Agilent 1260 Infinity II

High Temperature Dual Angle LSD

User Manual

Agilent Technologies

Notices

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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 G7822B Agilent 1260 Infinity II High Temperature Dual Angle Light Scattering Detector.

1 Introduction to the High Temperature Dual Angle LSD

This chapter gives an introduction to the HT Dual Angle Light Scattering Detector.

2 Site Requirements and Specifications

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

3 Using the Module

This chapter provides information on how to use the module.

4 Optimizing Performance

This chapter gives hints on how to optimize the performance or use additional devices.

5 Troubleshooting and Diagnostics

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6 Maintenance and Repair

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7 Appendix

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Introduction to the High Temperature Dual Angle LSD

This chapter gives an introduction to the HT Dual Angle Light Scattering Detector.

Introduction to the High Temperature Dual Angle LSD

The G7822B Light Scattering Detector is a static light-scattering system with detectors positioned at both 15 ° and 90 ° to the incident laser beam. The detector is designed to be installed inside the temperature chamber of the 1260 Infinity II High Temperature GPC system. Alternatively, it can be installed inside a custom temperature chamber. This configuration is used to determine the molecular weight, radius of gyration and other parameters for a wide range of molecular sizes, typically from 100 to 10000000 Da and radii from 10 nm to 150 nm.

Installation of the detector within the detector chamber of the GPC system allows for the determination of the light scattering at the elevated temperatures that are commonly used to effect the separation. Locating the flow cell inside a constant temperature oven can provide additional accuracy and precision to the measurements than use of a stand alone detector. An additional benefit is that the distance between the end of the column and the flow cell can be minimized, thus reducing post column band broadening effects.

Module Components

The G7822B Light Scattering Detector consists of two components:

1. Flow cell, which is installed inside the temperature chamber of the 1260 Infinity II High Temperature GPC system.
2. Laser Control Module, which is fitted to the rear panel of the 1260 Infinity II High Temperature GPC system.

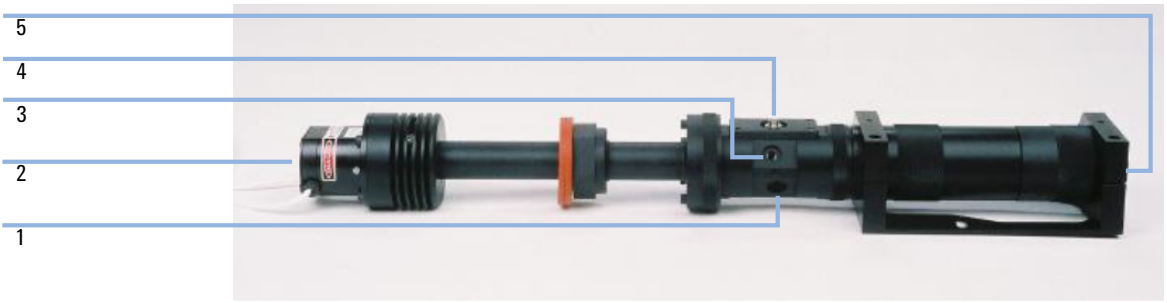

Figure 1 G7822B Laser/Flow cell/Detector module

1	Waste Outlet
2	LASER Head Assy
3	Solvent inlet
4	90 °optical connection to control module
5	15 ° optical connection to control module

Figure 2 G7822B Laser Control module Front Panel

1	Laser On/Off indicator
2	Power On/Off indicator

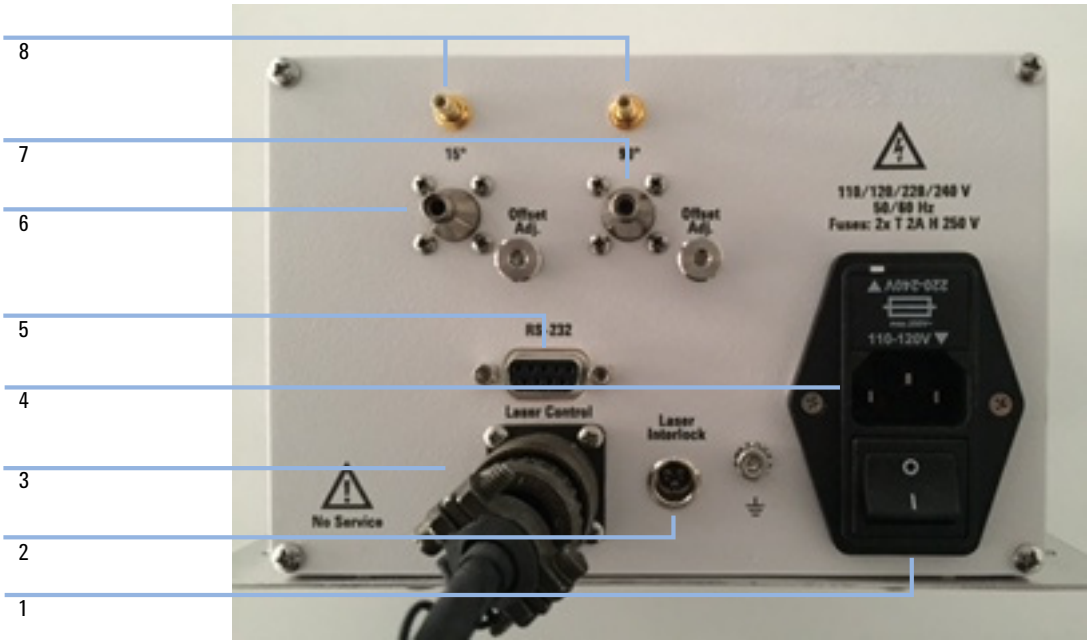

Figure 3 G7822B Laser Control module Back Panel

1	Power switch
2	Laser Interlock
3	Laser Control connector
4	Power inlet
5	I/O connector
6	15 ° optical input connection
7	90 ° optical input connection
8	Analogue connector

How the Detector Operates

Light Scattering refers to the process in which light from an incident polarized laser beam is scattered in all directions when it interacts with a molecule or particle. Light scattering is an everyday occurrence and was first described by Lord Rayleigh in the late 1800's. An example of light scattering is the scattering of sunlight by particles in the atmosphere: the sky is blue because shorter visible wavelength radiation (blue light) is scattered more strongly by the gas molecules in air than light of longer wavelengths (red light).

The detector measures the physical properties of polymers (synthetic polymers and natural polymers such as proteins and polysaccharides), virons, liposomes and particles vía Static Light Scattering. For details, see "Static Light Scattering" on page 14.

Measurements can be made on a sample in a cuvette or in a flowing stream such as that found in high performance liquid chromatography (HPLC), size exclusion chromatography (SEC) or gel permeation chromatography (GPC). In flowing streams, measurements are made on each elution slice using a unique light scattering design and very fast digital signal processors (which are essentially special purpose computers).

Physical Basis of Light Scattering

Light consists of perpendicular electric and magnetic fields that oscillate in a direction that is perpendicular to the direction of propagation of the light as shown in Figure 4 on page 13. When light strikes a molecule, the electrons will experience a force due to the electric field and will move slightly. This movement will induce an oscillating dipole moment that will radiate light in all directions at the oscillating frequency. This radiated light is the scattered light that is detected and processed as described below.

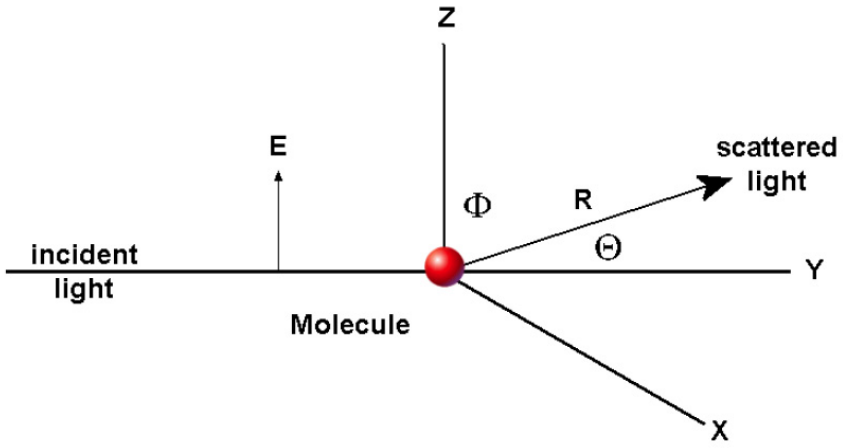

Figure 4 Light scattered by a molecule

Figure 4 on page 13 describes the spatial arrangement of the incident light and scattered light in the light scattering experiment. The light is polarized in the vertical direction, thus the electric field will oscillate in the Z direction and the magnetic field will oscillate in the X direction.

A diode laser, which is a monochromatic source of light that can be focused to a very small point in the center of the sample cell, is used in the light scattering system. The typical source is a semiconductor laser that provides 20 – 30 mW at 658 nm. The scattered light is collected at a given angle and orientation (for example, 15 ° or 90 °) from the incident radiation, and is used to deduce the desired molecular properties.

Static Light Scattering

Measuring Molecular Weight

The electric dipole moment that is induced is shown in Equation 1:

$$\vec{p} = \alpha \vec{E}$$

Dipole moment

where

p	dipole moment
α	polarizability
E	electric field

The polarizability can be related to measurable parameters via Equation 2:

$$\alpha = M_w \left(\frac{dn/dc}{2 \cdot \pi \cdot N_A} \right)$$

Polarizability α

where

M_w	molecular weight
N_A	Avogadro Number (6.02 x 10^{23} molecules/mol)
dn/dc	change in the index of refraction as a function of the change in concentration. It is considered to be a constant for any specified solvent-solute pair under constant operating conditions.

The oscillating dipole will radiate light in all directions at the oscillating frequency. This is the origin of scattered light. If a single molecule has dimensions that are small with respect to the wavelength of the incident light, the intensity of the light can be defined by Equation 3:

$$I_S = \frac{[4 \cdot \pi^2 \cdot M_W \cdot \sin^2 \Phi \cdot (dn/dc)^2 \cdot I_0]}{N_A{}^2 \cdot \lambda_0{}^4 \cdot R^2}$$

Light intensity
where

I_s	intensity of the radiated light I_s
I_0	intensity of the incident light
α_0	wavelength of light in a vacuum
Φ	angle the light is scattered relative to the transmitted incident beam
R	direction of the scattered light

If we collect light from a volume V of a solution with a concentration c (g/ml), the intensity of scattered light can be found by multiplying Equation 3 by the number of molecules in the volume V.

The number of molecules can be expressed by:

$$N_A \cdot c \cdot \frac{V}{M_W}$$

Number of molecules

Now if we solve for M_W, we obtain Equation 4:

$$M_W = \frac{[N_A{}^2 \cdot \lambda_0{}^4 \cdot R^2 \cdot I_S]}{4 \cdot \pi^2 \cdot M_W \cdot \sin^2 \Phi \cdot c \cdot (dn/dc)^2 \cdot I_0 \cdot V}$$

Collecting all the constants and instrumental parameters into an overall instrumental constant, A, we obtain Equation 5:

$$M_W = \frac{[I_S]}{A \cdot c \cdot (dn/dc)^2 \cdot I_0}$$

Equation 5 can be used to measure the molecular weight M_W of small molecules at any scattering angle Θ. It should be noted, however, that larger molecules scatter less light at high values of Θ than at low angles because of interference effects caused by the fact that light scattered from one part of the molecule travels a different distance from another part of the molecule, and is not in phase with light scattered. This phenomenon can be quantified by defining the light scattering form factor P(Θ) (Equation 6). A more detailed discussion of the form factor is presented in "The Form Factor" on page 19.

$$P(\Theta) = \frac{scattering\ intensity\ at\ angle\ \Theta}{scattering\ intensity\ at\ angle\ \Phi}$$

It should be noted that P(Θ) can be written as a series as shown in Equation 7:

$$P(\Theta) = 1 - \frac{1}{1!}\left(\frac{1}{3}\cdot q^2 \cdot R_g^2\right) + \frac{1}{2!}\left(\frac{1}{3}\cdot q^2 \cdot R_g^2\right)^2 - \frac{1}{3!}\left(\frac{1}{3}\cdot q^2 \cdot R_g^2\right)^3 + \ldots$$

where

R_g	radius of gyration of the molecule

and

$$q = \frac{4\pi \cdot n \cdot \sin\left(\frac{\Theta}{2}\right)}{\lambda_0}$$

where

n	index of refraction of the liquid
λ_0	wavelength of light in a vacuum

For scattering at 15 ° and 90 °, Equation 7 can be expressed as Equations 8 and 9, respectively:

$$P(\Theta)=1-26.3\left(\frac{R_g \cdot n}{\lambda_0}\right)^2$$

P(Θ) at 15 °

$$P(\Theta)=1-0.0897\left(\frac{R_g \cdot n}{\lambda_0}\right)^2$$

P(Θ) at 90 °

We present a table of P values for 15 ° and 90 ° as a function of molecular weight (for molecules with molecular weight from 5 – 50000 kDa) in Table 1 on page 17. These values assume that the molecules are random coils.

Table 1 Value of P(90°) and P(15°) for λ_0 = 685 nm, n = 1.5

M_W	R_g (approx) nm	P (15 °)	P (90 °)
$5 \cdot 10^3$	2.3	0.9993	1.0000
$5 \cdot 10^4$	7	0.9993	0.9998
$5 \cdot 10^5$	23	0.9993	0.9976
$5 \cdot 10^6$	70	1[1]	0.9780
$5 \cdot 10^7$	230	1[1]	0.7622

[1] values depend on shape

If the value of P(Θ) found in Equation 7 is below 0.7, higher order components become important. In this case, P(Θ) depends on R_g and also on the shape of the molecule as shown in Figure 5 on page 18:

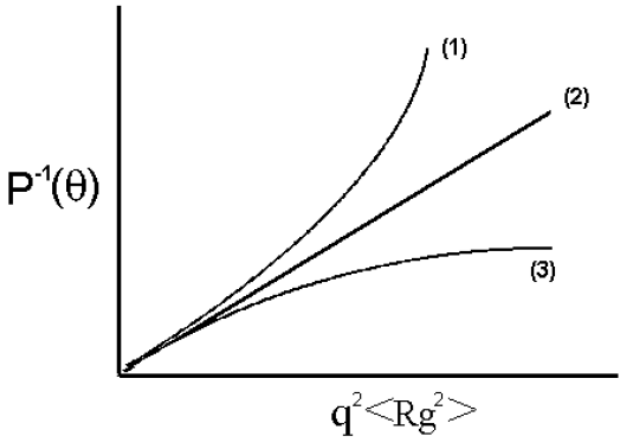

Figure 5 Values of $P^{-1}(\Theta)$ as a function of $q^2 R_g^2$ for various particle shapes: 1 = Sphere, 2 = Gaussian Coils, 3 = Rods

It is clear that all three molecular shapes yield the same value of $P^{-1}(\Theta)$ when $q^2 R_g^2$ is less than approximately 1. As the value of $P^{-1}(\Theta)$ increases, the shape of the molecule clearly influences the light scattering intensity.

Using Refractive Index to Measure Concentration

Refractive index measurements can be used in conjunction with static light scattering measurements to determine the concentration of the compound in the chromatographic slice. The difference in refractive index between the solution under study and the pure solvent is measured by passing a light beam through two cells. One of the cells contains pure solvent and the other contains the eluent as it passes through the cell after the column. The cell with the pure solvent should be filled with the solvent prior to the separation and should be at the same temperature as the eluent. The observed signal (RI), which corresponds to the deviation of the light beam, is proportional to the difference in the refractive index of the fluid in the two cells as shown in Equation 10:

$$RI = B(dn/dc) \cdot c$$

where

B	instrumental constant
c	concentration of the sample in the solvent
dn/ dc	change in the index of refraction of the solution as a function ofconcentration. It is considered as a constant for any specified solvent-solute pair under constant operating conditions.

The Form Factor

The form factor at a particular angle is the ratio of the signal at that angle when compared to the signal expected at the theoretical angle of 0 ° (where there is not form factor) as indicated by equation 6. The importance of the form factor is that small molecules (that is, those with a radius < 10 nm, which is small when compared to the wavelength of the incident light) are studied, generate comparable signals at all angles, while large molecules generate signals that are smaller at higher angles and larger at small angles.

Characteristics of Low-Angle (15 °) Light Scattering

Low-angle light scattering data is collected at a 15 ° angle to the incident beam and is typically used for determination of the molecular weights of large molecules. This measurement angle is especially useful for the study of proteins with molecular weight of greater than 1000 kDa and for random coils with molecular weight between 200 kDa and about 10000 kDa. In addition, 15 ° data is also used with 90 ° data to measure R_g, the radius of gyration of molecules over a limited range of sizes (12 – 150 nm) using static light scattering analysis.

Characteristics of High-Angle (90 °) Light Scattering

High-angle light scattering data is collected at a 90 ° angle to the incident beam and is typically used with static light scattering analysis to measure the molecular weight of smaller molecules such as proteins with a molecular weight below 1000000 Da, random coils with molecular weight below 200000 Da and for lower molecular weight non-spherical coil polymers.

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 2 on page 25. Consequently there is no voltage selector in the rear of the module. There are also no externally accessible fuses, because automatic electronic fuses are implemented in the power supply.

WARNING

Hazard of electrical shock or damage of your instrumentation

can result, if the devices are connected to a line voltage higher than specified.

➔ Connect your instrument to the specified line voltage only.

WARNING

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

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

➔ Always unplug the power cable before opening the cover.

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

WARNING

Inaccessible power plug.

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

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

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

Power Cords

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

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

WARNING

Absence of ground connection

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

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

WARNING

Unintended use of supplied power cords

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

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

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

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

WARNING

Power cords

Solvents may damage electrical cables.

➔ Prevent electrical cables from getting in contact with solvents.

➔ Exchange electrical cables after contact with solvents.

Bench Space

The detector should be placed in a position so that the distance between the end of the column and the flow cell of the detector is minimized. This will reduce post column band broadening effects and optimize chromatographic resolution. Typically, the Flow Cell is installed within the oven of the 1260 Infinity II High Temperature GPC system.

The Control electronics modules at the back of the 1260 Infinity II High Temperature GPC system should be placed in an area that is free from drafts and/or significant temperature changes. Avoid placing the modules near air conditioning vents, windows, ovens, etc.

The system should be placed on a sturdy bench top that can support the units, and provides access to all components.

Environment

Your module will work within the specifications at ambient temperatures and relative humidity described in Table 2 on page 25.

ASTM drift tests require a temperature less than 2 °C/h (3.6 °F/h) over one hour period. Our published drift specification (refer also to Table 3 on page 26) 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/h (1.8 °F/h). Turbulences around one minute or less can be ignored.

CAUTION

Condensation within the module

Condensation can damage the system electronics.

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

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

NOTE

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

Physical Specifications

Table 2 Physical Specifications

Type	Specification	Comments
Weight	9 kg (20 lbs)	
Dimensions (height × width × depth)	250 x 210 x 210 mm (9.9 x 8.2 x 8.2 inches)	Control unit
Line voltage	100/120/220/240 V~, ± 10 %	Control unit
Fuses	2 x T 2 A H 250 V	
Line frequency	50 / 60 Hz, ± 5 %	
Power consumption	70 W / 80 VA	
Ambient operating temperature	10 – 30 °C (50 – 86 °F)	
Ambient non-operating temperature	-40 – 70 °C (-40 – 158 °F)	
Humidity	< 80 % r.h. at 40 °C (104 °F)	Non-condensing
Operating altitude	Up to 3000 m (9842 ft)	
Non-operating altitude	Up to 4600 m (15092 ft)	For storing the module
Safety standards: IEC, EN, CSA, UL	Installation category II, Pollution degree 2	For indoor use only.
ISM Classification	ISM Group 1 Class A	According to CISPR 11

Performance Specifications

Table 3 Agilent 1260 Infinity II High Temperature Dual Angle LSD (G7822B) Performance Specifications

Type	Specification
Detection type	Dual Angle LSD
Rayleigh Scattering Angles	90 ° and 15 °
Light Scattering Volume Drift	0.01 µL
Laser Wavelenghth/Power	658 nm/30 mW
Sample Cell Volume	10 µL

3
Using the Module

This chapter provides information on how to use the module.

Using the Module

The power on switch for the Laser Control Module is on the rear panel. The green light on the face panel should illuminate when the power is turned on.

Allow the system to warm up and equilibrate for a short period of time (ca 30 min) and monitor the signal, which should be close to zero. If necessary, you can reposition the signal to zero using the potentiometers on the top of the rear panel of the Laser Control Module.

CAUTION

Wrong position of fiber optic cables

➔ The fiber optic cables must be securely in position in both the detector heads and the laser control module before the power is turned on.

CAUTION

Irreversible damage to the detector

➔ Do not remove the cables while the system is powered up.

4
Optimizing Performance

This chapter gives hints on how to optimize the performance or use additional devices.

Optimizing Light Scattering Performance

Purging the Light-Scattering Detector

The LS detector can be flushed with any miscible solvent.

NOTE

Monitor the pressure during the flushing procedure to ensure that excessive pressure does not occur.

Depending on the solvent choice, some equilibration of the detector may be required. This may last several hours.

1. Introduce the solvent at a reduced flow of typically no higher than 0.5 mL/min into the flow cell.
2. Flush the sample cell for a minimum of 5 min.
3. Increase the flow to the operating flow (typically 1.0 mL/min).

The detector is fully equilibrated and ready to use.

Maintaining and Cleaning the LS Flow Cell

A typical mistake when using light scattering, especially with a new unit, is pumping the fines that are typically present in new columns into the light scattering cell. This causes a high baseline offset and in the worst case a dirty flow cell requiring cleaning. When using light scattering, it is highly recommended to flush new columns with at least 10 column volumes of solvent before connecting them to the light scattering detector.

In addition, another common mistake is to turn the pump on and off without proper flow rate control. Turning the pump from zero flow to 1 mL/min has the effect of shocking the column bed. This again releases fines from the column and radically affects the light scattering baselines, causing increased off-set and spikes. It is therefore recommended to change the flow rate by no more than 0.2 mL/min/min.

To maximise and optimize performance of your Agilent HT-LSD it is recommended to follow these steps:

1. Always filter the solvent and samples to 0.1 µm.
2. Rinse the system with pure solvent before and after use.
3. If the solvent is changed, make sure that the two solvents are miscible. If not, use an intermediate solvent such as isopropanol.
4. If you are using a buffer, make sure that the buffer salt is soluble in the mobile phase as the fraction of organic solvent is increased when a gradient is used.
5. If a new column is used, flush it with 10 column volumes of mobile phase before connecting it to the detector.
6. Ensure the flowcell does not dry out.
7. Ensure the flow rate change is not higher than 0.2 mL/min/min.

The baseline offsets of common GPC solvent under typical operating conditions are given below for guidance:

Table 4 LS baseline offsets in common GPC solvents with mechanical offsets adjustment

Eluent	LS 15 ° Baseline	LS 90 ° Baseline	Flow
Tetrahydrofuran (THF)	<175 mV	<350 mV	1 mL/min
Trichlorobenzene (TCB)	<300 mV	<600 mV	1 mL/min

If problems do occur, in most cases the flow cell can be cleaned and particular matter removed by pumping pure solvent through the detector for several hours. This process can be shortened if the high-temperature GPC system is set close to its upper operating temperature.

5
Troubleshooting and Diagnostics

This chapter gives an overview about troubleshooting the detector.

Troubleshooting

If a problem is encountered Agilent Technologies advises that the troubleshooting section should be followed first to resolve the problem. If there is an error or fault and you follow the recommended course of action and the result is not satisfactory, then please direct the matter to Agilent Technologies or your local distributor.

Malfunctions within the HT-LS detector can arise from four general sources:

- the detector itself is operating outside specification,
- the other detector(s) installed can be dirty or operating outside specification,
- the HT-GPC system can have a broken, dirty, or non- optimally operating component, but the problem is manifesting itself in the HT-LS detector,
- a mobile phase and/or column problem, which by its very nature is spread throughout the LC system but appears as a malfunction of the HT-LS detector.

To troubleshoot the HT-LS detector you must be able to separate the HT-LS detector's performance within the LC system from its performance outside the LC system.

Troubleshooting a GPC System

Standard practice is to add one component at a time back into the GPC system so that the component causing the problem is easily identified if/ when the condition reoccurs.

Begin troubleshooting by adding the pump to the HT-LSD first and finish by adding the column last. If the GPC system has more than one detector installed or there is another type of detector available, use them to aid in troubleshooting.

6
Maintenance and Repair

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

Introduction to Maintenance

The module is designed for easy maintenance. Maintenance can be done from the front with the module in place at the back of the Agilent 1260 Infinity II High Temperature System.

NOTE

There are no serviceable parts inside.

Do not open the module.

Warnings and Cautions

WARNING

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

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

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

WARNING

Sharp metal edges

Sharp-edged parts of the equipment may cause injuries.

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

WARNING

Toxic, flammable and hazardous solvents, samples and reagents

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

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

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

➔ Do not operate the instrument in an explosive atmosphere.

CAUTION

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

ESD can damage electronic boards and components.

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

CAUTION

Safety standards for external equipment

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

Cleaning the Module

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

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

➔ Do not use an excessively damp cloth during cleaning.

➔ Drain all solvent lines before opening any connections in the flow path.

Storage of the Detector

In case the detector is not used for some time (stored), fill the bridge (be sure to purge both IP and DP) with Tetrahydrofuran (THF).

Overview of Maintenance Parts

p/n	Description
PL0660-0002	In-line Filter Assembly (LDV), SST
G7822-63000	Filter frit SST, 0.5 µm

7
Appendix

This chapter provides safetey and other general information.

General Safety Information

General Safety Information

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

WARNING

Ensure the proper usage of the equipment.

The protection provided by the equipment may be impaired.

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

Safety Standards

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

General

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

Before Applying Power

WARNING

Wrong voltage range, frequency or cabling

Personal injury or damage to the instrument

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

NOTE

Note the instrument's external markings described under "Symbols" on page 48.

Ground the Instrument

WARNING

Missing electrical ground

Electrical shock

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

Do Not Operate in an Explosive Atmosphere

WARNING

Presence of flammable gases or fumes

Explosion hazard

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

Do Not Remove the Instrument Cover

WARNING

Instrument covers removed

Electrical shock

➔ Do Not Remove the Instrument Cover

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

Do Not Modify the Instrument

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

In Case of Damage

WARNING

Damage to the module

Personal injury (for example electrical shock, intoxication)

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

Solvents

The light scattering offset is a direct measurement of the scattering of the solvent or eluent. If the solvent is “dirty” and contains particulates, the scattering will be higher. Table 4 on page 31, compiled from empirical data, should be used as a general guideline to the expected offsets for a few commonly used eluents. The best performance and the lowest solvent scattering is generally obtained when the eluent has been filtered through a 0.02 µm (best, or < 0.2 µm is acceptable) 2 – 3 times.

WARNING

Toxic, flammable and hazardous solvents, samples and reagents

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

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

Symbols

Table 5 Symbols

	The apparatus is marked with this symbol when the user should refer to the instruction manual in order to protect risk of harm to the operator and to protect the apparatus against damage.
	Indicates dangerous voltages.
	Indicates a protected ground terminal.
	The apparatus is marked with this symbol when hot surfaces are available and the user should not touch it when heated up.
	Flammable Material For Sample Thermostat which uses flammable refrigerant consult Agilent Information Center / User Manual before attempting to install or service this equipment. All safety precautions must be followed.
	Confirms that a manufactured product complies with all applicable European Community directives. The European Declaration of Conformity is available at: http://regulations.corporate.agilent.com/DoC/search.htm
	Manufacturing date.
	Power symbol indicates On/Off. The apparatus is not completely disconnected from the mains supply when the power switch is in the Off position
	Pacemaker Magnets could affect the functioning of pacemakers and implanted heart defibrillators. A pacemaker could switch into test mode and cause illness. A heart defibrillator may stop working. If you wear these devices keep at least 55 mm distance to magnets. Warn others who wear these devices from getting too close to magnets.

Table 5 Symbols

	Magnetic field Magnets produce a far-reaching, strong magnetic field. They could damage TVs and laptops, computer hard drives, credit and ATM cards, data storage media, mechanical watches, hearing aids and speakers. Keep magnets at least 25 mm away from devices and objects that could be damaged by strong magnetic fields.
	Indicates a pinching or crushing hazard
	Indicates a piercing or cutting hazard.
	External Laser warning label located on rear of detector
	Internal Laser warning label located on light source
	Internal Laser beam label located on light source

WARNING

A WARNING

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

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

CAUTION

A CAUTION

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

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

Waste Electrical and Electronic Equipment Directive

Abstract

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

NOTE

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

Product Category:

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

NOTE

Do not dispose of in domestic household waste

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

Radio Interference

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

Test and Measurement

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

Sound Emission

Manufacturer's Declaration

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

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

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

Agilent Technologies on Internet

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http://www.agilent.com

www.agilent.com

In This Book

This manual contains information on the Agilent 1260 Infinity II High Temperature Dual Angle Light Scattering Detector (G7822B).

The manual describes the following:

- Introduction,
- Site requirements,
- Using the module,
- Optimizing performance,
- Troubleshooting and diagnostics,
- Maintenance and repair,
- Safety information

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