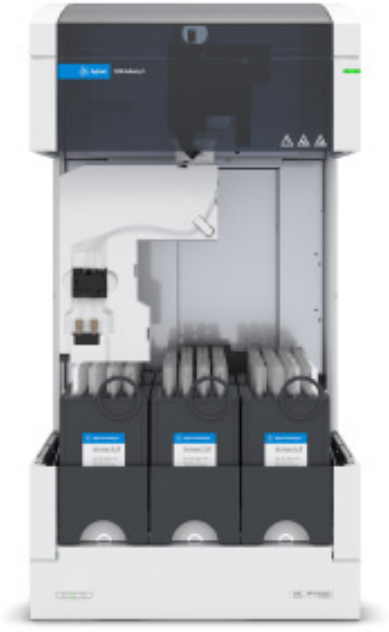
1290 Infinity II
Preparative Open-Bed Fraction Collector

Agilent InfinityLab LC Series

User Manual



Notices

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Safety Notices

CAUTION

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

WARNING

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

In This Guide

This manual contains technical reference information about the Agilent 1290 Infinity II Preparative Open-Bed Fraction Collector (G7159B).

1 Introduction

This chapter gives an introduction to the module and an instrument overview.

2 Site Requirements and Specifications

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

3 Using the Fraction Collector

This chapter explains the essential operational parameters of the module.

4 Preparing the Fraction Collector

This chapter explains the operational parameters of the module.

5 Troubleshooting and Diagnostics

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

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 describes the maintenance of the module.

8 Parts for Maintenance and Repair

This chapter provides information on parts for maintenance and repair.

9 Identifying Cables

This chapter provides information on cables used with the module.

10 Hardware Information

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

11 Appendix

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

Contents

1 Introduction

This chapter gives an introduction to the module and an instrument overview.

Intended Use

The 1290 Infinity II Preparative Open-Bed Fraction Collector is designed to be used in combination with other InfinityLab LC modules in a preparative-scale HPLC system to separate and purify inorganic or organic compounds via reversed-phase chromatography applications. The module can collect fractions of desired volume for sample purification or for later analysis.

The product is intended to be used by professional laboratory users.

Product Description

The Agilent 1290 Infinity II Preparative Open-Bed Fraction Collector is the ideal solution that automatically manages high-capacity fraction collection of purified peaks for semi-preparative and preparative scale purification. Collect milligrams to multi-gram quantities of sample intuitive with ease. The Agilent 1290 Infinity II Preparative Open-Bed Fraction Collector features handling a wide variety of collection vessels with ease and capacity of up to 5.9 L by using 150 x 25 mm (L x OD). The containers use identification tags to automatically detect the vessel dimensions. With a novel robotic technology, Y-, Z-, theta-axis probe functionality minimizes sample carryover between the fractions during movements between the vessels. The Agilent 1290 Infinity II Preparative Open-Bed Fraction Collector is optimized for flow rates up to 200 mL/min, and can be easily integrated with any Agilent solvent delivery module, autosampler, or detector. For high-throughput applications, you can combine up to three fraction collectors in a single LC system. Scale up your fraction capacity based on your demand up to a maximum of 1296 fractions.

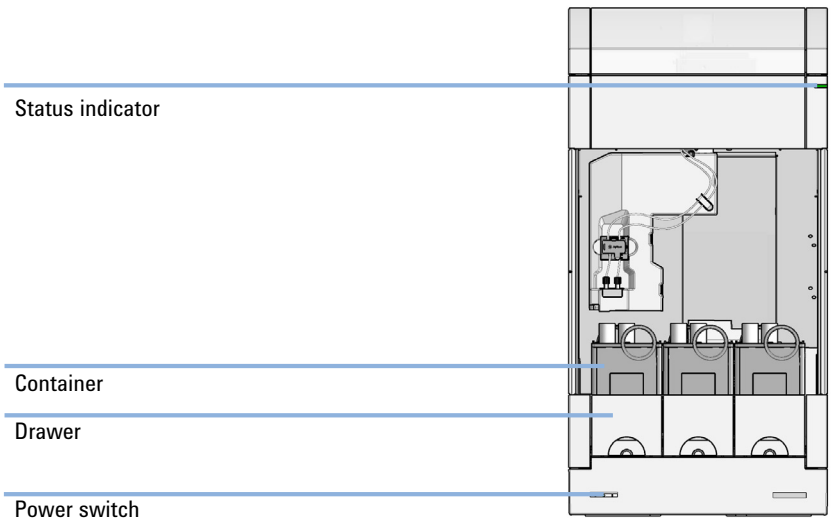


Figure 1 Overview of the open-bed fraction collector

Features

- *Maximize your flexibility* – Choose how much you want to collect, whether you prefer a large number of fractions which enables collection of up to 432 fraction in 150 x 12 mm (L x OD) vessels, or you prefer large volumes, or any combination of formats. Fraction Containers are available in eight formats, and you mix them to accommodate the different vessel ODs.
- *High capacity* – Using one type of drawer and offering six different type of containers, the Agilent 1290 Infinity II Preparative Open-Bed Fraction Collector can collect a maximum of 5.9 L.
- *Scalable collection volumes* – The Agilent 1290 Infinity II Preparative Open-Bed Fraction Collector enhances flexibility by providing differently optimized tubing kits. Optimized for collections up to 200 mL/min.
- *Accurate collection modes* – real time peak or mass detection algorithms allow to achieve accurate, reproducible fraction detection every time.
- *Lowest delay volumes* - Optimized tubing and unique delay sensor for accurate collection minimize peak dispersion.
- *Low carryover* - The Agilent 1290 Infinity II Preparative Open-Bed Fraction Collector is designed for low carryover due to extremely fast Y-, Z-, and Theta-axis movement, thus minimizing sample loss during movements from vessel-to-vessel.

Overview of the Module

The Fraction Collector transport mechanism uses a cartesian robot. The Y drive together with the Theta drive optimize the positioning for the fraction containers. The robot moves above a position and the diverter valve switches to collect in the according collection position.

All axes of the transport mechanism are driven by very fast BLDC motors. Optical encoders ensure the correct operation of the movement.

The entire flow path including the diverter valve and delay sensor are always flushed by the mobile phase for minimum internal carry-over.

To reduce carry-over further, you have the possibility to rinse the diverter valve on a rinse port. The bottle containing the mobile phase for the wash procedure will be located in the solvent bottle cabinet. The rinse waste produced during this operation is channeled safely away through a waste drain.

Fraction Collector Principle

The movements of the Fraction Collector components during the sequence are monitored continuously by the Fraction Collector processor. The processor defines specific time windows and mechanical ranges for each movement. If a specific step of the sequence is not completed successfully, an error message is generated.

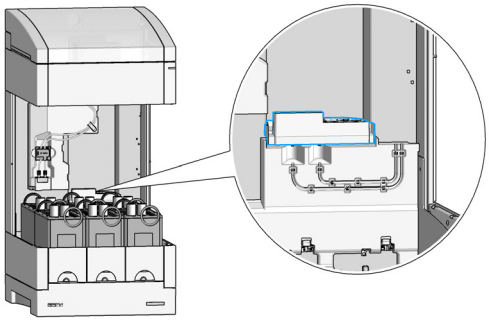
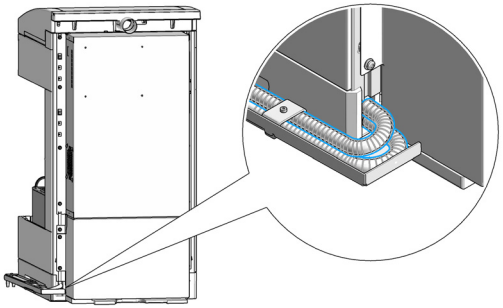
The standard fractioning sequence occurs in the following order:

1. The Fraction Collector starts always from the home position.
2. When the sample is injected, the fraction probe with diverter valve moves to the required position.
3. When the trigger is given by the detector, the diverter valve opens to collect the fraction.
4. When the trigger is given by the detector, the diverter valve closes and the arm moves to the next fraction position or back to the home position if this function is chosen in the CDS.

Fractioning Sequence

Before the start of the sequence, and during an analysis, the diverter valve is in the fraction start position. In this position, the mobile phase flows through the diverter valve towards waste.

Leak and Waste Concept

1 Rinse Port 	**2** Drain Outlet 

Leak Sensor

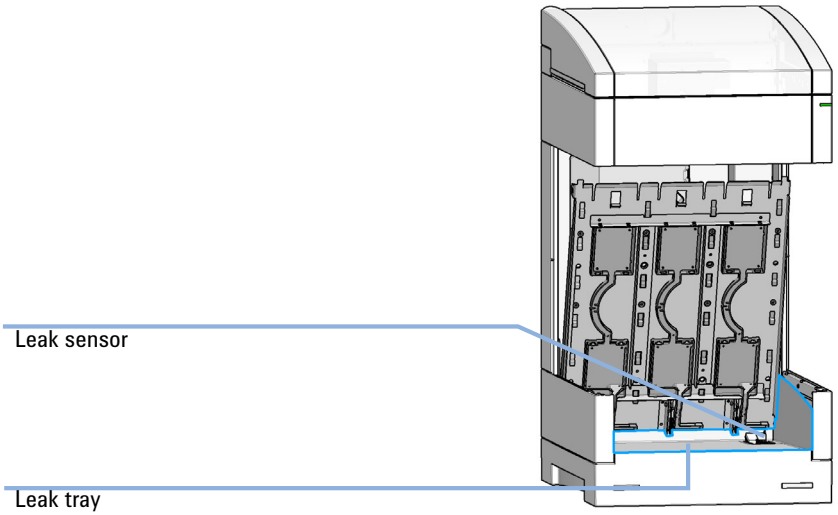


Figure 2 Position of leak tray and leak sensor

CAUTION

Solvent incompatibility

The solvent DMF (dimethyl formamide) leads to corrosion of the leak sensor. The material of the leak sensor, PVDF (polyvinylidene fluoride), is incompatible with DMF.

- ✓ **Do not use DMF as mobile phase.**
- ✓ **Check the leak sensor regularly for corrosion.**

2 Site Requirements and Specifications

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

Site Requirements

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

Power Considerations

The module power supply has wide ranging capability. It accepts any line voltage in the range described in Table 1 on page 22. Consequently there is no voltage selector in the rear of the module. There are also no externally accessible fuses, because automatic electronic fuses are implemented in the power supply.

WARNING

Hazard of electrical shock or damage of your instrumentation

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

- ✓ **Connect your instrument to the specified line voltage only.**

WARNING

Electrical shock hazard

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

The cover protects users from personal injuries, for example electrical shock.

- ✓ **Do not open the cover.**
- ✓ **Do not operate the instrument and disconnect the power cable in case the cover has any signs of damage.**
- ✓ **Contact Agilent for support and request an instrument repair service.**

WARNING

Inaccessible power plug.

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

- ✓ **Make sure the power connector of the instrument can be easily reached and unplugged.**
- ✓ **Provide sufficient space behind the power socket of the instrument to unplug the cable.**

Power Cords

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

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

WARNING

Unintended use of power cords

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

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

WARNING

Absence of ground connection

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

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

WARNING

Electrical shock hazard

Solvents may damage electrical cables.

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

Bench Space

The module dimensions and weight (see Table 1 on page 22) allow you to place the module on almost any desk or laboratory bench. It needs an additional 2.5 cm (1.0 inches) of space on either side and approximately 8 cm (3.1 inches) in the rear for air circulation and electric connections.

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

The module should be operated in a horizontal position.

Condensation

CAUTION

Condensation within the module

Condensation can damage the system electronics.

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

Exhaust and Vapour Management

You can operate the module in three different scenarios:

1 Under laboratory fume hood:
   - Ensure adequate fume hood ventilation: the recommended ventilation speed is 200 m^3/h with closed sash window and 490 m^3/h with open sash window.

2 On laboratory desk with module-specific fume hood:
   - Connect the exhaust tube to the laboratory's venting system.
   - Ensure a minimum air flow of 6 L/s through the exhaust tube.
   - Ensure an underpressure in the venting system.

3 Without fume hood:
   - Ensure adequate laboratory ventilation: the recommended air exchange rate is 10 times per hour, the minimum required air exchange rate is 8 times per hour.

WARNING

Hazardous or toxic fumes and vapors

Organic solvent vapors can reach harmful, toxic, or explosive concentrations when they are not removed sufficiently with an appropriate venting system.

- ✓ **Ensure that your venting/air exchange solution meets the requirements specified here for your relevant operation scenario.**
- ✓ **Ensure that the solvent temperature is always kept below the specified limit.**

For details, refer to the *Site Preparation Checklist*.

Waste Management

WARNING

Large amount of toxic, explosive, flammable, or corrosive solvents

✓ **Ensure that all waste is safely disposed according to your existing waste management solution.**

For details, refer to the *Site Preparation Checklist*.

Physical Specifications

Table 1 Physical Specifications

Type	Specification	Comments
Weight	30.6 kg (67.4 lbs)	
Dimensions (height × width × depth)	781 mm x 393 mm x 622 mm (30.7 inches, 15.5 inches, 24.5 inches)	
Line voltage	100 – 240 V~, ± 10 %	Wide-ranging capability
Line frequency	50 or 60 Hz, ± 5 %	
Power consumption	350 VA, 350 W	
Ambient operating temperature	4-40°C (39 -104°F)	
Ambient non-operating temperature	-40 – 70 °C (-40 – 158 °F)	
Humidity	≤80 % r.h. up to 31 °C, decreasing to 50 % r.h. at 40 °C	Non-condensing
Operating altitude	Up to 3000 m (9842 ft)	
Safety standards: IEC, EN, CSA, UL	Installation category II, Pollution degree 2	For indoor use only.
ISM Classification	ISM Group 1 Class B	According to CISPR 11
Permitted solvents	Boiling point ≥56 °C (133 °F). Auto-ignition temperature ≥200 °C (394 °F).	Do not use any solvent that is not explicitly mentioned on the "solvent compatibility" list.

Performance Specifications

Table 2 Performance Specifications

Type	Specification	Comment	Method/Conditions
Delay volume	Calculated by Lab Advisor. Dead volume in Valve tip appr. 30 µL		
Time to move from vessel to vessel	0.3 s		Tested with OD 30 mm vessels. Vessels next to each other.
Minimum system flow	1 mL/min		
Maximum system flow	200 mL/min		
Maximum collection volume	78 mL	With 30x150 mm (OD x L) tube	
Maximum capacity	432 fractions 5.9 L	using 12 mm OD tubes using 25 x 150 mm (OD x L) tubes	
Trigger modes	Off	Fraction triggering is disabled. No fractions are collected.	
	Peak-based	When a peak is discovered by a peak trigger, fractions are collected. Depending on the max. fill volume, each fraction will use one or more vessel(s).	
	Peak-based, collecting time slices	When a peak is discovered by a peak trigger, fractions are collected and each fraction is split into separate slices of a specified duration. Depending on the max. fill volume, each slice will use one or more vessel(s).	
	Peak-based, collecting volume slices	When a peak is discovered by a peak trigger, fractions are collected and each fraction is split into separate slices of a specified volume. Depending on the max. fill volume, each slice will use one or more vessel(s).	

Table 2 Performance Specifications

Type	Specification	Comment	Method/Conditions
	Peak-based with time slice recovery	The complete output of the fraction collector is recovered into separate slices of a specified duration. When a peak is discovered by a peak trigger, fractions are collected in dedicated vessels. Depending on the max. fill volume, Recovery and Fractions will use one or more vessel(s).	
	Peak-based with volume slice recovery	The complete output of the fraction collector is recovered into separate slices of a specified volume. When a peak is discovered by a peak trigger, fractions are collected in dedicated vessels. Depending on the max. fill volume, Recovery and Fractions will use one or more vessel(s).	
	Time-based, collecting a number of fractions	Starting at a given time, the output of the fraction collector is separated into a specified number of fractions. Collecting a specified number of fractions works only when a stop time is set in the fraction collector or the trigger mode is followed by another instruction in the timetable of the fraction collector. Depending on the max. fill volume, each fraction will use one or more vessel(s).	
	Time-based, collecting time slices	Starting at a given time, the output of the fraction collector is collected into separate slices of a specified duration. Depending on the max. fill volume, each slice will use one or more vessel(s).	

Table 2 Performance Specifications

Type	Specification	Comment	Method/Conditions
	Time-based, collecting volume slices	Starting at a given time, the output of the fraction collector is collected into separate slices of a specified volume. Depending on the max. fill volume, each slice will use one or more vessel(s).	
Trigger sources	G7115A, 1260 Infinity II DAD G7165A, 1260 Infinity II MWD G7114A, 1260 Infinity II VWD G6120BA, LC/MS Single Quad VL G6130BA, LC/MS Single Quad SL G7121A, 1260 Infinity II FLD G4260B, 1260 Infinity II ELSD G7162A, 1260 Infinity II RID		
Diverter valve	3/2 valve		
Maximum pressure	6 bar (switching)		
Drawers	Drawer ambient		
Fraction containers	**Tube Containers, ambient:** Tube Container for 30 x 150 mm tubes, ambient, 10 tubes Tube Container for 30 x 100 mm tubes, ambient, 10 tubes Tube Container for 25 x 150 mm tubes, ambient, 18 tubes Tube Container for 25 x 100 mm tubes, ambient, 18 tubes Tube Container for 16 x 150 mm tubes, ambient, 36 tubes Tube Container for 16 x 100 mm tubes, ambient, 36 tubes Tube Container for 12 x 150 mm tubes, ambient, 72 tubes Tube Container for 12 x 100 mm tubes, ambient, 72 tubes SBS Wellplate Container, height adjustable, up to 3 SBS footprint vessels	SBS Wellplate Container, height adjustable, up to 3 SBS footprint vessels	
Minimum tube height	50 mm		
Maximum tube height	160 mm		

Table 2 Performance Specifications

Type	Specification	Comment	Method/Conditions
Instrument Control	LC & CE Drivers A.02.17 or above Instrument Control Framework (ICF) A.02.04 or above Instant Pilot (G4208A) with firmware B.02.22 or above Lab Advisor B.02.10 or above	For details about supported software versions refer to the compatibility matrix of your version of the LC & CE Drivers	
Communication	Controller Area Network (CAN), Local Area Network (LAN) ERI: ready, start, stop and shut-down signals		
Maintenance and safety-related features	Extensive diagnostics, error detection and display with Agilent Lab Advisor software. Leak detection, safe leak handling, leak output signal for shutdown of pumping system and low voltages in major maintenance areas		
GLP features	Early maintenance feedback (EMF) for continuous tracking of instrument usage with user- settable limits and feedback messages. Electronic records of maintenance and errors.		
Housing	All materials recyclable.		

3 Using the Fraction Collector

This chapter explains the essential operational parameters of the module.

Warnings and Cautions

WARNING

Leaking solvents

- ✓ **Ensure a safe drain of liquids into the inlet of your waste management system.**
- ✓ **Regularly check all tubing connections for tightness and proper tubing positions.**

Solvent Information

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.**
- ✓ **Avoid high vapor concentrations. Keep the solvent temperature at least 40 K below the boiling point of the solvent used. This includes the solvent temperature in the sample compartment. For the solvents methanol and ethanol keep the solvent temperature at least 25 K below the boiling point.**
- ✓ **Do not operate the instrument in an explosive atmosphere.**
- ✓ **Reduce the volume of substances to the minimum required for the analysis.**
- ✓ **Never exceed the maximum permissible volume of solvents (8 L) in the solvent cabinet. Do not use bottles that exceed the maximum permissible volume as specified in the usage guideline for solvent cabinet.**
- ✓ **Ground the waste container.**
- ✓ **Regularly check the filling level of the waste container. The residual free volume in the waste container must be large enough to collect the waste liquid.**
- ✓ **To achieve maximal safety, regularly check the tubing for correct installation.**

Solvents Excluded from Intended Use

The module is *not* designed for normal phase chromatography.

Do not use solvents with an auto-ignition temperature below 200 °C (392 °F). Do not use solvents with a boiling point below 56 °C (133 °F).

Do not use solvents of ignition Class IIC according IEC 60079-20-1 (for example, carbon disulfide).

Recommendations on the Use of Solvents

Observe the following recommendations on the use of solvents.

- Follow the recommendations for avoiding the growth of algae, see the pump manuals.
- Small particles can permanently block capillaries and valves. Therefore, always filter solvents through 22 µm filters.
- Avoid or minimize the use of solvents that may corrode parts in the flow path. Consider specifications for the pH range given for different materials such as flow cells, valve materials etc. and recommendations in subsequent sections.

Recommended Wash Solvents

- water
- ethanol
- methanol
- water/acid (especially for basic compounds)
- water/base (especially for acidic compounds)
- water/acetonitrile

NOTE For different wash solvents as mentioned above, verify that the wash solvent is suitable for the silicone wash tubing.

Material Information

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

Disclaimer

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

PEEK

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

It is stable in the specified pH range (for the Bio-inert LC system: pH 1 – 13, see bio-inert module manuals for details), and inert to many common solvents.

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

When used above room temperature, PEEK is sensitive to bases and various organic solvents, which can cause it to swell. Under such conditions, normal PEEK capillaries are very sensitive to high pressure. Therefore, Agilent uses stainless steel cladded PEEK capillaries in bio-inert systems. The use of stainless steel cladded PEEK capillaries keeps the flow path free of steel and ensures pressure stability to at least 600 bar. If in doubt, consult the available literature about the chemical compatibility of PEEK.

Polyimide

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

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

Polyethylene (PE)

Agilent uses UHMW (ultra-high molecular weight)-PE/PTFE blends for yellow piston and wash seals, which are used in 1290 Infinity pumps, 1290 Infinity II pumps, the G7104C and for normal phase applications in 1260 Infinity pumps.

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

Tantalum (Ta)

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

Stainless Steel (SST)

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

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

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

  This reaction, in which stainless steel probably acts as a catalyst, occurs quickly with dried chloroform if the drying process removes the stabilizing alcohol.
- Chromatographic grade ethers, which can contain peroxides (for example, THF, dioxane, diisopropylether). Such ethers should be filtered through dry aluminium oxide which adsorbs the peroxides.
- Solutions of organic acids (acetic acid, formic acid, and so on) in organic solvents. For example, a 1 % solution of acetic acid in methanol will attack steel.
- Solutions containing strong complexing agents (for example, EDTA, ethylene diamine tetra-acetic acid).
- Mixtures of carbon tetrachloride with 2-propanol or THF.

Titanium (Ti)

Titanium is highly resistant to oxidizing acids (for example, nitric, perchloric and hypochlorous acid) over a wide range of concentrations and temperatures. This is due to a thin oxide layer on the surface, which is stabilized by oxidizing compounds. Non-oxidizing acids (for example, hydrochloric, sulfuric and phosphoric acid) can cause slight corrosion, which increases with acid concentration and temperature. For example, the corrosion rate with 3 % HCl (about pH 0.1) at room temperature is about 13 µm/year. At room temperature, titanium is resistant to concentrations of about 5 % sulfuric acid (about pH 0.3). Addition of nitric acid to hydrochloric or sulfuric acids significantly reduces corrosion rates. Titanium is sensitive to acidic metal chlorides like $FeCl_3$ or $CuCl_2$. Titanium is subject to corrosion in anhydrous methanol, which can be avoided by adding a small amount of water (about 3 %). Slight corrosion is possible with ammonia > 10 %.

Diamond-Like Carbon (DLC)

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

Fused silica and Quartz (SiO_2)

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

Gold

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

Zirconium Oxide (ZrO_2)

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

Platinum/Iridium

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

Fluorinated polymers (PTFE, PFA, FEP, FFKM, PVDF)

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

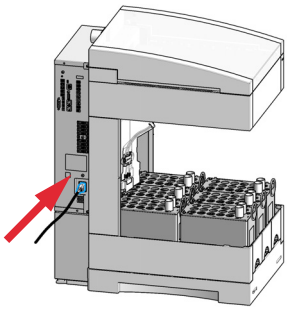
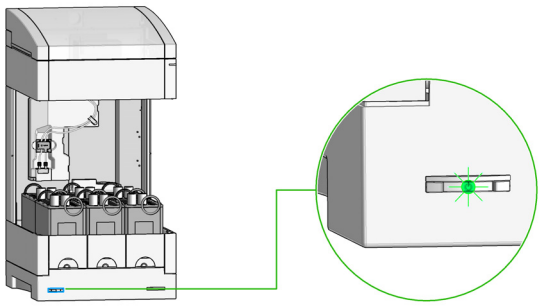
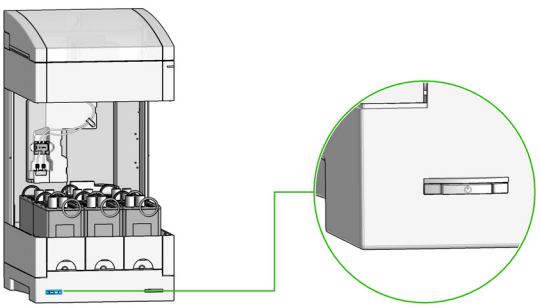
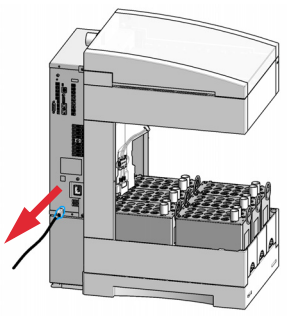
TFE/PDD copolymer tubings, which are used in all Agilent degassers except G1322A/G7122A, are not compatible with fluorinated solvents like Freon, Fluorinert, or Vertrel. They have limited life time in the presence of Hexafluoroisopropanol (HFIP). To ensure the longest possible life with HFIP, it is best to dedicate a particular chamber to this solvent, not to switch solvents, and not to let dry out the chamber. For optimizing the life of the pressure sensor, do not leave HFIP in the chamber when the unit is off.

The tubing of the leak sensor is made of PVDF (polyvinylidene fluoride), which is incompatible with the solvent DMF (dimethyl formamide).

Sapphire, Ruby and Al_2O_3-based ceramics

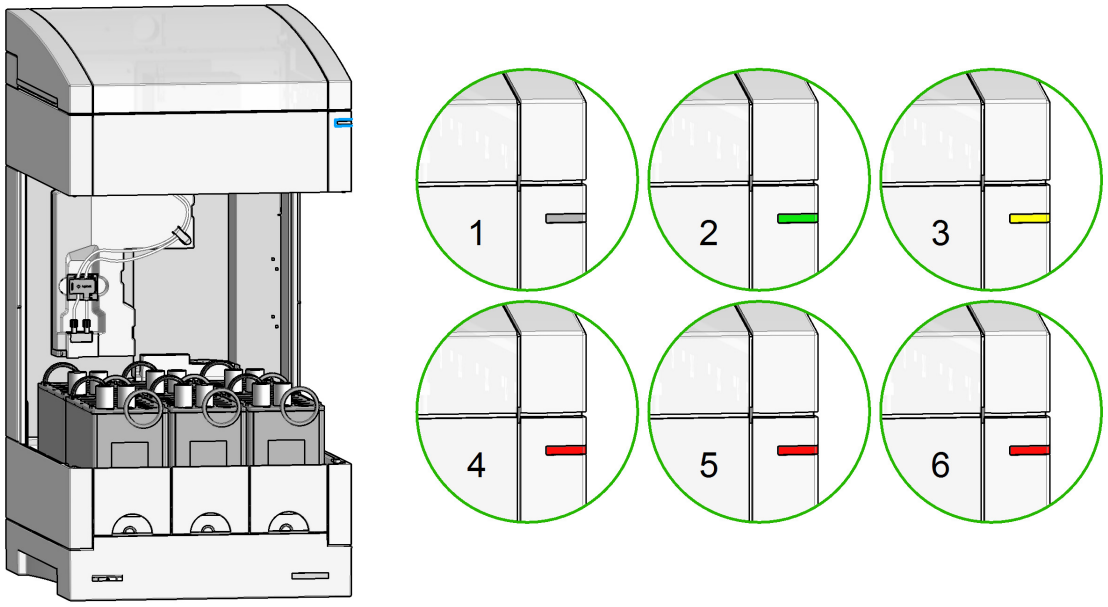
Sapphire, ruby and ceramics based on aluminum oxide Al_2O_3 are inert to almost all common acids, bases and solvents. There are no documented incompatibilities for HPLC applications.

Turn on/off

1 Plug in the power cable. 	**2** Power switch: On 
3 Power switch: Off 	**4** Unplug the power cable. 

Status Indicators

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

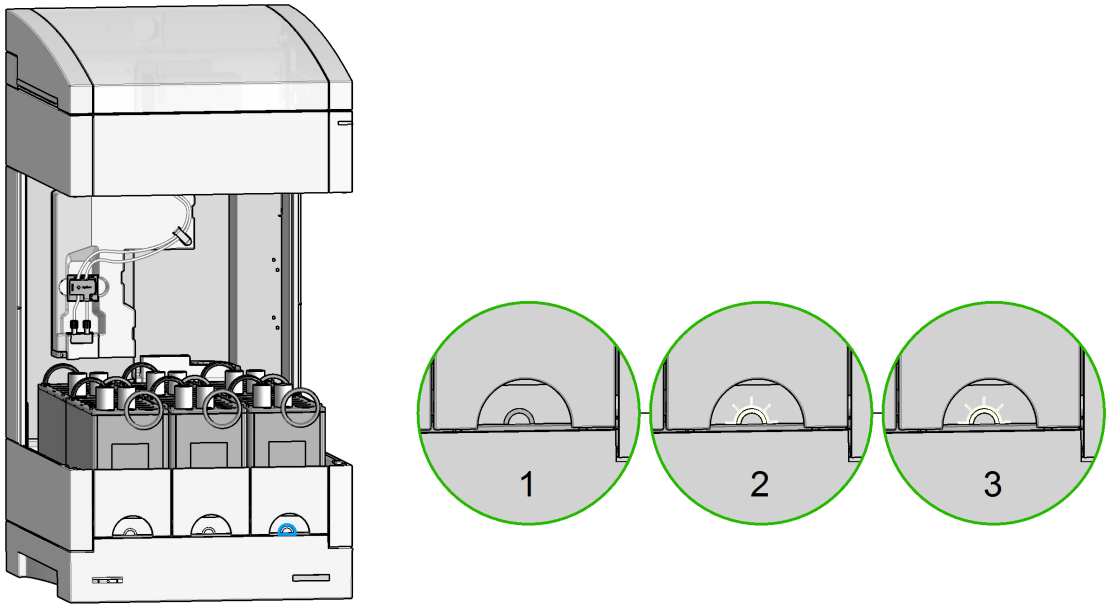


Status indicators

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

Drawer Status Indicator

1



The drawer status indicator indicates one of three possible conditions:

1: off: drawer not detected

2: on: drawer detected and not in use = drawer can be pulled out

3: blinking: drawer detected and in use = drawer blocked

NOTE

Do not try to remove the drawer when the drawer status indicator is blinking.

Exchange Drawers

Parts required	p/n	Description
	G9321-60085	Drawer ambient
	G9321-60201	InfinityLab Drawer Gilson 207, ambient

WARNING

Toxic, flammable and hazardous solvents, samples and reagents

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

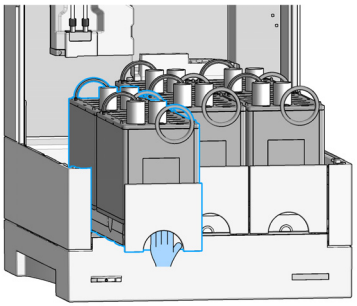
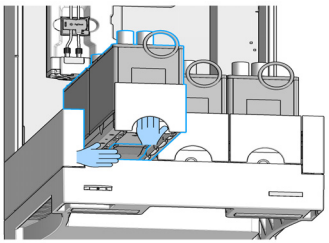
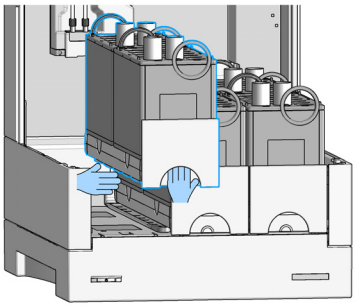
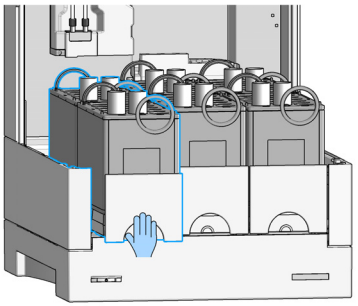
- ✓ **When working with these substances observe appropriate safety procedures (for example by wearing goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the vendor, and follow good laboratory practice.**
- ✓ **The volume of substances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

WARNING

Protruding drawers

Open drawers protrude from the module. Crashing into open drawers can lead to injuries and damage to the module.

- ✓ **Always remove or close a drawer completely.**

1 Remove the drawer. 	**2** Release the drawer by pushing the metal plate underneath the drawer with the second hand. 
3 Exchange the drawer 	**4** Install the drawer. 

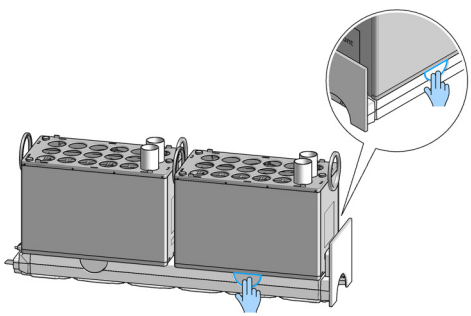
Exchange Containers

Parts required	#	p/n	Description
	1	G9321-60015	Tube Container for 30 mm x 150 mm tubes, ambient, 10 tubes
OR	1	G9321-60058	Tube Container for 30 mm x 100 mm tubes, ambient, 10 tubes
OR	1	G9321-60025	Tube Container for 25 mm x 150 mm tubes, ambient, 18 tubes
OR	1	G9321-60035	Tube Container for 25 mm x 100 mm tubes, ambient, 18 tubes
OR	1	G9321-60129	Tube Container for 16 mm x 150 mm tubes, ambient, 36 tubes
OR	1	G9321-60055	Tube Container for 16 mm x 100 mm tubes, ambient, 36 tubes
OR	1	G9321-60131	Tube Container for 12 mm x 150 mm tubes, ambient, 72 tubes
OR	1	G9321-60045	Tube Container for 12 mm x 100 mm tubes, ambient, 72 tubes
OR	1	G9321-60051	SBS Container, ambient

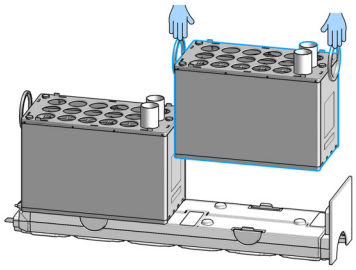
For a list of further containers, refer to the *Parts* section.

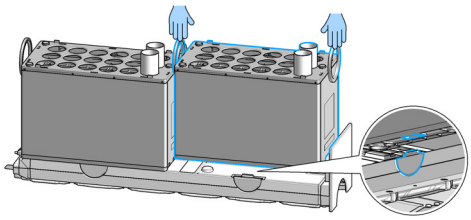
Preparations Remove the drawer from the module.

1 Press the release buttons to release the container from the drawer.



2 Lift the container up at the circular handles.



3 Insert the new container. **NOTE** Mind the correct orientation of the container on the drawer. Check if the container is fixed properly ("Click"). 	

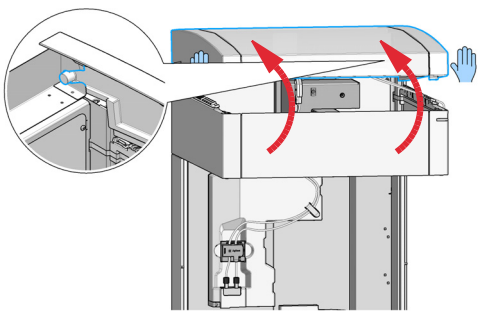
Replace Inlet/Waste Tubings

Parts required	#	p/n	Description
	1	G9321-60951	1290 Inf II PrepFC Tubing Kit 200 for flow rates up to 200 mL/min
OR	1	G9321-60952	1290 Inf II PrepFC Tubing Kit 50 for flow rates up to 50 mL/min
OR	1	G9321-60953	1290 Inf II PrepFC Tubing Kit 8 mL for flow rates up to 8 mL/min
OR	1	G9321-60954	1290 Inf II PrepFC Tubing Kit 150 mL for flow rates up to 150 mL/min

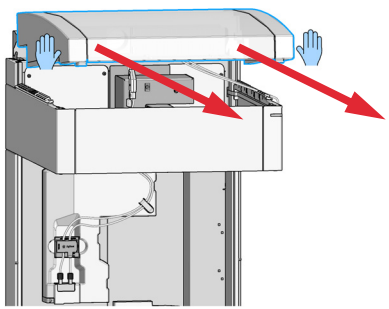
Preparations Move to **Change Tubing Position** via Lab Advisor.

1 Open and remove the top fume hood.

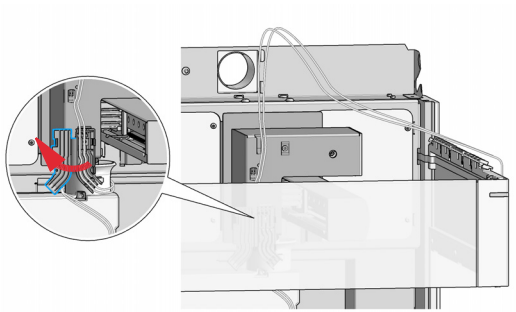
a Swing up the fume hood against the mechanical stop.



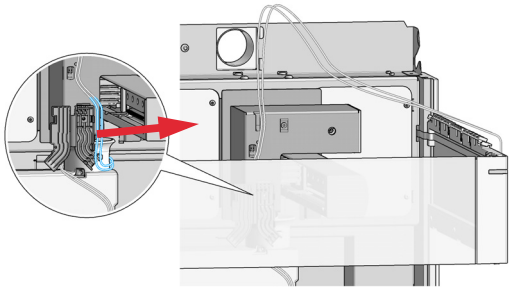
b Remove the fume hood by pulling it toward you.



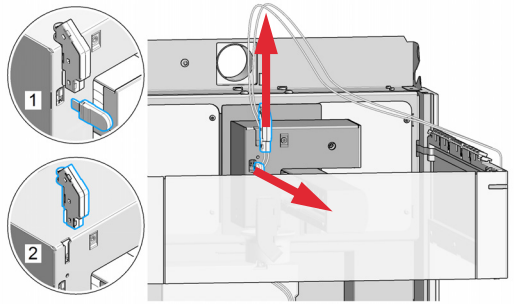
2 Open the tube holder.



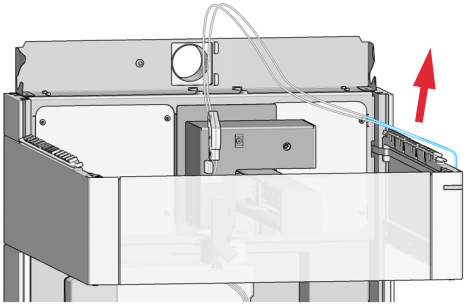
3 Remove the tubings from the tube holder.



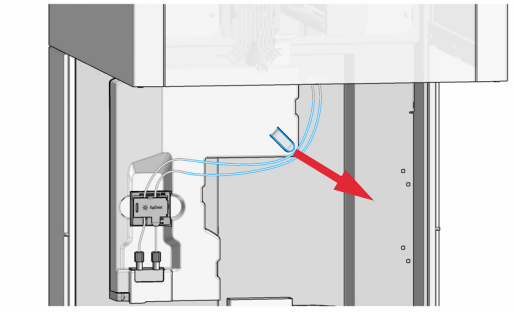
4 Remove tubing clip and dongle from the fraction collector.



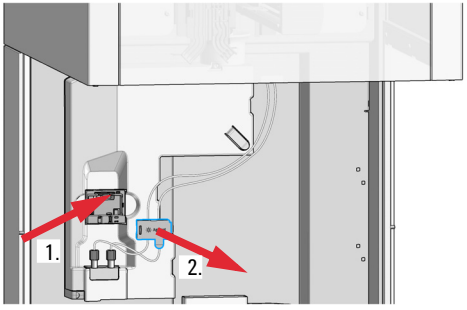
5 Remove the Inlet/Waste Tubings from the capillary holder.



6 Remove the tubings from under the clamp at the robotics arm.



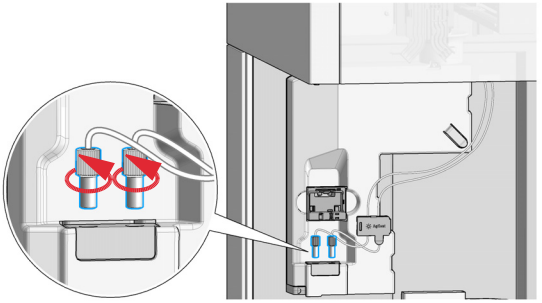
7 Remove the delay sensor holder: Unlock the device with the lever (1.), then pull out (2.).



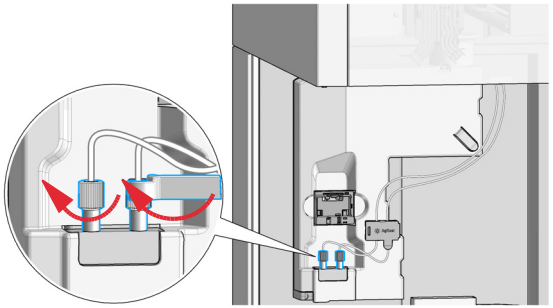
NOTE

Do not remove the delay sensor holder from the tubing.

8 Unscrew the tubings from the valve assembly.



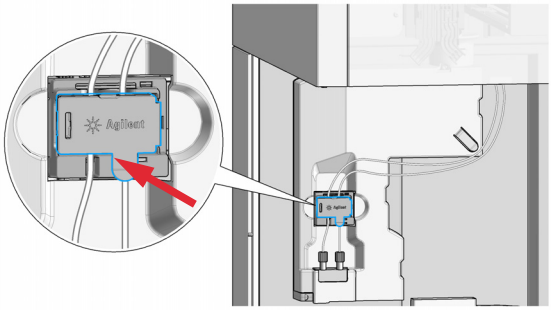
9 Screw the tubings of the new inlet/waste tubing kit into the valve assembly. Tighten the fittings finger-tight, then use the Fitting handle (about ¼ turn).



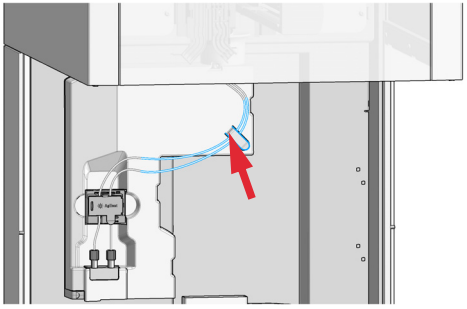
10 Install the delay sensor holder.

NOTE

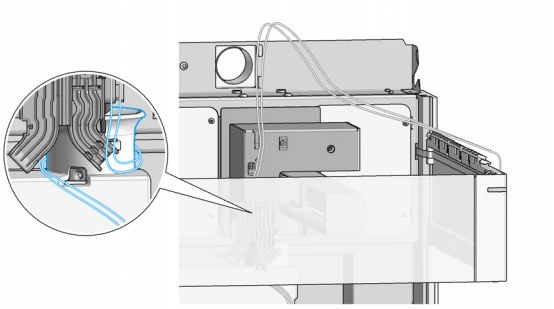
Make sure that the holder is fixed properly. Press the small button to insert the tubing properly.



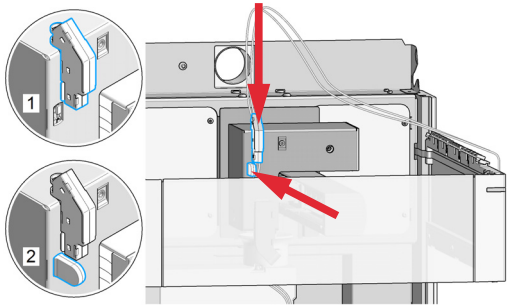
11 Route the tubings under the clamp at the robotics arm.



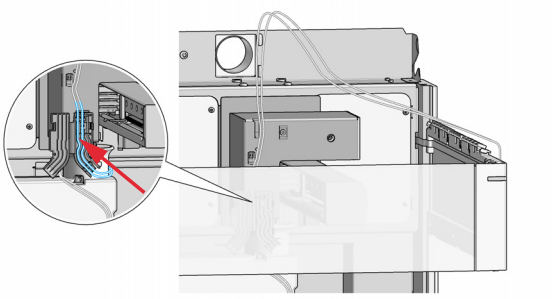
12 Route the tubings clockwise (one turn) around the robotics arm.



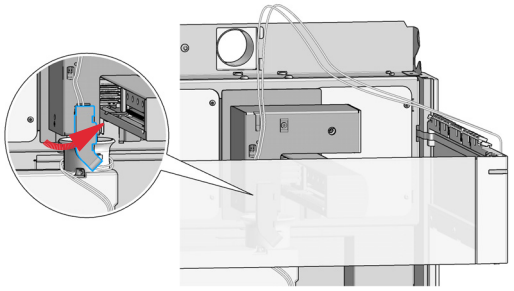
13 Push the clip into the housing and connect the dongle.



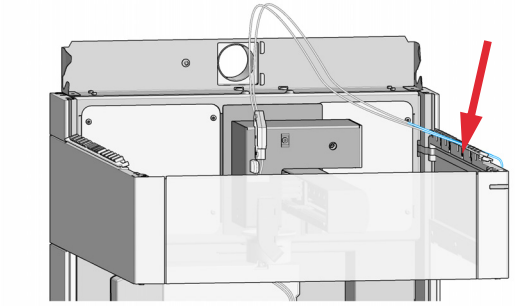
14 Install the tubings to the tube holder.



15 Close the tube holder.

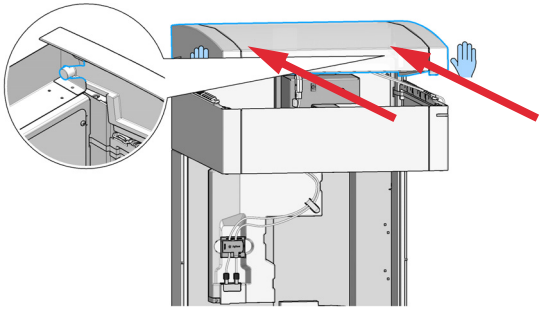


16 Install the Inlet/Waste Tubings to the capillary holder. Position them approximately in the middle of the capillary holder.

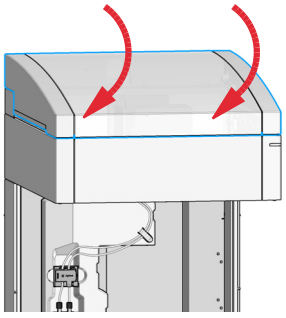


17 Install the top fume hood and close it.

a Push the top fume hood into the recession.



b Close the top fume hood.



Configuration and Operation of the Open Bed Fraction Collector

Delay Volumes and Delay Calibration

Once software is installed and the fraction collector is ready to be operated, the fraction delay time needs to be determined. Figure 3 on page 47 shows a schematic drawing of the flow path between the detector and the fraction collector with the two delay volumes V_{D1} and V_{D2}. For peak-based fraction collection the system delay times t_{D1} and t_{D2} can be calculated by dividing the delay volumes by the flow rate.

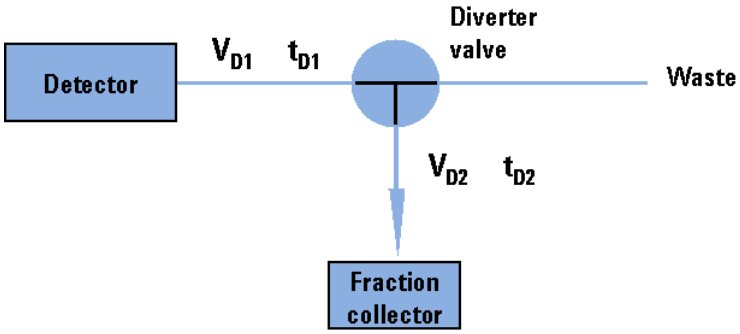


Figure 3 Delay volumes and delay times

The delay volume V_{D2} is a system parameter, it depends on the installed fraction collector tubing. Delay volume V_{D1}, which is specified through the installed Fraction Collector Tubing Kit, is determined using the **Delay Volume Calibration** feature of the Lab Advisor software.

When a peak is detected during a purification run (Figure 4 on page 48) the diverter valve is triggered using the following delay time calculations:

- Start of fraction collection: $t = t_0 + t_{D1}$
- End of fraction collection: $t = t_E + t_{D1} + t_{D2}$

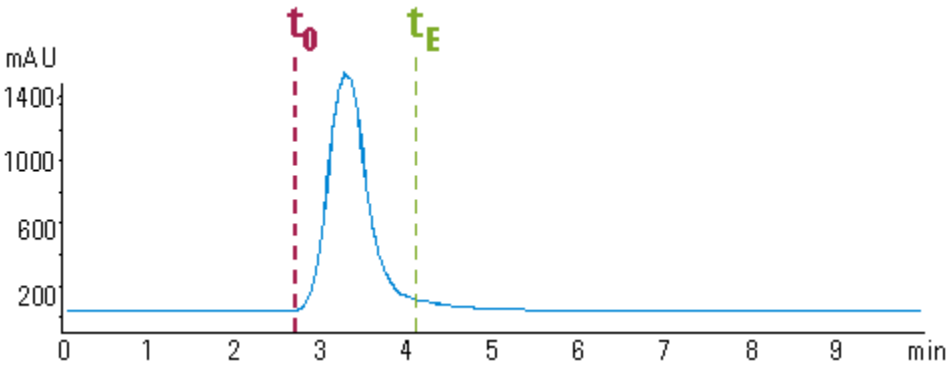


Figure 4 **Chromatogram from a UV-detector with peak starting at t_0 and ending at t_E**

Performing a Delay Calibration with an UV Detector

1. Place a vial containing the Delay Sensor Calibrant (5190-8223) in position 1 of the autosampler.
2. Remove the installed column and replace for the delay coil or union.
3. Connect a bottle of water to Channel A
4. Open a session of Lab Advisor and connect to the system with the Fraction Collector.
5. Navigate to **Service and Diagnostics**, select **Delay Volume Calibration** from the available tests.
6. Click **Run** and follow the prompts from the Wizard.

NOTE

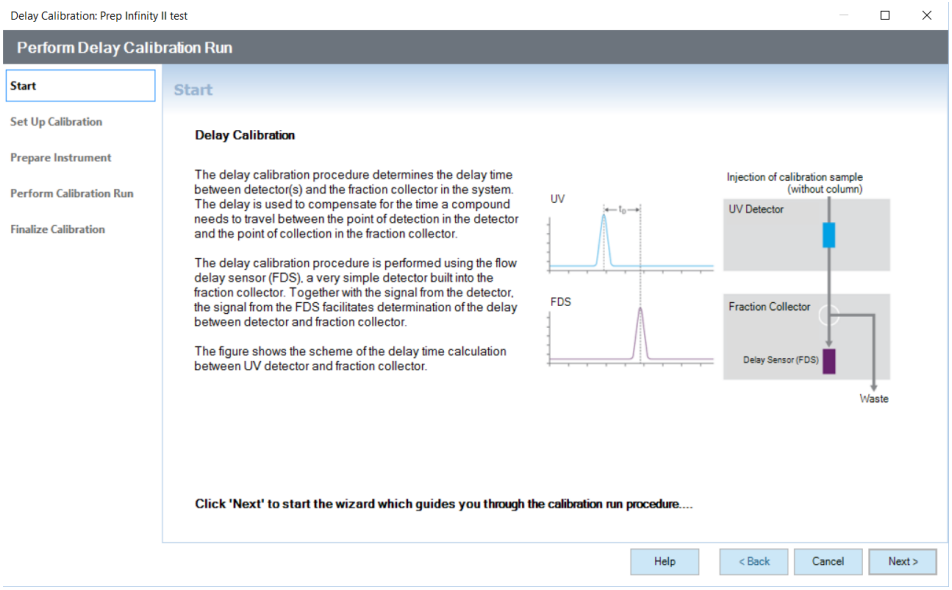
Every Agilent detector that is used for triggering fractions has an internal signal delay caused by filtering the raw data. The signal delay depends on the Peakwidth setting of the detector and is accounted for when the fraction collector is triggered.

Perfom a Delay Calibration Run in OpenLAB CDS Chemstation Edition

The delay calibration procedure determines the delay time between detector(s) and the fraction collector in the system. The delay is used to compensate for the time a compound needs to travel between the point of detection in the detector and the point of collection in the fraction collector.

The delay calibration procedure is performed using the flow delay sensor (FDS), a very simple detector built into the fraction collector. Together with the signal from the detector, the signal from the FDS facilitates determination of the delay between detector and fraction collector.

The figure shows the scheme of the delay time calculation between UV detector and fraction collector.



Help:

Start

The **Start** page of the **Delay Calibration Wizard** contains a description of the fraction collector delay calibration process, together with a schematic diagram of the connections for the detector and fraction collector.

Cancel	Closes the **Delay Calibration Wizard** without consequence.
Next	Displays the Set Up Calibration page of the **Delay Calibration Wizard** ("Set Up Calibration" on page 50).

Set Up Calibration

The **Set Up Calibration** page of the **Delay Calibration Wizard** performs three steps to prepare for the delay calibration:

1 **Instrument Check**

The system checks that the instrument is ready for calibration. If the instrument check fails, an error is displayed and the delay calibration is not possible until the error has been cleared.

2 **Fraction Collector Module Selection**

If you have only one fraction collector configured, its module type ID and serial number are displayed in the field. If you have configured a fraction collector cluster, click the down arrow and select the fraction collector from the drop-down list.

3 **Module Connection Verification**

A connection to the selected module is established, and all required parameters are read from the module. The identities of the **Linked Pump** and **Peak Detectors** are shown (module type ID and serial number); for the peak detectors, the currently stored delay volumes are also shown.

An error is displayed if the selected module does not support Delay Calibration.

Back	Displays the Start page of the **Delay Calibration Wizard** ("Start" on page 50).
Cancel	Closes the **Delay Calibration Wizard** without consequence.
Next	Displays the Prepare Instrument for Calibration page of the **Delay Calibration Wizard** ("Prepare Instrument for Calibration" on page 51). This button is active only when a fraction collector has been selected.

Prepare Instrument for Calibration

The **Prepare Instrument** page of the **Delay Calibration Wizard** leads you through the preparation of the instrument for the delay calibration run.

The required preparation steps are listed in a three-column table:

Activity	A short description of the preparation activity.
Status	The current status of the preparation activity. When the activity is complete, the status is **Done**.
Information	Any additional information about the activity, for example, user interaction.
Start Preparation Procedure	Click to start the preparation of the instrument; follow any on-screen instructions that appear during the process. The instructions given depend on the configuration of the module.

NOTE

Once you have started the preparation of the instrument, clean-up steps are required to bring the instrument back into an operational state. The **Finalize Calibration** page includes the required clean-up steps.

Back	Displays the Set Up Calibration page of the **Delay Calibration Wizard** ("Set Up Calibration" on page 50). This button is active only until you have started the preparation of the instrument.
Cancel	Before preparation Closes the **Delay Calibration Wizard** without consequence. After preparation Displays the Delay Calibration — Close dialog box.
Next	Displays the Perform Calibration Run page of the **Delay Calibration Wizard** ("Perform Calibration Run" on page 52). This button is active only when the preparation of the instrument is complete.

Perform Calibration Run

Use the **Perform Calibration** page of the **Delay Calibration Wizard** to start the delay calibration run using the current method. The run parameters are listed; a warning is given if the method has been changed. You can switch to a different method or edit the sample information before starting the run.

System On	Click to turn the system on.
System Off	Click to turn the system off.
Edit Sample Info	Displays the Sample Info dialog box, which allows you to edit the sample information for the calibration run.
Load Method	Displays the **Method Browser** for master methods, which allows you to select a different master method to load and use for the calibration run.
Automatically activate Delay Sensor Signal	Mark this check box to automatically switch on the collection of the signal from the fraction collector's flow delay sensor. This signal is necessary to calculate the delay time/volume. **NOTE** When you mark this check box, the method is modified.
Start Calibration Run	Starts the delay calibration run. The message line describes the progress of the run. You can perform multiple calibration runs; this button is active after each calibration run has completed.
Delay Evaluation	Opens the Delay Evaluation window to allow you to determine the delay volume(s) ("Delay Evaluation" on page 53). This button is active only when at least one delay calibration run has been performed.

At the end of each calibration run, you can choose to either evaluate the data or start another calibration run.

Back	Displays the Prepare Instrument for Calibration page of the **Delay Calibration Wizard** ("Prepare Instrument for Calibration" on page 51). This button is active only until a calibration run has been started.
Cancel	Displays the Delay Calibration — Close dialog box.
Next	Displays the Finalize Calibration page of the **Delay Calibration Wizard**. This button is inactive until the calibration run is complete.

Delay Evaluation

The **Delay Evaluation** window enables you to determine the delay times/volumes between the peak detector(s) and the fraction collector. The **Delay Evaluation** window is split into two sections:

- the left pane contains the delay calculations
- the right pane shows the signals from the peak detector(s) and the fraction collector delay sensor.

Load Data File Displays a file selection dialog box that allows you to select a delay calibration data file to use for the calculation of the delay times/volumes.

Delay Calibration

The **Delay Calibration** pane contains the parameters and results of the delay calculations:

Pump Flow	The pump flow as given in the data file or as a user-specified value. The flow specified here is used to calculate the delay volumes. Click **Change Flow** to display the Change Pump Flow dialog box, which allows you to change the pump flow that is used for the delay calculations.
Delay Volumes	The delay volumes are shown in a four-column table: **Peak Detector** The type ID and serial number of the peak detector. **Calibration Signal** Click the down-arrow and select the signal to use for the delay calibration for this peak detector from the drop-down list. **Calc. Delay Time (min)** The calculated delay time (the difference between the retention time of the target peak given by the fraction collector delay sensor and the retention time of the peak in the selected calibration signal). **Delay Volume (mL)** The calculated delay volume (the product of the delay time and the specified flow).
Apply to Module	Click the down-arrow and select the fraction collector to which to apply the calculated delay volumes. Click **Apply Delay Volumes** to write the delay volumes to the selected fraction collector.
MSD to Fraction Collector Delay Time	The values used to calculate the delay time between the MSD and the fraction collector. Click **Copy to Clipboard** to copy the calculated delay time to the clipboard so that you can paste it into the method.
Create Calibration Summary	Displays the delay calibration parameters and results in the Delay Calibration Summary window.

Signals

The **Signals** pane contains a signal plot for each peak detector, and one for the fraction collector delay sensor. By default, the largest peak in each signal plot is identified and highlighted as the target peak, but you can change the identification if there is more than one peak in the plot and the wrong peak has been identified.

Each signal plot can be handled individually, for example, by zooming in.

For each signal, the description of the current signal is given. For detectors with multiple signals, click the down-arrow and select a different signal from the drop-down list, if required.

The peak number of the selected target peak (by default, the largest peak) is also shown. For signal plots with multiple peaks, click the down-arrow and select a different peak from the drop-down liat, if required.

 Displays the Edit Integration Settings dialog box.

The MSD signal is, by default, the TIC, but an additional control allows you to extract and display an EIC.

Unzoom All Sets all signal plots to their original zoom states.

Setting up a Fraction Collector Method

Fraction Trigger Mode

Use Timetable: Enables the **Timetable**, but requires a timetable event.

Peak-based: If **Peak-based** is selected, the collection of a fraction is triggered by the signal of the detector. The detailed trigger conditions are specified in the **Peak Detectors** table. In the peak-based trigger mode all entries in the timetable are ignored.

Max. Peak Duration: Defines a maximum collection time in case that the signal does not reach the condition to cut the fraction as exhibited in Figure 5 on page 56. This could be caused by tailing peaks or if the baseline is drifting during gradient runs. The default value is set to 0.5 minutes. If broad peaks are expected, this value should be increased without exceeding the run time.

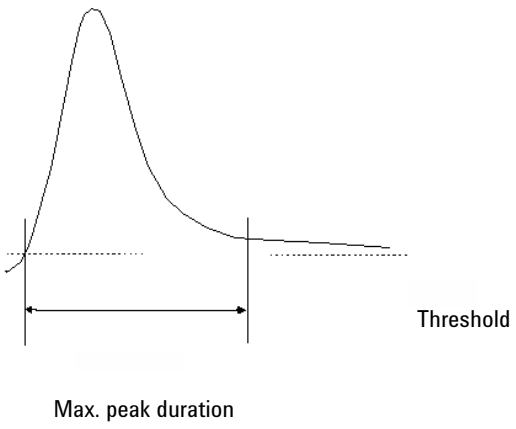


Figure 5 Maximum Fraction Duration

Peak Detectors

In the **Peak Detectors** section a list of all peak detectors that are connected to the system is displayed. Agilent InfinityLab LC Series diode array detectors, multiwavelength detectors, variable wavelength detectors and fluorescence detectors are recognized automatically. Other detectors, e.g. Agilent 6000 mass-selective detectors or HP1050 detectors, are connected through the Universal Interface Box (UIB).

The peak detector table contains seven columns:

Working Mode

For each peak detector **Threshold only, Threshold/Slope** or **Slope only** are possible.

In the **Threshold only** mode the settings for **Up Slope**, **Down Slope** and **Upper Threshold** in the subsequent columns are ignored. Fraction collection is triggered whenever the detector signal exceeds the specified threshold value. When the signal drops below the threshold value fraction collection is stopped.

In the **Slope only** mode fraction collection is triggered on the slope of the detector signal. Adequate values for **Up Slope** and **Down Slope** can be specified in the corresponding fields.

In the **Threshold/Slope** mode fraction collection is triggered on the corresponding values for threshold and slope. The fraction collection is started if the detector signal exceeds both the threshold and the **Up Slope** value. The fraction collection is stopped if the detector signal drops either below the threshold or the **Down Slope** value.

To specify the trigger values **Up Slope**, **Down Slope**, **Threshold** and **Upper Threshold** we recommend to use the **Fraction Preview** tool as described in "Fraction Preview" on page 59.

Upper Threshold

At high absorbance values the light intensity on the detector is extremely low and consequently detector noise will be superimposed on the detector signal. In this case the detector noise might trigger fraction collection. To avoid false fraction collection triggering, we recommend setting an **Upper Threshold** well below the limit where this false triggering effect might occur. As soon as the detector signal exceeds the **Upper Threshold**, settings for **Up Slope** or **Down Slope** will be ignored until the signal drops again below the **Upper Threshold**.

When using more than one peak detector fraction collection can be triggered either when **all selected peak detectors** detect a peak or when **at least one selected**

peak detector detects a peak basing on the settings in the peak detectors table above.

If an MSD is used for mass-based fraction collection, **Use MSD for mass-based Fraction Collection** must be checked.

Timetable

The **Timetable** can be used to program changes in the Fraction Trigger Mode during the analysis by entering a Time and specifying the trigger settings.

Trigger Mode Off, Peak Based and Time Based can be selected. If the Off is selected, no fractions are collected. The last entry in the timetable has to be the command Off.

Whenever the **Peak Based** mode is specified fractions will be collected based on the peak detection parameters given in the Peak Detector table. Additionally a **Maximum Peak Duration** in minutes has to be specified. This parameter is mandatory if you use Peak Controlled fraction collection, but is disabled for Time Based fraction collection.

When the Time Based mode is chosen two different options are available:

- The **# of Fractions** can be edited to collect a fixed number of equal fractions in a give time interval. This time interval is defined by the time value in the current and following timetable line.
- **Timeslices [min]** can be edited to collect fractions with a defined collection time. With this option the collection time of the last fraction can be shorter. This depends on the overall runtime.

For editing the Timetable the functions **Insert**, **Append**, **Cut**, **Copy** and **Paste** are offered.

To access the additional sections in the **Setup Fraction Collector** dialog box click **More.**

Time

In the time section of the dialog box the **Stoptime** and the **Posttime** for the fraction collector can be specified. By default the Stoptime is set to as pump and the posttime is switched OFF.

Auxiliary

In the Auxiliary section the **Maximum fill volume** per location can be specified. If as configured is selected, the pre-configured volume is used. This ensures that the location (well, vial or tube) cannot be overfilled during fraction collection. This volume can be further reduced by defining a customized volume.

Fraction Preview

To determine the appropriate fraction collection parameters the Agilent ChemStation provides a valuable tool that becomes accessible by pushing the button labelled Fraction Preview Tool (see Figure 6 on page 59) in the Peak Detectors section.

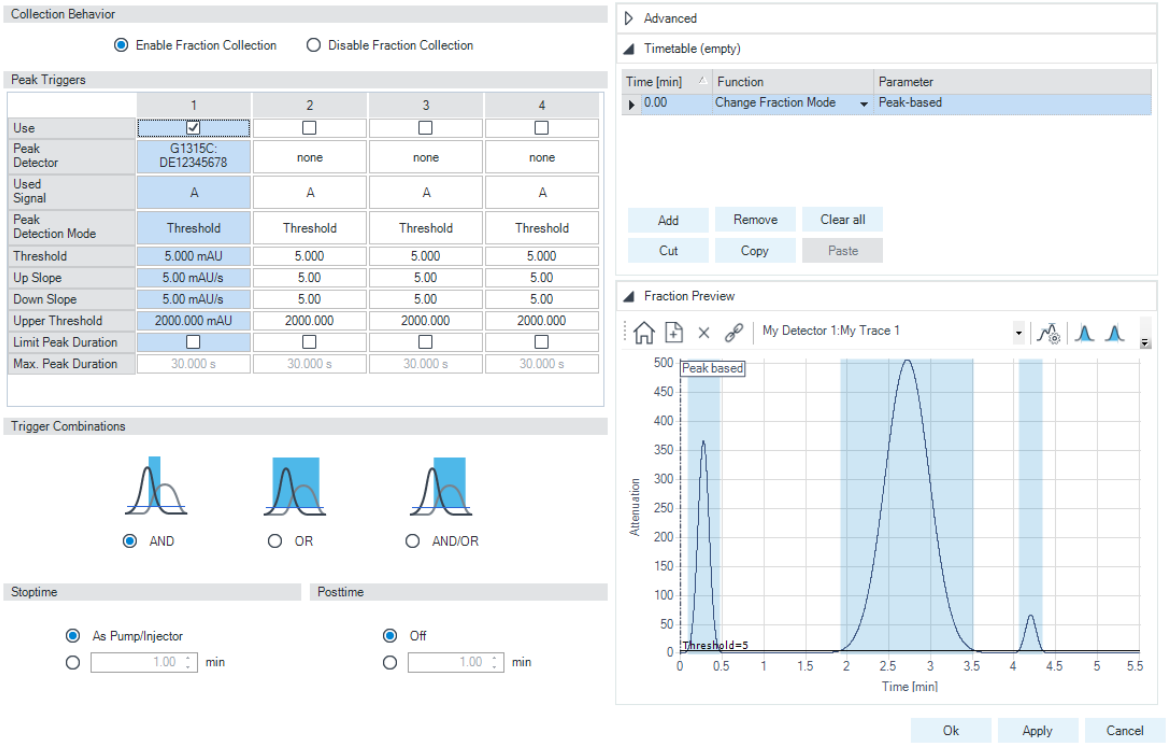


Figure 6 **Fraction Preview dialog box**

The Fraction Preview screen allows to test the fraction collection parameters against an example chromatogram. It can also be used to optimize the fraction collection parameters interactively. With the help of this tool values for up and down slope as well as for upper and lower threshold can easily be graphically specified. To load a chromatogram (for example a pilot run) click **Load Signal**. Parameters can now be changed either manually in the Detector Table and Timetable or graphically in the **Fraction Preview** screen. By pushing the desired buttons on the right hand side of the **Fraction Preview** screen the chromatogram can be zoomed, the values for up and down slope can be specified and the upper and lower threshold level can be set- up. The graphically specified values are automatically transferred to the Peak Detector Table.

Prepare the Module for Transportation

When

- For transportation within the laboratory
- For shipping the module

Parts required

Description
Transport Foam
Shipping Block
Screw M3
Protect Foam Y-Axis

Preparations

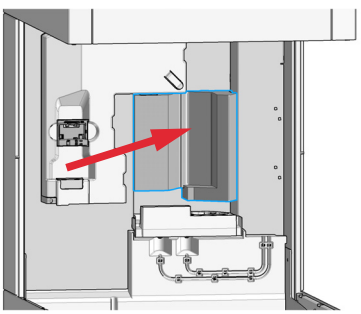
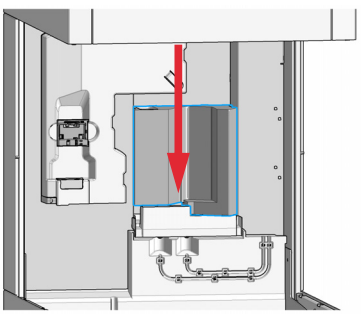
- Remove all containers and drawers.
- Remove all vessels from the rinse port.

CAUTION

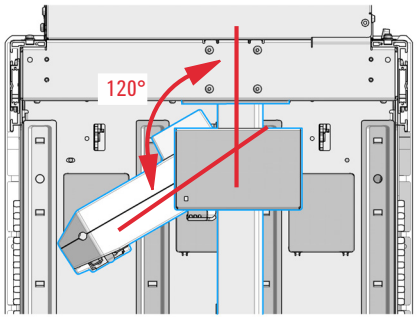
Free movement of Theta-assembly along Y-assembly

Damage of Theta- or Y-assembly

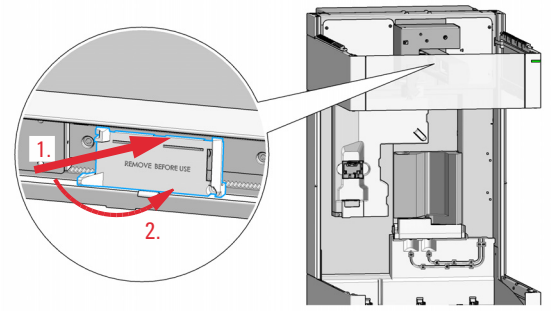
✓ **Block the Theta-assembly with the shipping block before transporting the module.**

1 Insert the transportation foam to the rear panel. 	2 Push the transportation foam down to the rinse port. 

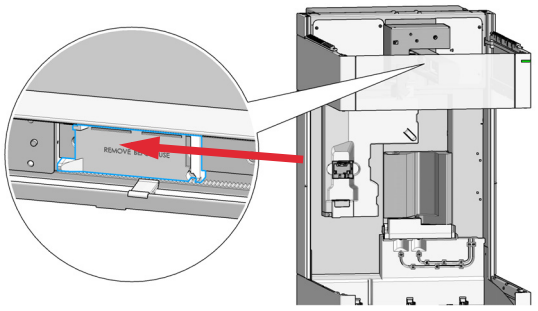
3 Using "Single Steps" from the Service and Diagnostics section in Lab Advisor, move the robotics to the park position.



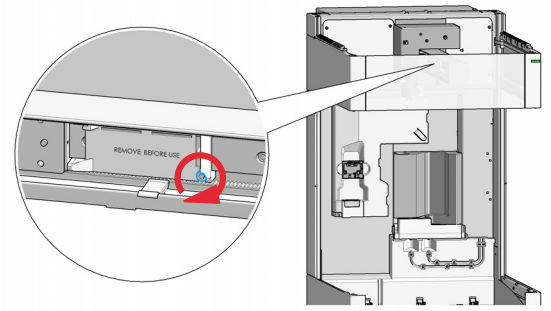
4 Insert the shipping block into the rail on the collector arm.



5 Move the shipping block backward on the rail until the two screwholes of the shipping block and the rail lie on top of each other.



6 Fix the shipping bolt with the M3 screw.



7 For shipping the module to another location, position the module in the transportation box and fix it correctly.

4 Preparing the Fraction Collector

This chapter explains the operational parameters of the module.

Best Practices

Regular Inspections

Inspect the inlet/waste tubings and exchange them if they are worn out or show visible signs of damage.

Power up / Shut down

Power up

- Check that the robotics is not obstructed.

Shut down

- Remove filled containers from the fraction collector after use.
- Pump a rinse solution through the fraction collector at the end of a run to avoid clogging.
- Use recommended solvents to store the system.

Prepare the Fraction Collector

- Flush the LC system.
- Make sure to have a stable detector baseline.
- Make sure that fraction tubes are empty or that there is at least enough space for the next fraction.

Using the Fraction Collector

- Rinse the dripping adapter between runs.
- Pooling: Make sure that all fraction collection locations are large enough to completely collect all pooled fractions.

Capillary Color Coding Guide

Type

Key	Description
Capillary	Connection capillaries
Loop	Loop capillaries
Seat	Autosampler needle seats
Tube	Tubing
Heat exchanger	Heat exchanger

Material

Key	Description
ST	Stainless steel
Ti	Titanium
PK	PEEK
FS/PK	PEEK-coated fused silica*
PK/ST	Stainless steel-coated PEEK**
PTFE	PTFE
FS	Fused silica

*Fused silica in contact with solvent
**PEEK in contact with solvent

Fitting Left/Fitting Right

Key	Description
W	Swagelok + 0.8 mm Port id
S	Swagelok + 1.6 mm Port id
M	Metric M4 + 0.8 mm Port id
E	Metric M3 + 1.6 mm Port id
U	Swagelok union
L	Long
X	Extra long
H	Long head
G	Small head SW 4 mm
N	Small head SW 5 mm
F	Fingertight
V	1200 bar
B	Bio
P	PEEK

The **type** gives some indication on the primary function, like a loop or a connection capillary.
The **material** indicates which raw material is used.
The **fitting** left/right indicate which fitting is used on both ends of the capillary.

At-a-glance color-coding keys

The color of your capillary will help you quickly identify the capillary id – see the chart to the right for reference.

Color-coding key for Agilent capillary tubing

Internal Diameter in mm	Color code
0.015	Orange
0.025	Yellow
0.05	Beige
0.075	Black
0.1	Purple
0.12	Red
0.17	Green
0.20/0.25	Blue
0.3	Grey
0.50	Bone White

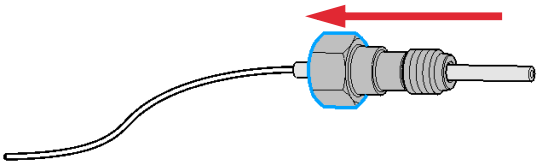
Tip: As you move to smaller-volume, high efficiency columns, you'll want to use narrow id tubing, as opposed to the wider id tubing used for conventional HPLC instruments.

Figure 7 Syntax for capillary description

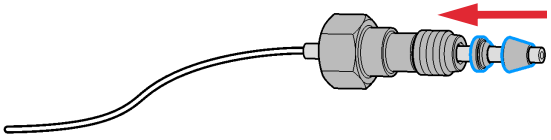
Swage Fittings

1 Select a nut that is long enough for the fitting you'll be using.

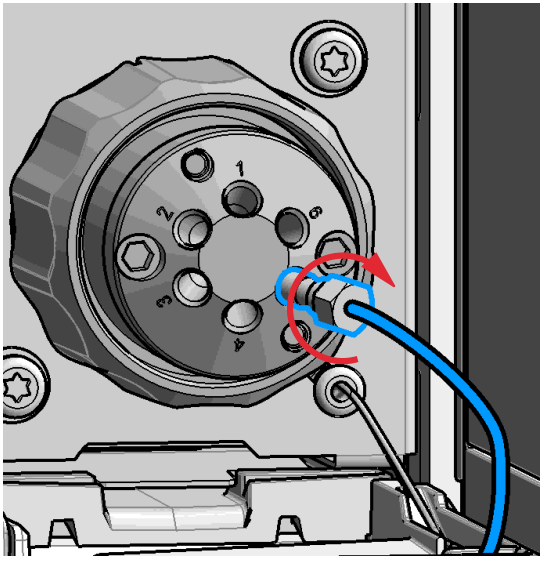
2 Slide the nut over the end of the tubing or capillary.



3 Carefully slide the ferrule components on after the nut and then finger-tighten the assembly while ensuring that the tubing is completely seated in the bottom of the end fitting.

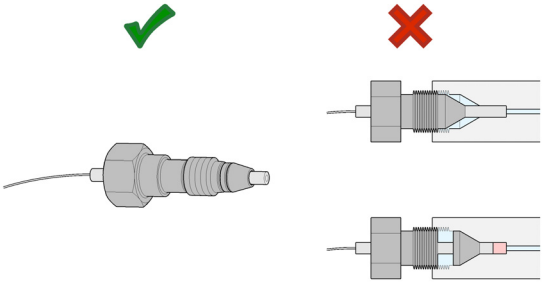


4 Use a column or injection valve to gently tighten the fitting which forces the ferrule to seat onto the tubing or capillary.



NOTE

Don't overtighten. Overtightening will shorten the lifetime of the fitting.

5 Loosen the nut and verify that the ferrule is correctly positioned on the tubing or capillary. 	

NOTE

The first time that the swagelock fitting is used on a column or an injection valve, the position of the ferrule is permanently set. If changing from a column or an injection valve to another, the fitting may leak or decrease the quality of the separation by contributing to band broadening. Worst case, the receptor fitting can be damaged.

Setting up the Fraction Collector with the Instrument Control Interface

Overview

Parameters described in following sections are offered by the instrument control interface and can usually be accessed through Agilent instrument control software. For details, please refer to manuals and online help of respective user interfaces.

In order to setup or change the configuration parameters of your fraction collector select **More Fraction Collector> Configuration** from the Instrument menu or right-click on the fraction collector icon in the graphical user interface.

Instrument Configuration

Use the **Instrument Configuration** dialog box to examine and, if necessary, modify your instrument configuration. The **Configurable Modules** panel contains a list of all modules available for configuration. The **Selected Modules** panel contains the list of configured modules.

Auto Configuration: Under **Communication settings**, select either the **Host Name** option or the **IP address** option and enter the appropriate value for the host computer to enable automatic detection of the hardware configuration. The system configures the instrument automatically with no further manual configuration necessary.

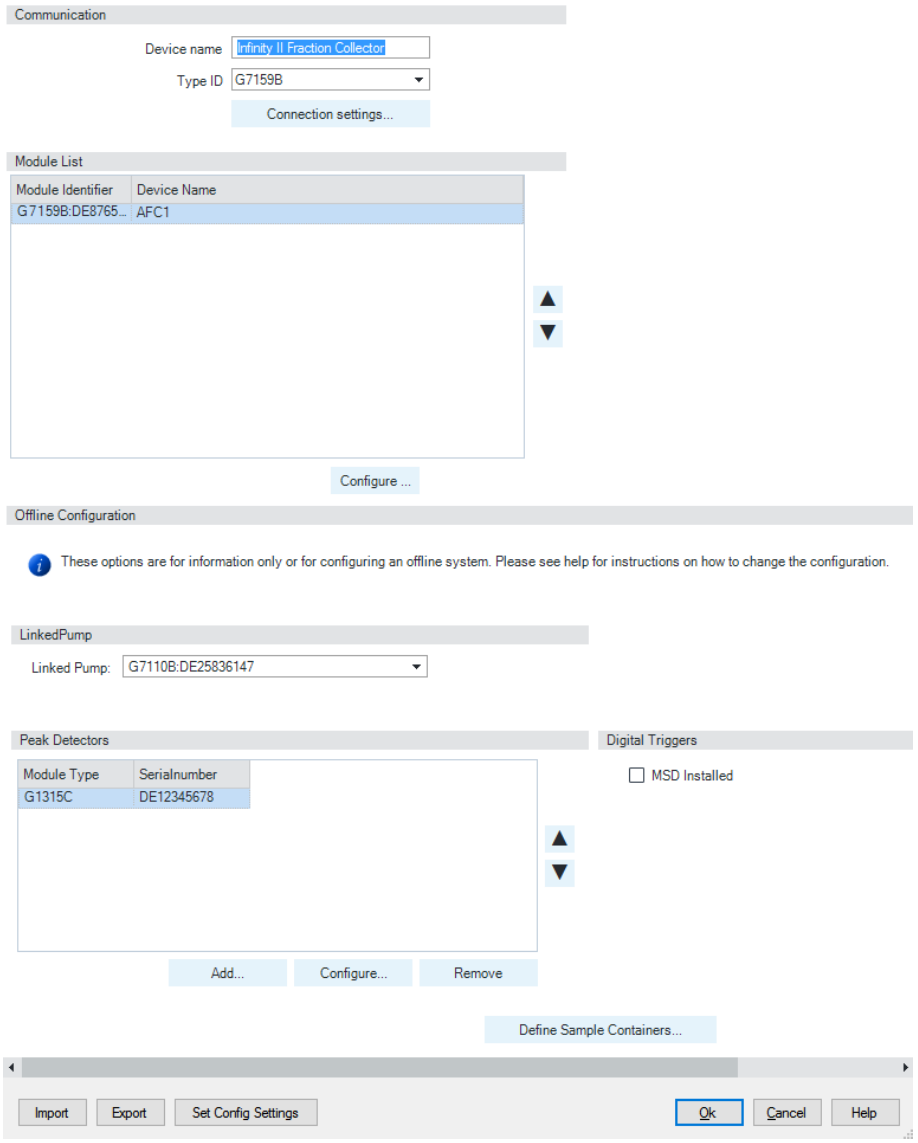


Figure 8 Instrument Configuration

The Fraction Collector configuration parameters are in four sections:

- **Communication**
- **Module List**
- **Peak Detectors**
- **Linked Pump**

Table 3 Instrument configuration parameters

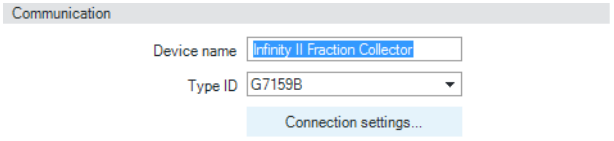
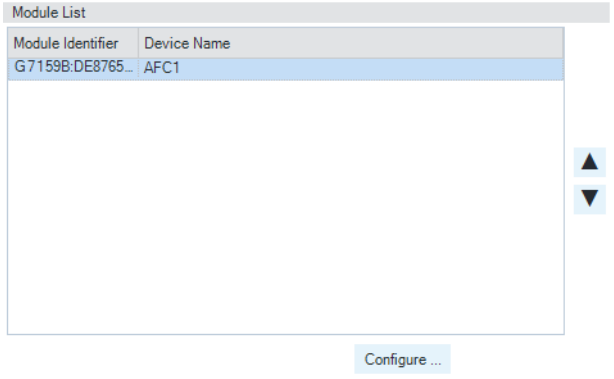
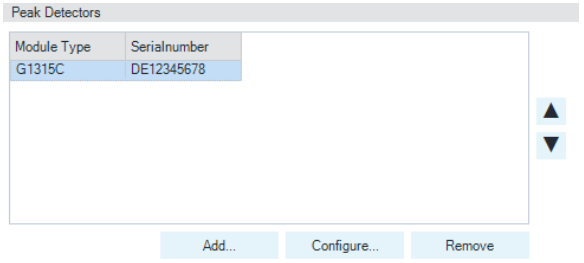
Parameter	Description
	**Communication**: The parameters in this dialog box are detected automatically during autoconfiguration. • **Device name**, • **Type ID**, • Button: **Connection settings**
	**Module List**: • **Module identifier (Type ID: Serial number)**, • **Device name**, • Button: **Configure** (**Device name, Serial number, Firmware revision**)

Table 3 Instrument configuration parameters

Parameter	Description
	**Peak Detectors**: • **Module type**: product number of the peak detector detected during autoconfiguration • **Serial number**: serial number of the peak detector detected during autoconfiguration • **Digital trigger: MSD Installed**, • Buttons: **Add**, **Configure** (**Peak detector**), **Remove** To change the order of the peak detectors, select one from the list and use the up and down arrows to move it to the desired position in the list.
	**Linked Pump**: • If your system is configured with only one Agilent pump, the pump is detected automatically during autoconfiguration and identified as the linked pump. • If your system is configured with more than one Agilent pump, click the down-arrow and select the pump that delivers the main flow to the Infinity II Fraction Collector.

Fraction Collector User Interface (Dashboard Panel)

Table 4 Fraction Valve User Interface

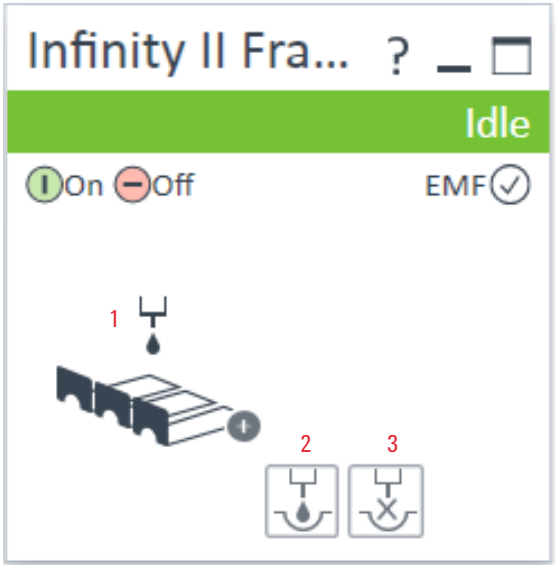
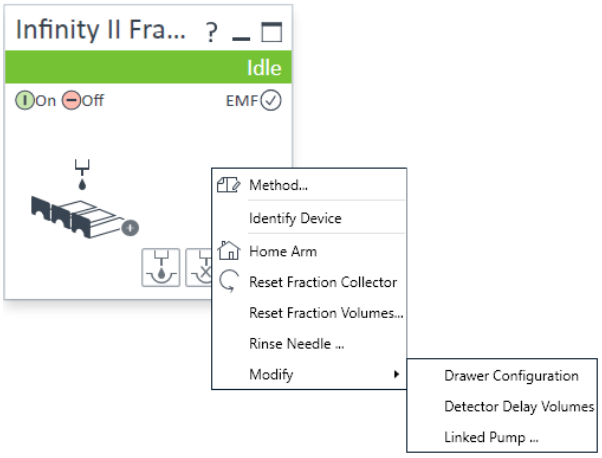
Parameter	Description
	*Module graphic* The items in the Fraction Collector graphic have the following meaning and function: • 1: Denotes collection to a fraction location. The current collection location is shown to the right of the graphic. The tooltip displays the current configuration of fraction locations in your instrument. • 2: Starts manual fraction collection. This button is active only during a run where fraction collection is enabled. • 3: Stops manual fraction collection. This button is active only during a run where fraction collection is enabled.
	Instrument Actuals The following fraction collector actuals are displayed: • **Current location**: The fraction location currently in use. • **Fraction mode**: The current fraction mode. • **Purge Status**: The status of the purge procedure. • **Flush Status**: The status of the Flush procedure.

Table 4 Fraction Valve User Interface

Parameter	Description
	*Context Menu* The context menu of the dashboard panel contains the following commands: • **Method**: Displays the Fraction Collector's Method Setup dialog box. • **Identify Device**: Causes the LED on the front of the module to blink for a few seconds. • **Home Arm**: Moves the robot arm to its home position. • **Reset Fraction Collector**: Sends a reset signal to fraction collector. During the reset, the fraction collector is in a Not Ready state. • **Reset Fraction Volumes**: Informs the fraction collector that the collection bottles and waste bottle are all empty. • **Rinse Needle**: Displays the **Rinse** dialog box, which allows you to specify the rinse parameters. • **Modify** > **Drawer Configuration**: Displays the **Modify Drawer Configuration** dialog box, which allows you to view and (if necessary) modify the drawer configuration of your device. • **Modify** > **Detector Delay Volumes**: The table lists all potential analog peak detection sources configured in your instrument. To modify the delay volume, enter the new delay volume (in µL) in the **Delay Volume (µL)** field of the appropriate peak detector. The changes in delay volumes are registered when you leave the dialog box with **OK**. • **Modify** > **Linked Pump**: Click the down-arrow and select the pump that delivers the main flow from the drop-down list. The list includes all pumps that can be used as linked pump. Choose **None** if the pump that delivers the main flow does not support linking.

Method Parameter Settings

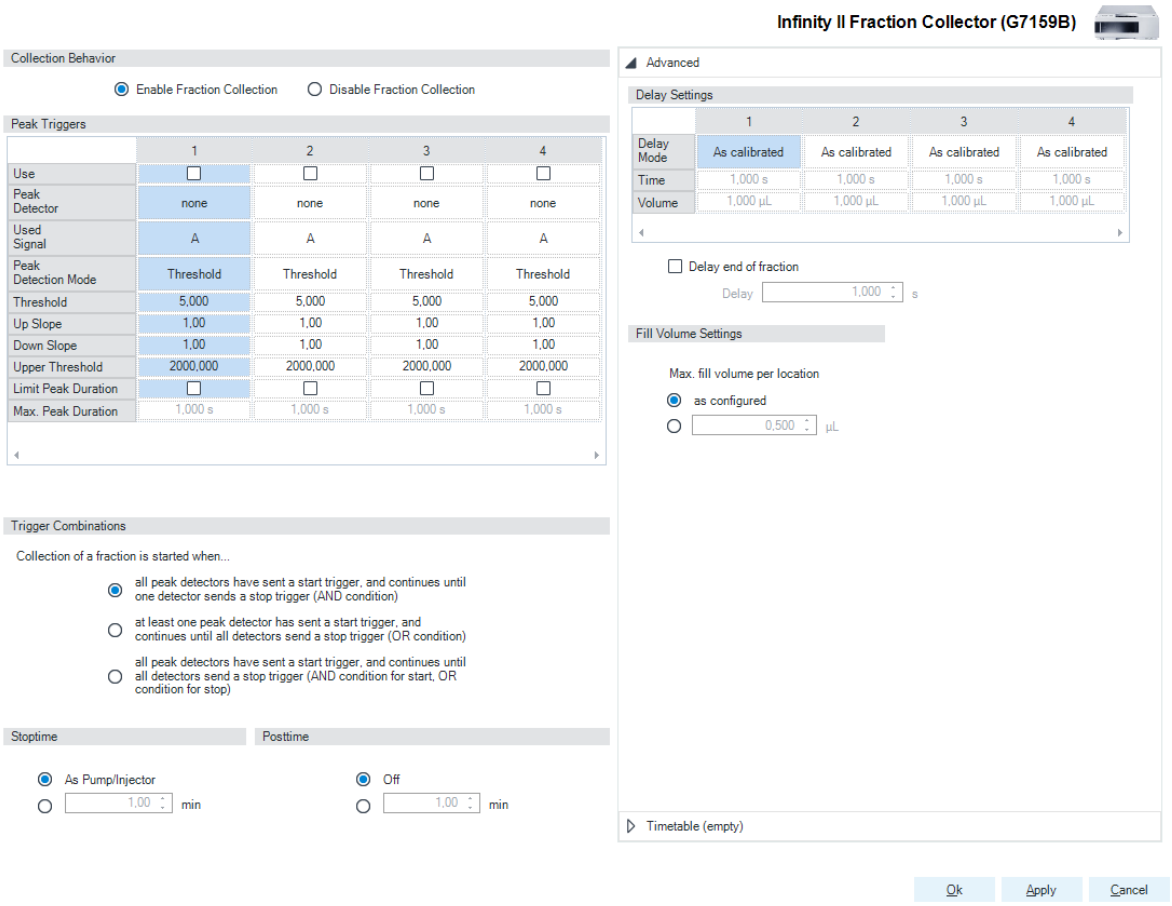


Figure 9 Method settings

The Fraction Collector method setup parameters are in eight sections:

- **Collection Behavior**
- **Peak Triggers**
- **Trigger Combinations**
- **Stoptime**
- **Posttime**
- **Advanced**
- **Timetable**
- **Fraction Preview**

Table 5 Method Parameter Settings

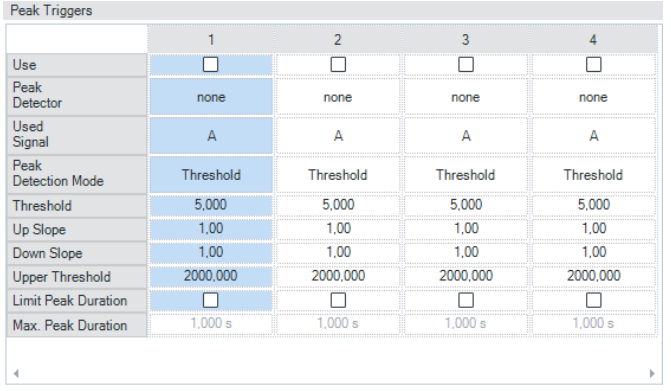
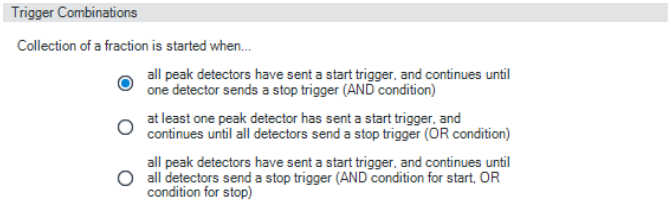
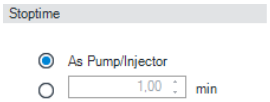
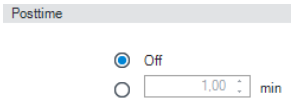
Parameter	Description
	**Collection Behavior** Use this setting to either enable or disable the fraction collection parameters of the instrument.
	**Peak Triggers** Use the Peak Triggers table to specify the detection settings of the peak detectors available in your system. • **Peak Detection Mode** The following detection modes are available: ◦ **Off** (The peak detector is not used) ◦ **Slope** (Detects peaks based on slope values only) Limits: **Up slope**: 0.01 – 10000 units/s, **Down slope**: 0.01 – 10000 units/s ◦ **Threshold** (Detects peaks based on threshold values only) Limits: **Threshold**: -10000 – 10000 units,**Upper threshold**: 0.01 – 10000 units ◦ **Threshold and Slope** (Detects peaks based on both threshold and slope values) • **Max Peak Duration** ◦ You can **Limit Peak Duration** to stop the fraction collection in cases where the baseline drifts and the signal does not drop below the specified threshold value. Limits: 1 – 10000 s

Table 5 Method Parameter Settings

Parameter	Description
	**Trigger Combinations** Use the **Trigger Combinations** to specify how multiple peak triggers are combined to start or stop Fraction Collection. You can choose that: • Collection of a fraction is started when **all peak detectors** have sent a start trigger, and continues until **one detector** sends a stop trigger (AND condition) • Collection of a fraction is started when at least **one peak detector** has sent a start trigger, and continues until **all detectors** send a stop trigger (OR condition) • Collection of a fraction is started when **all peak detectors** have sent a start trigger, and continues until **all detectors** send a stop trigger (AND condition for start, OR condition for stop)
	**Stoptime** Enables you to set a time at which the fraction collector stops an analysis. If the fraction collector is used with other Agilent Modular LC modules, the fraction collector stoptime stops the fraction collector only and does not stop any other modules. Limits: 0.01 – 99999.00 min or **As Pump/Injector**
	**Posttime** You can set the **Posttime** so that your fraction collector remains in the post-run state during the **Posttime** to delay the start of the next analysis. When the **Posttime** has elapsed, the fraction collector is ready for the next analysis. Limits: 0.01 – 99999.00 min or **Off** (0.0 min)
Advanced	See "Advanced Settings" on page 77
Timetable	See "Timetable Settings" on page 79
Fraction Preview	Use the **Fraction Preview** screen to test the fraction collection parameters against one or more reference signals. You can also use the **Fraction Preview** to optimize the fraction collection parameters interactively.

Advanced Settings

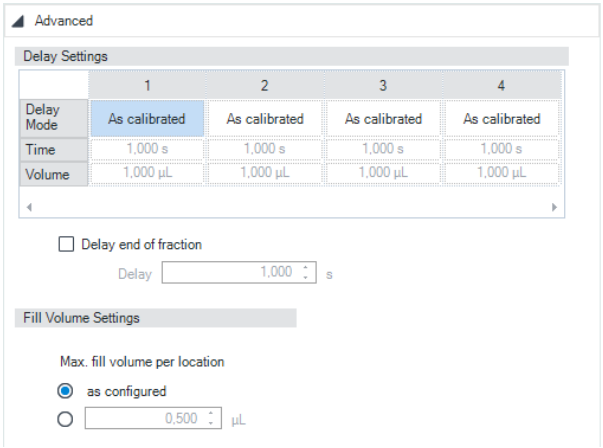
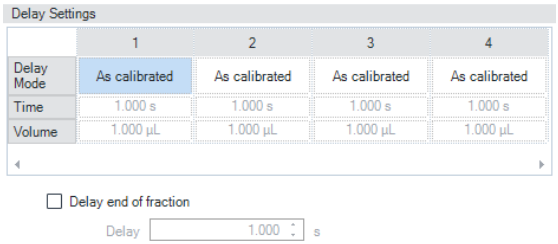
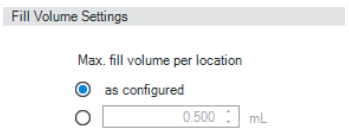


Figure 10 Advanced settings

The Fraction Collector method setup advanced parameters are in three sections, depending on the configuration:

- **Delay Settings**
- **Fill Volume Settings**
- **3rd Party Pump Flow** (only visible if there is no Agilent pump recognized.)

Table 6 Advanced Parameters Description

Parameter	Description
	**Delay Settings** Use the **Delay Settings** table to specify the delay that is applied to a peak trigger signal. You can specify this setting for each peak detector separately. You can choose from: • **Off** (No delay is applied to fraction collection and collection starts as soon as the trigger conditions are met) • **As calibrated** (Delays fraction collection by a pre-defined delay volume, where for each peak trigger, the delay volume can be displayed (and edited) using the **Modify Detector Delay Volumes** dialog box, accessed from the context menu of the instrument's dashboard panel) • **Use Time** (Enables the **Time** field to allow you to set a delay time) • **Use Volume** (Enables the **Volume** field to allow you to set a delay volume) **Delay end of fraction**: An additional delay can be set if you want to delay the end of fraction collection by an additional amount of time. Specify the additional time used to delay the end of fraction collection in seconds.
	**Fill Volume Settings** Use the **Fill Volume Settings** to specify the **Maximum fill volume** used in your method.
3rd Party Pump Flow	If your Fraction Collector is not connected to a Linked Pump, specify a Pump Flow for the Fraction Collection method. **NOTE** This section is only visible if there is no Agilent pump recognized.

Timetable Settings

NOTE A timetable entry is crucial to enable any fraction collection.

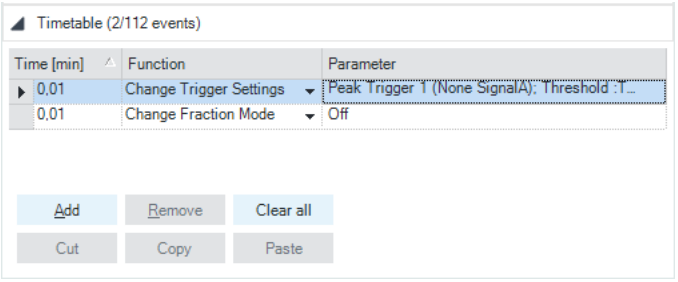


Figure 11 Timetable settings

Use the Timetable to program changes in the fraction collector parameters during the analysis by entering a time in the Time field and appropriate values in the following fields of the timetable. The values in the fraction collector timetable change instantaneously at the time defined in the timetable.

The following parameters can be changed:

- **Fraction Mode**
- **Trigger Settings**

Table 7 Timetable Functions

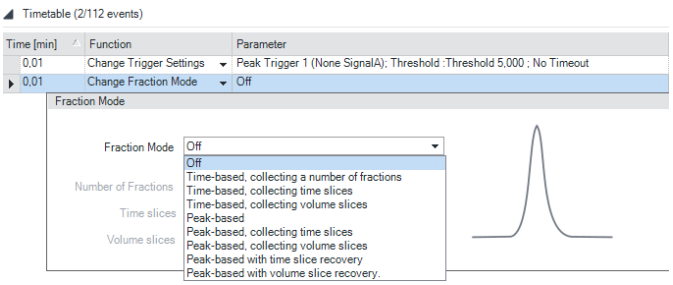
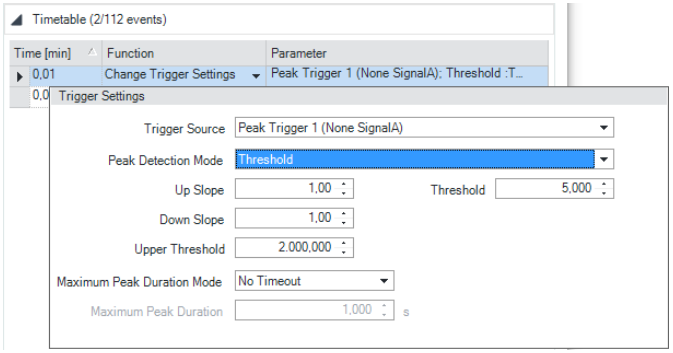
Function	Parameters
	**Fraction Mode** • **Off** (Turns off the current fraction collection, where you use Off to turn off fraction collection at the end of the run if you have not specified a **Stoptime**) • **Time-based, collecting a number of fractions** (Fractions are collected between this time and the next change of fraction mode or Off, where you specify the number of fractions to collect in the **Number of Fractions** field) • **Time-based, collecting time slices** (Time-slice fractions are collected between this time and the next change of fraction mode or Off. where you specify the duration of the time-slices to collect in the **Time slices** field) • **Time-based, collecting volume slices** (Volume-slice fractions are collected between this time and the next change of fraction mode or Off, where you specify the volume of the fractions to collect in the **Volume slices** field) • **Peak-based** (Fractions are collected based on the peak detection settings) • **Peak-based, collecting time slices** (Time-slice fractions are collected during the elution of a peak, based on the peak detection settings, where you specify the duration of the time-slices to collect in the **Time slices** field) • **Peak-based, collecting volume slices** (Volume-slice fractions are collected during the elution of a peak, based on the peak detection settings, where you specify the volume of the fractions to collect in the **Volume slices** field) • **Peak-based with time-slice recovery** (Time-slice fractions are collected between this time and the next change of fraction mode or Off, where when the peak detector encounters a peak, the peak is collected independently of the time slices, specified by the duration of the time-slices to collect in the **Time slices** field) • **Peak-based with volume-slice recovery** (Volume-slice fractions are collected between this time and the next change of fraction mode or Off, where when the peak detector encounters a peak, the peak is collected independently of the volume slices, specified by the volume of the fractions to collect in the **Volume slices** field)

Table 7 Timetable Functions

Function	Parameters
	**Trigger Settings** • **Trigger Source** (Click the down-arrow and select the trigger source from the drop-down list) • **Peak Detection Mode** (Click the down-arrow and select the peak detection mode from the drop-down list). You can select from: ◦ **Slope** (Detects peaks based on slope values only) Limits: **Up Slope**: 0.01 – 10000 units/s, **Down Slope**: 0.01 – 10000 units/s ◦ **Threshold** (Detects peaks based on threshold values only) Limits: **Threshold**: -10000 – 10000 units, **Upper Threshold**: 0.01 – 10000 units ◦ **Threshold and Slope** (Detects peaks based on both threshold and slope values) • **Maximum Peak Duration Mode** (Click the down-arrow and select the mode from the drop-down list). You can select from: ◦ **No Timeout** (The peak duration has no limit) ◦ **Use Max Peak Duration** (The peak has a maximum duration, set in the **Maximum Peak Duration** field)

NOTE

In order to collect fractions, three criteria are required:

1 Collection Behavior must be enabled.

2 At least one Peak Trigger channel must be selected.

3 At least one Timetable event must be specified, to Change Fraction Mode to one of the Time Based or Peak Based modes.

Pooling

Pooling is the collection of multiple fractions into the same collection vessel. You can pool fractions from either multiple injections of the same sample or single injections of different samples.

Fractions are pooled automatically when you specify multiple injections from the same location in one line of the sequence table, or if the same fraction start location is specified for sequential locations in the sequence table.

If a location exceeds its maximum fill volume during pooling, the fraction collection is stopped with an error condition.

5 Troubleshooting and Diagnostics

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

User Interfaces

- Depending on the user interface, the available tests and the screens/reports may vary.
- Preferred tool should be Agilent Lab Advisor Software, see "Agilent Lab Advisor Software" on page 85.
- The Agilent OpenLAB ChemStation C.01.03 and above do not include any maintenance/test functions.
- Screenshots used within these procedures are based on the Agilent Lab Advisor Software.

Agilent Lab Advisor Software

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

The Agilent Lab Advisor software is available in two versions:

- Lab Advisor Basic
- Lab Advisor Advanced

Lab Advisor Basic is included with every Agilent 1200 Infinity Series and Agilent InfinityLab LC Series instrument.

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

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

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.

What Are Error Messages

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

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

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

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

General Error Messages

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

Timeout

Error ID: 0062

The timeout threshold was exceeded.

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

Shutdown

Error ID: 0063

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

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

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

Remote Timeout

Error ID: 0070

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

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

Lost CAN Partner

Error ID: 0071

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

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

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

Leak Sensor Short

Error ID: 0082

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

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

Probable cause	Suggested actions
1 Defective leak sensor.	Exchange the leak sensor.
2 Leak sensor incorrectly routed, being pinched by a metal component.	• Make sure the leak sensor is installed correctly. • Correct the routing of the cable. • If cable defective, exchange the leak sensor.
3 Power switch assembly defective	Exchange the power switch assembly.
4 Cable or contact problem.	• Inspect the flat ribbon cable from the power switch board to the main board. • Inspect the contacts on the flat ribbon cable's ends.

Leak Sensor Open

Error ID: 0083

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

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

Probable cause	Suggested actions
1 Leak sensor not connected to the Power Switch board.	Ensure the leak sensor is connected correctly.
2 Defective leak sensor.	Exchange the leak sensor.
3 Leak sensor incorrectly routed, being pinched by a metal component.	Exchange the leak sensor.
4 Power switch assembly defective	Exchange the power switch assembly.

Compensation Sensor Open

Error ID: 0081

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

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

Probable cause	Suggested actions
1 Loose connection between the power switch board and the main board	Check the ribbon cable between the power switch board and the main board.
2 Defective power switch assembly	Exchange the power switch assembly.

Compensation Sensor Short

Error ID: 0080

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

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

Probable cause	Suggested actions
1 Defective power switch assembly	Exchange the power switch assembly.
2 Loose connection between the power switch board and the main board	Check the ribbon cable between the power switch board and the main board.

Fan Failed

Error ID: 0068

The cooling fan in the module has failed.

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

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

Probable cause	Suggested actions
1 Fan cable disconnected.	Ensure the fan is connected correctly.
2 Defective fan.	Exchange fan.
3 Defective main board.	Exchange the main board.

Leak

Error ID: 0064

A leak was detected in the module.

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

Probable cause	Suggested actions
1 Loose fittings.	Ensure all fittings are tight.
2 Broken capillary.	Exchange defective capillaries.

7 Maintenance

This chapter describes the maintenance of the module.

Introduction to Maintenance

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

NOTE

There are no serviceable parts inside.

Do not open the rear of the module.

Warnings and Cautions

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

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

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

WARNING **Sharp metal edges**

Sharp-edged parts of the equipment may cause injuries.

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

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

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

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

CAUTION

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

ESD can damage electronic boards and components.

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

CAUTION

Safety standards for external equipment

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

CAUTION

Overpressure at inlet tubing

Overpressure can burst the inlet tubing

- ✓ Use the provided Pressure Restriction Valve (PRV) to protect the inlet tubing.
- ✓ Regularly inspect the inlet / waste tubing assembly and the valve to needle tubing for kinks and blockages.
- ✓ Exchange them if they are worn out or show visible signs of damage.

Cleaning the Module

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

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

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

Overview of Maintenance

The procedures described in this section can be done with the Fraction Collector in place in the stack. These procedures can be done on a more frequent basis.

Table 8 Overview of maintenance procedures

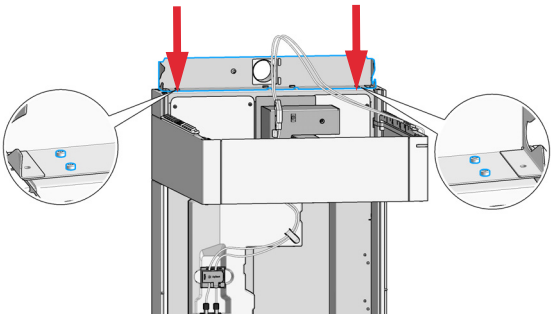
Procedure	Typical Frequency	Notes
Replacing the Inlet / Outlet tubings	When worn out, when showing visual signs of damage, typically once per year.	See "Replace Inlet/Waste Tubings" on page 43
Replace the Dripping Adapter	When worn out, when showing visual signs of damage, typically once per year.	See "Replace the Dripping Adapter for the Fraction Valve" on page 104

Install and Remove the Top Fume Hood

Parts required	p/n	Description
	G9321-68200	Top Fume Hood Kit

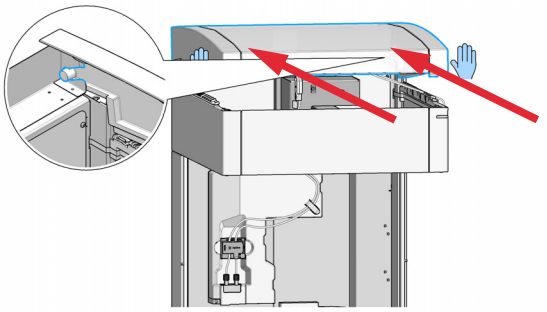
See chapter *Parts* for details.

1 Install the exhaust sheet by fixing the four screws to the fraction collector.

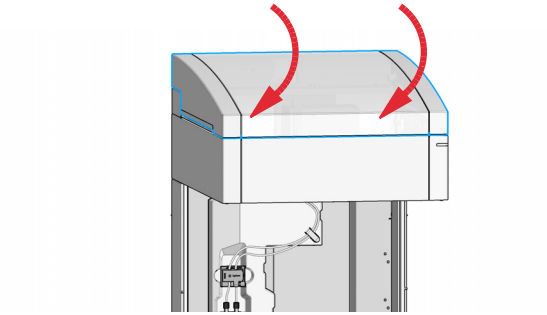


2 Install the top fume hood and close it.

a Push the top fume hood into the recession.

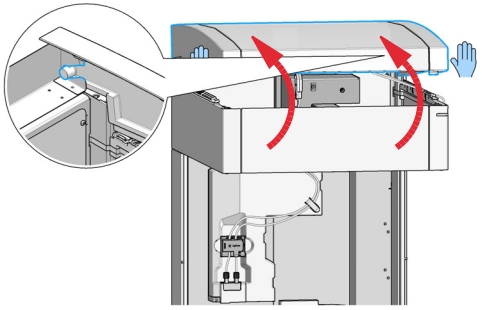


b Close the top fume hood.

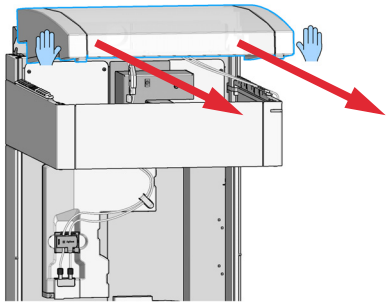


3 Open and remove the top fume hood.

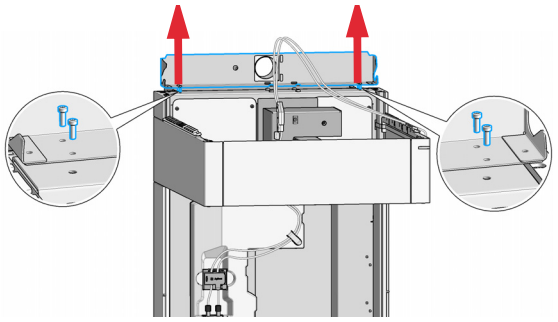
a Swing up the fume hood against the mechanical stop.



b Remove the fume hood by pulling it toward you.



4 Remove the screws fixing the exhaust sheet to the fraction collector, then remove the exhaust sheet.

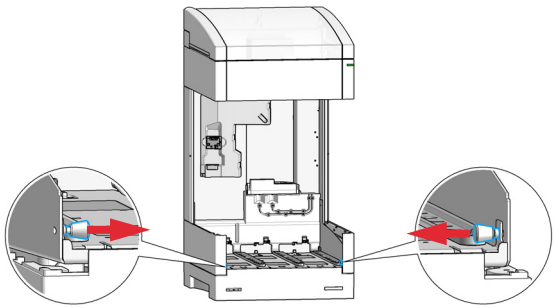


Clean the Leak Pan

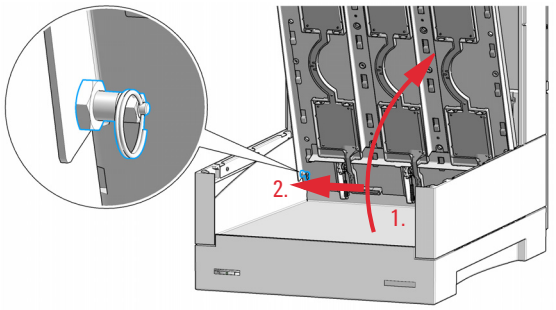
Preparations

- Turn off the flow and the instrument.
- Remove all drawers from the module.
- Move the robotics to the home position.

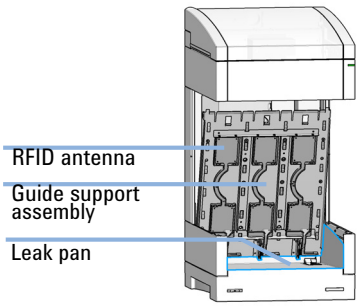
1 Pull the release knobs on both sides at the front of the guide support assembly.



2 Open the guide support assembly (1.) and fix it at the back with the spring-loaded pin (2.).



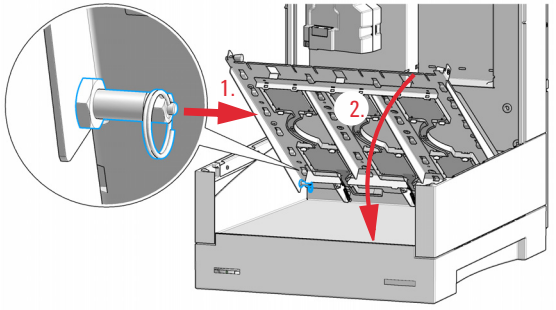
3 Clean the leak pan.



NOTE

Don't touch or clean the RFID antennas on the back side (lower side) of the guide support assembly.

4 Release the spring-loaded pin and lower the guide support into its original position.



5 If the release knobs do not snap in, slightly turn them.

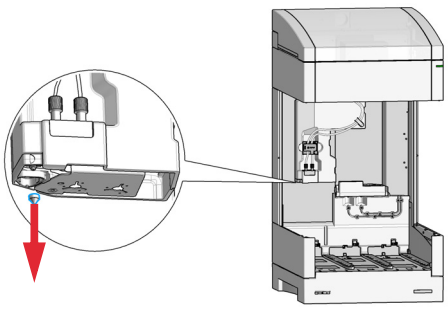
Replace the Dripping Adapter for the Fraction Valve

Tools required	p/n	Description
	5067-7028	Z-Axe Maintenance Tool

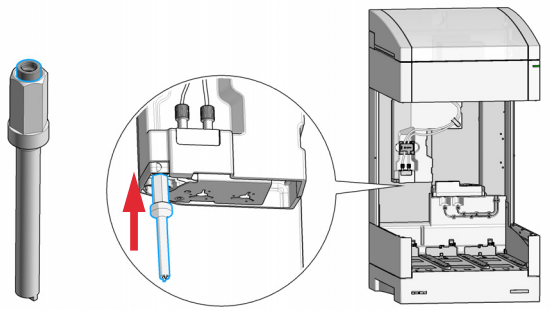
This tool has a bifunctional shank. One side serves as a tool for exchanging the needle tubing. The other side is designed for removing and installing of the dripping adapter. When the former functionality is desired the shank is plugged into a handle. Then the tool for the dripping adapter is covered by the handle. In that case removal of the handle is required to obtain the other side of the shank for operation.

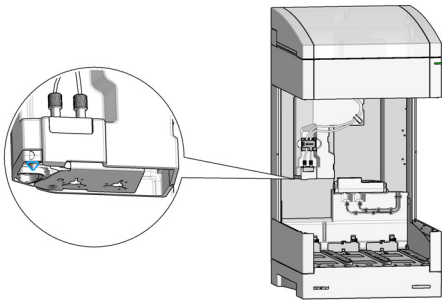
Parts required	p/n	Description
	G9321-26600	Dripping-Adapter for Fraction-Valve

1 Pry the old dripping adapter off the fraction valve with a blade of the Multi Tool.



2 Use Z-Axe Maintenance Tool (5067-7028) to clip the new dripping adapter on to the end of the fraction valve.



3 Remove Z-Axe Maintenance Tool (5067-7028). 	

Replace the Module Firmware

When

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

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

Tools required

Description
Agilent Lab Advisor software

Parts required

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

Preparations

Read update documentation provided with the Firmware Update Tool.

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

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

Module Specific Information

There is no specific information for this module.

8 Parts for Maintenance and Repair

This chapter provides information on parts for maintenance and repair.

Supported Containers

p/n	Description
G9321-60015	Tube Container for 30 mm x 150 mm tubes, ambient, 10 tubes
G9321-60058	Tube Container for 30 mm x 100 mm tubes, ambient, 10 tubes
G9321-60025	Tube Container for 25 mm x 150 mm tubes, ambient, 18 tubes
G9321-60035	Tube Container for 25 mm x 100 mm tubes, ambient, 18 tubes
G9321-60129	Tube Container for 16 mm x 150 mm tubes, ambient, 36 tubes
G9321-60055	Tube Container for 16 mm x 100 mm tubes, ambient, 36 tubes
G9321-60131	Tube Container for 12 mm x 150 mm tubes, ambient, 72 tubes
G9321-60045	Tube Container for 12 mm x 100 mm tubes, ambient, 72 tubes
G9321-60051	SBS Container, ambient

List of Recommended Fraction Tubes

p/n	Description
5190-9090	Fraction Tubes 150 mm x 30 mm, 78 mL (pack of 100) fits with p/n G9321-60015
5042-6458	Fraction Tubes 100 mm x 30 mm, 50 mL (pack of 100) fits with p/n G9321-60058
5190-9091	Fraction Tubes 150 mm x 25 mm, 55 mL (pack of 100) fits with p/n G9321-60025
5042-6459	Fraction Tubes 100 mm x 25 mm, 35 mL (pack of 100) fits with p/n G9321-60035
5190-9092	Fraction Tubes 150 mm x 16 mm, 21 mL (pack of 250) fits with p/n G9321-60129
5022-6532	Fraction Tubes 100 mm x 16 mm, 14 mL (pack of 250) fits with p/n G9321-60055
5190-9093	Fraction Tubes 150 mm x 12 mm, 11 mL (pack of 250) fits with p/n G9321-60131
5022-6531	Fraction Tubes 100 mm x 12 mm, 7 mL (pack of 250) fits with p/n G9321-60045

Fraction Collector Accessory Kit

The Fraction Collector Accessory Kit (G9321-68002) contains the following items:

#	p/n	Description
1	5065-9971	Barbed Y-Connector, PP for 3/16 in ID Tube
1	5181-1519	CAN cable, Agilent module to module, 1 m
1	5500-1155	Tube Connector, 90 degree, ID 6.4
2	5063-6527	Tubing, Silicon Rubber, 1.2 m, ID/OD 6/9 mm
1	8710-0510	Open-end wrench 1/4 — 5/16 inch
1	5067-6840	Back Pressure Regulator
1	8710-1930	Plastic tubing cutter
1	5067-7028	Z-Axe Maintenance Tool
1	5067-6857	PREP Pressure Relief Valve Kit
1	5067-7022	Bend Protection Spring
1	G9321-60046	Waste Tube Guide

Tubing Kits

Tubing Kit G9321-60951

1290 Inf II PrepFC Tubing Kit 200 (G9321-60951) contains the following parts:

#	p/n	Description
1	G9321-40081	Delay Sensor Clip
1	G9321-40128	Tube holder
1	5023-2878	2.4 m Tubing ESD PTFE (OD2/ID1.2)
1	5023-2636	2.4 m Tubing ESD PTFE (OD2.5/OD1.6)
2	5023-2871	Fitting 1/4-28 for Tube-OD 2.5 mm ESD-PEEK
2	5023-2872	Fitting 1/4-28 for Tube-OD 2.0 mm ESD-PEEK
1	5043-1471	Fitting Handle
5	G9321-20052	Tubing Segment
1	G9321-87712	Label Tubing IN ID1.2
1	G9321-87716	Label Tubing Out To Waste
1	5067-6785	EEPROM tag assembly
1	G9321-90120	Fract.Tubing Inl.2 Outl.6 TechNote ENG

Tubing Kit G9321-60952

1290 Inf II PrepFC Tubing Kit 50 (G9321-60952) contains the following parts:

#	p/n	Description
1	G9321-40081	Delay Sensor Clip
1	G9321-40128	Tube holder
1	5067-6785	EEPROM tag assembly
1	5023-2637	2.4 m Tubing ESD PTFE (OD1.6/ID0.8)
1	5023-2636	2.4 m Tubing ESD PTFE (OD2.5/OD1.6)
2	5023-2871	Fitting 1/4-28 for Tube-OD 2.5 mm ESD-PEEK
2	5023-2874	Fitting 1/4-28 for Tube-OD 1.6 mm ESD-PEEK
1	5043-1471	Fitting Handle
5	G9321-20052	Tubing Segment
1	G9321-87708	Label Tubing IN ID0.8
1	G9321-87716	Label Tubing Out To Waste
1	G9321-90120	Fract.Tubing Inl.2 Outl.6 TechNote ENG

Tubing Kit G9321-60953

1290 Inf II PrepFC Tubing Kit 8 mL (G9321-60953) contains the following parts:

#	p/n	Description
1	G9321-40081	Delay Sensor Clip
1	G9321-40128	Tube holder
1	5067-6785	EEPROM tag assembly
1	5023-3072	2.4 m Tubing ESD PTFE (OD1.6/ID0.5)
1	5023-2636	2.4 m Tubing ESD PTFE (OD2.5/OD1.6)
2	5023-2874	Fitting 1/4-28 for Tube-OD 1.6 mm ESD-PEEK
2	5023-2871	Fitting 1/4-28 for Tube-OD 2.5 mm ESD-PEEK
1	5043-1471	Fitting Handle
5	G9321-20052	Tubing Segment
1	G9321-87716	Label Tubing Out To Waste
1	G9321-87705	Label PrepFC Tubing IN ID 0.5
1	G9321-90120	Fract.Tubing Inl.2 Outl.6 TechNote ENG

Tubing Kit G9321-60954

1290 Inf II PrepFC Tubing Kit 150 mL (G9321-60954) contains the following parts:

#	p/n	Description
1	G9321-40081	Delay Sensor Clip
1	G9321-40128	Tube holder
1	5067-6785	EEPROM tag assembly
1	5023-2878	2.4 m Tubing ESD PTFE (OD2/ID1.2)
1	5023-2636	2.4 m Tubing ESD PTFE (OD2.5/OD1.6)
1	G9321-87713	Label Tubing IN ID1.2
1	G9321-87716	Label Tubing Out To Waste
5	G9321-20052	Tubing Segment
2	5023-2871	Fitting 1/4-28 for Tube-OD 2.5 mm ESD-PEEK
2	5023-2872	Fitting 1/4-28 for Tube-OD 2.0 mm ESD-PEEK
1	5043-1471	Fitting Handle
1	G9321-90120	Fract.Tubing Inl.2 Outl.6 TechNote ENG

Top Fume Hood Kit

Item	p/n	Description
	G9321-68200	Top Fume Hood Kit contains the following items:
1	G9321-60830	Top Fume Hood
2	0515-1753	SCREW-MACH-M3X0.5-8MM-LG-PAN-HD
3	G9321-00100	Exhaust Sheet
4	G1364-03201	Exhaust Tube Adapter
5	5067-5406	Screw Tx20, M4 x 8 mm

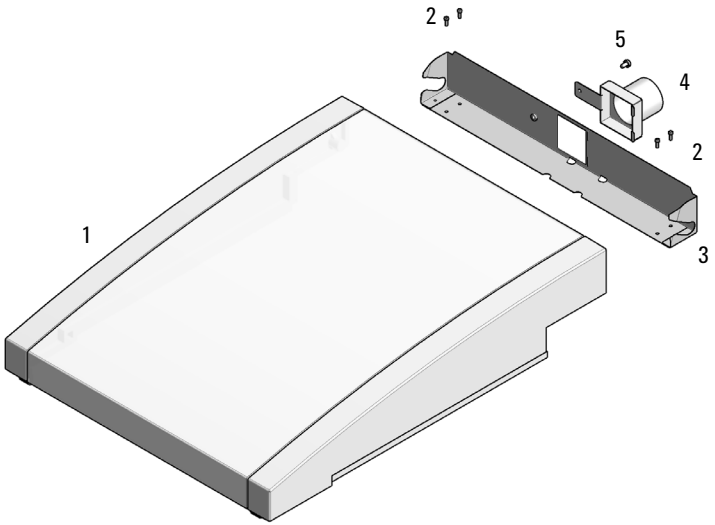


Figure 12 Top Fume Hood Kit

9 Identifying Cables

This chapter provides information on cables used with the module.

Cable Overview

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

Analog cables

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

Remote cables

p/n	Description
5188-8029	ERI to general purpose
5188-8044	Remote Cable ERI – ERI
5188-8045	Remote Cable APG – ERI
5188-8059	ERI-Extension-Cable 1.2 m
5061-3378	Remote Cable to 35900 A/D converter
01046-60201	Agilent module to general purpose
5188-8057	Fraction Collection ERI remote Y-cable

CAN cables

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

LAN cables

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

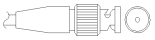
RS-232 cables (not for FUSION board)

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

USB cables

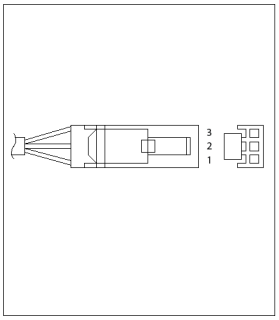
p/n	Description
5188-8050	USB A M-USB Mini B 3 m (PC-Module)
5188-8049	USB A F-USB Mini B M OTG (Module to Flash Drive)

Analog Cables

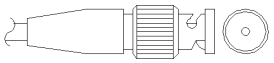


One end of these cables provides a BNC connector to be connected to Agilent modules. The other end depends on the instrument to which connection is being made.

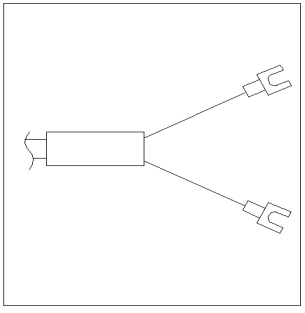
Agilent Module to 35900 A/D converters

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

Agilent Module to BNC Connector

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

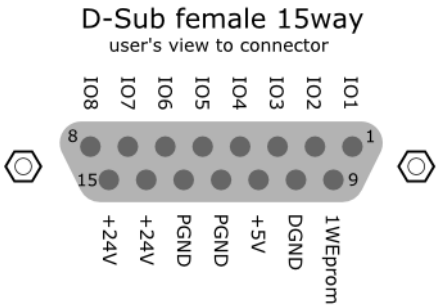
Agilent Module to General Purpose

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

Remote Cables

ERI (Enhanced Remote Interface)

- 5188-8029 ERI to general purpose (D-Sub 15 pin male - open end)
- 5188-8044 ERI to ERI (D_Sub 15 pin male - male)
- 5188-8059 ERI-Extension-Cable 1.2 m (D-Sub15 pin male / female)

p/n 5188-8029	pin	Color code	Enhanced Remote	Classic Remote	Active (TTL)
	1	white	IO1	START REQUEST	Low
	2	brown	IO2	STOP	Low
	3	green	IO3	READY	High
	4	yellow	IO4	POWER ON	High
	5	grey	IO5	NOT USED	
	6	pink	IO6	SHUT DOWN	Low
	7	blue	IO7	START	Low
	8	red	IO8	PREPARE	Low
	9	black	1wire DATA		
	10	violet	DGND		
	11	grey-pink	+5V ERI out		
	12	red-blue	PGND		
	13	white-green	PGND		
	14	brown-green	+24V ERI out		
	15	white-yellow	+24V ERI out		
	NC	yellow-brown			

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

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

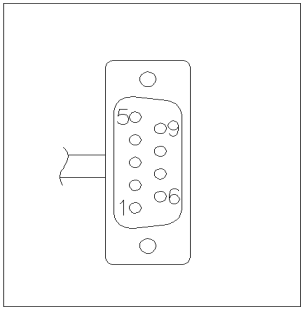
- 5188-8057 ERI to APG and RJ45 (Connector D_Subminiature 15 pin (ERI), Connector D_Subminiature 9 pin (APG), Connector plug Cat5e (RJ45))

Table 9 5188-8057 ERI to APG and RJ45

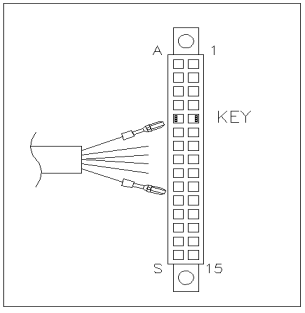
p/n 5188-8057	Pin (ERI)	Signal	Pin (APG)	Active (TTL)	Pin (RJ45)
					
	10	GND	1		5
	1	Start Request	9	High	
	2	Stop	8	High	
	3	Ready	7	High	
	4	Fraction Trig-ger	5	High	4
	5	Power on	6	High	
	6	Shut Down	4	High	
	7	Start	3	High	
	8	Prepare	2	High	
	Ground	Cable Shield-ing	NC		

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

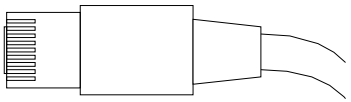
Agilent Module to Agilent 35900 A/D Converters

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

Agilent Module to General Purpose

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

CAN/LAN Cables



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

CAN Cables

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

LAN Cables

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

RS-232 Cables

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

USB

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

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

10 Hardware Information

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

Firmware Description

The firmware of the instrument consists of two independent sections:

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

Resident System

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

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

Main System

Its properties are:

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

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

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

Firmware Updates

Firmware updates can be done with the Agilent Lab Advisor software with files on the hard disk (latest version should be used).

Required tools, firmware and documentation are available from the Agilent web:
http://www.agilent.com/en-us/firmwareDownload?whid=69761

The file naming conventions are:

PPPP_RVVV_XXX.dlb, where

- PPPP is the product number, for example, 1315B for the G1315B DAD,
- R the firmware revision, for example, A for G1315B or B for the G1315C DAD,
- VVV is the revision number, for example 650 is revision 6.50,
- XXX is the build number of the firmware.

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

NOTE

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

Main and resident firmware must be from the same set.

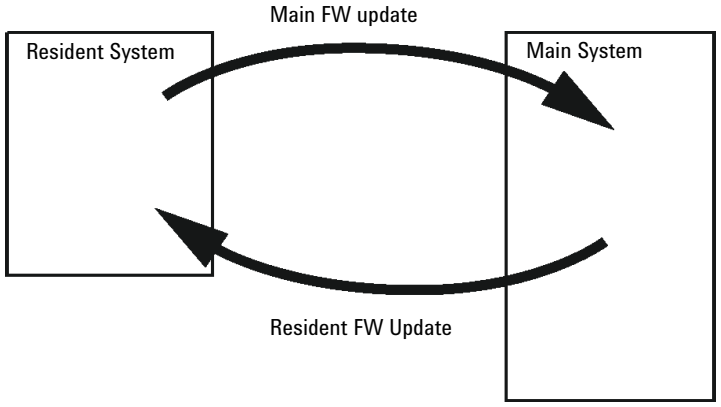


Figure 13 Firmware Update Mechanism

NOTE

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

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

All this specific information is described in the documentation provided with the firmware update tools.

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

- **http://www.agilent.com/en-us/firmwareDownload?whid=69761**

Electrical Connections

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

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

Serial Number Information (ALL)

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

CCXZZ00000	Format
CC	Country of manufacturing • DE = Germany • JP = Japan • CN = China
X	Alphabetic character A-Z (used by manufacturing)
ZZ	Alpha-numeric code 0-9, A-Z, where each combination unambiguously denotes a module (there can be more than one code for the same module)
00000	Serial number

Side View of the Module

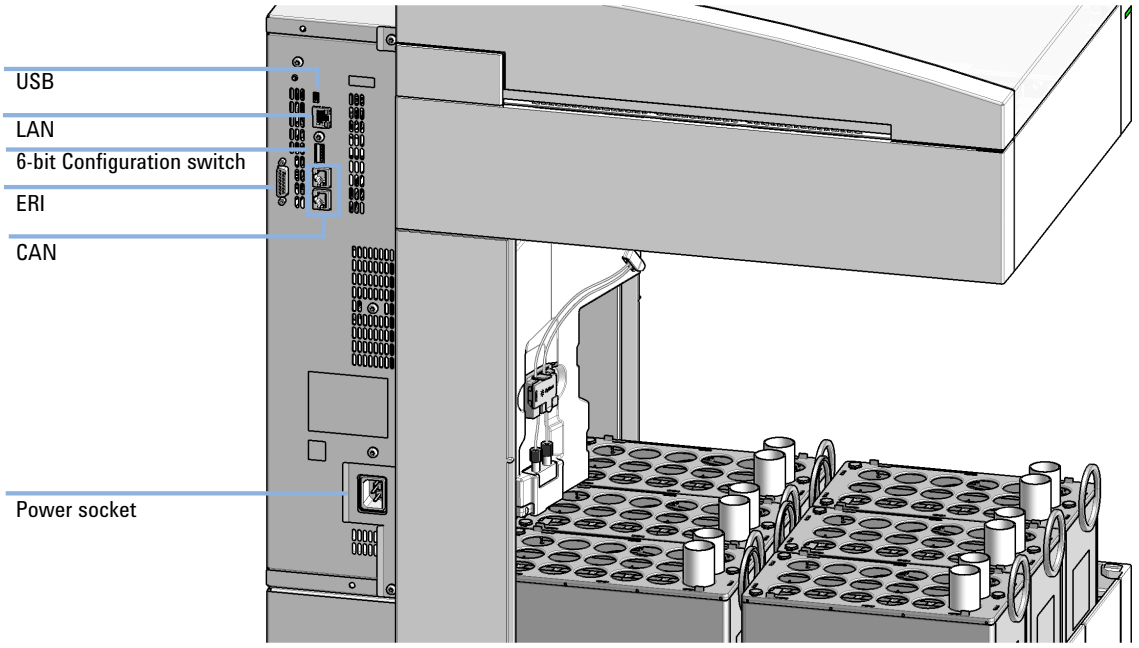


Figure 14 Side view of the fraction collector

Interfaces

The Agilent InfinityLab LC Series modules provide the following interfaces:

Table 10 Agilent InfinityLab LC Series Interfaces

Module	CAN	USB	LAN (on-board)	RS-232	Analog	APG (A) / ERI (E)	Special
Pumps							
G7104A/C	2	No	Yes	Yes	1	A	
G7110B	2	Yes	Yes	No	No	E	
G7111A/B, G5654A	2	Yes	Yes	No	No	E	
G7112B	2	Yes	Yes	No	No	E	
G7120A	2	No	Yes	Yes	1	A	
G7161A/B	2	Yes	Yes	No	No	E	
Samplers							
G7129A/B/C	2	Yes	Yes	No	No	E	
G7167B/C, G5667A	2	Yes	Yes	No	No	E	
G7157A	2	Yes	Yes	No	No	E	
Detectors							
G7114A/B	2	Yes	Yes	No	1	E	
G7115A	2	Yes	Yes	No	1	E	
G7117A/B/C	2	Yes	Yes	No	1	E	
G7121A/B	2	Yes	Yes	No	1	E	
G7162A/B	2	Yes	Yes	No	1	E	
G7165A	2	Yes	Yes	No	1	E	

Table 10 Agilent InfinityLab LC Series Interfaces

Module	CAN	USB	LAN (on-board)	RS-232	Analog	APG (A) / ERI (E)	Special
Fraction Collectors							
G7158B	2	Yes	Yes	No	No	E	
G7159B	2	Yes	Yes	No	No	E	
G7166A	2	No	No	No	No	No	Requires a host module with on-board LAN with minimum FW B.06.40 or C.06.40, or with additional G1369C LAN Card
G1364E/F, G5664B	2	Yes	Yes	No	No	E	THERMOSTAT for G1330B
Others							
G7116A/B	2	No	No	No	No	No	Requires a HOST module via CAN
G7122A	No	No	No	Yes	No	A	
G7170B	2	No	No	No	No	No	Requires a host module with on-board LAN with minimum FW B.06.40 or C.06.40, or with additional G1369C LAN Card

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

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

Overview Interfaces

CAN

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

LAN

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

NOTE

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

USB

The USB interface replaces the RS-232 Serial interface in new FUSION generation modules. For details on USB refer to "USB (Universal Serial Bus)" on page 140.

Analog Signal Output

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

Remote (ERI)

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

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

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

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

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

NOTE

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

Table 11 ERI signal distribution

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

Special Interfaces

There is no special interface for this module.

ERI (Enhanced Remote Interface)

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

ERI Description

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

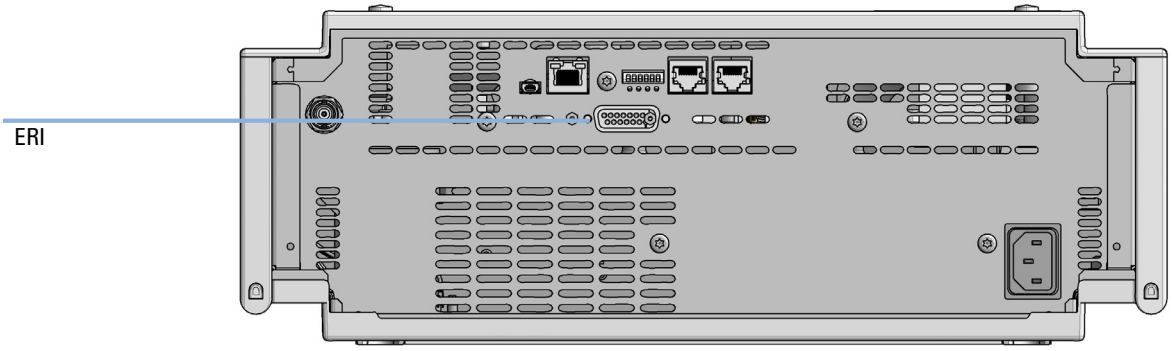
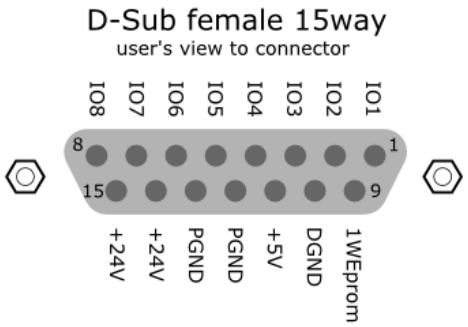


Figure 15 Location of the ERI interface (example shows a G7114A/B VWD)



Pin	Enhanced Remote
1	IO 1 (START REQUEST)
2	IO 2 (STOP)
3	IO 3 (READY)
4	IO 4 (POWER ON)
5	IO 5 (NOT USED)
6	IO 6 (SHUT DOWN)
7	IO 7 (START)
8	IO 8 (PREPARE)
9	1 wire DATA
10	DGND
11	+5 V ERI out
12	PGND
13	PGND
14	+24 V ERI out
15	+24 V ERI out

IO (Input/Output) Lines

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

1-Wire Data (Future Use)

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

5V Distribution (Future Use)

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

24V Distribution (Future Use)

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

USB (Universal Serial Bus)

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

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

Setting the 6-bit Configuration Switch

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

All modules with FUSION electronics:

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

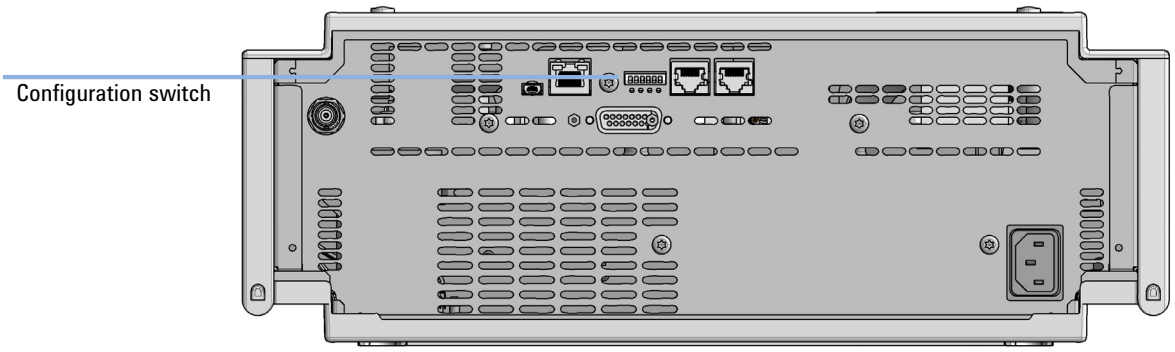


Figure 16 Location of Configuration switch (example shows a G7114A/B VWD)

Table 12 6-bit Configuration Switch

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

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

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

3 Default IP Address is 192.168.254.11

4 Host Name will be the MAC address.

Special Settings

Boot-Resident/Main

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

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

Forced Cold Start

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

- Boot Main System / Revert to Default Data

  The instrument will boot to main mode and changes to the module's default parameter. May be also required to load resident firmware into the module.
- Boot Resident System / Revert to Default Data

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

CAUTION

Loss of data

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

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

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

Table 13 Boot Resident / Forced Coldstart

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

Early Maintenance Feedback

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

EMF Counters

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

Using the **EMF Counters**

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

Setting the **EMF Limits**

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

Instrument Layout

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

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

11 Appendix

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

General Safety Information

General Safety Information

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

WARNING

Ensure the proper usage of the equipment.

The protection provided by the equipment may be impaired.

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

Safety Standards

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

General

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

Before Applying Power

WARNING

Wrong voltage range, frequency or cabling

Personal injury or damage to the instrument

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

NOTE

Note the instrument's external markings described under "Safety Symbols" on page 152.

Ground the Instrument

WARNING

Missing electrical ground

Electrical shock

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

Do Not Operate in an Explosive Atmosphere

WARNING

Presence of flammable gases or fumes

Explosion hazard

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

Do Not Remove the Instrument Cover

WARNING

Instrument covers removed

Electrical shock

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

Do Not Modify the Instrument

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

In Case of Damage

WARNING

Damage to the module

Personal injury (for example electrical shock, intoxication)

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

Solvents

WARNING

Toxic, flammable and hazardous solvents, samples and reagents

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

- ✓ **When working with these substances observe appropriate safety procedures (for example by wearing goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the vendor, and follow good laboratory practice.**
- ✓ **Do not use solvents with an auto-ignition temperature below 200 °C (392 °F). Do not use solvents with a boiling point below 56 °C (133 °F).**
- ✓ **Avoid high vapor concentrations. Keep the solvent temperature at least 40 K below the boiling point of the solvent used. This includes the solvent temperature in the sample compartment. For the solvents methanol and ethanol keep the solvent temperature at least 25 K below the boiling point.**
- ✓ **Do not operate the instrument in an explosive atmosphere.**
- ✓ **Do not use solvents of ignition Class IIC according IEC 60079-20-1 (for example, carbon disulfide).**
- ✓ **Reduce the volume of substances to the minimum required for the analysis.**
- ✓ **Never exceed the maximum permissible volume of solvents (8 L) in the solvent cabinet. Do not use bottles that exceed the maximum permissible volume as specified in the usage guideline for solvent cabinet.**
- ✓ **Ground the waste container.**
- ✓ **Regularly check the filling level of the waste container. The residual free volume in the waste container must be large enough to collect the waste liquid.**
- ✓ **To achieve maximal safety, regularly check the tubing for correct installation.**

NOTE

For details, see the usage guideline for the solvent cabinet. A printed copy of the guideline has been shipped with the solvent cabinet, electronic copies are available in the Agilent Information Center or via the Internet.

Safety Symbols

Table 14 Symbols

	The apparatus is marked with this symbol when the user shall 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.
	Sample Cooler unit is designed as vapor-compression refrigeration system. Contains fluorinated greenhouse gas (refrigerant) according to the Kyoto protocol. For specifications of refrigerant, charge capacity, carbon dioxide equivalent (CDE), and global warming potential (GWP) see instrument label.
	Flammable Material For Sample Thermostat which uses flammable refrigerant consult Agilent Information Center / User Manual before attempting to install or service this equipment. All safety precautions must be followed.
	Confirms that a manufactured product complies with all applicable European Community directives. The European Declaration of Conformity is available at: **http://regulations.corporate.agilent.com/DoC/search.htm**
	Manufacturing date.
	Power symbol indicates On/Off. The apparatus is not completely disconnected from the mains supply when the power switch is in the Off position
	Pacemaker Magnets could affect the functioning of pacemakers and implanted heart defibrillators. A pacemaker could switch into test mode and cause illness. A heart defibrillator may stop working. If you wear these devices keep at least 55 mm distance to magnets. Warn others who wear these devices from getting too close to magnets.

Table 14 Symbols

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

WARNING

A WARNING

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

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

CAUTION

A CAUTION

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

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

Waste Electrical and Electronic Equipment (WEEE) Directive

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

NOTE

Do not dispose of in domestic household waste

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

Radio Interference

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

Test and Measurement

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

Sound Emission

Manufacturer's Declaration

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

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

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

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http://www.agilent.com

In This Book

This manual contains technical reference information about the Agilent 1290 Infinity II Preparative Open-Bed Fraction Collector (G7159B). The manual describes the following:

- introduction,
- requirements and specifications,
- using the fraction collector,
- optimizing,
- troubleshooting and diagnostics,
- errors,
- test functions,
- maintenance,
- parts and materials,
- hardware information,
- safety and related information.

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