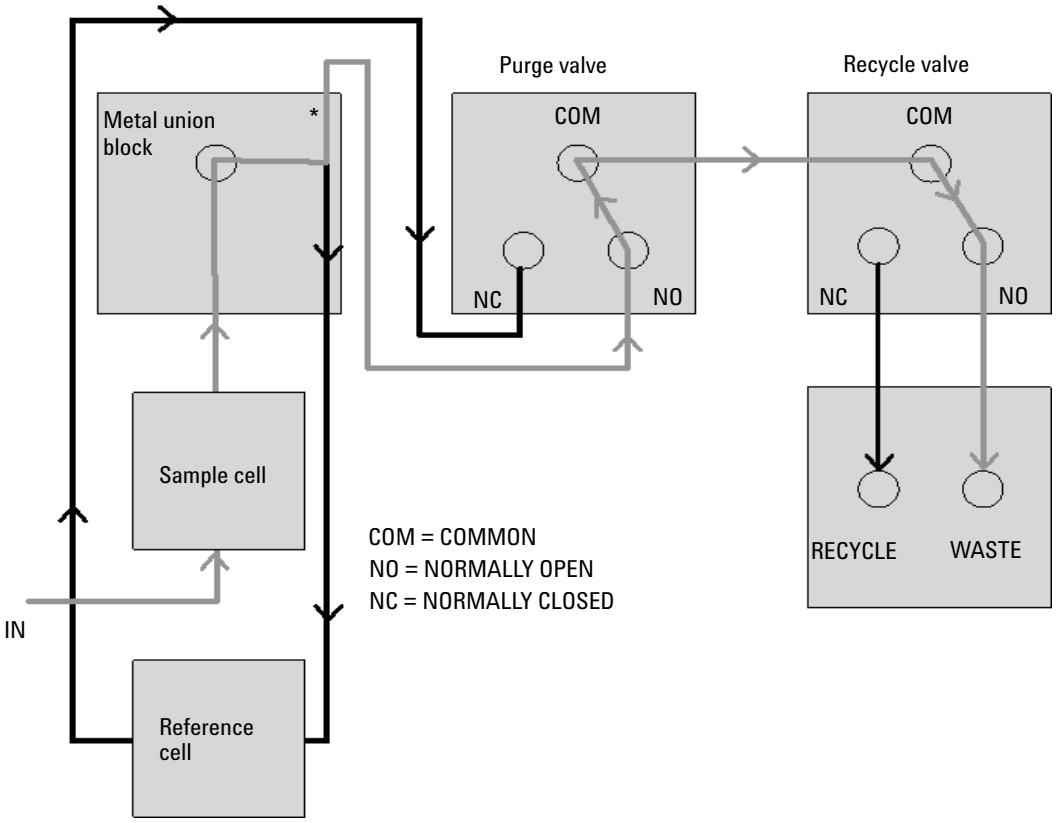



**Figure 7** Flow path with the Purge- and Recycle-Valves = OFF

| |
|---|
| Grey lines = flowing path<br>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 |

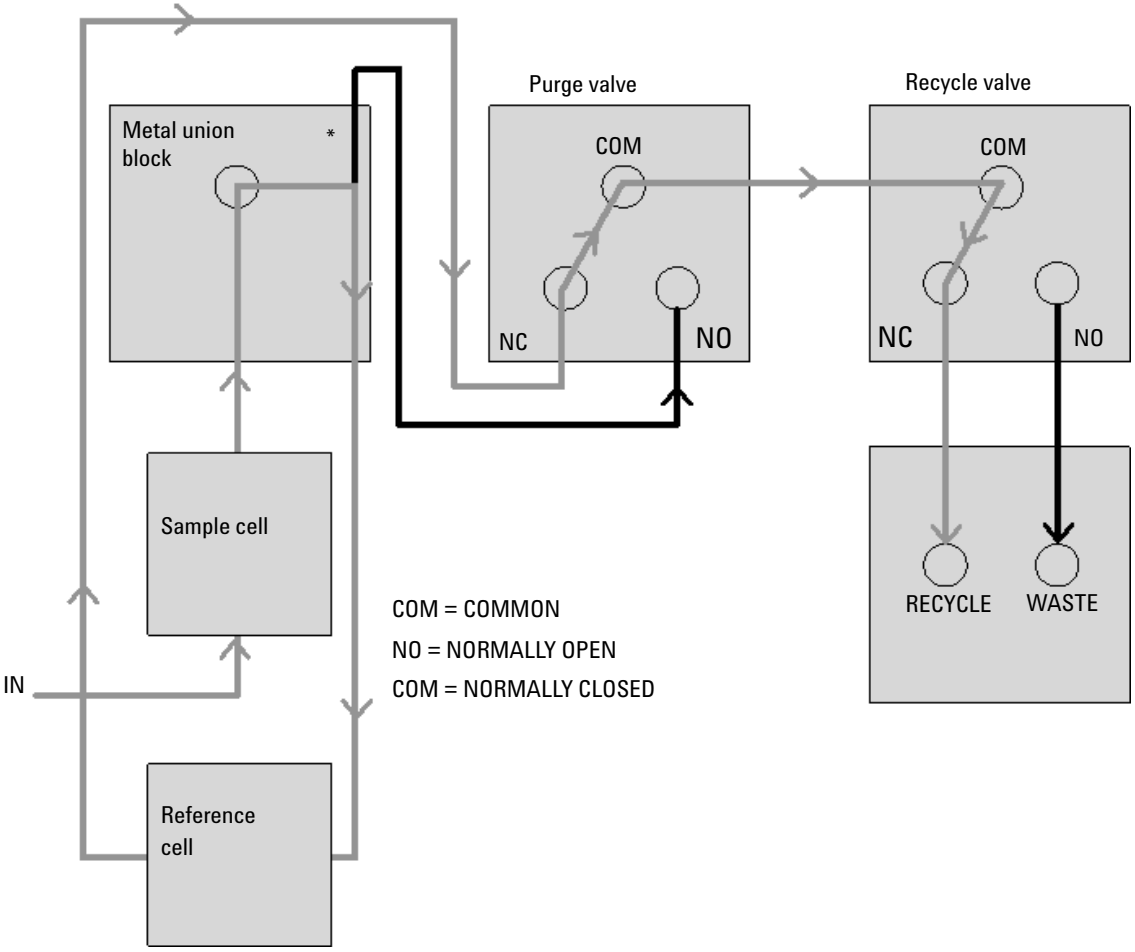



**Figure 8** Flow path with the Purge- and Recycle-Valves = ON

| | |
|---|---|
| | Grey lines = flowing path<br>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 |

# 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 detector and the analytical conditions, and not on a predefined time interval. The early maintenance feedback (EMF) feature monitors the usage of specific components in the instrument, and provides feedback when the user-selectable limits have been exceeded. The visual feedback in the user interface provides an indication that maintenance procedures should be scheduled.

## EMF Counters

The detector provides one EMF counter for the reference liquid age. The counter increments with the time that liquid remains in the reference cell, and can be assigned a maximum limit which provides visual feedback in the user interface when the limit is exceeded. The counter is reset to zero after the reference cell is purged.

## Using the EMF Counters

The user-selectable EMF limits for the EMF counters enable the early maintenance feedback to be adapted to specific user requirements. The useful counter time since last purge is dependent on the requirements for the analysis, therefore, the definition of the maximum limits need to be determined based on the specific operating conditions of the instrument.

### Setting the EMF Limits

The setting of the EMF limits must be optimized over one or two maintenance cycles. Initially, no EMF limit should be set. When instrument performance indicates maintenance is necessary, take note of the values displayed by reference liquid age counters. Enter these values (or a value slightly less than the displayed values) as an EMF limit, and then reset the EMF counter to zero. The next time the EMF counter exceed the new EMF limit, the EMF flag will be displayed, providing a reminder that maintenance needs to be scheduled.

# Instrument Layout

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

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

# 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 interface board slot is used for external contacts and BCD bottle number output or LAN connections.
- The REMOTE connector may be used in combination with other analytical instruments from Agilent Technologies if you want to use features such as start, stop, common shut down, prepare, and so on.
- With the appropriate software, the RS-232C connector may be used to control the module from a computer through a RS-232C connection. This connector is activated and can be configured with the configuration switch.
- The power input socket accepts a line voltage of 100 – 240 VAC ± 10 % with a line frequency of 50 or 60 Hz. Maximum power consumption varies by module. There is no voltage selector on your module because the power supply has wide-ranging capability. There are no externally accessible fuses, because automatic electronic fuses are implemented in the power supply.

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

## Rear View of the Module

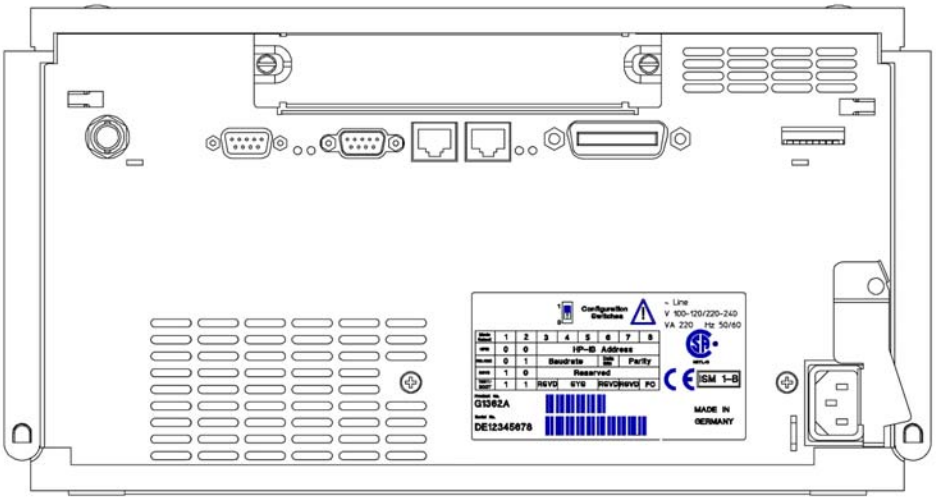


**Figure 9** Rear View of Detector – Electrical Connections and Label

**NOTE** The GPIB interface has been removed with the introduction of the 1260 Infinity modules.

## Serial Number Information

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

| | |
|---|---|
| CCXZZ00000 | Format |
| CC | Country of manufacturing (DE Germany) |
| 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 modules provide the following interfaces:

**Table 1** Agilent 1200 Infinity Series Interfaces

| Module | CAN | LAN/BCD (optional) | LAN (on-board) | RS-232 | Analog | APG Remote | Special |
|---|---|---|---|---|---|---|---|
| **Pumps** | | | | | | | |
| G1310B Iso Pump<br>G1311B Quat Pump<br>G1311C Quat Pump VL<br>G1312B Bin Pump<br>G1312C Bin Pump VL<br>1376A Cap Pump<br>G2226A Nano Pump | 2 | Yes | No | Yes | 1 | Yes | |
| G4220A/B Bin Pump | 2 | No | Yes | Yes | No | Yes | |
| G1361A Prep Pump | 2 | Yes | No | Yes | No | Yes | CAN-DC- OUT for CAN slaves |
| **Samplers** | | | | | | | |
| G1329B ALS<br>G2260A Prep ALS | 2 | Yes | No | Yes | No | Yes | THERMOSTAT for G1330B |
| G1364B FC-PS<br>G1364C FC-AS<br>G1364D FC-µS<br>G1367E HiP ALS<br>G1377A HiP micro ALS<br>G2258A DL ALS | 2 | Yes | No | Yes | No | Yes | THERMOSTAT for G1330B<br>CAN-DC- OUT for CAN slaves |
| G4226A ALS | 2 | Yes | No | Yes | No | Yes | |
| **Detectors** | | | | | | | |
| G1314B VWD VL<br>G1314C VWD VL+ | 2 | Yes | No | Yes | 1 | Yes | |
| G1314E/F VWD | 2 | No | Yes | Yes | 1 | Yes | |

**Table 1** Agilent 1200 Infinity Series Interfaces

| Module | CAN | LAN/BCD (optional) | LAN (on-board) | RS-232 | Analog | APG Remote | Special |
|---|---|---|---|---|---|---|---|
| G4212A/B DAD | 2 | No | Yes | Yes | 1 | Yes | |
| G1315C DAD VL+<br>G1365C MWD<br>G1315D DAD VL<br>G1365D MWD VL | 2 | No | Yes | Yes | 2 | Yes | |
| G1321B FLD<br>G1362A RID | 2 | Yes | No | Yes | 1 | Yes | |
| G4280A ELSD | No | No | No | Yes | Yes | Yes | EXT Contact<br>AUTOZERO |
| **Others** | | | | | | | |
| G1316A/C TCC | 2 | No | No | Yes | No | Yes | |
| G1322A DEG | No | No | No | No | No | Yes | AUX |
| G1379B DEG | No | No | No | Yes | No | No | AUX |
| G4227A Flex Cube | 2 | No | No | No | No | No | |
| G4240A CHIP CUBE | 2 | Yes | No | Yes | No | Yes | CAN-DC- OUT for CAN slaves<br>THERMOSTAT for G1330A/B (NOT USED) |

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

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

# 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 G1369A/B 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 connected PC with the appropriate control software.

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

## RS-232C (Serial)

The RS-232C connector is used to control the module from a computer through RS-232C connection, using the appropriate software. This connector can be configured with the configuration switch module at the rear of the module. Refer to *Communication Settings for RS-232C*.

**NOTE** There is no configuration possible on main boards with on-board LAN. These are pre-configured for

- 19200 baud,
- 8 data bit with no parity and
- one start bit and one stop bit are always used (not selectable).

The RS-232C is designed as DCE (data communication equipment) with a 9-pin male SUB-D type connector. The pins are defined as:

**Table 2** RS-232C Connection Table

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

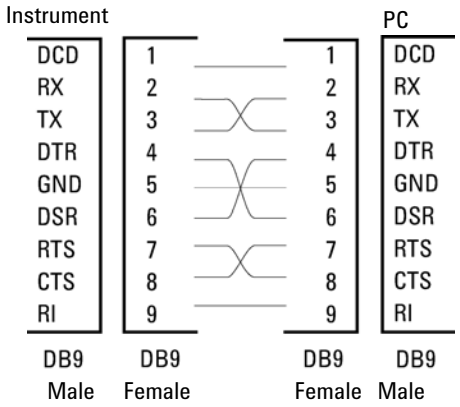



**Figure 10** RS-232 Cable

## Analog Signal Output

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

## APG Remote

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

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

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

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

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

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

**Table 3** Remote Signal Distribution

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

## Special Interfaces

Some modules have module specific interfaces/connectors. They are described in the module documentation.

# Setting the 8-bit Configuration Switch (On-Board LAN)

The 8-bit configuration switch is located at the rear of the module. Switch settings provide configuration parameters for LAN, serial communication protocol and instrument specific initialization procedures.

All modules with on-board LAN, e.g. G1315/65C/D, G1314D/E/F, G4212A/B, G4220A:

- Default is ALL switches DOWN (best settings) - Bootp mode for LAN.
- For specific LAN modes switches 3-8 must be set as required.
- For boot/test modes switches 1+2 must be UP plus required mode.

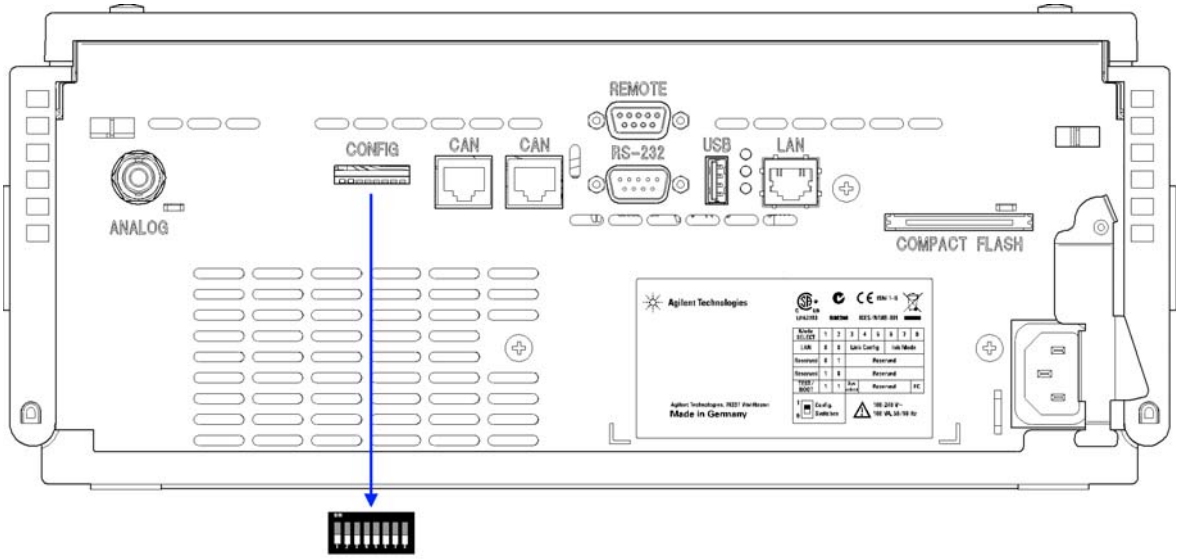



**Figure 11** Location of Configuration Switch (example shows a G4212A DAD)

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

**Table 4** 8-bit Configuration Switch (with on-board LAN)

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

**Legend:**

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

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

**NOTE** For explanation of "Boot Resident System" and "Revert to Default Data (Coldstart)" refer to "Special Settings" on page 36.

# Setting the 8-bit Configuration Switch (without On-Board LAN)

The 8-bit configuration switch is located at the rear of the module.

Modules that do not have their own LAN interface (e.g. the TCC) can be controlled through the LAN interface of another module and a CAN connection to that module.

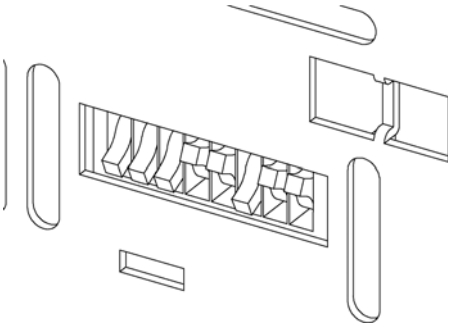


**Figure 12** Configuration switch (settings depend on configured mode)

All modules without on-board LAN:

- default is ALL DIPS DOWN (best settings) - Bootp mode for LAN
- for boot/test modes DIPS 1+2 must be UP plus required mode

Switch settings provide configuration parameters for GPIB address, serial communication protocol and instrument specific initialization procedures.

**NOTE** With the introduction of the Agilent 1260 Infinity, all GPIB interfaces have been removed. The preferred communication is LAN.

**NOTE** The following tables represent the configuration switch settings for the modules without on-board LAN only.

**Table 5** 8-bit Configuration Switch (without on-board LAN)

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

**NOTE** The LAN settings are done on the LAN Interface Card G1369A/B. Refer to the documentation provided with the card.

## Communication Settings for RS-232C

The communication protocol used in the column compartment supports only hardware handshake (CTS/RTR).

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

**Table 6** Communication Settings for RS-232C Communication (without on-board LAN)

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

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

**Table 7** Baudrate Settings (without on-board LAN)

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

**Table 8** Data Bit Settings (without on-board LAN)

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

**Table 9** Parity Settings (without on-board LAN)

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

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

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

## Special Settings

The special settings are required for specific actions (normally in a service case).

**NOTE** The tables include both settings for modules – with on-board LAN and without on-board LAN. They are identified as LAN and no LAN.

### Boot-Resident

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

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

**Table 10** Boot Resident Settings (without on-board LAN)

| | Mode Select | SW1 | SW2 | SW3 | SW4 | SW5 | SW6 | SW7 | SW8 |
|---|---|---|---|---|---|---|---|---|---|
| LAN | TEST/BOOT | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| No LAN | TEST/BOOT | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |

### Forced Cold Start

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

**CAUTION** Loss of data

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

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

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

**Table 11** Forced Cold Start Settings (without on-board LAN)

| | Mode Select | SW1 | SW2 | SW3 | SW4 | SW5 | SW6 | SW7 | SW8 |
|---|---|---|---|---|---|---|---|---|---|
| LAN | TEST/BOOT | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| No LAN | TEST/BOOT | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |

# 2
# Site Requirements and Specifications



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

# Site Requirements

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

## Power Considerations

The module power supply has wide ranging capability. It accepts any line voltage in the range described in Table 12 on page 43. 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**

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

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

➔ Always unplug the power cable before opening the cover.

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

**CAUTION**

Unaccessable power plug.

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

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

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

## Power Cords

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

**WARNING**

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

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

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

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

---

**WARNING**

**Use of unsupplied cables**

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

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

---

**WARNING**

**Unintended use of supplied power cords**

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

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

---

## Bench Space

The module dimensions and weight (see Table 12 on page 43) 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 should carry an Agilent system, make sure that the bench is designed to bear the weight of all modules.

The module should be operated in a horizontal position.

## Environment

Your detector will work within the specifications at ambient temperatures and relative humidity described in Table 12 on page 43.

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 44) is based on these conditions. Larger ambient temperature changes will result in larger drift.

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

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

**CAUTION** Condensation within the module

Condensation will damage the system electronics.

➔ Do not store, ship or use your module under conditions where temperature fluctuations could cause condensation within the module.

➔ If your module was shipped in cold weather, leave it in its box and allow it to warm slowly to room temperature to avoid condensation.

# Physical Specifications

**Table 12** Physical Specifications

| Type | Specification | Comments |
|---|---|---|
| Weight | 17 kg (38 lbs) | |
| Dimensions (height × width × depth) | 180 x 345 × 435 mm (7 x 13.5 × 17 inches) | |
| Line voltage | 100 – 240 VAC, ± 10% | Wide-ranging capability |
| Line frequency | 50 or 60 Hz, ± 5% | |
| Power consumption | 160 VA / 65 W / 222 BTU | Maximum |
| Ambient operating temperature | 0–55 °C (32–131 °F) | |
| Ambient non-operating temperature | -40–70 °C (-4–158 °F) | |
| Humidity | < 95%, at 25–40 °C (77–104 °F) | Non-condensing |
| Operating Altitude | Up to 2000 m (6562 ft) | |
| Non-operating altitude | Up to 4600 m (15091 ft) | For storing the module |
| Safety standards: IEC, CSA, UL | Installation Category II, Pollution Degree 2 | For indoor use only. |

# Performance Specifications

**Table 13** Performance Specifications Agilent 1260 Infinity Refractive Index Detector

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

**Table 13** Performance Specifications Agilent 1260 Infinity Refractive Index Detector

| Type | Specification | Comments |
|---|---|---|
| Control and data evaluation | Parameter entry, signal display, on-line help and diagnostics with the Agilent 1260 Infinity Control Module. Optional PCMCIA card for method, sequence and logbook storage and transfer. Agilent ChemStation for LC PC based software for control and data evaluation. | |
| Analog outputs | Recorder/integrator: 100 mV or 1 V, output range selectable, one output | |
| Communications | Controller-area network (CAN), LAN, RS-232C, APG<br>Remote: ready, start, stop and shut-down signals | |
| Safety and maintenance | Extensive diagnostics, error detection and display (through control module and ChemStation), leak detection, safe leak handling, leak output signal for shutdown of pumping system. Low voltages in major maintenance areas. | |
| GLP features | Early maintenance feedback (EMF) for continuous tracking of instrument usage with user-selectable limits and feedback messages. Electronic records of maintenance and errors. Automated operational qualification/performance verification (OQ/PV). | |
| Housing | All materials recyclable. | |

**Table 13** Performance Specifications Agilent 1260 Infinity Refractive Index Detector

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

**NOTE**

Based on ASTM method E-1303-95 Practice for Refractive Index Detectors used in Liquid Chromatography. Reference conditions; optics temperature 35 °C, response time 4 s, flow 1.0 mL/min LC-grade Water, restriction capillary, column compartment temperature 35 °C, Agilent on-line degasser G1322A, pump and thermostatted column compartment. Instrument equilibrated for 2 hours.

# 3
# Installing the Refractive Index Detector



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

# Unpacking the Detector

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

**CAUTION**

"Defective on arrival" problems

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

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

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

## Delivery Checklist

### Delivery Checklist

Ensure all parts and materials have been delivered with your module. The delivery checklist is shown below. For parts identification please check the illustrated parts breakdown in "Parts for Maintenance" on page 141. Please report any missing or damaged parts to your local Agilent Technologies sales and service office.

**Table 14** Delivery Checklist 1260 RID

| Description | Quantity |
|---|---|
| Detector | 1 |
| Power cable | 1 |
| User Manual (on User Documentation CD) | 1 |
| Accessory kit (p/n G1362-68755) | 1 |

## Accessory Kit

Accessory kit (p/n G1362-68755) contains some accessories needed for the installation of the detector.

| p/n | Description |
|---|---|
| G1362-68706 | Interface tubing kit |
| G1362-87300 | Interfacing capillary |
| G1362-87301 | Restriction capillary |
| 5181-1516 | CAN cable, Agilent module to module, 0.5 m |
| 0100-1847 | PEEK adapter 1/4-28 to 10-32<br>(Adapter AIV to solvent inlet tubes) |

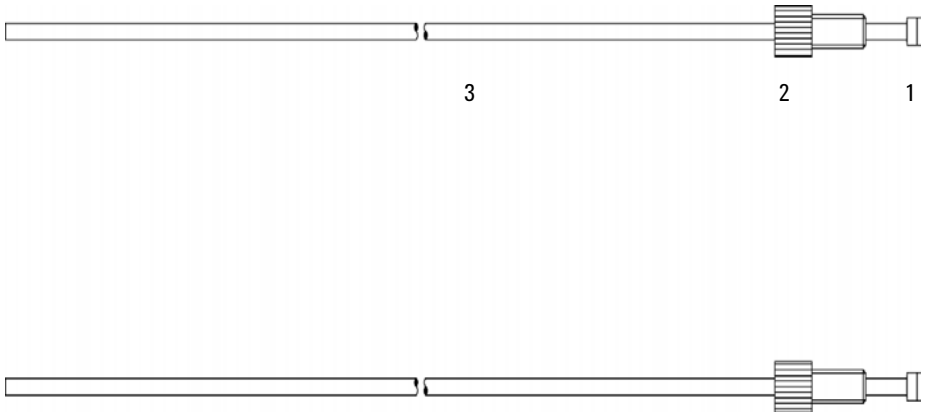



**Figure 13** Interface Tubing Kit Parts

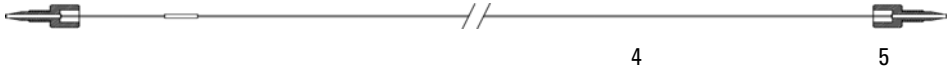



**Figure 14** Interfacing Capillary Parts

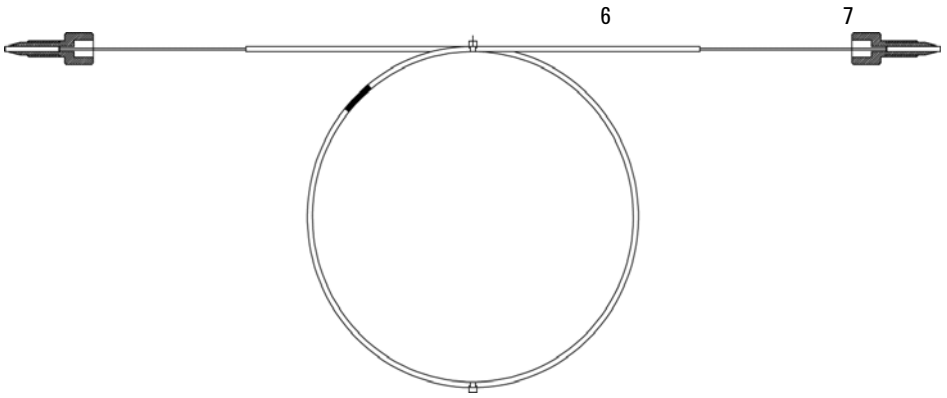



**Figure 15** Restriction Capillary Parts

# Optimizing the Stack Configuration

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

# Optimizing the One Stack Configuration

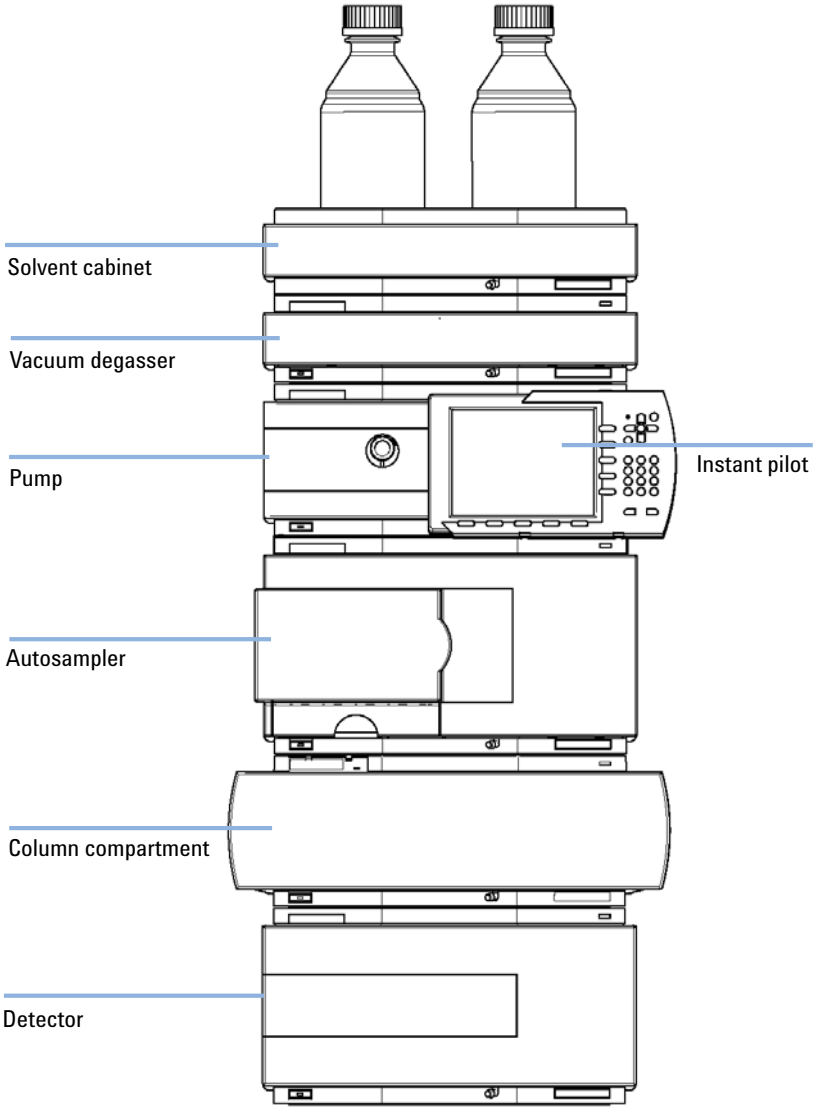



**Figure 16** Recommended Stack Configuration (Front View)

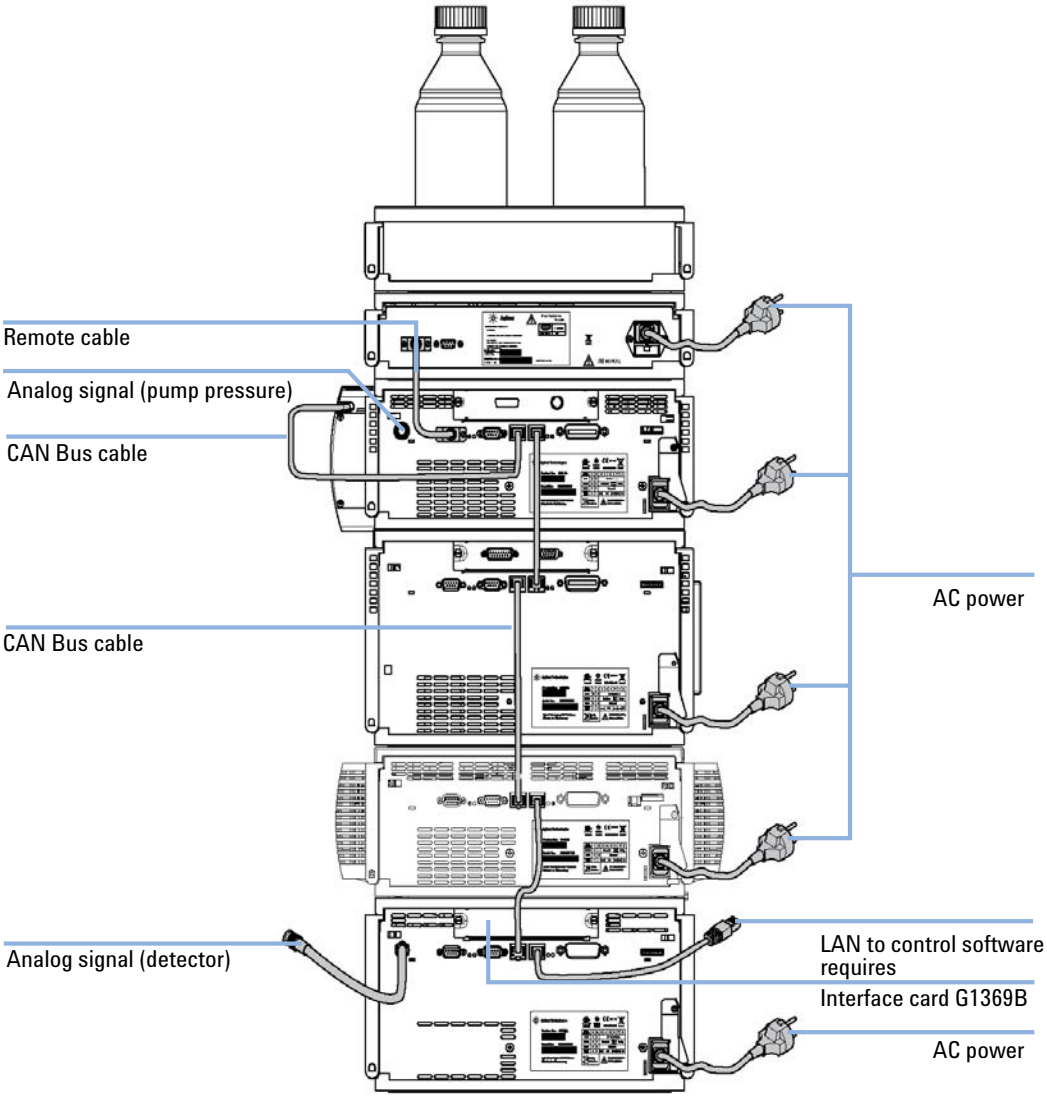



**Figure 17** Recommended Stack Configuration (Rear View)

## Optimizing the Two Stack Configuration

To avoid excessive height of the stack when the autosampler thermostat is added to the system it is recommended to form two stacks. Some users prefer the lower height of this arrangement even without the autosampler thermostat. A slightly longer capillary is required between the pump and autosampler. (See Figure 18 on page 54 and Figure 19 on page 55).

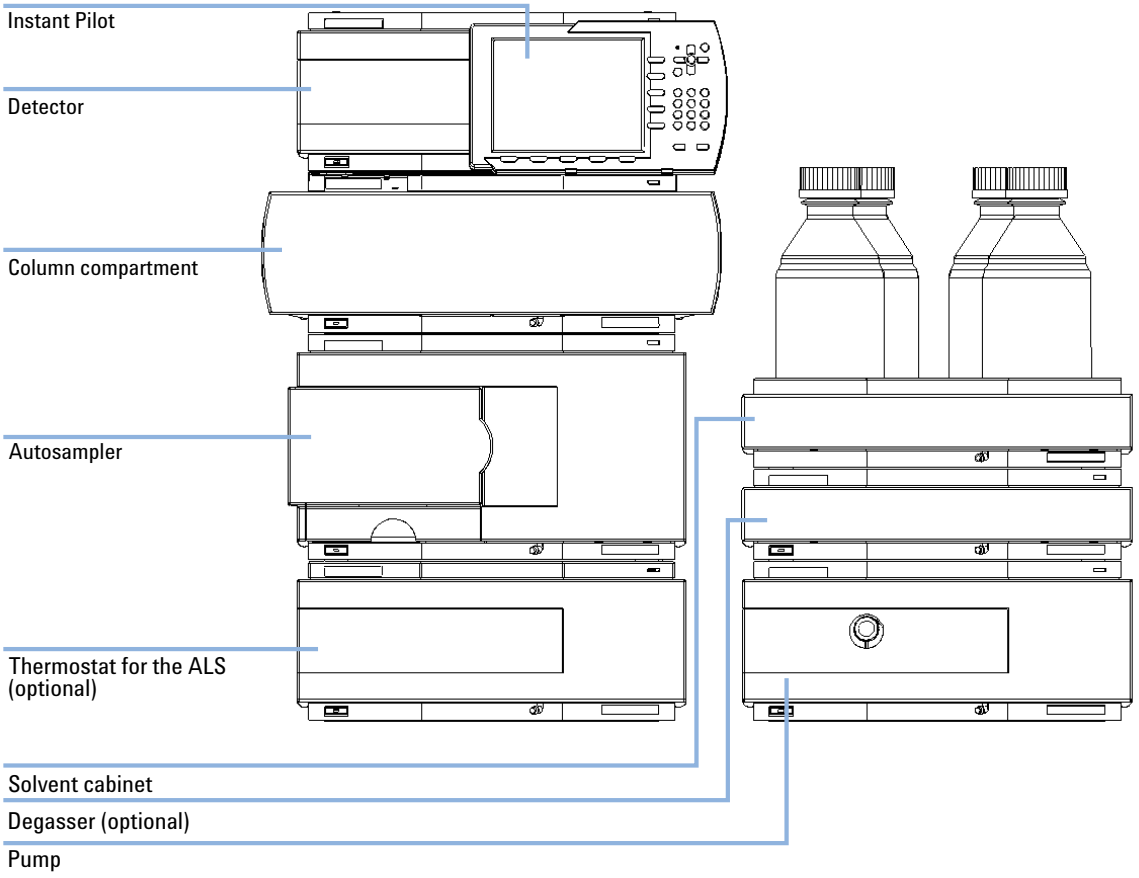



**Figure 18** Recommended Two Stack Configuration for 1260 (Front View)

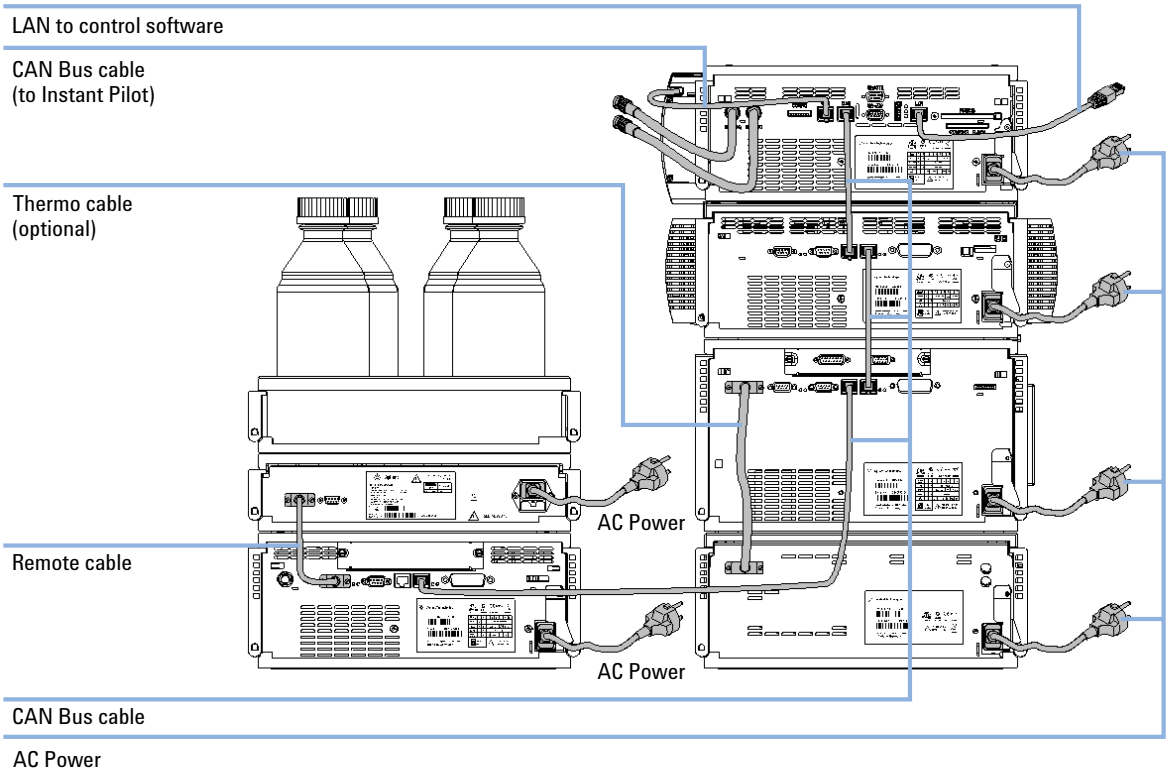



**Figure 19** Recommended Two Stack Configuration for 1260 (Rear View)

# Installing the Detector

| | |
|---|---|
| **Parts required** | **Description**<br>Power cord<br>For other cables see "Cable Overview" on page 146 |
| **Hardware required** | Agilent 1260 Infinity Refractive Index Detector (G1362A) |
| **Preparations** | • Locate bench space<br>• Provide power connections<br>• Unpack the detector |

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

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

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

➔ Make sure that it is always possible to access the power plug.

➔ Remove the power cable from the instrument before opening the cover.

➔ Do not connect the power cable to the Instrument while the covers are removed.

**NOTE** The detector was shipped with default configuration settings. To change these settings see "Setting the 8-bit Configuration Switch (without On-Board LAN)" on page 33.

1 Install the LAN interface board in the detector (if required), see "Replacing the Interface Board" on page 139.

2 Place the detector in the stack or on the bench in a horizontal position.

3 Ensure the line power switch at the front of the detector is OFF.

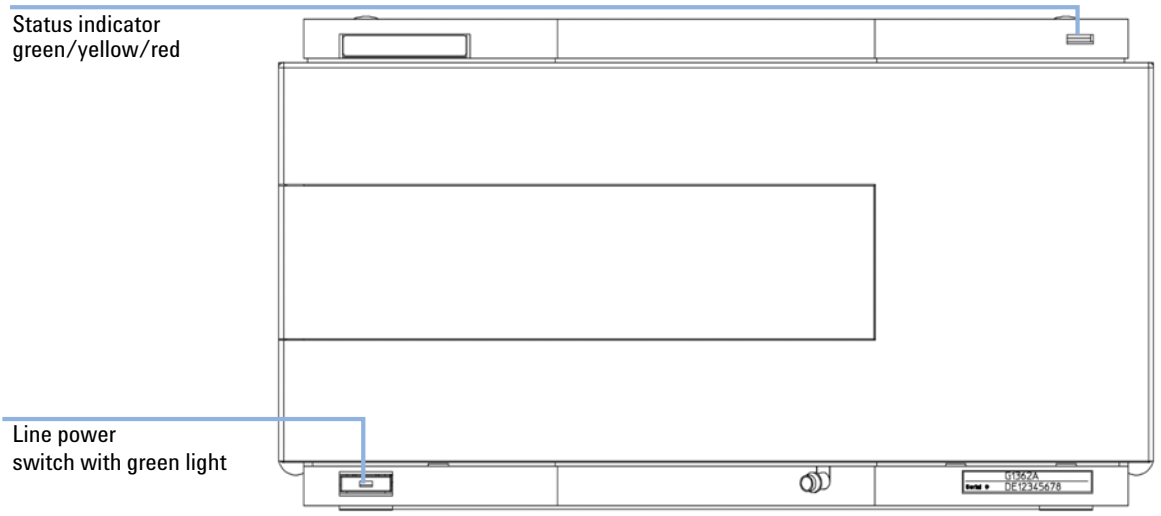



**Figure 20** Front View of Detector

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

5 Connect the CAN cable to other Agilent modules.

6 If an Agilent ChemStation is the controller, connect the LAN connection to the LAN interface board in the detector.

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

8 Connect the APG remote cable (optional) for non-Agilent modules.

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

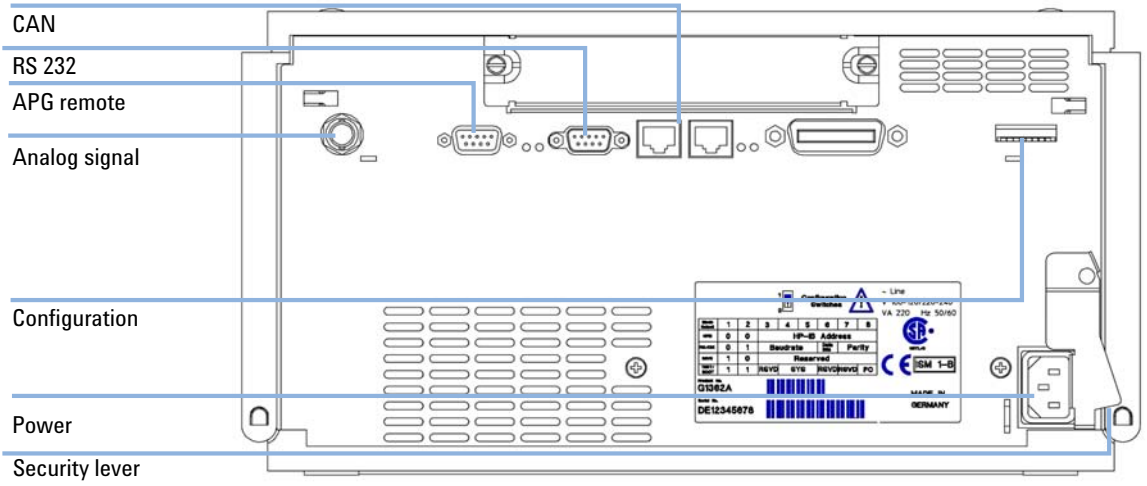



**Figure 21** Rear View of Detector

**NOTE** The GPIB interface has been removed with the introduction of the Agilent 1260 Infinity modules

# Flow Connections

**Tools required** ¼ inch wrench

**Parts required**

| # | p/n | Description |
|---|---|---|
| 1 | G1362-68706 | Interface tubing kit |
| 1 | G1362-87300 | Interfacing capillary |

**Hardware required** Other modules

**Preparations**

- Detector is installed in the LC system.

**WARNING**

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

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

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

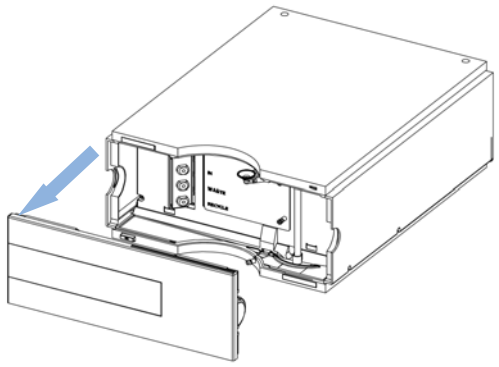
➔ The amount of substances should be reduced to the minimal volume required for the analysis.

➔ Do not operate the instrument in an explosive atmosphere.

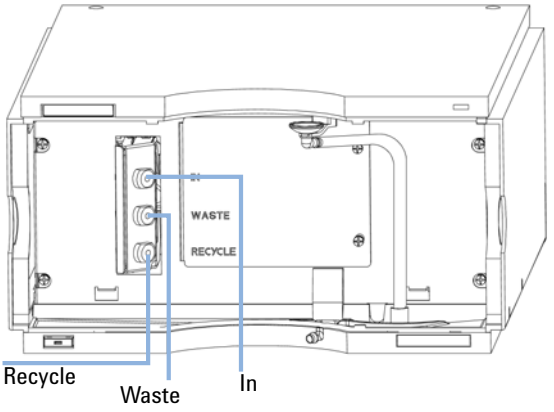
**NOTE**

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

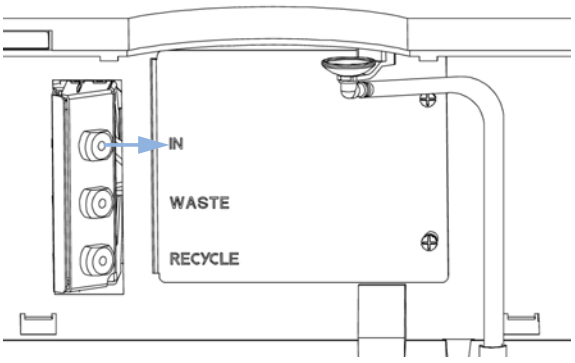
**1** Press the release buttons and remove the front cover to gain access to the interface port area.



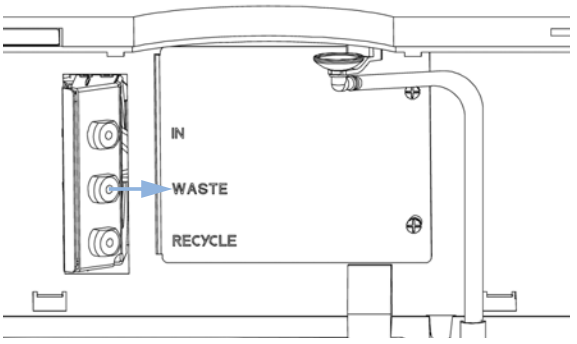
**2** Locate the in, waste and recycle ports.




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



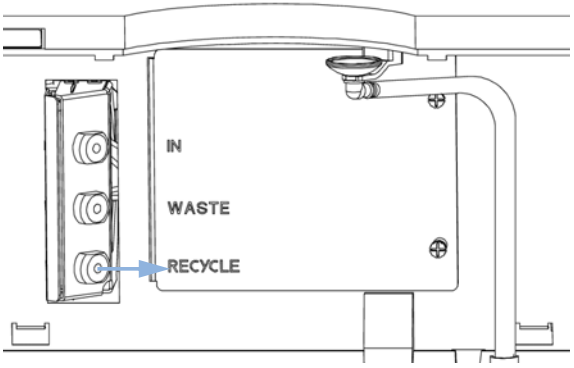

**4** Remove the blanking plug and connect one of the tubes from the interface tubing kit to the waste port.



**NOTE**

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

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




**NOTE**

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

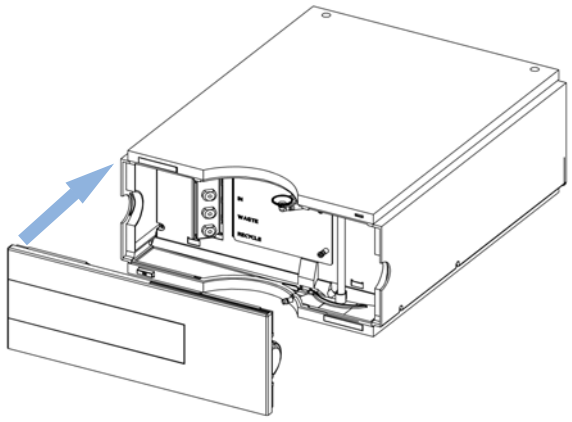
**NOTE**

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

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

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

**8** Establish flow and observe if leaks occur.

| | |
|---|---|
| **9** Replace the front cover.<br>  | |

The installation of the detector is now complete.

# 4 Using the Refractive Index Detector



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

# Operation of the Refractive Index Detector

This chapter can be used for

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

## Before Using the System

### Solvent Information

Consult the manual of your pump about suitable solvents.

### Priming and Purging the System

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

**Table 15** Choice of Priming Solvents for Different Purposes

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

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

2 Flush all tubes with at least 30 ml of solvent.

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

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

# Refractive Index Detector Control

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

How To Get There:

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

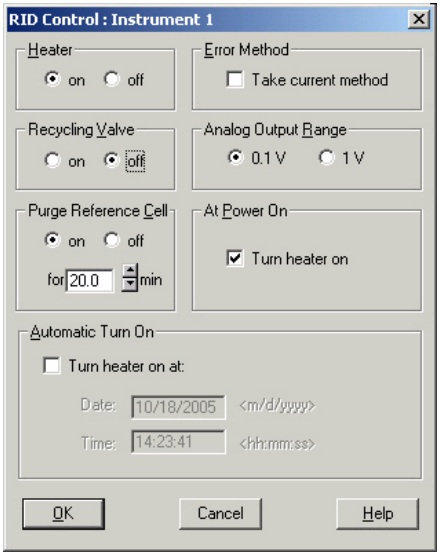



**Figure 22** Refractive Index Detector Control

- **Heater**: Select the **on** option to switch the RID heater on. This parameter requires to set the Optical Unit Temperature. Select the **off** option to switch the optical unit heater off.
- **Error Method**: The **Error Method** group enables you to select the method that is run when an error occurs. It ensures that the instrument shuts down in a controlled manner if the ChemStation control is discontinued for any reason. When **Take current method** is checked the current method is copied to the module and stored; if an error occurs, the module will run the stored method.
- **Recycling Valve**: Select the **on** option to switch the recycling of the eluent on. The **off** option diverts the flow of the RID to the waste bottle.

- **Analog Output Range**: The **Analog Output Range** group allows you to select the voltage ranges of the analog output of the refractive index detector. Select 0.1 V to set the full-scale output to 0.1 volts. Select 1 V to set the full-scale output to 1 volt.
- **Purge Reference Cell**: This parameter is used to exchange the content of the reference cell in the case of solvent change or reference cell contamination. Enter a time interval (minutes) to purge the reference cell of the Agilent 1260 Infinity RID. This will be started immediately if you click **OK** on this window. Allow additional time for baseline stabilization after purging.
- **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.
- **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.

## Refractive Index Detector Settings

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

How To Get There:

The Agilent 1260 Infinity RID Signal dialog box is displayed when you select **Setup RID Signal** from the **Instrument menu**.

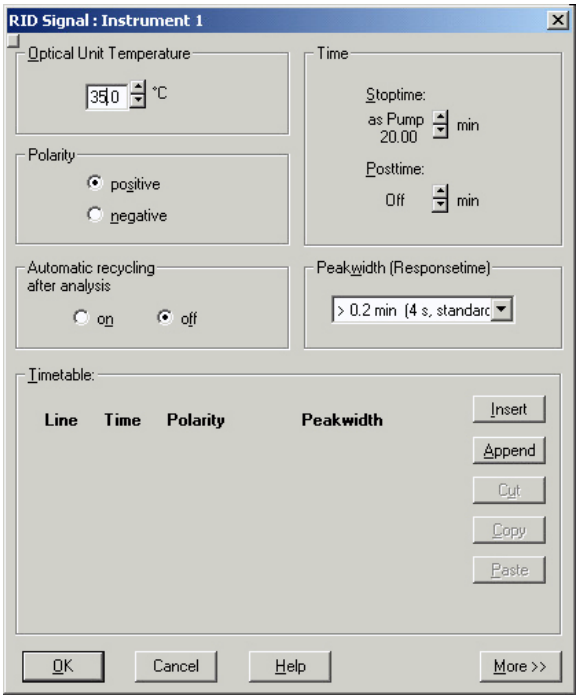



**Figure 23** Refractive Index Detector Settings

- **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.
- **Polarity**: This item sets the polarity of the RID signal. Because of the nature of analytes and eluents refractive index detectors can show negative and positive peaks, even within a run. Select the Signal Polarity you expect from your data from **Negative** or **Positive**.

- **Automatic Recycling**: This parameter can be used to select between automatic recycling of the eluent (**on**) or directing the eluent to the waste outlet of the RID (**off**) after the run.
- **Time**:

  **Stoptime**

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

  **Posttime**

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

# Refractive Index Detector More Settings

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

How To Get There:

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

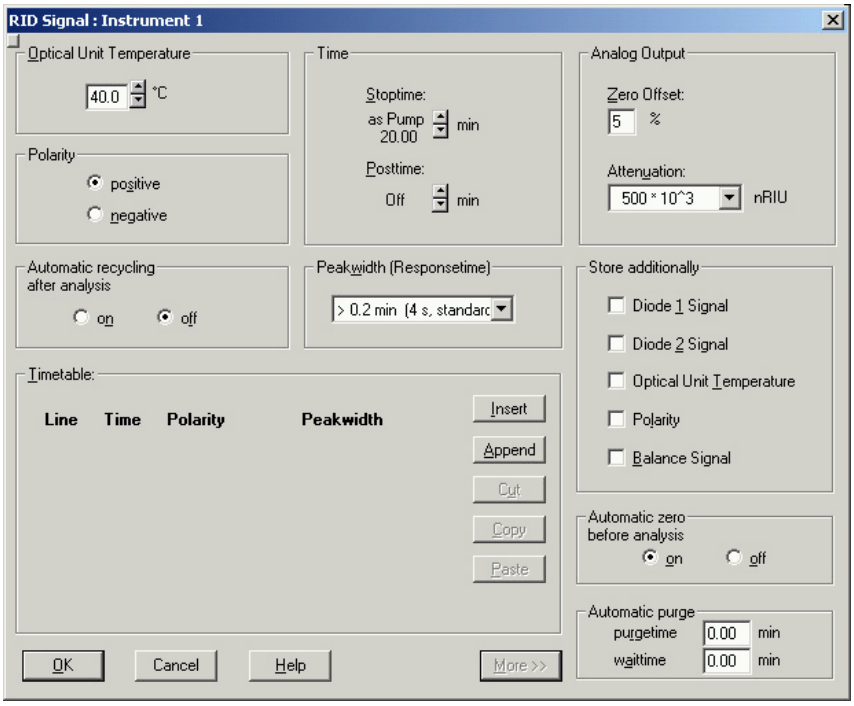



**Figure 24** More RID Settings

- **Analog Output**: If the **Analog Output** is used a zero offset (limits between 1 and 99 %) can be selected to enable the display of negative peaks. The attenuation settings helps to keep all peaks on scale. Choose the appropriate setting from the list.
- **Store Additionally**: Here you can choose to store additional signal that may help during method development and diagnosis with the RID. The following parameters can be selected:

**Diode 1 signal**

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

**Diode 2 signal**

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

**Optical unit temperature**

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

**Polarity**

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

**Balance signal**

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

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

# Running a Checkout Sample

This chapter describes the check out of the Agilent 1260 Infinity Refractive Index Detector using the Agilent isocratic checkout sample.

**When**

If you want to checkout the detector

**Parts required**

| # | p/n | Description |
|---|---|---|
| 1 | 993967-902 | Zorbax Eclipse XDB C18, 150mm x 4.6mm i.d. |
| 1 | 01080-68704 | Agilent isocratic checkout sample |

1 Turn the detector on.

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

2 Set up the instrument with the following chromatographic conditions.

**Table 16** Chromatographic Conditions

| | |
|---|---|
| Mobile phases | 30% Water, 70% Acetonitrile |
| Column | Zorbax Eclipse XDB C18, 150 mm x 4.6 mm i.d. |
| Sample | Isocratic standard sample |
| 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) |

3 Set the RID setpoints according to Figure 25 on page 73.

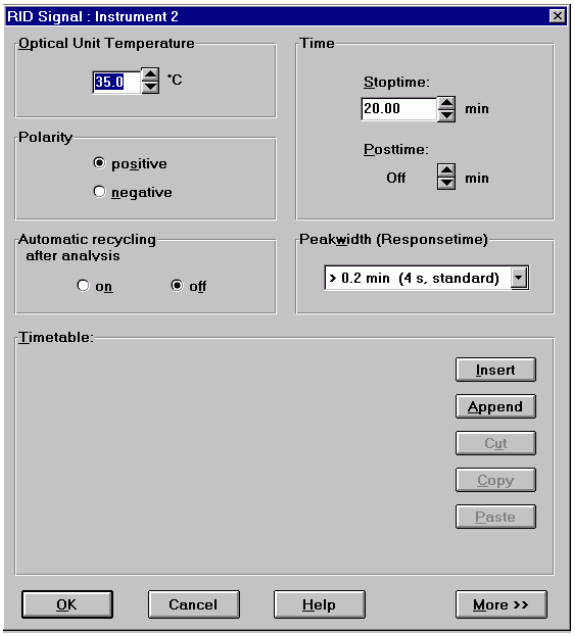



**Figure 25** RID Check Out Sample Parameters

4 Turn the heater **ON** and purge the detector reference cell for 20 minutes as shown in Figure 26 on page 74:

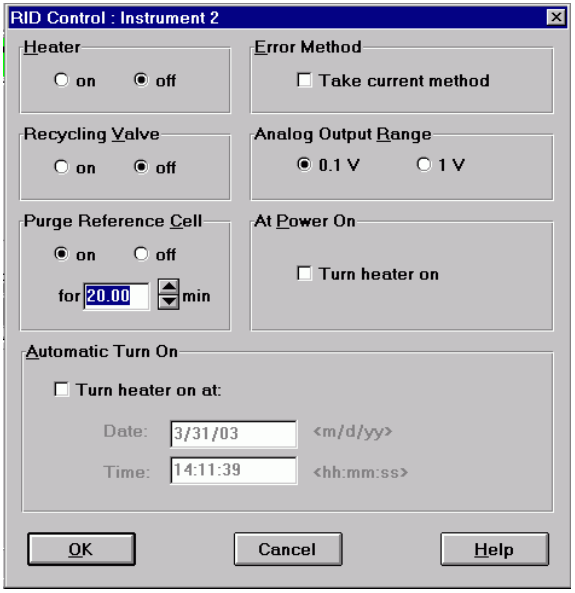



**Figure 26** RID Check Out Sample Control

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

The resulting chromatogram is shown in the figure below:

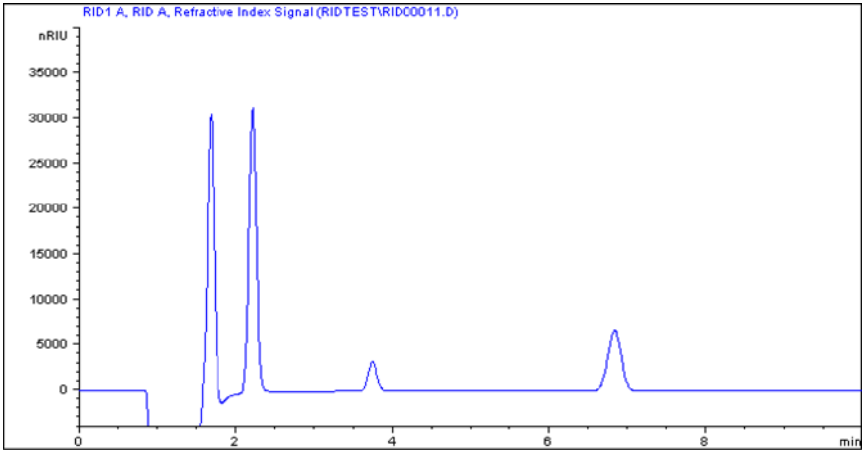



**Figure 27** Isocratic Standard Sample Chromatogram

**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 - nothing more.

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

# Checking Baseline Noise and Drift

## Setting the Test Conditions

This chapter describes checking the baseline noise and drift for the Agilent 1260 Infinity Refractive Index Detector.

**When** If you want to checkout the detector

**Tools required** LC system with G1362A 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 17** Chromatographic Conditions

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

4 Set the RID setpoints according to Figure 28 on page 77.

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

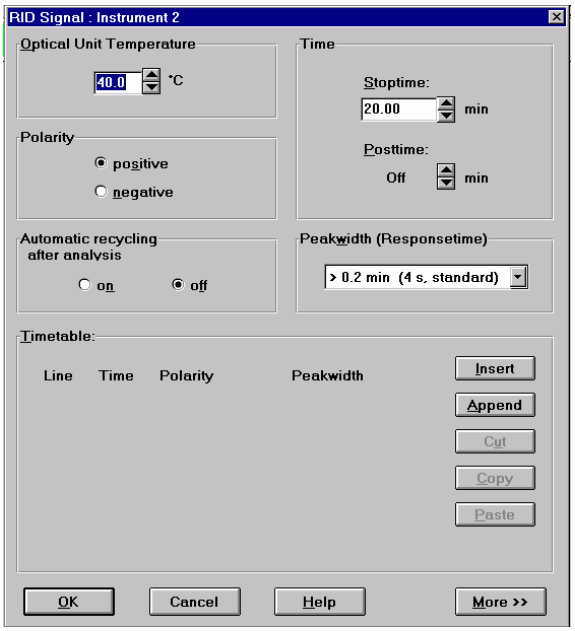



**Figure 28** RID Baseline Check Parameters

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

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

5 Edit the Agilent ChemStation method.

6 Specify the report style Performance + Noise as shown in Figure 29 on page 78

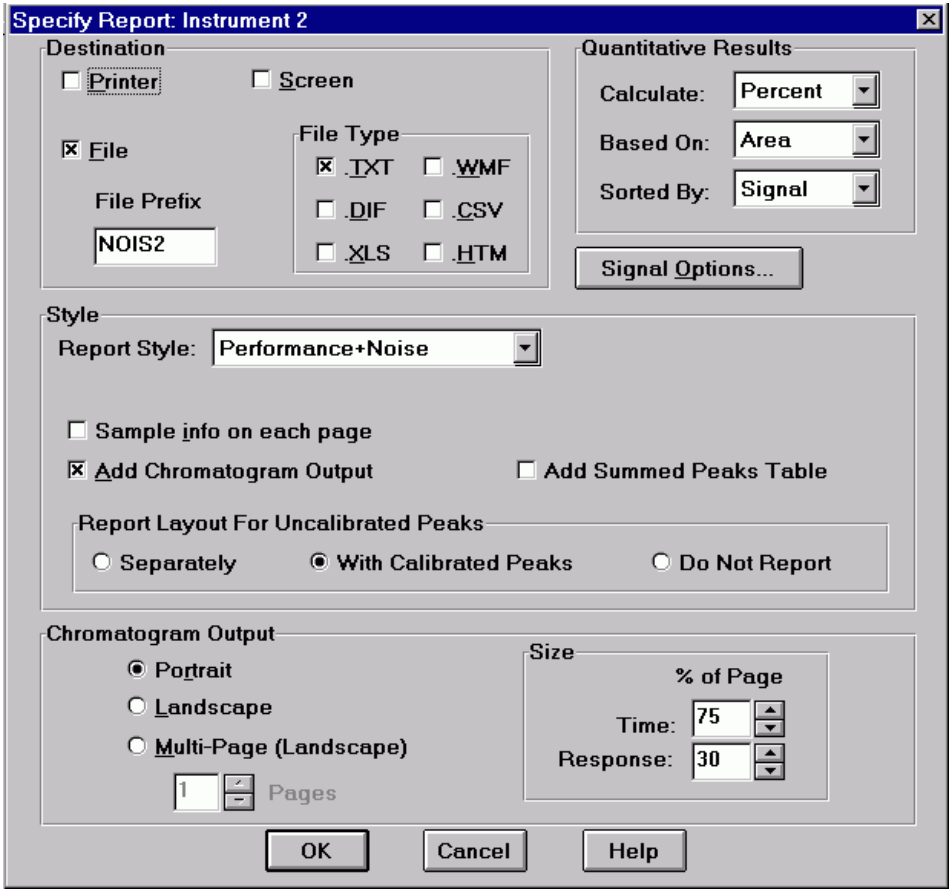



**Figure 29** RID Baseline Check Out Report

7 Set the noise determination time range to 0 - 20 minutes as shown in Figure 30 on page 79:

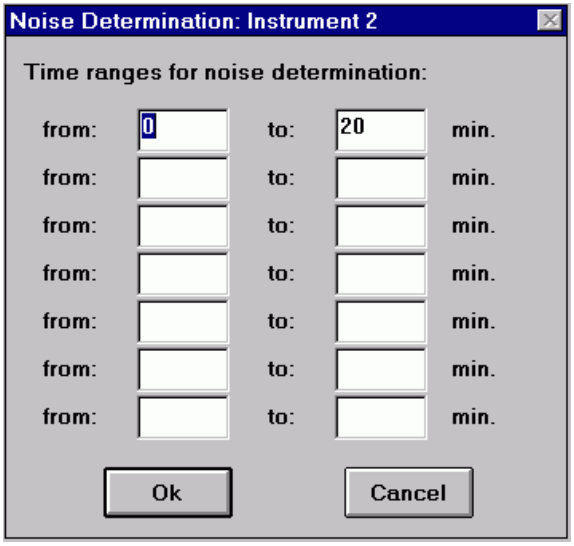



**Figure 30** RID Baseline Check Out Noise Ranges

8 **Save** the Agilent ChemStation method.

9 Turn the heater **ON** and purge the detector reference cell for 20 minutes as shown in Figure 31 on page 80:

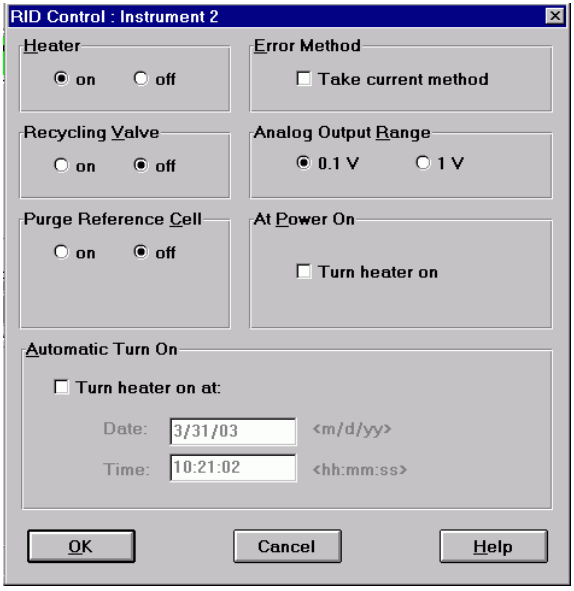



**Figure 31** RID Baseline Check Control

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

**11** The Agilent ChemStation report is shown in Figure 32 on page 81:

OQNOIS2.txt - Notepad

File Edit Search Help

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

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

Multiplier             :      1.0000
Dilution               :      1.0000


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

Noise determination:

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


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

**Figure 32** Baseline Check Out Results

## 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

See “Refractive Index Detector Control” on page 66.

# 5 Optimizing the Refractive Index Detector



This chapter provides information on how to optimize the detector.

# Refractive Index Detector Optimization

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

1 Position the solvent and waste reservoirs correctly

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

2 Do not overpressurize the flow cell

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

3 Use the correct solvents

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

4 Check for leaks

Leaks within the LC instrument that the refractive index detector is connected to will cause problems with baseline long term noise or drift. Confirm that the instrument is free from leaks by performing the 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 (p/n 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 (p/n 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



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

# Overview of the Module's Indicators and Test Functions

## Status Indicators

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

## Error Messages

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

## Not-Ready Messages

During the wait for a specific condition to be reached or completed the detector will generate a not-ready message. For each message a short description is provided (see "Not-Ready Messages" on page 114).

## Refractive Index Calibration

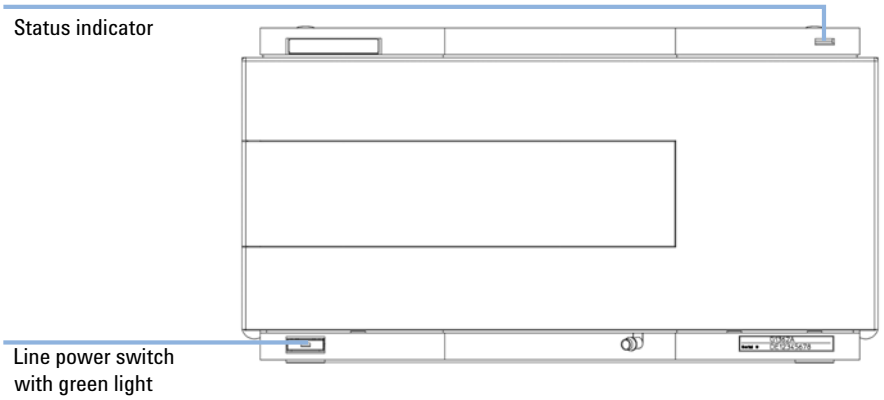
Refractive index calibration is recommended after exchange of the optical unit to ensure correct operation of the detector. The procedure uses a solution of known refractive index compared to LC grade water (see "Refractive Index Calibration" on page 118).

## Optical Balance

Optical balance allows the balance of light falling on the light receiving diodes to be restored. The sample and reference cells must both be fully purged before the procedure is started, see "Optical Balance" on page 123.

# Status Indicators

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




## Power Supply Indicator

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

## Module Status Indicator

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

- When the status indicator is *OFF* (and power switch light is on), the module is in a *prerun* condition, and is ready to begin an analysis.
- A *green* status indicator, indicates the module is performing an analysis (*run* mode).
- A *yellow* indicator indicates a *not-ready* condition. The module is in a not-ready state when it is waiting for a specific condition to be reached or completed (for example, immediately after changing a set point), or while a self-test procedure is running.
- An *error* condition is indicated when the status indicator is *red*. An error condition indicates the module has detected an internal problem which affects correct operation of the module. Usually, an error condition requires attention (e.g. leak, defective internal components). An error condition always interrupts the analysis.
- A *red-blinking* (modules with on-board LAN) or *yellow-blinking* (modules without on-board LAN) indicator indicates that the module is in resident mode (e.g. during update of main firmware).
- A *fast red-blinking* (modules with on-board LAN) or *fast yellow-blinking* (modules without on-board LAN) indicator indicates that the module is in boot loader mode (e.g. during update of main firmware). In such a case try to re-boot the module or try a cold-start.

# User Interfaces

- Depending on the user interface, the available tests and the screens/reports may vary (see Chapter *"Test Functions and Calibrations"*).
- Preferred tool should be the Agilent Diagnostic Software, see “Agilent Lab Advisor Software” on page 95.
- The Agilent ChemStation B.04.02 and above may not include any maintenance/test functions.
- Screenshots used within these procedures are based on the Agilent Lab Advisor Software.

# Agilent Lab Advisor Software

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

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

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

This manual provides lists with the names of Error Messages, Not Ready messages, and other common issues.

# 7
# Error Information

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

# What Are Error Messages

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

# General Error Messages

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

## Timeout

The timeout threshold was exceeded.

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

## Shut-Down

An external instrument has generated a shut-down 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 *Service Manual* for the degasser or the 1260 pump that has the degasser built-in. |

## Remote Timeout

A not-ready condition is still present on the remote input. When an analysis is started, the system expects all not-ready conditions (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). |

## Synchronization Lost

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

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

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

## Leak

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 flow cell. |

## Leak Sensor Open

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

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

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

## Leak Sensor Short

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

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

| Probable cause | Suggested actions |
|---|---|
| 1 Defective flow sensor. | Please contact your Agilent service representative. |

## Compensation Sensor Open

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

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

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

## Compensation Sensor Short

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

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

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

## Fan Failed

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.

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

## Open Cover

The top foam has been removed.

The sensor on the main board detects when the top foam is in place. If the foam is removed, the fan is switched off, and the error message is generated.

| Probable cause | Suggested actions |
|---|---|
| **1** The top foam was removed during operation. | Please contact your Agilent service representative. |
| **2** Foam not activating the sensor. | Please contact your Agilent service representative. |
| **3** Dirty or defective sensor. | Please contact your Agilent service representative. |

## Cover Violation

The top foam has been removed.

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

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

# Refractive Index Detector Specific Error Messages

## Thermal Fuse Open

The thermal fuse of the optical unit heater has failed.

| Probable cause | Suggested actions |
|---|---|
| **1** Heater cable disconnected. | Please contact your Agilent service representative. |
| **2** Defective main board. | Please contact your Agilent service representative. |
| **3** Defective thermal fuse. | Please contact your Agilent service representative. |

## Heater Resistance Too High

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

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

## Heater Fuse

The electronic fuse of the heater has been activated.

| Probable cause | Suggested actions |
|---|---|
| 1 Short in heater circuit. | Power cycle the detector. |
| 2 Defective main board. | Please contact your Agilent service representative. |
| 3 Defective heater. | Please contact your Agilent service representative. |

## Wrong Temperature Profile

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

| Probable cause | Suggested actions |
|---|---|
| 1 Defective main board. | Please contact your Agilent service representative. |
| 2 Defective heater. | Please contact your Agilent service representative. |

## Undecipherable Temperature Signal

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

## Maximum Temperature Exceeded

The maximum heater temperature has been exceeded.

| Probable cause | Suggested actions |
|---|---|
| 1 Defective main board. | Please contact your Agilent service representative. |
| 2 Defective heater. | Please contact your Agilent service representative. |

## Purge Valve Fuse Blown

The electronic fuse on the purge valve has been activated.

| Probable cause | Suggested actions |
|---|---|
| 1 Short in purge valve circuit. | Power cycle the module. |
| 2 Defective purge valve. | Please contact your Agilent service representative. |
| 3 Defective main board. | Please contact your Agilent service representative. |

## Recycle Valve Fuse Blown

The electronic fuse on the recycle valve has been activated.

| Probable cause | Suggested actions |
|---|---|
| 1 Short in recycle valve circuit. | Power cycle the module. |
| 2 Defective recycle valve. | Please contact your Agilent service representative. |
| 3 Defective main board. | Please contact your Agilent service representative. |

## Purge Valve Not Connected

When activated no response was received from the purge valve.

| Probable cause | Suggested actions |
|---|---|
| 1 Purge valve disconnected. | Please contact your Agilent service representative. |
| 2 Defective purge valve. | Please contact your Agilent service representative. |
| 3 Defective main board. | Please contact your Agilent service representative. |

## Recycle Valve Missing

When activated no response was received from the recycle valve.

| Probable cause | Suggested actions |
|---|---|
| 1 Recycle valve disconnected. | Please contact your Agilent service representative. |
| 2 Defective recycle valve. | Please contact your Agilent service representative. |
| 3 Defective main board. | Please contact your Agilent service representative. |

## Lamp Voltage too Low

| Probable cause | Suggested actions |
|---|---|
| 1 Defective main board. | Please contact your Agilent service representative. |
| 2 Defective lamp or optics. | Please contact your Agilent service representative. |

## Lamp Voltage too High

| Probable cause | Suggested actions |
|---|---|
| 1 Contaminated flow cell. | Flush the flow cell. |
| 2 Defective main board. | Please contact your Agilent service representative. |
| 3 Defective lamp or optics. | Please contact your Agilent service representative. |

## Lamp Current too High

| Probable cause | Suggested actions |
|---|---|
| 1 Defective main board. | Please contact your Agilent service representative. |
| 2 Defective lamp or optics. | Please contact your Agilent service representative. |

## Lamp Current too Low

| Probable cause | Suggested actions |
|---|---|
| 1 Optical unit cable disconnected. | Please contact your Agilent service representative. |
| 2 Defective main board. | Please contact your Agilent service representative. |
| 3 Defective lamp or optics. | Please contact your Agilent service representative. |

## Wait Function Timed Out

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

| Probable cause | Suggested actions |
|---|---|
| 1 Time too short. | 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

| Probable cause | Suggested actions |
|---|---|
| 1 The purge valve is open, liquid is flowing through both sample and reference cell. | Allow the reference purge time to elapse. |

## Wait for Purge

| Probable cause | Suggested actions |
|---|---|
| 1 The detector is waiting after the automatic purge of the reference cell. | Allow the wait time to elapse. |

## Unbalanced Diodes

| Probable cause | Suggested actions |
|---|---|
| 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. | • Flush the reference cell with the mobile phase being used.<br>• Perform the RID Optical Balance procedure (see "The Optical Balance Procedure" on page 124). |

## Not Enough Light

| Probable cause | Suggested actions |
|---|---|
| 1 There is insufficient light falling on the light receiving diodes to generate a refractive index signal. | 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 | Suggested actions |
|---|---|
| 1 The sample cell content is varying too much from the reference cell. | Purge reference and sample cell. |

# 8
# Test Functions



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

# 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.

## The Refractive Index Calibration Procedure

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

**Tools required** 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 | 5061-3367 | Sample filter |
| 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.

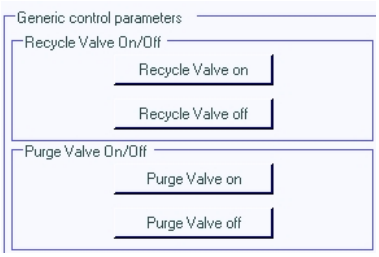
2 Preparing the pump.

   a Fill a suitable solvent bottle with LC grade water.

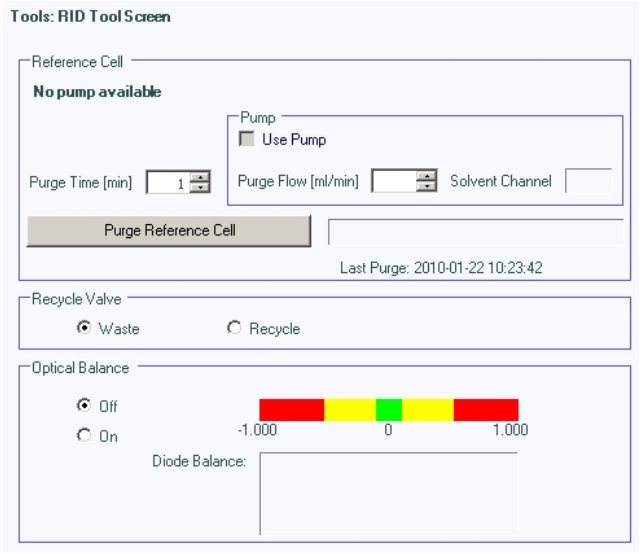
   b Connect this bottle to Channel A of the pump, A1 if a binary pump.

3 Using the Agilent LabAdvisor Software (B.01.03 SP4 or later) there are three screens used for the calibration process.

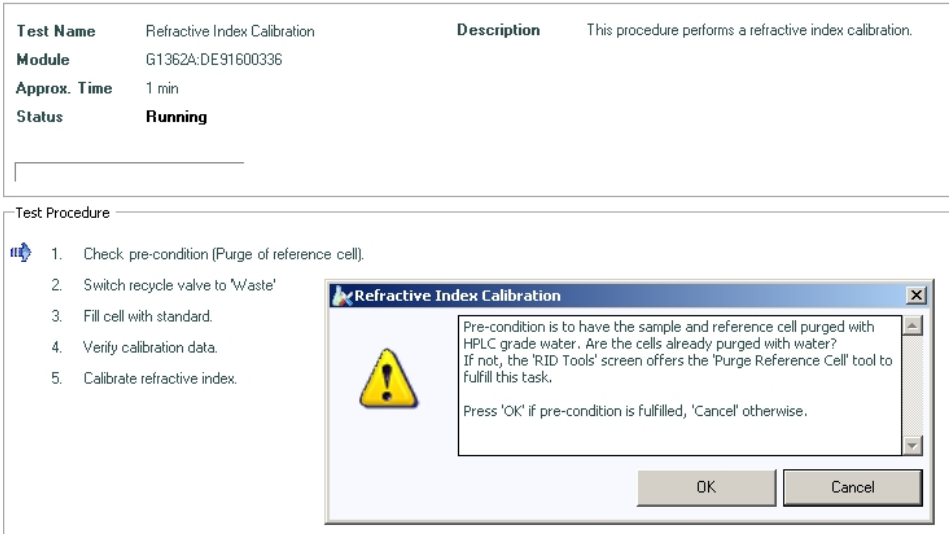
   a RID Module Service Center (via Tools).




   b RID Tools screen (via Tools). (If an Agilent pump is part of the system, the pump section is active.)




**c** RID Calibration screen (via Calibrations).




Use the functions as described in the steps below.

**4** Flushing the degasser and pump.

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.

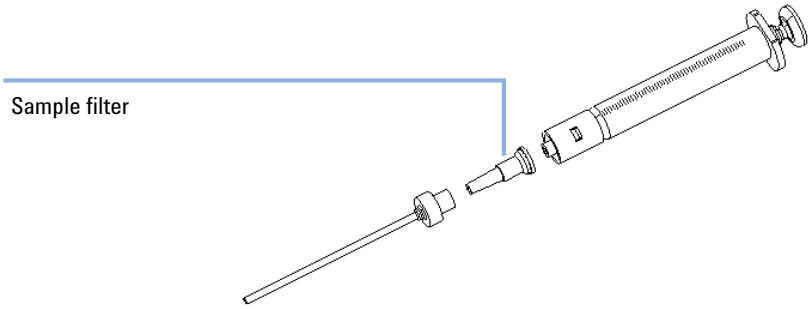



**Figure 33** Syringe with Sample Filter

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 Calibrate refractive index.

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

**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

## 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:

- $\text{diode}_1$ = signal proportional to the amount of light falling on $\text{diode}_1$
- $\text{diode}_2$ = signal proportional to the amount of light falling on $\text{diode}_2$

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

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

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

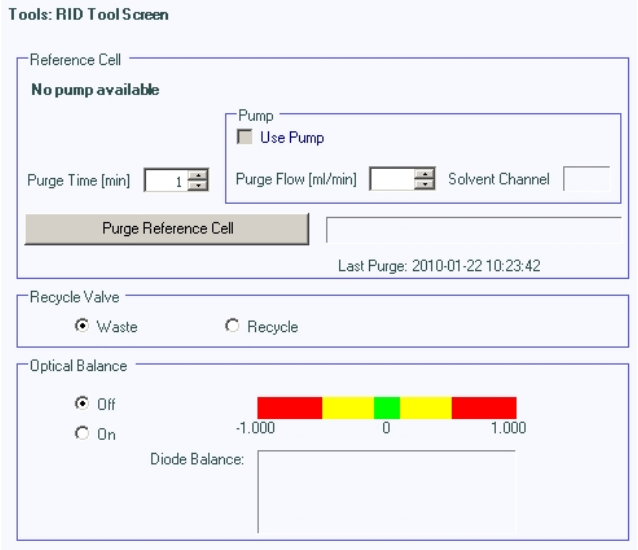
# The Optical Balance Procedure

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

**Tools required**
- 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. 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
2. Start optical balance.
   a. Using the Agilent LabAdvisor Software (B.01.03 SP3 or later) open the RID Tools screen.



3 Adjust optical balance.

a While monitoring the optical balance use the flat-headed screwdriver to turn the zero glass adjustment screw slowly (see Figure 34 on page 125).

b When the diode balance value reaches 0.00 optical balance is restored.

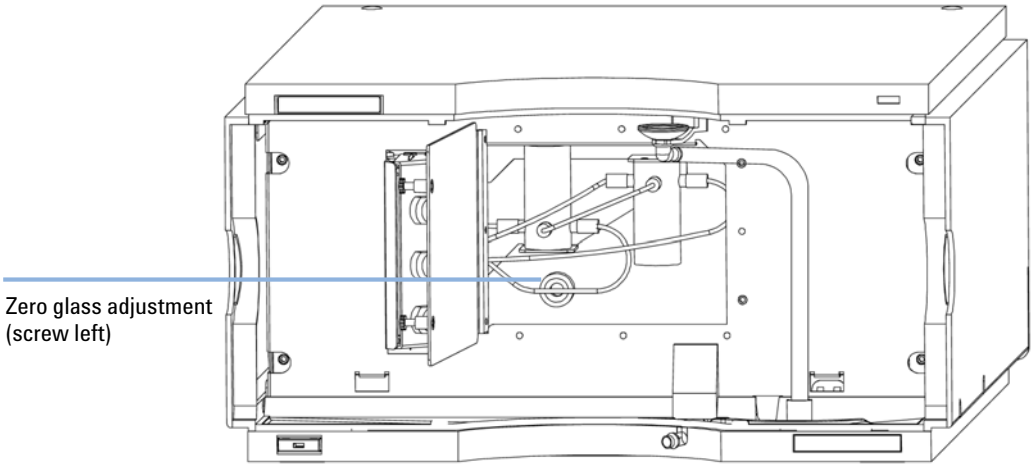



**Figure 34** Turning the zero glass adjustment screw

# Using the Build-in Test Chromatogram

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

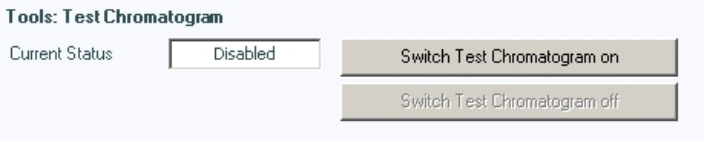
The built-in Test Chromatogram can be used to check the signal path from the detector to the data system and the data analysis or via the analog output to the integrator or data system. The chromatogram is continuously repeated until a stop is executed either by means of a stop time or manually.

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

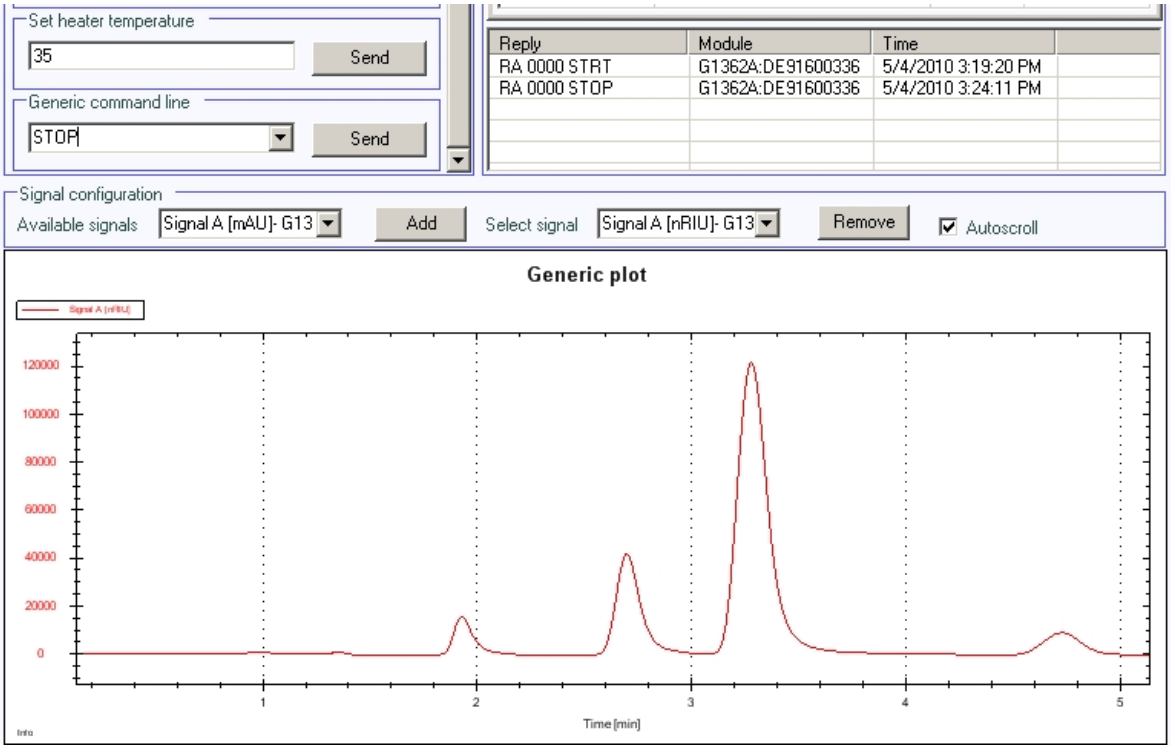



**Figure 35** Test Chromatogram with Agilent LabAdvisor

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.

# 9 Maintenance



This chapter provides general information on maintenance of the detector.

# Introduction to Maintenance

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

**NOTE**

There are no serviceable parts inside.

Do not open the module.

# Warnings and Cautions

**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 amount of substances should be reduced to the minimal volume required for the analysis.
- ➔ Do not operate the instrument in an explosive atmosphere.

---

**WARNING**

**Electrical shock**

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

- ➔ Do not remove the metal top cover of the module. No serviceable parts inside.
- ➔ Only certified persons are authorized to carry out repairs inside the module.

---

**WARNING**

**Personal injury or damage to the product**

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

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

---

**CAUTION**

Safety standards for external equipment

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

# Detector Maintenance Procedures

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

**Table 18** 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

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

**WARNING**

**Liquid dripping into the electronic compartment of your module.**

**Liquid in the module electronics can cause shock hazard and damage the module.**

➔ Do not use an excessively damp cloth during cleaning.

➔ Drain all solvent lines before opening any fittings.

# Flow Cell Flushing

**When** If flow cell is contaminated

**Tools required** Glass syringe, adapter

**Parts required**

| # | Description |
|---|---|
| 1 | Strong solvent, 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 in the flow cell can build up algae. Therefore do not leave aqueous solvents in the flow cell for long periods. Add a small percentage of organic solvents (e.g. Acetonitrile or Methanol ~ 5%).

**NOTE**

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

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

1. Flush with the strong solvent.
2. Leave this solution in the cell for about one hour.
3. Flush with mobile phase.

**NOTE**

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

# Correcting Leaks

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

**Tools required** Tissue
Two 1/4 inch wrenches for capillary connections

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

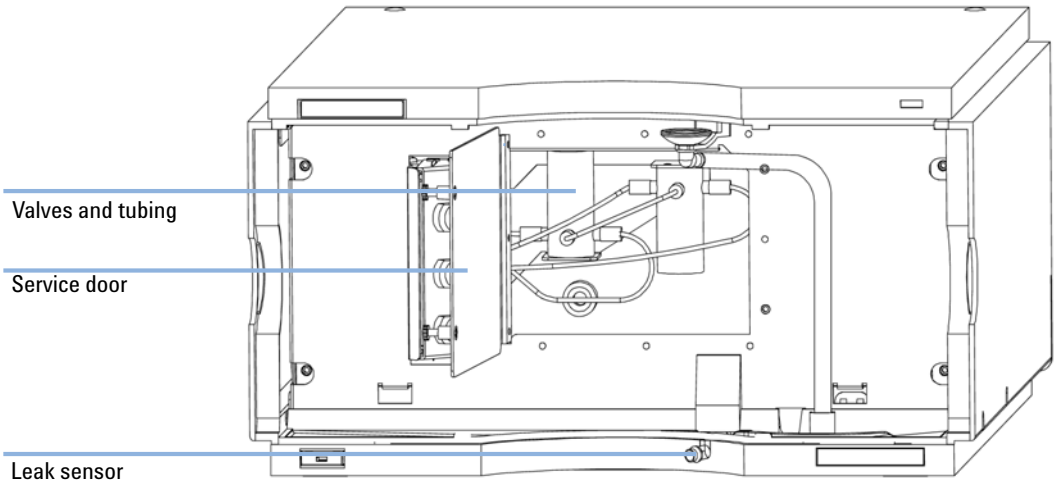



**Figure 36** Observing for Leaks

# Replacing Leak Handling System Parts

**When** If the parts are corroded or broken

**Parts required**

| # | p/n | Description |
|---|---|---|
| 1 | 5061-8388 | Leak funnel |
| 1 | 5041-8389 | Leak funnel holder |
| 1 | 5042-9974 | Tubing Flex (1.5 m) |

Leak tubing 120 mm required.

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

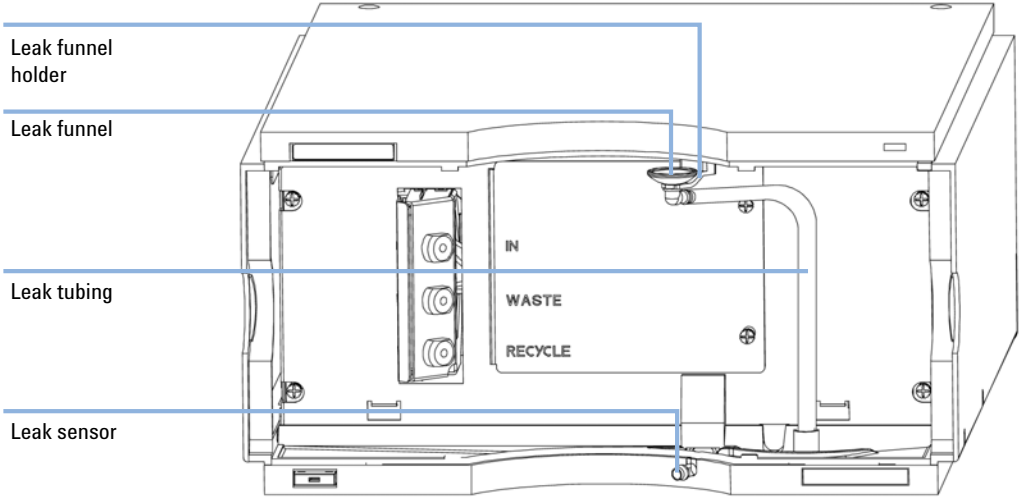



**Figure 37** Replacing Leak Handling System Parts

# Replacing the Detector's Firmware

**When**

The installation of newer firmware might be necessary
- if a newer version solves problems of older versions or
- to keep all systems on the same (validated) revision.

The installation of older firmware might be necessary
- to keep all systems on the same (validated) revision or
- if a new module with newer firmware is added to a system or
- if third part control software requires a special version.

**Tools required**

- LAN/RS-232 Firmware Update Tool or
- Agilent Diagnostic Software
- 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 LAN/RS-232 FW Update Tool and the documentation from the Agilent web.
   - http://www.chem.agilent.com/scripts/cag_firmware.asp.

2 To load the firmware into the module follow the instructions in the documentation.

*Module Specific Information*

There is no specific information for this module.

# Replacing the Interface Board

**When** For all repairs inside the detector or for installation of the board

**Parts required**

| # | p/n | Description |
|---|---|---|
| 1 | G1351-68701 | Interface board (BCD) with external contacts and BCD outputs |
| 1 | G1369B or G1369-60002 | Interface board (LAN) |

"Setting the 8-bit Configuration Switch (without On-Board LAN)" on page 33

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

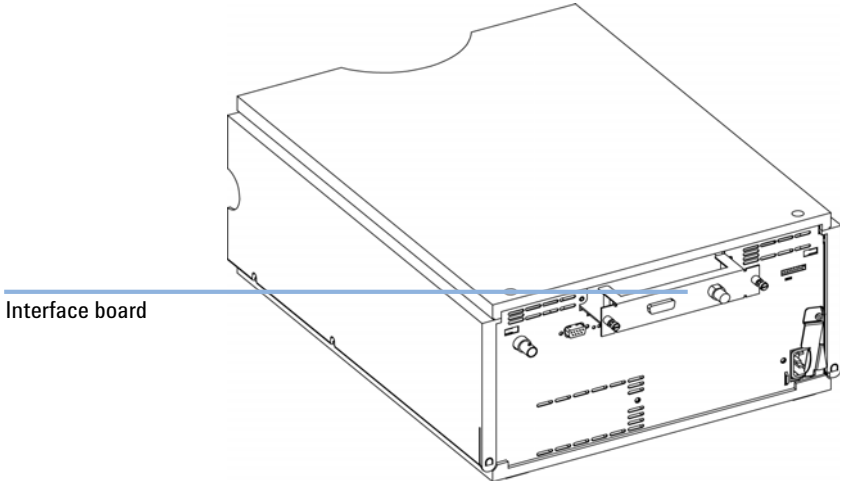



**Figure 38** Location of the Interface Board

# 10
# Parts for Maintenance



This chapter provides information on parts for maintenance.

# Accessory Kits

Accessory kit (p/n G1362-68755) contains some accessories needed for the installation of the detector.

| p/n | Description |
|---|---|
| G1362-68706 | Interface tubing kit |
| G1362-87300 | Interfacing capillary |
| G1362-87301 | Restriction capillary |
| 5181-1516 | CAN cable, Agilent module to module, 0.5 m |
| 0100-1847 | PEEK adapter 1/4-28 to 10-32<br>(Adapter AIV to solvent inlet tubes) |

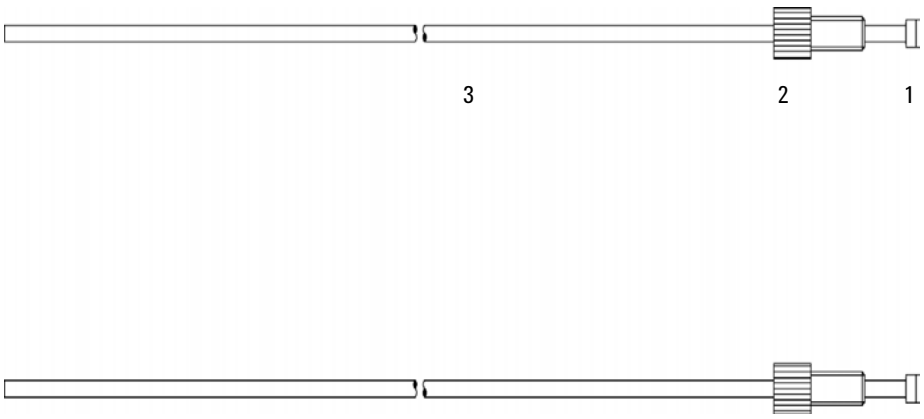



**Figure 39** Interface Tubing Kit Parts

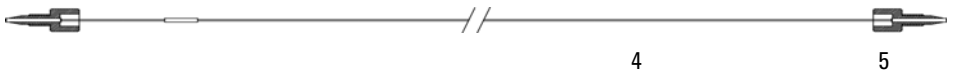



**Figure 40** Interfacing Capillary Parts

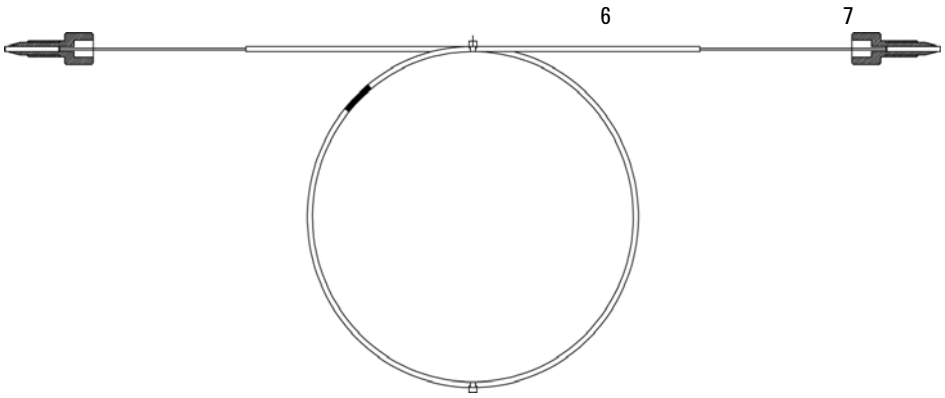



**Figure 41** Restriction Capillary Parts

# 11
# Identifying Cables



This chapter provides information on cables used with the Agilent 1260 Infinity LC modules.

# Cable Overview

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

### Analog cables

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

### Remote cables

| p/n | Description |
|---|---|
| 03394-60600 | Agilent module to 3396A Series I integrators |
| | 3396 Series II / 3395A integrator, see details in section "Remote Cables" on page 150 |
| 03396-61010 | Agilent module to 3396 Series III / 3395B integrators |
| 5061-3378 | Agilent module to Agilent 35900 A/D converters (or HP 1050/1046A/1049A) |
| 01046-60201 | Agilent module to general purpose |

### BCD cables

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

### CAN cables

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

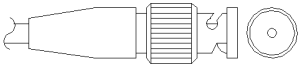
### LAN cables

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

### RS-232 cables

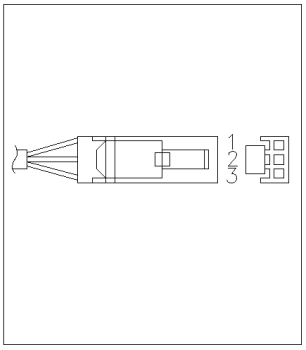
| p/n | Description |
|---|---|
| G1530-60600 | RS-232 cable, 2 m |
| RS232-61600 | RS-232 cable, 2.5 m<br>Instrument to PC, 9-to-9 pin (female). This cable has special pin-out, and is not compatible with connecting printers and plotters. It's also called "Null Modem Cable" with full handshaking where the wiring is made between pins 1-1, 2-3, 3-2, 4-6, 5-5, 6-4, 7-8, 8-7, 9-9. |
| 5181-1561 | RS-232 cable, 8 m |

# Analog Cables

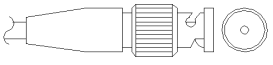


One end of these cables provides a BNC connector to be connected to Agilent modules. The other end depends on the instrument to which connection is being made.

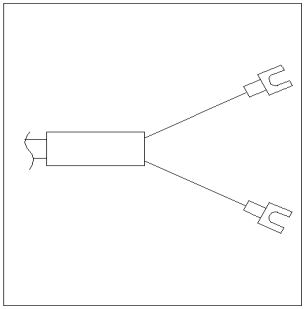
## Agilent Module to 3394/6 Integrators

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

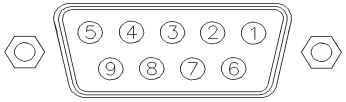
## Agilent Module to BNC Connector

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

## Agilent Module to General Purpose

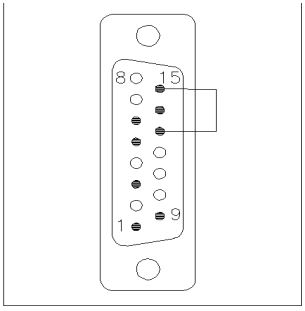
| p/n 01046-60105 | Pin 3394/6 | Pin Agilent module | Signal Name |
|---|---|---|---|
|  | 1 | | Not connected |
| | 2 | Black | Analog - |
| | 3 | Red | Analog + |

# Remote Cables




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

## Agilent Module to 3396A Integrators

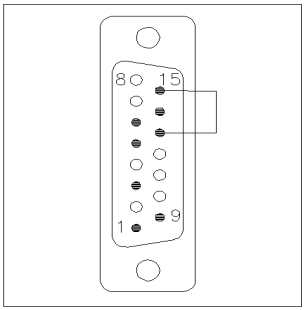
| p/n 03394-60600 | Pin 3394 | Pin Agilent module | Signal Name | Active (TTL) |
|---|---|---|---|---|
|  | 9 | 1 - White | Digital ground | |
| | NC | 2 - Brown | Prepare run | Low |
| | 3 | 3 - Gray | Start | Low |
| | NC | 4 - Blue | Shut down | Low |
| | NC | 5 - Pink | Not connected | |
| | NC |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



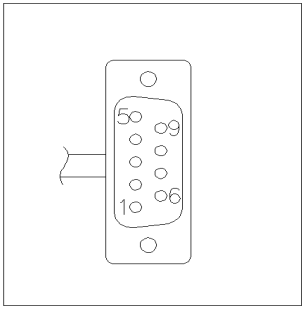
## Agilent Module to 3396 Series II / 3395A Integrators

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

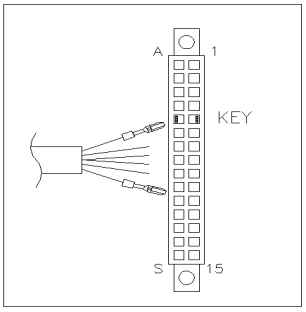
## Agilent Module to 3396 Series III / 3395B Integrators

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

## Agilent Module to Agilent 35900 A/D Converters

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

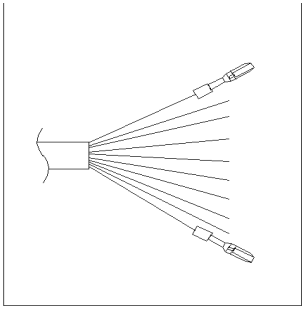
## Agilent Module to General Purpose

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

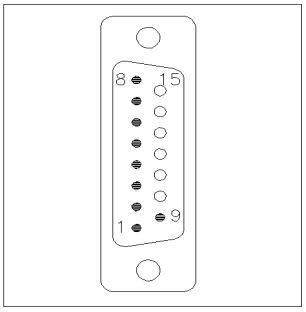
# BCD Cables


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

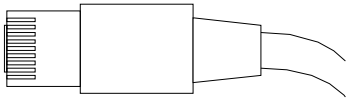
## Agilent Module to General Purpose

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

## Agilent Module to 3396 Integrators

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

# CAN/LAN Cables



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

### CAN Cables

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

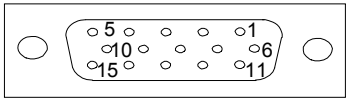
### LAN Cables

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

# Agilent Module to PC

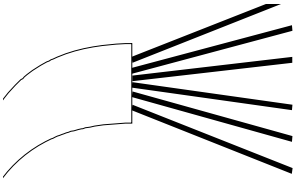
| p/n | Description |
|---|---|
| G1530-60600 | RS-232 cable, 2 m |
| RS232-61600 | RS-232 cable, 2.5 m<br>Instrument to PC, 9-to-9 pin (female). This cable has special pin-out, and is not compatible with connecting printers and plotters. It's also called "Null Modem Cable" with full handshaking where the wiring is made between pins 1-1, 2-3, 3-2, 4-6, 5-5, 6-4, 7-8, 8-7, 9-9. |
| 5181-1561 | RS-232 cable, 8 m |

# External Contact Cable




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

## Agilent Module Interface Board to general purposes

| External contact cable - Agilent module interface board to general purposes (p/n G1103-61611) | Color | Pin Agilent module | Signal Name |
|---|---|---|---|
|  | White | 1 | EXT 1 |
| | Brown | 2 | EXT 1 |
| | Green | 3 | EXT 2 |
| | Yellow | 4 | EXT 2 |
| | Grey | 5 | EXT 3 |
| | Pink | 6 | EXT 3 |
| | Blue | 7 | EXT 4 |
| | Red | 8 | EXT 4 |
| | Black | 9 | Not connected |
| | Violet | 10 | Not connected |
| | Grey/pink | 11 | Not connected |
| | Red/blue | 12 | Not connected |
| | White/green | 13 | Not connected |
| | Brown/green | 14 | Not connected |
| | White/yellow | 15 | Not connected |

# 12
# Appendix



This chapter provides safetey and other general information.

# General Safety Information

## Safety Symbols

**Table 19** Safety Symbols

| Symbol | Description |
|---|---|
|  | The apparatus is marked with this symbol when the user should refer to the instruction manual in order to protect risk of harm to the operator and to protect the apparatus against damage. |
|  | Indicates dangerous voltages. |
|  | Indicates a protected ground terminal. |
|  | Indicates eye damage may result from directly viewing the light produced by the deuterium lamp used in this product. |
|  | The apparatus is marked with this symbol when hot surfaces are available and the user should not touch it when heated up. |

**WARNING**

**A WARNING**

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

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

**CAUTION**

A CAUTION

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

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

## General Safety Information

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

**WARNING**

**Ensure the proper usage of the equipment.**

**The protection provided by the equipment may be impaired.**

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

## Safety Standards

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

## Operation

Before applying power, comply with the installation section. Additionally the following must be observed.

Do not remove instrument covers when operating. Before the instrument is switched on, all protective earth terminals, extension cords, auto-transformers, and devices connected to it must be connected to a protective earth via a ground socket. Any interruption of the protective earth grounding will cause a potential shock hazard that could result in serious personal injury. Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any intended operation.

Make sure that only fuses with the required rated current and of the specified type (normal blow, time delay, and so on) are used for replacement. The use of repaired fuses and the short-circuiting of fuse holders must be avoided.

Some adjustments described in the manual, are made with power supplied to the instrument, and protective covers removed. Energy available at many points may, if contacted, result in personal injury.

Any adjustment, maintenance, and repair of the opened instrument under voltage should be avoided whenever possible. When inevitable, this has to be carried out by a skilled person who is aware of the hazard involved. Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present. Do not replace components with power cable connected.

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

Do not install substitute parts or make any unauthorized modification to the instrument.

Capacitors inside the instrument may still be charged, even though the instrument has been disconnected from its source of supply. Dangerous voltages, capable of causing serious personal injury, are present in this instrument. Use extreme caution when handling, testing and adjusting.

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

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

## Abstract

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

**NOTE**

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

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

*Do not dispose off in domestic household waste*

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

# Lithium Batteries Information

**WARNING**

**Lithium batteries may not be disposed-off into the domestic waste. Transportation of discharged Lithium batteries through carriers regulated by IATA/ICAO, ADR, RID, IMDG is not allowed.**

**Danger of explosion if battery is incorrectly replaced.**

➔ Discharged Lithium batteries shall be disposed off locally according to national waste disposal regulations for batteries.

➔ Replace only with the same or equivalent type recommended by the equipment manufacturer.

**WARNING**

**Lithiumbatteri - Eksplosionsfare ved fejlagtig håndtering.**

**Udskiftning må kun ske med batteri af samme fabrikat og type.**

➔ Lever det brugte batteri tilbage til leverandøren.

**WARNING**

**Lithiumbatteri - Eksplosionsfare.**

**Ved udskiftning benyttes kun batteri som anbefalt av apparatfabrikanten.**

➔ Brukt batteri returneres appararleverandoren.

**NOTE**

Bij dit apparaat zijn batterijen geleverd. Wanneer deze leeg zijn, moet u ze niet weggooien maar inleveren als KCA.

# Radio Interference

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

## Test and Measurement

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

# Sound Emission

## Manufacturer's Declaration

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

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

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

# Solvent Information

## Flow Cell

To protect optimal functionality of your flow-cell:

- Avoid the use of alkaline solutions (pH > 9.5) which can attack quartz and thus impair the optical properties of the flow cell.
- If the flow cell is transported while temperatures are below 5 °C, it must be assured that the cell is filled with alcohol.
- Aqueous solvents in the flow cell can built up algae. Therefore do not leave aqueous solvents sitting in the flow cell. Add a small % of organic solvents (e.g. acetonitrile or methanol ~5 %).

## Use of Solvents

Observe the following recommendations on the use of solvents.

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

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

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

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

# Agilent Technologies on Internet

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

http://www.agilent.com

Select Products/Chemical Analysis

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

# Index

## F



## G



## H



## I



## L



## M

## T



## U



## V



## W

www.agilent.com

# In This Book

This manual contains technical reference information about the Agilent 1260 Infinity Refractive Index Detector G1362:

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



Printed in Germany
05/12

G1362-90011 Rev. B

Agilent Technologies