



# **Agilent PL-GPC 220 Integrated HT-GPC/SEC System**

**User Manual**



**Agilent Technologies**

# Notices

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

## In This Guide...

This manual contains information on the Agilent PL-GPC 220 Integrated HT-GPC/SEC System (G7820A)

### **1 Introduction to PL-GPC 220**

This chapter gives an instrument overview and an introduction to the function of the PL-GPC 220.

### **2 Site Requirements and Specifications**

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

### **3 Unpacking the Instrument**

This chapter gives information on how to unpack your PL-GPC 220.

### **4 Using the Module**

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

### **5 Troubleshooting and Diagnostics**

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

### **6 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.

### **7 Maintenance**

This chapter provides general information on maintenance of the PL-GPC 220.

## **In This Guide...**

### **8 Parts for Maintenance**

This chapter provides information on parts for maintenance.

### **9 Appendix**

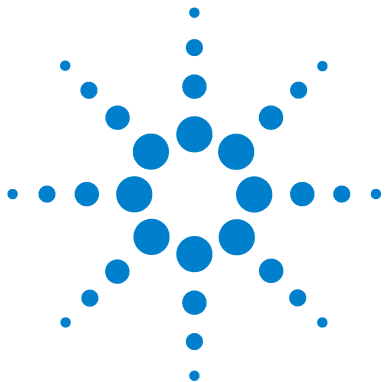
This chapter provides addition information on safety, legal and web.

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# 1 Introduction to PL-GPC 220

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This chapter gives an instrument overview and an introduction to the function of the PL-GPC 220.



## Introduction

The Agilent PL-GPC 220 Integrated HT GPC/SEC System is a fully automated chromatograph designed specifically for Gel Permeation Chromatography (GPC) / Size Exclusion Chromatography (SEC). The instrument features a 40-position carousel, high sensitivity refractive index detector and a reliable isocratic solvent delivery system housed uniquely in a temperature controlled enclosure. The open architecture of the column oven enables multi-detection options both inside and outside of the oven. Although the system was designed for prolonged high temperature operation, the system delivers an equal level of performance across the whole of its temperature operating range (30 – 220 °C).



**Figure 1** Front View of the Agilent PL-GPC 220 System



# System Description and General Operation

## Instrument Overview

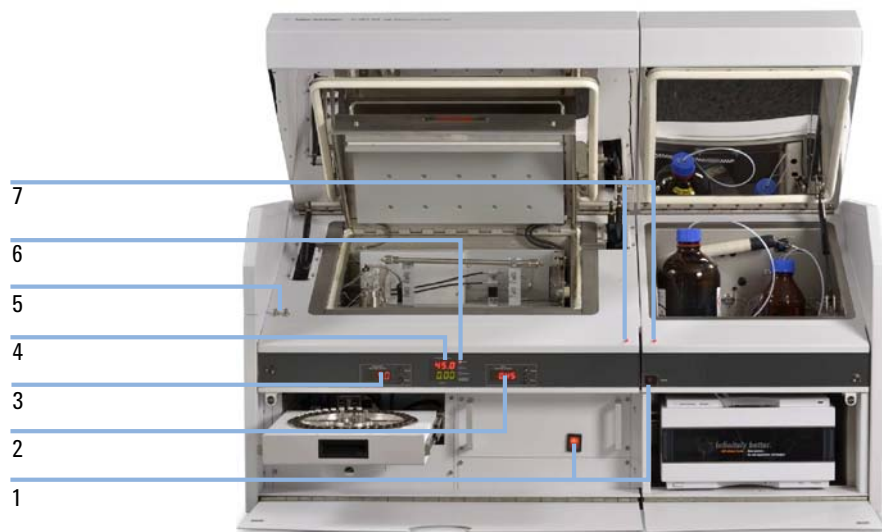


**Figure 2** Overview (modules)

1	Control drawer
2	Autosampler
3	Main oven module
4	Solvent delivery module
5	Pump
6	Solvent degasser

# 1 Introduction to PL-GPC 220

## System Description and General Operation



**Figure 3** Overview (display and control elements)

1	Power switches
2	Oven over-temperature display and control
3	Autosampler over-temperature display and control
4	Temperature and RI display
5	Oven and laser safety interlock switches
6	Status indicator
7	Power indicators

## Solvent Module



**Figure 4** PL-GPC 220 Solvent Module

The top section of the solvent module is temperature controlled to 32 °C, preventing solvents such as 1,2,4-trichlorobenzene and dimethyl sulfoxide freezing should the laboratory temperature fall below 15 °C. The warm air from the top solvent section is then circulated across the pump head and degasser and ventilated from the rear of the unit.

A vapor sensor located at the rear of the bottom section of the solvent module samples the air before it is ventilated from the unit.

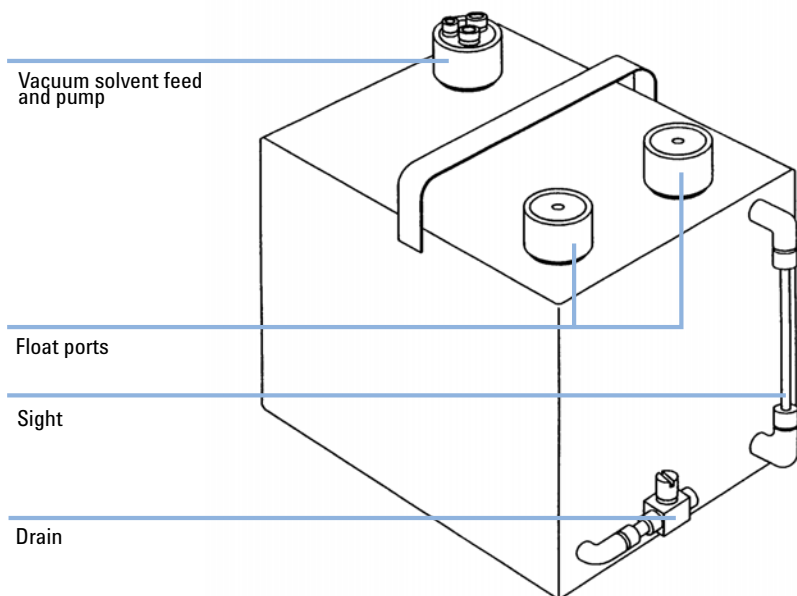
The top section of the solvent module will accommodate one of the following reservoirs:

- 2 x 2 L bottles (see [Figure 4](#) on page 11)
- 1 x 13 L stainless steel tank (see [Figure 5](#) on page 12).

In the case of this last option, the tank can be vacuum-filled with fresh eluent and the waste is plumbed directly out through the back of the module and piped to an external container.

## 1 Introduction to PL-GPC 220

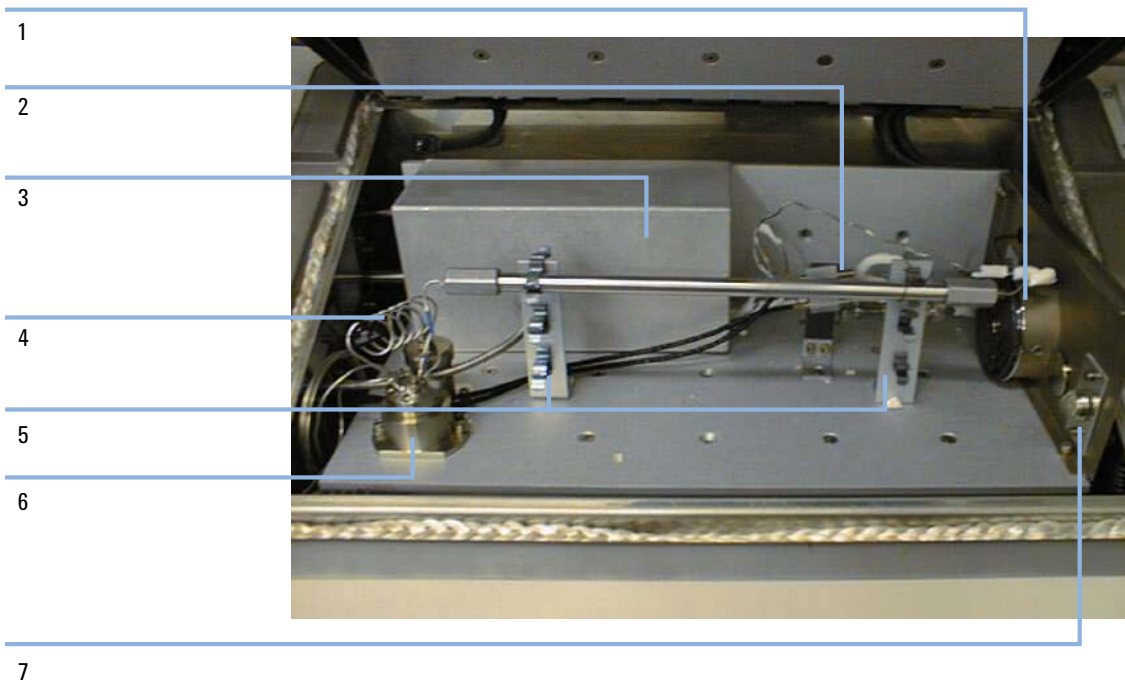
### System Description and General Operation



**Figure 5** Stainless steel tank

All the optional vessels are fitted with float switch, which trigger an audible alarm should the eluent container run too low or the waste container get too full. No action by the instrument will take place at this point and, therefore, it is advisable to check the levels in the solvent vessels daily and to set the minimum pressure slightly above zero, so that if the pump is starved of solvent, the low minimum pressure alarm will be activated and cause the system to default to the STANDBY mode.

## Column Oven



**Figure 6** Standard Oven Configuration

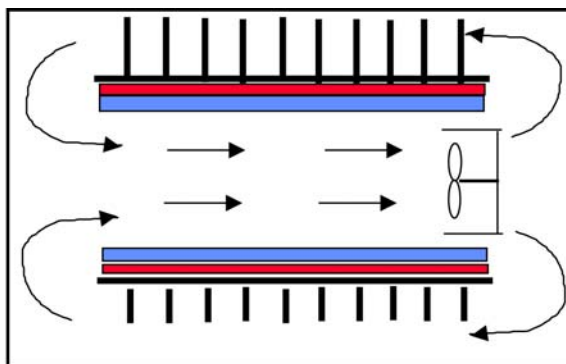
1	Oven Fan with Heaters
2	Temperature Sensors
3	Differential Refractive Index Detector
4	Sample Needle Assembly
5	Column Mounts
6	Injection Valve
7	Vapour Sensor

## 1 Introduction to PL-GPC 220

### System Description and General Operation

The low split line of the oven allows easy access to the oven facilitating column exchange and routine maintenance. The temperature within the oven is controlled by eight active heaters; 3 are built into the base of the oven and 4 in the oven lid, the eighth heater is mounted directly in front of the fan and it is this heater that provides the fine control.

Figure 7 on page 14 illustrates the location of the heaters (red lines) in the oven construction and the airflow around the heaters (black arrows).



**Figure 7** PL-GPC 220 Oven Construction

## PL-GPC 220 Autosampler

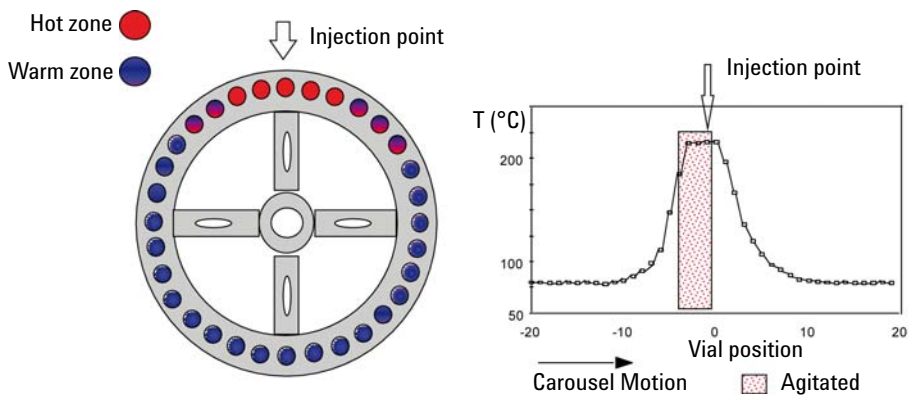


The carousel will accommodate 40 x 2 mL sample vials, 39 of these (positions 1 to 39) are used for sample injection. The 40th or zero vial is dedicated as the “index” vial and must remain on the carousel at all times. This index vial is used during the initialization process of the autosampler and is used as a waste container should an injection sequence malfunction. In this case, the contents of the loop and injection system will be emptied into this index vial to circumvent blockage due to precipitation of the polymer should the instrument cool down. It is therefore important to keep an empty vial fitted with a clean, shiny cap in the zero position of the carousel at all times.

Each of the vials is contained in an individual brass cup that glides across the heated track of the carousel. Two heaters control the temperature of the carousel; each can be independently set providing two zones of heating on the carousel.

# 1 Introduction to PL-GPC 220

## System Description and General Operation

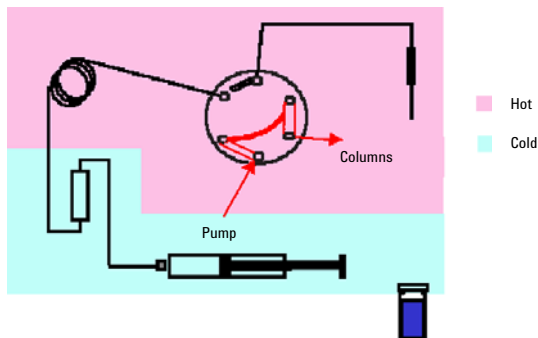


**Figure 8** Temperature controlled zones in the carousel



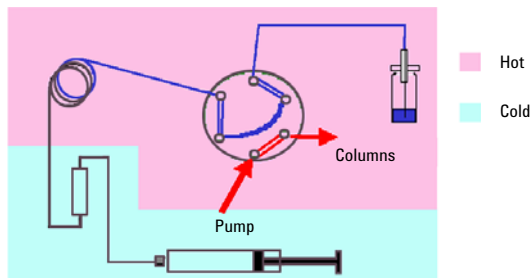
## Injection Sequence

### 1 Default condition prior to injection:



- Injection valve in the Inject position
- Vial in carousel
- Syringe at mid point

### 2 Sample loaded

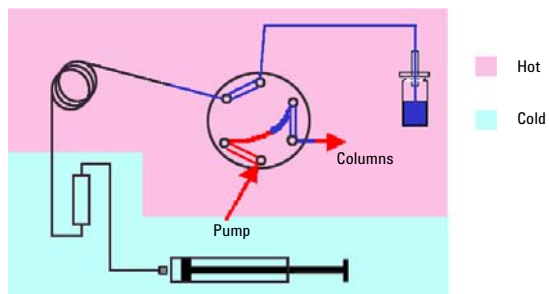


- Valve switched to load position
- Vial lifted to needle
- Syringe sucks 800 µL from the vial to fill the loop and partially fills the overflow loop

# 1 Introduction to PL-GPC 220

## System Description and General Operation

### 3 Sample injected



- Sample injected
- Excess sample from overflow loop returned to the vial
- Vial returned to the carousel



## 2 Site Requirements and Specifications

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



## Site Requirements

### Power Considerations

The instrument power supply has wide ranging capability. It accepts any line voltage in the range described in *Physical Specifications*. Consequently there is no voltage selector in the rear of the module.

Two power outlets are required; one for the main oven unit and one for the solvent module.

For countries where 230 V will have to be installed the main power leads are provided with NEMA-15 type plugs.

The mains supply should be fitted with an RCCB (Residual Current operated Circuit-Breaker).

#### 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.

---

#### CAUTION

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

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.
-

## 2 Site Requirements and Specifications

### Site Requirements

#### Bench Space

The standard instrument will require the following bench space:

- Width 140 cm (55 in)
- Depth 56 cm (22 in)
- Height 60 cm (23 in)

#### NOTE

The oven and solvent module lids open upwards to a full height of 97 cm (38 in). Please be aware of overhead obstructions.

If a G7821A PL-GPC 220 Viscometer or G7822A PL-GPC 220 Dual angle LSD is supplied with the instrument, allow an additional 30 cm (12 in) for each of these detector control systems on the width of the bench space.

The instrument is heavy, weighing 180 kg (370 lbs), and thus, it is advisable to locate the system on a sturdy bench, preferably fitted with wheels facilitating access to the rear of the unit should service be required.

#### Environment

#### 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.

Avoid positioning in direct sunlight.

#### Extraction Requirements

The instrument is equipped with two fan-forced exhausts (4 in diameter) at the rear of each module, which must be routed to a fume extraction system or vented into a hood via the supplied hoses. Both vent hoses for the instrument are 4 inches in diameter. The air flow of the extraction system should be <1.0 SLM.

Situate the instrument in a well-ventilated area.

# Physical Specifications

**Table 1** Physical Specifications PL-GPC 220

Type	Specification	Comments
Line voltage	230 V AC ( $\pm 10\%$ )	Single phase with earth
Power consumption	3300 VA, 2310 W/7900 BTU	
Line frequency	50 or 60 Hz ( $\pm 5\%$ )	
Size (width $\times$ depth $\times$ height)	1400 mm $\times$ 560 mm $\times$ 630 mm	
Packaged Size (width $\times$ depth $\times$ height)	930 mm $\times$ 760 mm $\times$ 860 mm	Two boxes
Weight	180 kg (396 lbs)	
Ambient operating temperature	15 – 35 °C (59 – 95 °F)	At constant temperature
Ambient non-operating temperature	-40 – 70 °C (-4 – 158 °F)	
Operating altitude	Up to 2000 m (6562 ft)	
Non-operating altitude	Up to 4600 m (15091 ft)	
Humidity	<80 % at 25 – 35 °C	
Safety standards	IEC	

## Performance Specifications

**Table 2** Performance Specifications of the PL-GPC 220

Unit	Type	Specification
<b>Pump</b>	Flow Range	0.2 – 10 mL/min Pump 0.1 – 5.0 mL/min software controlled
	Flow Rate Reproducibility <sup>1</sup>	≤0.07 % RSD, or ≤0.02 min SD whatever is greater, based on retention time at constant room temperature
<b>Oven</b>	Temperature Range	Ambient to 220 ° C
	Temperature Stability	<0.05 ° C/h
	Column Capacity	6 x 30 cm columns
<b>Detector</b>	Differential Refractometer	Deflection
	Cell Volume	8 µL
	Noise <sup>1</sup>	≤80 µV
	Drift <sup>1</sup>	≤10 mV/h
	Wavelength	890 nm
<b>Autosampler</b>	Carousel Capacity	40 x 2 mL Vials
	Injection Volume	flushed fixed loop; 5 – 500 µL
	Precision <sup>1</sup>	≤1 %
<b>Instrument Control</b>		Microprocessor
<b>Instrument Interface</b>		Windows 7 Advanced PC Control

<sup>1</sup> The technical specifications have been determined by experimentation and reflect the total system performance. The values quoted have been calculated from analyses performed in THF at 40 °C and in TCB at 160 °C.





### 3 Unpacking the Instrument

Unpacking the Instrument 26

This chapter gives information on how to unpack your PL-GPC 220.



## Unpacking the Instrument

### Damaged Packaging

If the delivery packaging shows signs of external damage, please call your Agilent Technologies sales and service office immediately. Inform your service representative that the 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.
-

## Unpacking the Instrument

Tools required	Description
	Phillips screwdriver (medium)
	Flat screwdriver (medium)

### WARNING

#### Very heavy weight

**The instrument weighs 185 kg (408 lbs).**

- Lift the main oven assembly with at least four persons.
  - Lift the solvent delivery unit with at least two persons.
  - Refer to local statutory Manual Lifting Regulations & Guidelines.
- 

### WARNING

#### Condensation in the instrument

**The electrical safety of the instrument cannot be guaranteed until it has dried out.**

- Leave the instrument standing in a warm, dry, ventilated environment for 1 h to let condensation evaporate.
  - Do not connect any electrical power until this period has expired.
- 

**The instrument is shipped on a specialized pallet inside a wooden carton. The main oven unit will be found in one of the boxes and the solvent delivery system and accessories in the second box. Unpack as follows:**

- 1 Remove the screws (Phillips screws, typically 3 per side) around the top edge of the carton, securing the lid in position. Lift off the lid.
- 2 Lift and remove the sheet of foam beneath the lidpackaging which protects the top of the unit.  
The top of the unit is revealed.
- 3 Remove the five sections of foam packaging surrounding the unit: one at each side, one piece at the front and two small sections behind the unit. The wires are tucked down between the two foam sections at the back.

### 3 Unpacking the Instrument

#### Unpacking the Instrument

#### NOTE

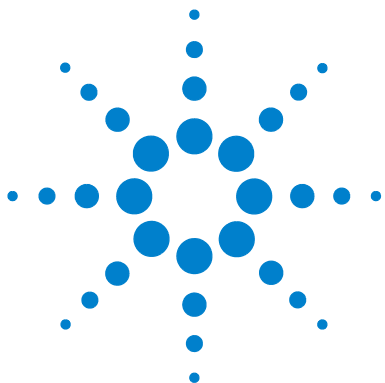
The packaging is designed to be a tight fit around the unit, and it is sometimes easier to remove the screws described in step 4 on page 28 before lifting this packaging clear.

---

- 4 Remove the screws (Phillips screws, typically 3 per side) from around the base of the carton to enable the collapsible wooden sleeve, forming the side walls of the carton, to be lifted over and clear of the unit.

The instrument is now visible on its indented pallet - small indentations have been made to secure the unit's feet. The unit is firmly held down to the pallet by plastic bands which tie the instrument down to the sub-platform above the main pallet.

- 5 Cut the plastic bands to enable the unit to be lifted free from the pallet.  
The unit can now be lifted clear of the pallet.
- 6 Position the instrument on the laboratory bench.
- 7 Open the outer and inner oven lids, the solvent module lid and the solvent module front flap to let condensation evaporate.
- 8 Remove the foam packaging which surrounds the pump located in the base compartment of the solvent delivery module prior to operation.



## 4 Using the Module

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



## The Graphical User Interface

A Windows-based Graphical User Interface (GUI) providing total instrument control is used to operate the PL-GPC 220. An intuitive single control panel provides simplistic control as well as a comprehensive monitoring system. The instrument status can be rapidly assessed for each of the instrument's modules.

### NOTE

Onscreen help, accessed directly from the software control, provides an interactive guide to the operation of the instrument and should be used in addition to this manual.

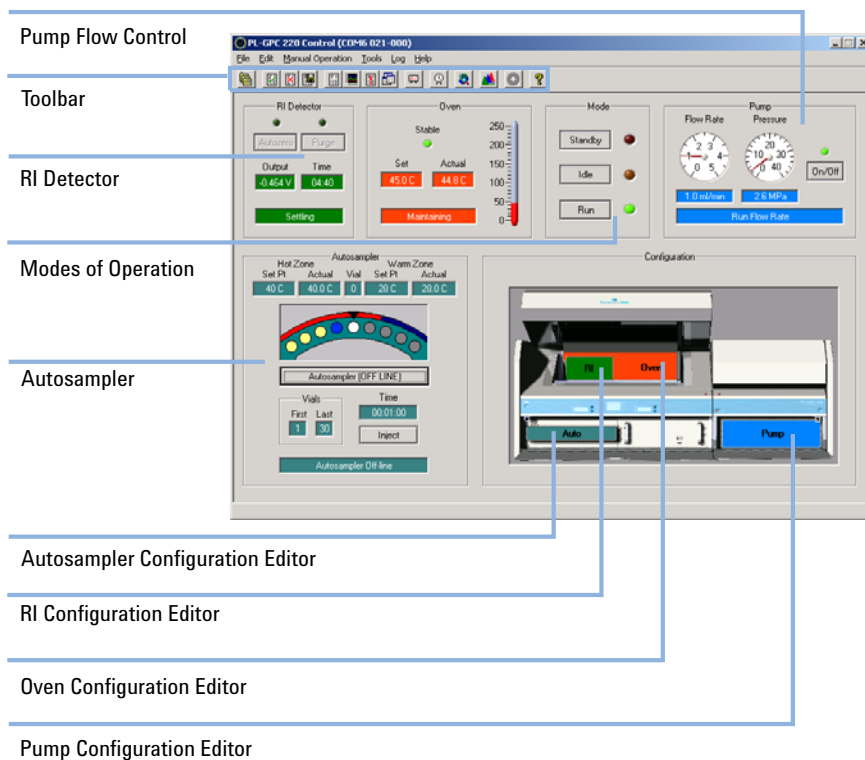


Figure 9 Graphical User Interface

The interface is split into logical areas of operation that reflect the modules of the instrument. Each section is colour-coded in accordance with the graphical representation of the instrument also shown on the interface. The pump is coded blue, the oven red, the refractometer green and the autosampler turquoise. For each of the controlled modules, the key information is displayed together with a statement of current activity.

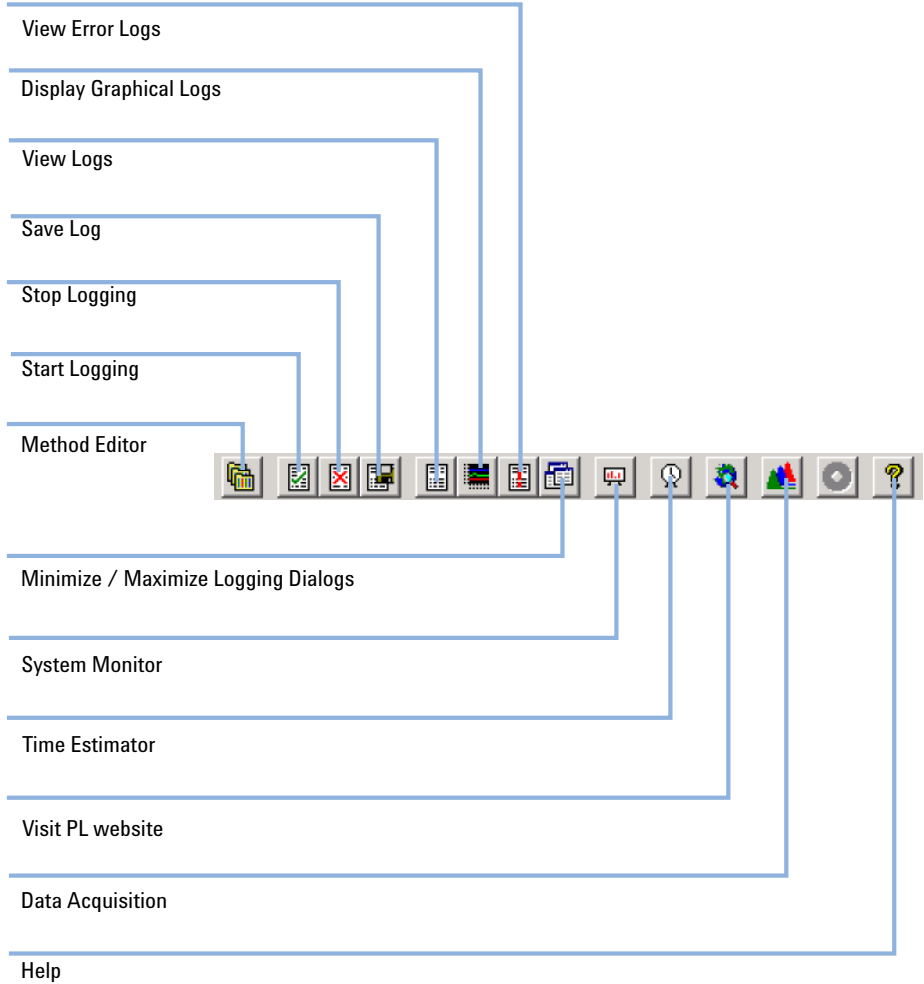
Consult the online help in the PL GPC 220 Control software for more details about the various data- and event-logging options available.

## 4 Using the Module

### The Graphical User Interface

# The Toolbar

The Toolbar contains the following icons:





## Modes of Operation

The PL-GPC 220 will be in one of the following operation modes:

- **STANDBY** – indicated by a RED LED on both the interface and the instrument display panel is the boot-up mode, in which all modules are off. This is the mode of operation the PL-GPC 220 is set for routine maintenance, such as solvent or column exchange or in any circumstance when the oven needs to be opened.
- **IDLE** – indicated by an AMBER LED. Use this mode to control the instrument in order to maintain oven temperature and a low flow rate (configurable, but typically set to 0.1 mL/min) so that the system is *ticking over* but not running samples. The carousel heaters are also turned off by default in IDLE mode.
- **RUN** – indicated by a GREEN LED, is the fully functional, operational mode. The oven temperature is at set point, the flow rate is typically at 1.0 mL/min, the carousel heaters are on, and the instrument is ready to run samples.

Following boot-up, the instrument will typically default to the STANDBY mode, unless the instrument is switched off in either the IDLE or RUN mode, in which case it will re-boot back into the mode it was switched off in.

## Pump Flow Control

The pump flow can be manually switched on/off in two places: the first using the **on/off** selection button in the pump module box, and the second is located in the **Manual Operation** tab. Both options allow the pump flow to be stopped/started in all three modes of operation.

## RI Detector

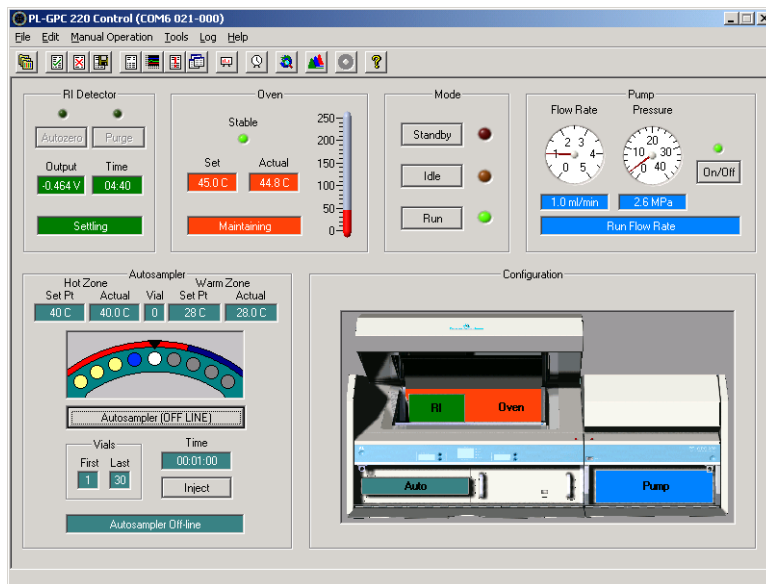
- **Autozero** – initializing the RI autozero function is a procedure, which should be performed after a purge cycle.
- **Purge** – open purge valve on RI reference cell (the length of RI purge is set in the RI configuration window). This procedure will de-stabilize the system; it is recommended that the baseline be monitored and if excessive drift is noticed then another purge cycle is performed. This procedure should be repeated until a stable baseline is observed.

## Autosampler

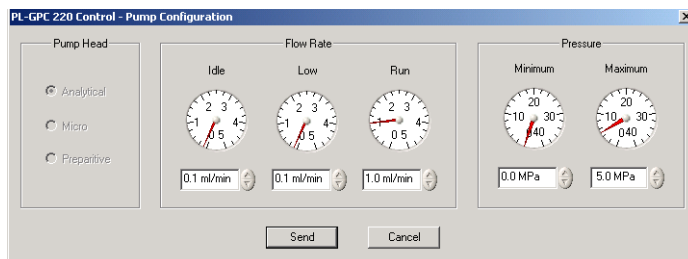
- **Autosampler (offline/online)** – This button is used to start and stop the autosampler.
- **Offline** – indicates that the autosampler is not in use.
- **Online** – indicates that the autosampler is in use and running using the parameters set up in autosampler configuration screen.
- **Inject** – this button is used to manually change the injection valve position, see “Injection Sequence” on page 17 for the description of positions. This tab also shows the position of the injection valve during the running sequence.

## Configuring the Controlled Modules - Configuration Editors

To change any of the set conditions, simply click on the coloured section of the instrument graphic to open the configuration editor for that module.



## Pump Configuration Editor



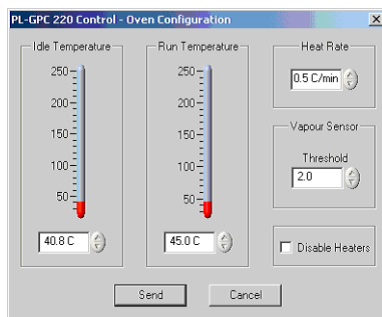
There are following **Flow Rate** settings:

- **Idle** – is the pump flow rate adopted while the system is operated in the IDLE mode.
- **Low** – is the pump flow adopted while the system is changing temperature.
- **Run** – is the flow rate used when the system is operated in the RUN mode.

Adjustment of the settings can be achieved by: clicking and dragging the needles of the dials, using the up or down arrows or just simply typing the required values in the edit boxes. To action a change made to the configuration, the values as displayed in the configuration editor, must be downloaded to the instrument by clicking on the **SEND** button. Clicking the **Cancel** button will close the dialogue without making changes to the control parameters.

The programmed minimum and maximum pressure settings enable pressure limits within which the pump can operate. If the recorded pump pressure (system pressure) falls outside these limits, the instrument will default to error conditions.

## Oven Configuration Editor



The PL-GPC 220 oven can be controlled at two temperatures:

- one programmed for the *Idle mode* and
- one for the *Run mode*.

Typically, these temperatures would be set at the same temperature, but if it was necessary to automatically change the temperature of the oven following a sample sequence, or if it was desirable to default the system to safer lower temperature should a problem occur, the **Idle Temperature** can be programmed at a different temperature from the **Run Temperature**.

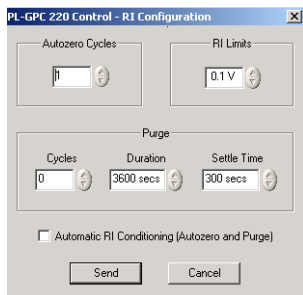
Temperatures can be set by clicking and dragging the thermometers, typing the value in the Edit box or using the up and down arrows adjacent to the Edit box.

**Heat Rate** is the rate at which the oven will heat to the set temperature. To prevent excessive over-shoot of the set temperature and prolonged stabilization time, it is advisable to use a heat rate of  $\leq 0.5$  °C for operating temperatures  $< 100$  °C. The minimum programmable heat rate is 0.4 °C/min and the maximum is 2 °C/min.

The **Vapour Sensor Threshold** determines the relative sensitivity of the sensor to organic solvent vapour concentration. For oven temperatures below 80 °C, a value of 5.0 is recommended, increasing to 6.0 for temperatures between 80 °C and 120 °C, and 7.0 for operation above 120 °C or if using chlorinated solvents at any temperature.

**Disable Heaters** – if this box is checked, the oven heaters will be disabled and the instrument can be run with the oven temperature at ambient temperature.

## RI Configuration Editor



The Refractive Index Detector can be programmed to automatically zero at regular intervals during an autosampler sequence. Setting the **Autozero** cycles to 1 will cause the instrument to autozero before each sample injection.

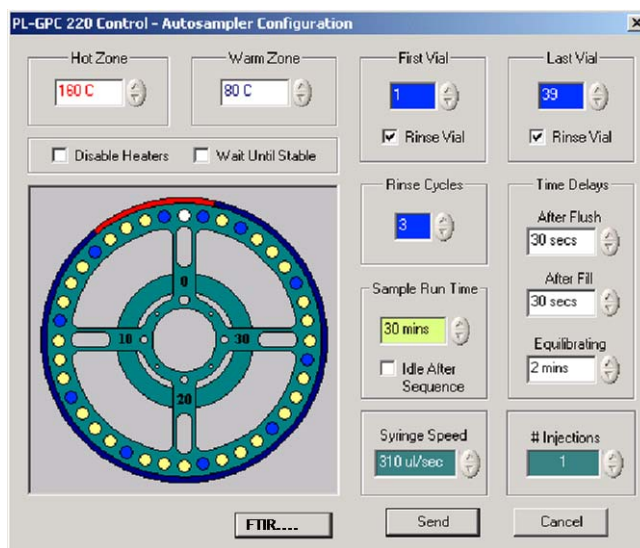
Similarly, the refractometer can be purged at regular intervals during an autosampler sequence by programming the **Cycles** field in the Purge section of the Configuration Editor. However, the suitability of this operation is application dependent and it may only be useful in some circumstances (e.g. using 1-chloronaphthalene at 210 °C).

The **Duration** of the purge is simply the time in seconds that the purge valve will remain open following a manual or automatic purge command.

The **Settle Time** is the time allowed in seconds following a purge that the system waits before the autozero command is actioned if an **Automatic RI Conditioning** is enabled.

Purging and zeroing the refractometer are typically executed manually following stabilization of the oven temperature when the temperature is changed or when the instrument is switched from Idle to Run. However, by checking the **Automatic RI Conditioning** box the system can be programmed to automatically purge and autozero the RI, 10 min after the oven set point is reached, in accordance with the parameters programmed in this dialog. The **RI Limits** value is used as the baseline stabilization threshold, and the system will continue cycling between purging, zeroing and monitoring until the baseline drift is less than the programmed limits measured over a 10 min period.

## Autosampler Configuration Editor



Within the Autosampler Configuration Editor, the autosampler carousel is graphically depicted providing an excellent visual assurance of the programmed autosampler sequence. For clarity, the vials to be injected (sample) are indicated in yellow and the vials to be used as rinse vials (injection system wash) are coded in blue. The other color coding used on the carousel are the heated zones; the red band on the circumference of the carousel illustrates the Hot Zone and the dark blue arc the Warm Zone.

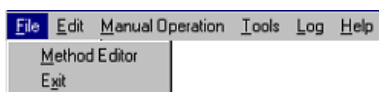
- **Hot Zone** – Temperature of the samples in the Hot Zone (measured at vial position 1). This zone spans the injection point and the area of the carousel that is magnetically stirred should the sample vial contain a magnetic flea.
- **Warm Zone** – Temperature of the samples contained in the Warm Zone measured at vial position 19.
- **Disable Heaters** – If this box is checked both Hot Zone and Warm Zone heaters will be disabled. (Use with caution, as problems may arise when running high temperature samples)
- **Wait Until Stable** – If this box is checked, the system will wait until the oven temperature is stable (non-flashing green LED) before performing sample injection.
- **First Vial** – Position in the carousel of the first vial in the autosampler sequence.

- **Last Vial** – Position in the carousel of the last vial in the autosampler sequence.
- **Rinse Vials** – These checkboxes under the first and last vial positions denote if the first or last vials are to be used as rinse vials.
- **Rinse Cycles** – A rinse vial (typical a vial containing solvent) can be programmed at regular intervals throughout the autosampler sequence. The example shown in the dialog above, programs a rinse after every 3 samples. Typically, a rinse at the beginning and the end of the autosampler sequence (First and Last only) is sufficient for most applications.
- **Sample Run Time** – The duration time of the sample run. Using 30 cm PLgel columns at 1.0 mL/min, the following sample run times are recommended (if a PL-GPC 220 Viscometer is installed in parallel, then the times shown in parentheses should be used to allow the viscometer break through peak to elute before the injection of the next sample):
  - 1 column – 12 min (30 min)
  - 2 columns – 25 min (45 min)
  - 3 columns – 35 min (55 min)
  - 4 columns – 45 min (65 min)
- **Idle After Sequence** – If this box is checked, the system will default to the IDLE mode on completion of the sequence. This has the advantage of reducing the solvent consumption (assuming the Idle Flow Rate is programmed to a low flow rate) and turning the heaters off in the carousel.
- **Time Delays**
  - **After Flush** – The wait time after the syringe has displaced the sample from the injection system back to the vial.
  - **After Fill** – The wait time after the syringe has sucked the sample from the vial.
  - **Equilibrating** – The time the sample is held in the injection loop prior to the injection valve switching from Load to Inject.
- **FTIR Button** - Launches the GPC/FTIR collection program if operated with a Agilent FTIR spectrometer.

## Methods

As an alternative to editing each of the module configuration editors one by one, all of the control parameters can be viewed, edited and saved as a named method by using the **Method Editor**.

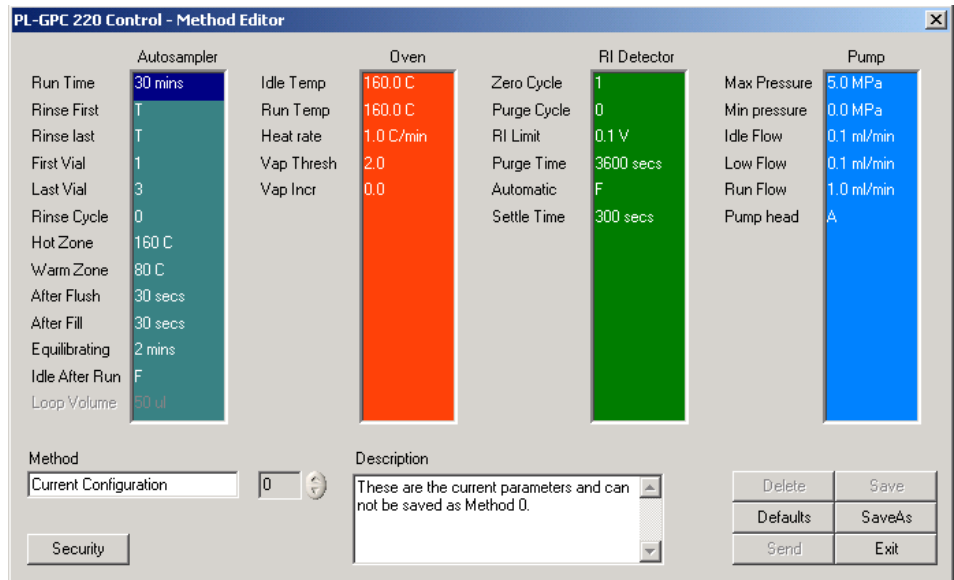
The Method Editor is accessed from the main **File Menu** or via the short cut icon (see [Figure 10](#) on page 40 for description of shortcuts).



**Figure 10** File Menu

[Figure 11](#) on page 41 below shows the Method Editor view. This versatile editor gives the user access to all the instrument settings on one screen and allows new methods to be saved or stored methods to be recalled. To change any of the settings, simply highlight the parameter you wish to change and type in the new value. Some of the entries require a T (true) or F (false) indicating the status. To save a method, click on the **Save** button to overwrite the current method or **SaveAs** to define a new method. Each method is given a name (up to 30 characters long), a number and a description (up to 100 characters). To use any of the stored methods, select it and once it is displayed in the editor click on the **Send** button. The instrument parameters displayed in the editor will only be downloaded to the PL-GPC 220 when the **Send** button has been pressed. The **Defaults** button restores the default conditions to the screen from which you may wish to start your custom method. The default method is typical conditions used for tetrahydrofuran at 40 °C with one PLgel 30 cm column.





**Figure 11** Method Editor

The **Security** button offers password protection for all or selected methods, restricting instrument control to those predefined conditions as set in the method. Activating the security system will only allow a user to view the instrument control parameters and downloading any changes to these parameters will be impossible.

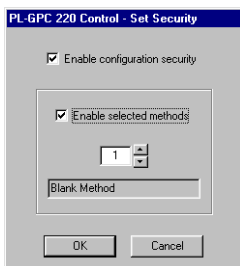
## Security

The Security dialog enables and disables access rights to total instrument control or just operational methods. Access to the dialog shown below is password protected with an option to change the password.

The default password is **POLYMER220** and this is case insensitive. Entering the correct password results in the following dialogue:

## 4 Using the Module

### The Graphical User Interface



Check the **Enable configuration security** box to enable the system security. If this box is not checked then all other items in this dialogue are disabled. Enabling the security will disable the **Send** button in all the module configuration editors. This will prohibit any change to the instrument operational parameters via these editors.

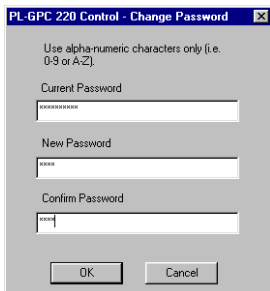
To **Enable selected methods** check this box. If the box is not checked then all methods are disabled and can not be used to change the instrument configuration.

Use the up and down arrows to select the method(s) to enable.

The Security options can also be accessed from the main control view under the **Tools** menu.

## Changing the Password

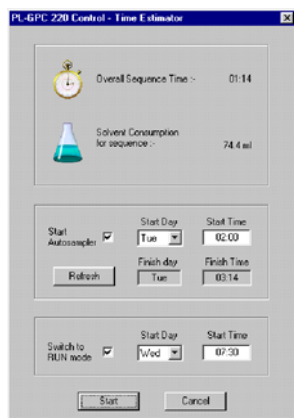
Also under the **Tools > Security** menu you will find a Change Password option from which the default password can be replaced with a user's personal password. The change password dialog is shown below:



If one forgets the password, the PL-GPC 220 Control will accept the default password once the GPC220.pwd file is deleted from the install directory.

## Time Estimator

The Time Estimator is a useful tool that provides the overall time duration of a programmed run sequence together with the calculated solvent consumption. It also enables the user to program timed events, namely when the autosampler should start a run and when the instrument should switch into or out of the Run mode. The programmed date and time are with respect to the computer's system clock and thus, it is advisable to ensure that this is set correctly.

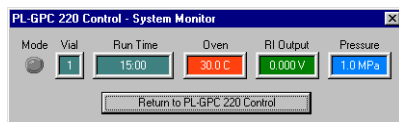


- Check the **Start Autosampler** box to enable a timed A/S start.
- The **Refresh** button will update the finish details based on the programmed A/S-set up.
- Enter the **Start Day** and **Start Time**. The time is entered according to the 24 hour format.
- The **Switch to RUN mode** can be programmed to occur before the A/S start or after A/S will automatically default to Idle mode following a sample sequence when started automatically.

Once the Time Estimator has been configured, clicking the **Start** button will action the program by minimizing the main control screen and leaving just the Time Estimator dialog displayed. This dialog will remain on the screen until the A/S sequence starts or until the **Cancel** button is pressed.

## System Monitor

While the system is running, it is often preferential to display the data acquisition on the computer screen rather than the instrument control. The System Monitor minimizes the PL-GPC 220 Control to an informative icon, displaying the important parameters.



## Data Acquisition

The Data Acquisition option enables one to program a link from the PL-GPC 220 Control to another program of choice. It is designed to instantly bring up the data acquisition package, but can be program to run a Windows™ based executable. For convenience, three data acquisition packages have been pre-programmed; PL Caliber, TriSEC and Precision Acquire.



Before starting the Data Acquisition shortcut, you must first configure the path to where the desired program is to be found. Default paths for PL Caliber, TriSEC and Precision Acquire have been pre-programmed and if these programs exist in these default locations then the option will be active. In this case, simply select the appropriate box to launch the required package when the Start acquisition option is selected. If none of the options are available, but one is present on the PC, click the browse ... to set the correct path.

## Setting Up the PL-GPC 220

### Starting the Instrument

- 1 Switch on the solvent delivery module and wait until the alarm stops sounding.

#### NOTE

When the instrument is first installed, this alarm may sound for up to 2 min while the vapor sensor heats up.

- 2 Ensure a capped vial is placed in the carousel before powering up the instrument and the carousel is pushed fully in.

- 3 Switch on the main unit.

Again the beep will sound while the system initializes.

During the initialization process, the instrument will perform the following tests:

- Test the buzzer
- Initialize the pump
- Initialize the oven
- Initialize the autosampler
  - Find zero vial
  - Raise vial into the oven
  - Purge the syringe
  - Lower the vial
  - Reset the syringe to the mid position
- Toggle the injection valve 3 times

When the initialization process has completed, the instrument should be left in the STANDBY (red light) mode with the pump and heaters off.

- 4 Launch the PL-GPC 220 Control software from the control PC.
- 5 Replace the columns by a barrel connector.

## 4 Using the Module

### Setting Up the PL-GPC 220

- 6 Flush the entire system with the solvent required. See [“Introducing Solvent to the PL-GPC 220”](#) on page 47.

#### NOTE

When changing between two immiscible solvents, intermediary solvent(s) should be used that are fully miscible with the chromatography solvents used.

---

## Introducing Solvent to the PL-GPC 220

**Preparations** Instrument is running.

- 1 Place the solvent line fitted with sinter into the solvent reservoir.
- 2 Open the purge valve on the front of the pump (turn counter-clockwise) and allow the solvent to flow from the pump purge valve into the waste container.
- 3 To assist the flow through the pump switch the pump flow on at  $\sim 2.0 - 4.0$  mL/min. This is achieved by setting the Idle flow to the flow required and selecting **PUMP ON** in the Manual Operation menu.
- 4 Continue pumping through the pump purge outlet until the lines from the solvent reservoir to the degasser, the degasser lines and the pump inlet line are all free of air and full of the new solvent.

### NOTE

The solvent is passed through two channels of the degasser, each having a capacity of 7.0 mL and thus at least 20 – 25 mL of solvent needs to pass through the pump before the solvent delivery system is fully purged. It is recommended that the pump is purged for  $\sim 20$  min at 4.0 mL/min to ensure that the online degasser and pump is totally flushed with the new solvent.

- 5 Turn off the pump to stop the flow through the system and adjust the Idle flow rate to 1.0 mL/min.
- 6 Close the purge valve on the pump head and again manually turn on the pump to flush solvent through the remainder of the instrument.

### NOTE

Ensure that the waste line is placed into the waste container.

- 7 Flush the system for  $\sim 20$  min at 1.0 mL/min.
- 8 Using the Control software, open the DRI purge valve and set the PURGE time to 20 min.

### NOTE

If a purge column is installed ensure that the flow from the injection valve is capped while the system is in purge so that the flow is forced into the reference side of the RI cell.

## 4 Using the Module

### Setting Up the PL-GPC 220

- 9 If a viscometer is fitted, additional flushing of the viscometer pressure transducers is required - see the G7821A PL-GPC 220 Viscometer manual.
- 10 Once the system is totally flushed into the desired chromatography solvent:
  - a Turn off the pump.
  - b Close the DRI purge valve.
  - c Connect in the column set

#### NOTE

Before turning on the pump to flush the columns ensure the IDLE flow is set at a rate <0.3 mL/min.

---



## Running the PL-GPC 220

1 Using the Control software set following parameters as required:

- Oven temperature
- Vapor sensor threshold
- Pump flow rate

Typically, 1 mL/min is used for the RUN flow rate and 0.2 mL/min for the IDLE and LOW flow rates.

### WARNING

#### Fire, explosion

→ The oven temperature set point must be at least 10 °C lower than the solvent boiling point.

---

2 Set the oven temperature cut-out on the front panel of the instrument to 5 °C above the set oven temperature.

3 In the oven, remove the barrel connector and install the columns.

### NOTE

If the columns are not already in the solvent that is to be used as eluent they need to be transferred as indicated by the manufacturer. This can be performed in the PL-GPC 220, but do not flush the columns through the detectors, simply flush the columns directly to waste.

4 After installing the columns in the required solvent, manually turn the pump on.

Ensure there are no leaks from any connections.

5 Stop the flow and close both the inner and the outer oven lids.

6 Put the instrument into RUN mode.

Wait for the oven to stabilize at the Run temperature and Run flow rate to be established.

7 Purge the DRI reference cell via the Control software for at least 20 min.

Once the DRI baseline has settled after purging the instrument is ready to use.

## Changing Columns

### Preparations

System is in RUN mode.

- 1** Change the Idle and Low flow rates to 0.2 mL/min and the Idle temperature to 40 °C.
- 2** Put the instrument into IDLE mode and allow the oven cool.  
Oven temperature is at 40 °C.
- 3** Put the instrument into STANDBY mode and open the oven lids.
- 4** Assuming that the new columns are already in the required solvent, simply replace the old columns with the new columns.

OR

If a column solvent transfer is required carry this out according to the manufacturer's instructions.

- 5** Manually start the flow to check for leaks.  
Ensure that there are no leaks.
- 6** Close both the inner and outer oven lids and set the instrument to Run mode.

Wait until:

- The instrument is maintaining the oven temperature.
- The flow is at the Run flow rate.

- 7** Purge the DRI reference cell for at least 20 min using the Control software.

Once the DRI baseline has settled after purging, the instrument is ready to use.

## Changing Solvents in the PL-GPC 220

### Preparations

System is in RUN mode.

- 1 Change the Idle and Low flow rates to 0.2 mL/min and the Idle temperature to 40 °C.
- 2 Put the instrument into IDLE mode and let the oven cool.  
Only continue if oven is at 40 °C.
- 3 Put the instrument into STANDBY mode and open the oven lids.
- 4 Remove the columns from the system and replace with a barrel connector.
- 5 Replace the solvent reservoir with the new solvent or if an intermediary (Acetone) solvent is required.
- 6 Continue with following procedure: [“Introducing Solvent to the PL-GPC 220”](#) on page 47.

## Changing the Injection Loop

**Preparations**

The column is in RUN mode.

- 1** Change the Idle and Low flow rates to 0.2 mL/min and the Idle temperature to 40 °C.
- 2** Put the instrument into IDLE mode and let the oven cool.  
Only continue if oven is at 40 °C.
- 3** Put the instrument into STANDBY mode and open the oven lids.
- 4** Replace the injection loop with the new loop size.
- 5** Continue with following procedure: [“Running the PL-GPC 220”](#) on page 49.

# Running Samples on the PL-GPC 220

## Setting up the Autosampler Sequence

### Preparations

- Start the log file to monitor the condition of the instrument during operation.
- Ensure that there is sufficient eluent to carry out the analysis (you can use the **time estimator** tool on the Control software once you have defined the autosampler sequence).
- Ensure that there is sufficient capacity in the waste container.

- 1 Click on the autosampler image on the control software.
- 2 Set the first and last vials in the autosampler sequence.  
You will see the image of the carousel update with yellow sample vials.
- 3 Select any vial positions that you wish to be rinse vials.  
On the carousel image you will see the rinse vials turn blue.

### NOTE

Rinse vials contain only solvent and so can be used to *flush* the injection system.

- 4 Set an equilibration time as required.
- 5 Set the syringe speed. Typically, this is set at the second highest setting.
- 6 Set the **hot** and **warm** zone temperatures.
- 7 If you wish the instrument to go into IDLE mode after the autosampler sequence has finished, tick the **Idle after sequence** box (remember to check the Idle flow rates and Idle oven temperature settings).
- 8 Set the Run time, typically, the same as the data collection time.

### NOTE

If you are using a viscometer, remember to add time to the Run time to ensure that the negative DP peak arising from the flushing of the delay volume in the viscometer bridge elutes before data collection of the next sample in the sequence commences .

- 9 Click the **Send** button to update the instrument with the new autosampler settings.
- 10 Adjust the autosampler over temperature cut out to 30 °C above the hot zone temperature.
- 11 Wait 15 min to ensure that the autosampler has reached the required operating temperatures.

## Loading the Samples

### Preparations

- Start the log file to monitor the condition of the instrument during operation.
- Ensure that there is sufficient eluent to carry out the analysis (you can use the **time estimator** tool on the Control software once you have defined the autosampler sequence).
- Ensure that there is sufficient capacity in the waste container.

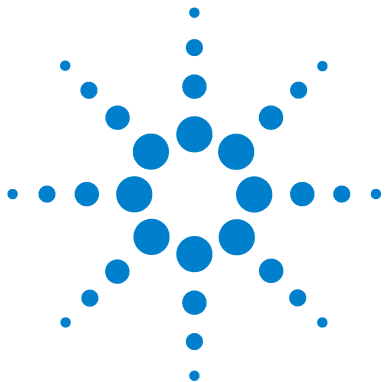
- 1 Pull out the autosampler carousel drawer.
- 2 Load the autosampler carousel with the sample and rinse vials in the appropriate vial positions.
- 3 Firmly push the autosampler carousel drawer back into position.  
You will hear an audible *click* as the autosampler fits into place.
- 4 Ensure that the data collection software you are using is ready to collect and the sequence run list has been defined (remember data will not be collected for rinse vials).

- 5 On the autosampler area of the Control software, click the **Autosampler Offline** button.

This will now change to **Autosampler Online** and the sequence will begin. You can follow the status of the run sequence in the software.

- 6 At any time, you can stop the autosampler sequence by clicking the **Autosampler Online** button.

The software will then prompt you to select a new start vial if the sequence is restarted.



## 5 Troubleshooting and Diagnostics

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

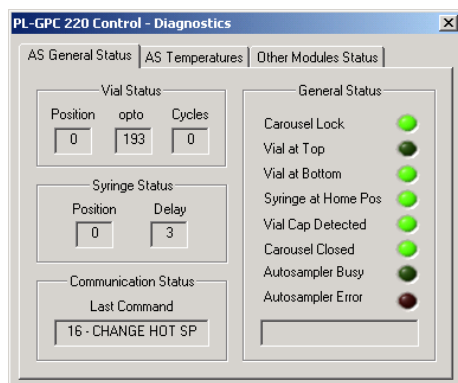


## Diagnostics

To enable the user to check the status of sensors while operating the instrument, a new diagnostic screen is now available from the Tools/Utility menu.

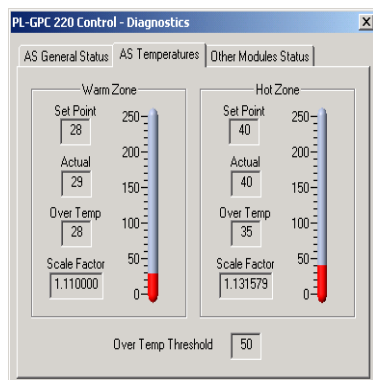
The diagnostic utility consists of three tabbed views:

- AS General Status displays the autosampler status



**Figure 12** Autosampler General Status

- AS Temperatures displays the autosampler temperatures



**Figure 13** Autosampler Temperatures



- Other Modules Status displays the other instrument functions

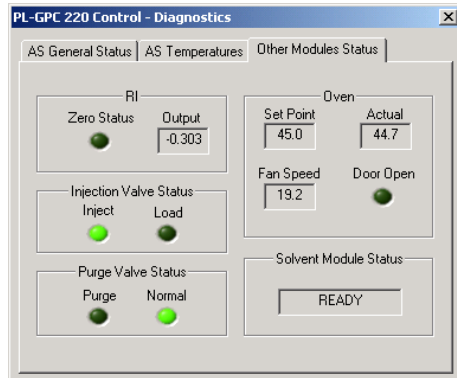


Figure 14 Other Module Status

## General Troubleshooting Guide

### Boot Up Problems

- No power
  - If power indicators, power switch or display panel are not illuminated, check the fuses at the rear of the control drawer.
- Fails to initialize pump
  - Check that the pump power switch is turned on.
  - Check the power cable is securely fitted to the rear of the pump.
  - Check the pump serial link is connected correctly to both the rear of the pump and the back of the PL-GPC 220 Control drawer.
- Injection valve failure
  - Check that the Link cables on the rear of the Control drawer are connected correctly.
  - If problem persists please contact your local Agilent service representative.
- Autosampler general error
  - Observe initialization sequence for autosampler:
    - Lower vial if lift not at bottom
    - Move syringe to position 1 (max suction)
    - Rotate carousel to Vial 0 position
    - Check that a vial is present
    - Raise vial
    - Move syringe to position 3 (max blow)
    - Wait 30 s
    - Lower vial
    - Move syringe to position 2 (middle)

#### NOTE

If all steps appear to succeed, it is probably only a transient problem.

If not, note which step fails. See [“Autosampler Problems”](#) on page 59 for corrective actions.

- If none of the above steps occur:
  - Ensure +5 V is present by observing the rotation of stirrer magnet.
  - Ensure +12 V is present by observing the rotation of ventilation fans in the baseplate.

## Autosampler Problems

Please contact your local Agilent service representative.

## RI Problems

- Fails to autozero correctly
  - Purge the RI thoroughly.
  - Check the purge column is not blocked (if fitted), by observing a significant decrease in system pressure when the purge valve opens.
- Low sensitivity
  - Clean the RI cell thoroughly (for example sonicate in 10 % nitric acid).

## Oven Temperature Control Problems

- Fails to heat
  - Check the over temperature cut-out has not tripped. Should be set about 5 °C above operating temperature.
- Temperature unstable
  - Check that the oven fan is rotating at high speed. The speed of the fan is recorded in the Service Engineer mode. Please contact your local Agilent service representative.
  - Check that the oven lid is fully closed and seals properly.
  - Check that the power line voltage is not below 200 V.
  - Check that the ambient temperature above 10 °C.
  - Ensure that the stability of power line voltage and ambient temperature. Protect the unit from draughts.

## Solvent Module Problems

- Alarm lights and buzzer on continuously
  - If Float Switches are plugged in, ensure they are placed in the respective solvent reservoirs.

## Pump Problems

- High back pressure generated at pump
  - Replace the purge frit
- Low flow rate
  - Purge pump to remove air bubbles
  - Please contact your local Agilent service representative to check the valves

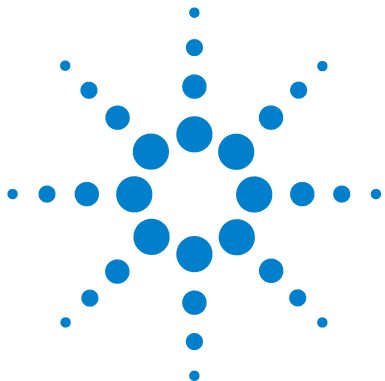
## Chromatography Problems

- RI baseline drift
  - Allow sufficient time for the system to equilibrate at temperature (8 hrs is usually enough).
  - Ensure that the oven temperature remains stable (see “[Oven Temperature Control Problems](#)” on page 60).
  - Check that the pump flow rate / back pressure is constant.
  - Check all plumbing connections between the Purge valve outlet and RI Reference inlet.
  - Check that the RI cell is not cracked.
- RI baseline noise
  - Purge the Pump head to clear air from the Check Valves.
  - Purge the RI Reference thoroughly to remove any air bubbles.
  - Check for presence of pump noise. Clean or replace check valves if necessary. The pump pressure is continually monitored when the Logging is turned on and the pressure history can viewed in the log table or plotted graphically –see the **LOG MENU** in the graphical user interface.
  - Clean or replace inline filter element.
  - Check that the degasser is operating correctly. The degasser pump motor should cut in and out to maintain low chamber pressure. If it runs continuously, there could be an air leak.
- Small or Non-Reproducible peaks
  - Check that the vials are filled to shoulder.
  - Inspect Valco valve seal for scoring and wear. May also see solvent drips on the outside of vials.
  - Check all autosampler tubing connections for leaks.
  - Check that the autosampler needle is not blocked.
  - Check that the autosampler syringe plunger seal is gas-tight.
  - Check that the syringe Luer adaptor not leaking.
- Long retention times
  - Check the pump flow rate.
  - Check for a leak on the Purge valve.

## **5 Troubleshooting and Diagnostics**

### **General Troubleshooting Guide**

- Mirrored peaks
  - Ensure that the purge valve is closed.
  - Inspect the RI cell for cracks, particularly in partition.



## 6 Error Information

Errors 64

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



## Errors

If an error occurs on the system the error handling system will generate a dialog similar to that shown below with a description of the error.

Errors are categorized as two types:

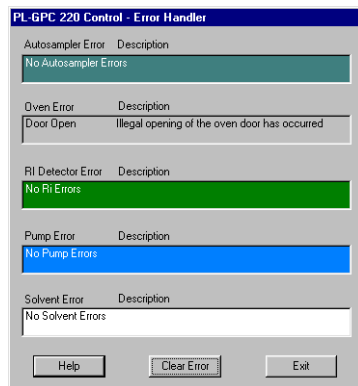
- Warnings

Warning messages simply display the appropriate dialog and the Error indicator on the front panel is flashed orange.

- Errors

Errors display the appropriate dialog the error indicator is flashed red and the beeper is sounded.

Depending on the severity of the error, following a short time delay, the instrument steps in to render the system safe. Details of the errors reported and the remedial actions are tabulated below, however, in general, severe errors will put the instrument into the STANDBY mode and the remainder will allow the system to continue.



**Figure 15** Error Handling Dialog

When an error occurs, pressing the help button on the error dialog will open the help file at the troubleshooting section giving further instructions on how to overcome the error reported.



The error will also be written to the error log file, which can be viewed by selecting the **View Error log** option from the **Log** menu.

**Table 3** Error overview

Type	GUI Error Message	Conditions	Response Time (Timeout, Retries)	LED	Beeper	Default Mode	Notes
<b>Pump</b>							
PRESSURE	"Pressure is currently outside set limits"	Pressure has exceeded the set min or max pressure settings	10 s (10 s, 1)	Flash Orange	NO	IDLE	Not STBY and not initializing
			50 s (10 s, 5)	Flash Red	YES	STBY	"
PUMP COMMS	"The pump is no longer responding"	No serial response from the pump	3 s (1 s, 3)	Flash Red	YES	STBY	
<b>Oven</b>							
TEMPERATURE	"Oven temperature has become unstable"	Temp +/- 2 °C from setpoint	- (-, -)	Flash Red	YES	STBY	Not STBY
FAN	"The fan is no longer operating correctly"	Frequency < 100 Hz	5 s (5 s)	Flash Red	YES	STBY	"
DOOR	"Illegal opening of the oven door has occurred"	I/O state change	- (-, -)	Flash Orange	YES		Heaters OFF while door open
V/F	"Temperature sensor is not responding correctly"	Temp = 0 °C or > 999.99 °C	- (-, -)	Flash Red	YES	STBY	"
SENSOR	"The vapour sensor is not responding correctly"	Open/Short circuit	5 s (5 s)	Flash Red	YES	STBY	"

## 6 Error Information

### Errors

**Table 3** Error overview

Type	GUI Error Message	Conditions	Response Time (Timeout, Retries)	LED	Beeper	Default Mode	Notes
OVEN VAPOUR	"Spillage may have occurred within the oven"	Voltage < set threshold	2 min (-, -)	Flash Orange	YES	STBY	Immediate alarm
			5 min (-, -)	"	YES	-	"
<b>RI</b>							
AZ FAIL	"Attempts to autozero the RI have failed"	Timeout or False Zero	20 min (10 min, 2)	Flash Orange	NO	-	Not STBY and not initializing
PURGE	"The purge valve is not functioning correctly"	Timeout	5 s (5 s)	Flash Red	NO	IDLE	"
INITIALIZATION	"Failed to initialize autosampler"	cmd failed response from autosampler	- (-, 0)	Flash Red	NO	-	
MOVE	"Failed to move carousel correctly"	"	- (-, 3)	Flash Red	NO	-	
VIAL LOWER	"Failed to lower vial from the oven"	"	- (-, 0)	Flash Red	NO	-	
VIAL LIFT	"Failed to lift vial from the carousel"	"	'- (-, 0)	Flash Red	NO	-	
SYRINGE	"Failed to move syringe"	"	- (-, 0)	Flash Red	NO	-	
CAROUSEL LOCK	"Failed to lock carousel after being closed"	cmd failure during autosampler run	- (-, 0)	Flash Red	NO	-	
LOAD	"Failed to switch valve to load position"	cmd failed response from autosampler	- (-, 3)	Flash Red	NO	-	
INJ	"Failed to switch valve to inject position"	"	- (-, 3)	Flash Red	NO	-	

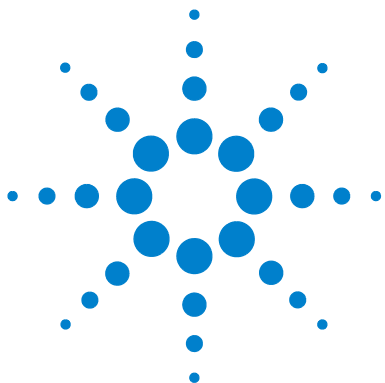
**Table 3** Error overview

Type	GUI Error Message	Conditions	Response Time (Timeout, Retries)	LED	Beeper	Default Mode	Notes
AUTO COMMS	"The autosampler is no longer responding"	pkt errors, no ack response	1.5 s (500 ms, 3)	Flash Red	NO	-	
		no command success response	variable, (variable, 0)	Flash Red	NO	-	
<b>Solvent</b>							
SOLVENT LEVEL	"Solvent level low or waste level high"	I/O state change	- (-, -)	Flash Red	NO	-	
SOLV VAP	"Vapor sensor and/or over-temp error"	"	- (-, -)	Flash Red	NO	-	

## 6 Error Information

### Errors





## 7 Maintenance

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This chapter provides general information on maintenance of the PL-GPC 220.



## **Introduction**

To ensure long, safe and trouble free operation of your instrument we recommend to inspect the system periodically. The instrument is designed to be a low maintenance instrument and does not generally require regular service. For your convenience an annual inspection is offered as part of our preventative service contract. Please contact your local office or agent for information about purchasing the preventive service option.

## 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 volume of substances should be reduced to the minimum required for the analysis.
  - Do not operate the instrument in an explosive atmosphere.
- 

### WARNING

#### **Electric shock**

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

- Do not remove the instrument control drawer.
  - Only certified persons are authorized to carry out repairs inside the module.
- 

### WARNING

#### **Fire and damage to the module**

##### **Wrong fuses**

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

**WARNING**

**Burns**

**Touching hot parts may cause burns.**

- Allow any hot parts to cool.
- 

**WARNING**

**Fire, electrical shock, burns and damage to the instrument**

**Moisture inside the instrument or on connectors is an electrical safety hazard.**

**Touching the connectors may bend the pins and therefore damage the instrument.**

**Hot parts are accessible in maintenance area.**

- Switch instrument off, disconnect both power cords and allow any hot parts to cool before undertaking any cleaning or maintenance procedures.
  - Ensure that no moisture enters the instrument.
  - Do not attempt to clean any connectors.
- 

**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.
-



## Cleaning

### **WARNING**

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

- Do not use an excessively damp cloth during cleaning.
  - Allow the instrument to dry off completely before reconnecting power.
- 

- 1 Moisten a soft cloth with diluted detergent solution.
- 2 Wipe down the exterior of the instrument.
- 3 Moisten a soft cloth with deionized water.
- 4 Wipe down the exterior of the instrument.
- 5 Allow the instrument to dry off completely before reconnecting power.

## Decontamination

### WARNING

#### Intoxication

**Potentially hazardous liquid spilt in the instrument.**

→ Wear appropriate personal protective equipment (gloves, safety glasses, lab coat and respirator if the level of hazard has been risk-assessed to be sufficiently high).

---

### NOTE

To be carried out only by trained service personnel.

---

- 1 Excess quantities of solvent spilt on or inside the instrument should be mopped up using absorbent cloths, followed by repeated wiping down with soft cloths moistened with acetone until the last traces of the hazardous liquid have been removed.
- 2 Identify and, if possible, correct the source of the leak.
- 3 Inspect cabling, parts and surfaces to determine whether or not any damage has occurred.
- 4 Allow the the instrument to dry completely before reconnecting power.
- 5 Dispose of contaminated waste appropriately.

## Testing Overtemperature Protection Systems

The solvent delivery module, oven and autosampler are fitted with independent over temperature protection systems to eliminate potential hazards due to failure of their respective temperature controllers. The trip points of the oven and autosampler protection can be adjusted by the user, while the trip point of the solvent module protection system is fixed at 42 °C.

The overtemperature protection systems for following modules should be tested regularly:

- Oven
- Autosampler
- Solvent module

## Oven Overtemperature Protection Test

### Preparations

This test can be carried out at any operating temperature above 40 °C.

If the instrument is at room temperature then it will be necessary to heat the oven.

To heat the oven:

- 1 Set the oven temperature to 40 °C and the heat rate to 0.5 °C/min.
- 2 Disable the autosampler heaters.
- 3 Put the instrument into RUN mode or IDLE mode (using a suitable solvent e.g. acetone) and wait for the oven temperature to stabilize.

- 1 Use a small screwdriver to reduce the setting on the oven over temperature display (on the right hand side of the front panel) until the value is 5 °C less than the actual oven temperature (displayed on the centre of the front panel).

A loud audible alarm will sound and the decimal points on the over temperature display will flash. The power to the oven heaters and waste transfer line is now interrupted. Do not press the **reset** button until the test is completed.

### NOTE

If the alarm does not sound: first check that the above procedure has been followed correctly.

If the procedure has been carried out correctly but no alarm sounds, disconnect both power cords from the instrument and contact your local Agilent Service Department.

- 2 Wait until the displayed oven temperature falls in order to verify correct operation of the protection system.

### NOTE

If the displayed oven temperature shows no decrease after 30 min while the alarm is sounding then switch the instrument off, disconnect both power cords and call your local Agilent Service Department.

- 3 Once oven cooling has been verified, adjust the over temperature display to 5 °C above the oven set point and press the **reset** button to silence the alarm.

This concludes the oven over temperature protection system test.

## Autosampler Overtemperature Protection Test

### Preparations

If the instrument is at room temperature, it will be necessary to heat both zones of the autosampler to 50 °C. This test can be carried out at higher temperatures but the warm and hot zones must both be at the same temperature, between 50 °C and 130 °C, before commencing the test.

The PL-GPC 220 must be in RUN mode for this test.

Remove all sample vials except Vial 0 if necessary.

### Warm Zone

- 1 Adjust the autosampler over temperature display setting (located on the left hand side of the front panel) to 4 – 6 °C higher than the current warm zone set point (shown on the Control software screen)
- 2 Increase the warm zone set point by 20 °C.
- 3 Wait a few seconds for the warm zone to heat up.  
A loud audible alarm will sound. The power to the autosampler heaters is now interrupted.
- 4 Wait at least three minutes for the warm zone to cool before pressing and holding the **reset** button.
- 5 Note the initial value on the over temperature display while the **reset** button is held.  
This indicates the actual warm zone temperature, which should initially be at or below the over temperature set point before rising quickly.
- 6 If the initial value shown is close to the warm zone set point then the protection system is not functioning correctly.

### NOTE

Disconnect both power cords from the instrument and call your local Agilent Service Department for assistance.

OR

Once warm zone cooling has been verified then adjust the over temperature display to 4 – 6 °C above the present warm zone set point and press the **reset** button to silence the alarm.

- 7 Wait a few minutes for the warm zone temperature to stabilize before proceeding with the hot zone over temperature test below.

#### Hot Zone

- 1 Ensure the over temperature display has been set to a value 4 – 6 °C above the warm zone set point.
- 2 Increase the hot zone set point to 20 °C above the warm zone set point.
- 3 Wait a little while for the hot zone to heat up.  
A loud audible alarm will sound. The power to the autosampler heaters is now interrupted.
- 4 Wait at least two minutes for the hot zone to cool before pressing and holding the **reset** button.
- 5 Note the initial value on the over temperature display while the **reset** button is held.  
This indicates the higher of the two zone temperatures, which should initially be at or below the over temperature set point before rising quickly.
- 6 If the initial value shown is close to the hot zone set point then the protection system is not functioning correctly.

#### NOTE

Disconnect both power cords from the instrument and call your local Agilent Service Department for assistance.

---

OR



Once hot zone cooling has been verified then adjust the over temperature display to 4 – 6 °C above the present hot zone set point and press the **reset** button to silence the alarm.

This concludes the autosampler over temperature protection system test.

## Solvent Module Overtemperature Protection Test

<b>Tools required</b>	<b>Description</b>
	A/F hex key, 3 mm
	Thermometer
	Glass of hot water 45 – 50 °C

<b>Preparations</b>	<p>The solvent module protection system can only be tested by heating the temperature probe above 42 °C.</p> <p>It may be necessary to remove solvent and waste bottles from the solvent module compartment to clear enough space.</p>
---------------------	--

<p><b>1</b> Switch ON the PL-GPC 220 oven unit and solvent module and set the instrument to IDLE.</p>	<p><b>2</b> Slacken off the two screws, which fix the compartment temperature sensor.</p> 
<p><b>3</b> Place the glass of hot water on the floor of the compartment.</p> 	<p><b>4</b> Make sure that the temperature of the water is above 45 °C.</p> <p><b>5</b> Check the temperature of the black rectangular heat sink fitted on the rear of the module. This should be warm to the touch, about 32 °C.</p>

## 7 Maintenance

### Testing Overtemperature Protection Systems

- 6 Dip the temperature sensor into the hot water.



After a few seconds the solvent module alarm buzzer will sound and an error notification will be displayed on the PL-GPC 220 Control software.

#### Next Steps:

- 7 Leave the probe in the hot water for a few minutes and check the temperature of the heat sink again. This should now be noticeably cooler.
- 8 If the alarm condition does not occur or the heatsink does not cool down then switch off and disconnect both power cords from the instrument.

#### NOTE

Contact your local Agilent Service Department for assistance.

OR

Once heat sink cooling has been verified remove the probe from the hot water and replace it in the mounting block.

- 9 Tighten the clamp screws slightly. Do not over-tighten.

The alarm will cease after a few seconds.

- 10 Clear the error on the Control software.

This concludes the autosampler over temperature protection system test.



## Testing Vapor Sensors

The vapor sensors are tested by simulating a solvent leak or spillage in the following modules:

- Oven
- Solvent module

## Solvent Module Vapor Sensor Test

<b>Parts required</b>	<b>Description</b> Absorbent paper (crumpled into a loose ball) Acetone Syringe
<b>Preparations</b>	Switch ON the PL-GPC 220 if necessary and set it to IDLE mode with the oven temperature set to 40 °C.

- 1 Ensure that the front flap on the solvent module is closed.
- 2 Place the paper on the floor of the solvent compartment (see [Figure](#) on page 82).
- 3 Squirt 5.0 mL of acetone onto the paper and immediately close the solvent module lid.



After a few seconds both the solvent module and oven module alarms will sound and an error notification will appear on the Control software.

- 4 Open the solvent module front flap and check that the pump and degasser module are powered down.
- 5 If the alarm condition does not occur or if the pump and degasser remain powered while the solvent module vapour alarm condition exists then switch off and disconnect the power cords from both units.

### NOTE

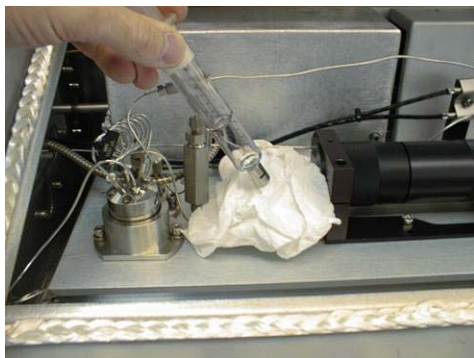
Contact your local Agilent Service Department for assistance.

- 6** Remove the paper ball from the solvent module and dispose of it appropriately.
- 7** Close the front flap again and wait a minute or so until the solvent module alarm ceases.
- 8** Clear the error on the Control software

This concludes the solvent module vapour sensor test.

## Oven Vapor Sensor Test

- |                       |  |
|-----------------------|--|
| <b>Parts required</b> | <b>Description</b><br>Absorbent paper (crumpled into a loose ball)<br>Acetone<br>Syringe   |
| <b>Preparations</b>   | Switch ON the PL-GPC 220 if necessary and set it to IDLE mode with the oven temperature set to 40 °C.<br><br><ol style="list-style-type: none"><li>1 Heat the oven to 40 °C in IDLE or RUN mode with a pump flow rate of 0.5 mL/min.</li><li>2 Open the solvent module lid and lift the end of the solvent return tube just out of the liquid so that you can see the solvent dripping into the bottle.</li><li>3 Check the vapour sensor threshold is set to 5.0 mL/min (in the oven configuration window)</li><li>4 Set the instrument to STANDBY mode (click <b>OK</b> to confirm).</li><li>5 Open the outer and inner oven lids and place the paper on the floor of the oven near the RI, <i>far away from the spiral heater and fan</i> (see “<a href="#">Oven Vapor Sensor Test</a>” on page 84).</li><li>6 Squirt 5.0 mL of acetone onto the paper and immediately close both lids.</li></ol> |



- 7 Set the instrument to IDLE mode.  
After a short period the oven module alarm will sound and a vapor error notification will appear in the Control software.

- 8 Wait for two minutes with the alarm sounding, then check that the solvent flow has stopped by watching for drips from the return tube.
- 9 If the alarm condition does not occur or if the pump flow has not stopped after three minutes then switch off and disconnect the power cords from both units.

**NOTE**

Contact your local Agilent Service Department for assistance.

---

- 10 Open the oven and remove the paper. Dispose of it appropriately.
- 11 Leave the oven open for one minute to allow the acetone vapour to disperse.
- 12 Close both oven lids.
- 13 Clear the error on the Control software

This concludes the oven vapour sensor test.

# Testing Solvent Level Sensors

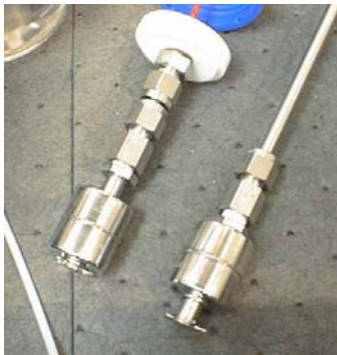
If your PL-GPC 220 solvent module is fitted with steel solvent tanks a pair of liquid level sensing float switches will have been provided. These can be tested after removing them from the tanks and laying them on the floor of the solvent compartment.

- 1** Remove the float switches from the tanks and lay them on the floor of the solvent compartment.

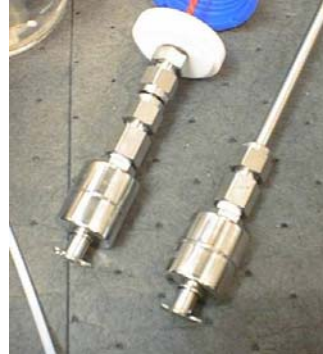


In normal operation the (long stem) solvent level switch will be UP and the (short stem) waste level switch will be DOWN.

No alarm should sound in this configuration (normal operation).



- 2** Test the high waste level by raising the waste float switch (waste level high).



OR

Test the low solvent level by lowering the solvent float switch (solvent level low).



Both of these two abnormal conditions should produce an audible solvent module alarm and an error notification on the Control software.

#### NOTE

If an alarm condition does not occur for both abnormal configurations, then contact your local Agilent Service Department for assistance.

Liquid level alarms are of a purely advisory nature and are not essential to the safe operation of the instrument.

- 3** Replace solvent tanks and float switches to resume normal operation of the PL-GPC 220.

## Testing Oven Door Interlock

A safety interlock switch is fitted to the outer oven door to disable the heaters if the door is opened while the instrument is running.

- 1 Set the instrument to IDLE or RUN mode.
- 2 Open the outer oven door.

An audible alarm should sound immediately and an error notification should be displayed by the Control software.

---

**NOTE**

If the alarm condition does not occur then switch off and disconnect the power cords from both units. Contact your local Agilent Service Department for assistance.

---

This concludes the oven door interlock test.



## Laser Interlock Switch

Adjacent to the oven door interlock is a safety interlock switch which will turn off the laser in the light scattering detector (when installed) when the oven door is opened.

- 1 Check the connection of cable from the safety interlock switch to the interlock connection at the rear of the light scattering control box.

## Degasser Test

The online degassing unit forms part of the the pump unit built into the solvent delivery module and is designed to remove dissolved gas from the solvent. The dissolved gas is removed from the solvent through a membrane (thin wall PTFE tubing) inside a vacuum chamber.

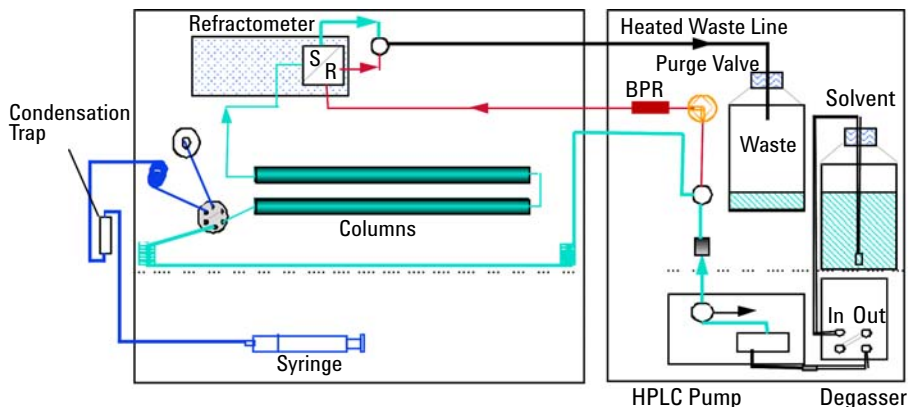
See the *Agilent 1260 Infinity Quaternary Pump* manual for further information.

## Back Pressure Regulator (BPR)

### Replace the Back Pressure Regulator (BPR)

The BPR is located at the rear of the solvent delivery module and is designed to provide a small backpressure (75 psi) on the purge line, when the purge valve is open so that flow is maintained in the analytical columns during a purge. Therefore, when the purge valve is opened, the solvent flow is split between the chromatography columns and the reference side of the RI cell maintaining flow through the column during the purge cycle. To ensure optimum performance of the chromatography columns, it is important to maintain flow through the columns at all times when operating at high temperature.

The purge valve is operated from the software and can be opened either manually or automatically programmed as part of the instrument set-up routine. During PURGE mode the backpressure displayed will be that of the BPR and at all times should be less than the NORMAL operating pressure.



**Figure 16** Purge Valve Purge Mode and Solvent Flow

- 1 Turn off the solvent flow.
- 2 Locate the BPR at the back of the solvent delivery module and remove it.

## **7 Maintenance**

### **Back Pressure Regulator (BPR)**

- 3** Fit the replacement BPR with the arrow in the direction of the flow, for example from right to left.
- 4** Turn on the flow and open the PURGE valve. Check the system backpressure and check for leaks at the joints disturbed.

## Differential Refractive Index Detector

The differential refractive index detector (DRI) is designed specifically for high temperature chromatography giving an excellent signal to noise ratio even at temperatures up to 220 °C. The light source and detectors are both external to the oven and only the optical bench is heated and maintained at the oven temperature.

In normal operation, very few problems are usual encountered with the DRI, since the tubing and cell are continually washed with solvent. However, to prevent contamination of the cell during the times when the system is not operated, we recommend that the system is flushed and stored in acetone or methanol. If the cell does become dirty, which will be manifested by a reduction in the chromatography performance and typically small peaks, we recommend the following sequence of maintenance to be carried out in order:

- 1 Purging the DRI Cell
- 2 Flushing the DRI Cell with a Cleaning Agent
- 3 Removal of the Cell and Replacement of Seals

## Purge the DRI Cell

The following problems are usually indicative that the reference cell in the DRI detector requires purging with fresh solvent:

- Drift on the baseline
  - Excessive noise on the baseline
  - Lack of sensitivity
- 1 In RUN mode open the purge valve by pressing the **PURGE** button.
  - 2 While in PURGE mode, enter the Pump configuration and increase the flow to 2.0 mL/min (if using a purge column).
  - 3 Allow the system to purge at 2.0 mL/min for 15 min, during which time the baseline can be monitored and should give a flat noise free baseline. If the baseline is off scale, press the **Autozero** button on the front panel.

### NOTE

At this point the PURGE light will go out and the Purge button will have to be pressed again once the RI has zeroed.

- 4 After approximately 15 min, reduce the FLOW back to the required operating flow (for example 1.0 mL/min) and wait for the pump flow rate to reach the set value.
- 5 Press the **Purge** button to close the purge valve.
- 6 Allow the system adequate time to settle after the purge.  
For high temperature applications, this settling time can be up to 8 hours.

## Flush the DRI Cell with a Cleaning Agent

### When

- Purging the reference side of the DRI cell does not cure the baseline noise or lack of sensitivity.
- Back pressure across the DRI is determined to be higher than normal

If no flow is achieved through the DRI system, this exercise would prove ineffective and the problem should be reported to Agilent.

### NOTE

The backpressure across the DRI system in THF at ambient temperature and at 1.0 mL/min is typically  $\leq 3$  bar.

### NOTE

The wettable parts in the DRI system are stainless steel, Hastalloy and quartz and thus the most effective cleaning is achieved by pumping a dilute solution of nitric acid (20 %) through the system.

### CAUTION

Damage to the tubing

Some instruments contain nickel tubing in the DRI flow path.

→ Do not flush instrument tubings containing nickel with nitric acid.

### Flush the sample side of the cell

- 1 Connect the inlet tubing of the DRI directly to the injection valve outlet using the wide bore Parker barrel connector provided.
- 2 Switch on the pump and set the flow rate at 1.0 mL/min.

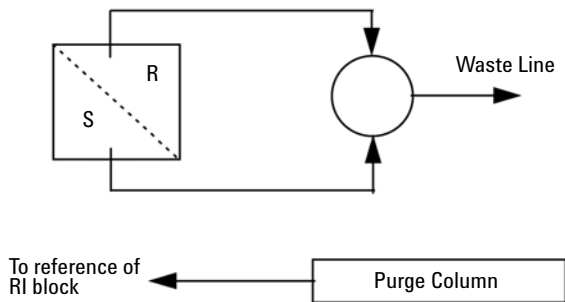
### Flush the reference side of the cell

- 1 Remove the purge column and replace it with a wide bore barrel connector.
- 2 Blank off the outlet of the injection valve and open the purge valve.
- 3 Switch on the pump and set the flow rate at 1.0 mL/min.

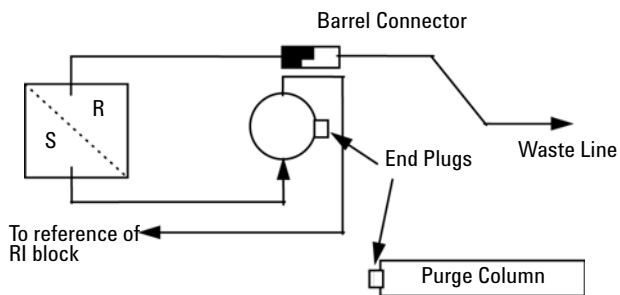
Alternatively both sides of the cell could be continually flushed by changing the plumbing from the conventional arrangement (Figure 17 on page 96) to sample and reference in series (Figure 18 on page 96).

## 7 Maintenance

### Differential Refractive Index Detector



**Figure 17** Conventional Plumbing



**Figure 18** Sample and Reference in Series for Continuous Flushing



## Autosampler

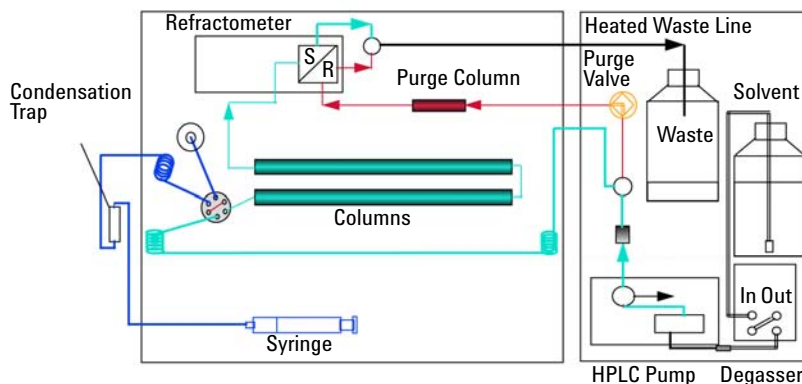
To ensure optimum performance of the autosampler system, it is recommended that the following important maintenance procedures be performed every 3 – 6 months depending on instrument usage.

## Lubricate Autosampler Syringe (not applicable to serial controlled A/S systems)

Parts required	Description
	Acetone
	Silicone oil
	<ol style="list-style-type: none"><li>1 Pull out the A/S carousel drawer to its maximum position to gain access to the syringe assembly beneath it.</li><li>2 Reach in over the top of the extended carousel and with both hands lift the syringe from its mounting. Disconnect it from the Luer lock needle assembly.</li><li>3 If the syringe is contaminated with solvent, wash it out with acetone and dry.</li><li>4 Place a couple of drops of silicone oil into the barrel of the syringe and replace the plunger.</li><li>5 Work the plunger up and down the barrel a few times to thoroughly disperse the oil.</li><li>6 Reconnect the syringe to the tubing and relocate in the mounting.</li><li>7 Return the A/S drawer to its normal operating position.</li></ol>

## Cleaning the Condensing Chamber

The condensing chamber is located behind the front left hand panel of the unit, and is accessible once the side panel is removed. The condensing chamber is plumbed between the syringe and the needle (Figure 19 on page 99) and its purpose is to capture any solvent vapours extracted during injection and to prevent the condensed solvent from reaching the syringe.



**Figure 19** Plumbing diagram

- 1 Remove the left hand side panel from the PL-GPC 220 main unit:
  - a Lift the top section of the panel front and up and disconnect the earth cable from the panel.
  - b Unscrew the clamping screw located at the rear and bottom of the lower panel, and the small x-head screw located in the centre at the top.
  - c Slide the panel forwards and tilt side ways to access the earth cable that should be disconnected from the panel.
- 2 Disconnect the condensing chamber from the attached tubing and remove from the instrument.
- 3 Wash the condensing chamber thoroughly with acetone and dry.
- 4 Replace the condensing chamber.
- 5 Replace the cable tie that holds the chamber in position.
- 6 Refit the side panel(s).

## Autosampler Track Lubrication

<b>Tools required</b>	<b>Description</b>
	Tissue
	Cotton bud (Q-tip®)

<b>Parts required</b>	<b>Description</b>
	Actone
	Graphite powder

- 1** Pull out the carousel drawer and remove the carousel complete with all its vial holders.
- 2** With a piece of tissue paper moistened with acetone, wipe clean the entire track that the vial holders sit on.
- 3** Using a cotton bud (Q-tip®) sprinkle a small amount of graphite powder over the track.
- 4** Replace the carousel and return the drawer to its operating position.

## Autosampler Needle Removal, Cleaning and Replacement

The most common cause of poor, incomplete injection is blockage of the outer sheath of the A/S needle. Although injection needle design changes have largely removed this problem, it is still recommended that the needle is removed occasionally and checked and cleaned.

### Tools required

#### Description

1/4 " - 5/16 " wrench

11 mm open-ended wrench

A hollow shaft 1/4 in nut spinner is preferable but not essential to remove and replace the needle

2 mm Allen key wrench

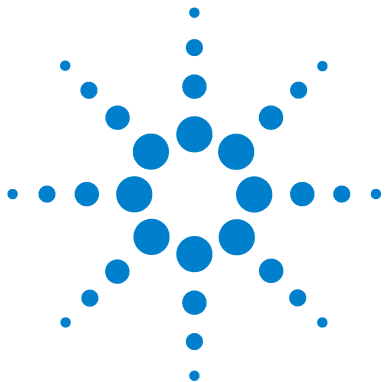
Allen wrench extender handle

- 1 Switch the PL-GPC 220 system off and remove the mains lead from the back of the unit.
- 2 Open the oven compartment lid and locate the Autosampler needle assembly, positioned between the RI block and the Valco valve head assembly.
- 3 Using the 1/4 in wrench, undo the Valco nut connected to the top of the needle assembly. Prevent the needle assembly from rotating with an 11 mm wrench.
- 4 Remove the interconnecting capillary tubing and push to one side to ease access to the needle.
- 5 Unscrew the two M3 stainless steel socket cap head screws on the side and rear of the needle assembly.
- 6 Withdraw the A/S needle assembly vertically clear of the instrument.
- 7 Using a 1/4 in wrench (hollow open-ended nut spinner if available), unscrew the needle.
- 8 Inspect the outer sheath of the needle and remove any traces of septum blocking the orifice. If the needle is blocked or damaged replace with a new one.
- 9 Tighten the needle into the holder and carefully return the needle assembly in to the guide tube. Be careful not to bend the needle or get it caught up on the spring.

## **7** Maintenance

### Autosampler

- 10** Holding the needle assembly firmly in position, tighten the two M3 stainless steel socket cap screws.
- 11** Reconnect the capillary tubing.
- 12** Reconnect the power lead(s) and the switch instrument ON.



## 8 Parts for Maintenance

Parts List 104

Pump Spares 105

This chapter provides information on parts for maintenance.



## Parts List

<b>p/n</b>	<b>Description</b>
PL0870-6110	Solvent reservoir filter
PL0800-0003	Injection valve rotor seal
PL1-23926	Vial locator solenoid and plunger assembly
PL4-32434	Replacement Inline filter cartridges
PL0810-0012	Autosampler needle (pk 2)



## Pump Spares

<b>p/n</b>	<b>Description</b>
G1312-60061	Purge valve 1260
G4280-60036	Passive inlet valve
G1312-60025	Active inlet valve body, without cartridge
G1312-60020	Cartridge for active inlet valve 600 bar
G1312-60022	Outlet ball valve
5067-4728	Seal cap
5063-6586 (2x)	Sapphire piston
0905-1175 (2x)	Wash seal (PTFE)
01018-22707	PTFE frits (pack of 5)
5063-6589	Standard seals (pack of 2)
5001-3707	Gold seal, outlet
5062-8562	Active Inlet Valve Cartridge (400 bar)
5001-3708	AIV gold washer
01018-21207	AIV plastiv cap
5062-2485 (2x)	Cap (pack of 4) 1 x pump outlet valve, 1 x pump purge valve

## 8 Parts for Maintenance

### Pump Spares





## 9 Appendix

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



## General Safety Information

### Safety Symbols

Table 4 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.
	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, observe appropriate safety procedures (for example, 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.

## Precautions

### WARNING

#### Fire, intoxication and damage to the instrument

##### Hazardous material on or inside the instrument.

- Do not use the instrument if material is split on or inside the instrument.
- Carry out appropriate decontamination method recommended by Agilent Technologies.
- If using methods not recommended by Agilent Technologies, check with Agilent Technologies that the method will not damage the instrument.
- Perform periodic leak checks on all wetted components, tubing and joints.
- Test the over temperature protection systems for the solvent module, oven and autosampler on a regular basis.
- Do not allow flammable and/or toxic solvents to accumulate.
- Follow recommended procedures and protocols for evacuation and disposal of flammable or toxic solvents. Never dispose of such products through municipal waste systems.

The PL-GPC 220 is designed to control the temperature of the column oven and autosampler at temperatures up to 220 °C.

### WARNING

#### Hot surfaces

##### The surface of the inner oven, autosampler and heated waste line will get extremely hot during normal operation (up to 220 °C).

- Handle these components carefully.
- Wear suitable protective gloves.

Vapor sensors are used in both modules of the PL-GPC 220 to alert the operator to solvent leaks.

**CAUTION**

**Solvent vapors**

Liberal use of organic solvents in close proximity to the instrument may activate the vapor sensors, causing the instrument to shutdown.

→ Exercise care when using solvents close to the instrument.

---

As part of the electrical safety regulations, forming part of the overall CE compliance, the unit is fitted with a surge safe device located at the rear of the instrument. This device protects the instrument from high voltage line surges by filtering the incoming supply.

**CAUTION**

**Insulation resistance test fails**

The surge safe device causes the instrument to fail the insulation resistance test of the standard portable appliance test (PAT Test).

→ Unplug the surge safe device before the PAT test is performed.

---



## The 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 off in domestic household waste

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

---

## Radio Interference

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

### **Test and Measurement**

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

## Sound Emission

### Manufacturer's Declaration

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

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

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

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## In This Book

This manual contains information on the Agilent PL-GPC 220 Integrated HT-GPC/SEC System (G7820A)

The manual describes the following:

- General information,
- Introduction
- Site requirements
- Unpacking
- Using the module
- Troubleshooting and diagnostics
- Error information
- Maintenance
- Parts
- Safety information

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