



Agilent 1290 Infinity Thermo-statted Column Compartment

User Manual



Agilent Technologies

Notices

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

In This Guide...

This manual covers the Agilent 1290 Infinity Thermostatted Column Compartment (TCC) (G1316C).

1 Introduction to the Column Compartment

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

2 Site Requirements and Specifications

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

3 Installing the Module

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

4 How to optimize the Column Compartment

This chapter provides information on how to optimize the thermostatted column compartment.

5 Troubleshooting and Diagnostics

Overview about the troubleshooting and diagnostic features.

6 Error Information

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

7 Test Functions and Calibrations

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

In This Guide...

8 Maintenance

This chapter describes the maintenance tasks for the TCC. If the instrument needs repair please contact your Agilent service representative.

9 Parts and Materials for Maintenance

This chapter provides information on parts for maintenance.

10 Identifying Cables

This chapter summarizes information on all cables.

11 Hardware Information

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

12 Appendix

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

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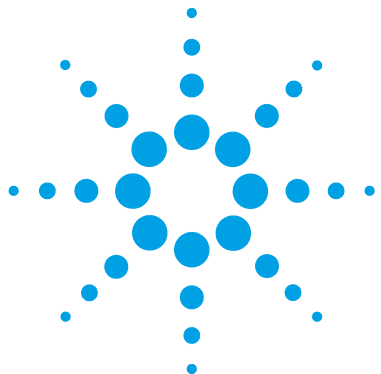
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This chapter gives an introduction to the TCC and an instrument overview.



Overview of the Module

The Agilent 1290 Infinity Thermostatted Column Compartment is a stackable temperature-controlled column compartment for LC. It is available as standalone module or as a component of an Agilent 1290 Infinity system. It is used for heating and cooling to meet extreme requirements of retention time reproducibility.

The main features of the 1290 Infinity Thermostatted Column Compartment are:

- Peltier heating and cooling from 10 degrees below ambient up to 100 °C with high heating and cooling speeds for maximum application flexibility and stability,
- holds up to three 30 cm columns,
- optimized design gives minimum dead volumes and maximum efficiency,
- two independently programmable heat exchangers contribute volumes of only 3 and 6 μl ,
- additional heating devices for low flow rates, which reduce the risk of additional dispersion,
- it can be supplemented by a kit to install a small heat exchanger with 1.6 μl delay volume to reduce the delay volume.
- electronic column-identification as standard for GLP documentation of column type, and major column parameters,
- optional high-quality Quick-Change Valve Heads.

For specifications, see “[Performance Specifications](#)” on page 28.

System Overview

The Concept of Heating and Cooling

The design of this thermostatted column compartment uses column heating and cooling devices with Peltier elements. The solvent entering the column compartment is heated up or cooled down to a settable temperature with two low-volume heat exchangers (3 μl on left side, 6 μl on right side), made of a short piece of capillary 0.17 mm i.d. leading through a heat exchanger. The heat exchanger is designed such that it can function simultaneously as an air heater. The shape of the heat exchanger surface allows the area around the column to be kept at a similar temperature level as the liquid running through the column. This is done by thermal convection and radiation between the heat exchanger fins. This design ensures that the column and the solvent flowing through it are almost at the same temperature.

Actual temperature control is accomplished at the heat exchanger. The solvent cools down or heats up on its transfer from the heating block to the column inlet. This depends on several factors: flow rate, setpoint temperature, ambient temperature and column dimensions.

In a flow-through temperature regulation system, there are necessarily slightly different temperatures at different positions. If, for example, the temperature set by the user is 40 °C, then the heat exchanger is regulated to a temperature of 40.8 °C which is different by a certain offset (here 0.8 °C). The solvent temperature at the column entry would be about 39 °C.

The actual temperature displayed on the user interface is always the derived temperature taken at the heat exchanger, corrected by the offset explained above.

Any type of heated column compartment brings one important consequence for column temperature equilibration. Before an equilibrium is reached, the whole mass of column, column packing, and solvent volume inside the column has to be brought to the selected temperature. This depends on several factors: flow rate, setpoint temperature, ambient temperature and column dimensions. The higher the flow rate, the faster the column equilibrates (due to thermostatted mobile phase).

1 Introduction to the Column Compartment System Overview

Figure 1 on page 12 shows a setpoint temperature of 40 °C. Some time after entering the setpoint the heat exchanger has reached its temperature and the control activity starts. The **TEMPERATURE NOT READY** signal will be cancelled 20 seconds after the sensed temperature was within a range of ± 0.5 °C of the setpoint (other values can be set via the user interface). However this does not necessarily mean that the column has already reached the correct temperature. The equilibration of the column may take longer. Stability of the pressure signal is a good indication for equilibrium.

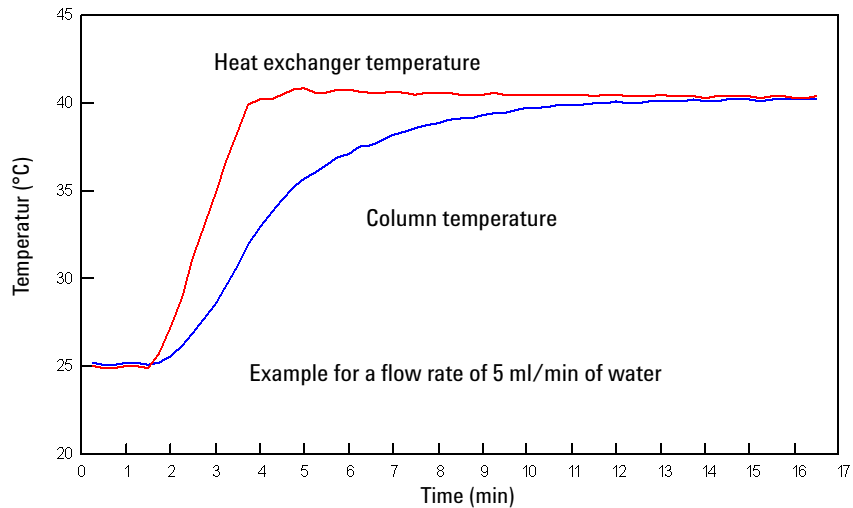


Figure 1 Equilibration of Heat Exchanger and Column Temperature

The temperature calibration and verification is described in the Service Manual.

Column-Identification System

The Agilent 1290 Infinity Thermostatted Column Compartment is equipped with a column-identification system. It allows to read and write column-specific information to and from an optionally available column-identification tag (part of the HPLC-starter-kits available for 1220, 1260 and 1290 Infinity pumps or separately as PN 5062-8588).

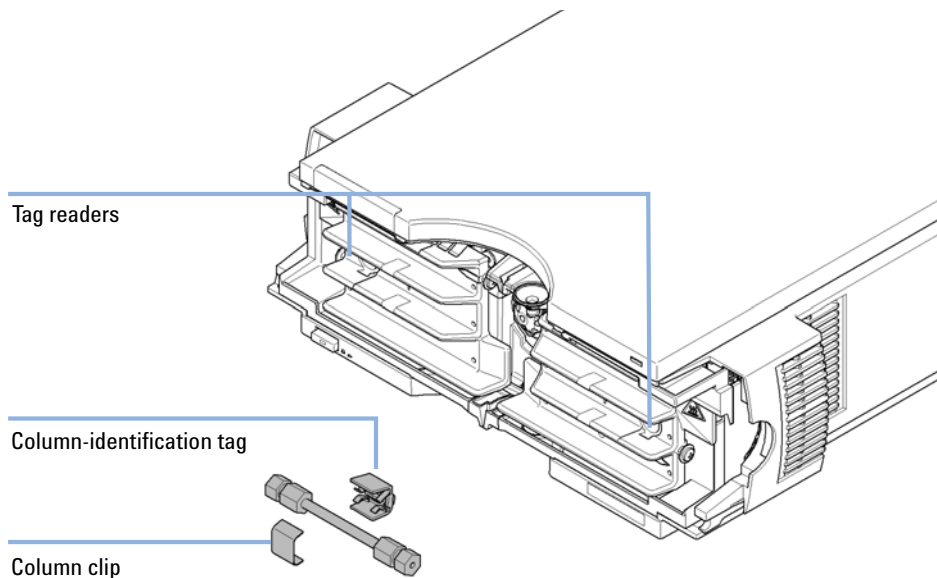


Figure 2 Column-Identification System

[Table 1](#) on page 14 shows the information that can be stored. The information fields can be edited via the user interface.

Table 1 Column-Identification Module Information

Item	Example	Comment
Product number	799160D-552	
Serial number	950522	Date of manufacturing
Batch number	1675	
Geometry	100 mm × 2.1 mm	
Stationary phase	ODS Hypersil	
Particle size	10 µm	
Number of injections	1267	See below.
Maximum pressure allowed	400 bar	
Maximum temperature recommended	70 °C	
Maximum pH recommended	12	
Column void volume		

The number of injections will be updated each run to create a column lifecycle (history). The user interface allows to edit all information.

If a 2 Position/6 Port valve and 2 Position/10 Port valve (see “[Column Switching Valve \(Optional\)](#)” on page 15) is installed in the module, the update of the number of injections depends on the position of the column switching valve. If the valve connects the left column to the flow path, the left but not the right column tag is updated (and vice versa). If no column switching valve is installed, both sides are updated at the same time. If an 8 Position/9 Port valve is installed, no tag is updated for avoiding ambiguity as more than 2 columns might be installed.

Column Switching Valve (Optional)

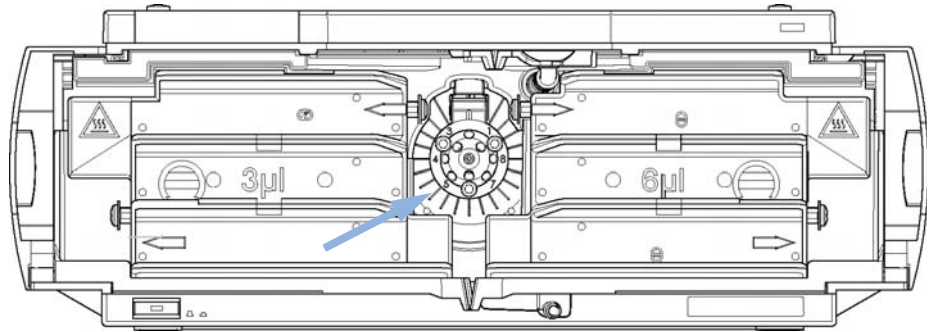


Figure 3 Location of Column Switching Valve

1 Introduction to the Column Compartment

Column Switching Valve (Optional)

Two Column Selection

The valve can select either column 1 or column 2. The offline column is sealed by connecting head to tail. Switching should be done when the flow is off and the pressure is zero.

NOTE

Before switching the valve, switch off the pump or set the flow to zero. Keeping the flow on while the valve is switched can cause exceeding the maximum pressure. This will stop method or sequence execution.

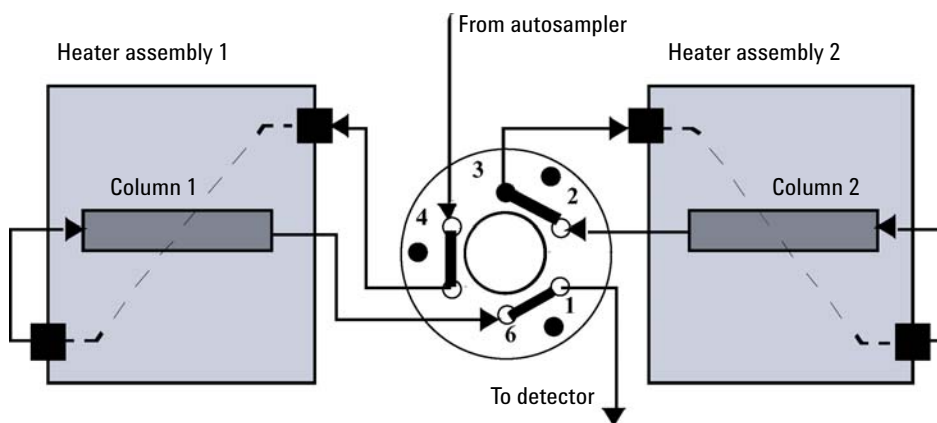


Figure 4 Column 1 Active

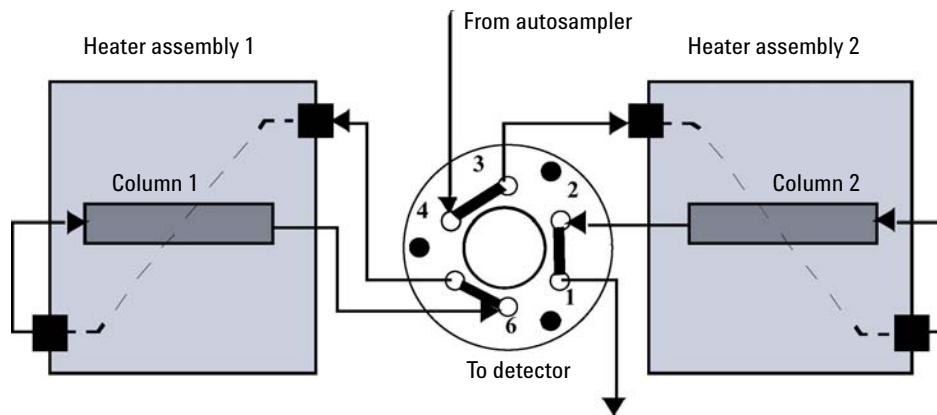


Figure 5 Column 2 Active

Precolumn Back-flushing

The sample is injected into series-connected precolumn and analytical column. After the valve has switched, the analytical column flow continues in normal direction. Only the precolumn is back-flushed, eluting highly retained peaks directly to the detector.

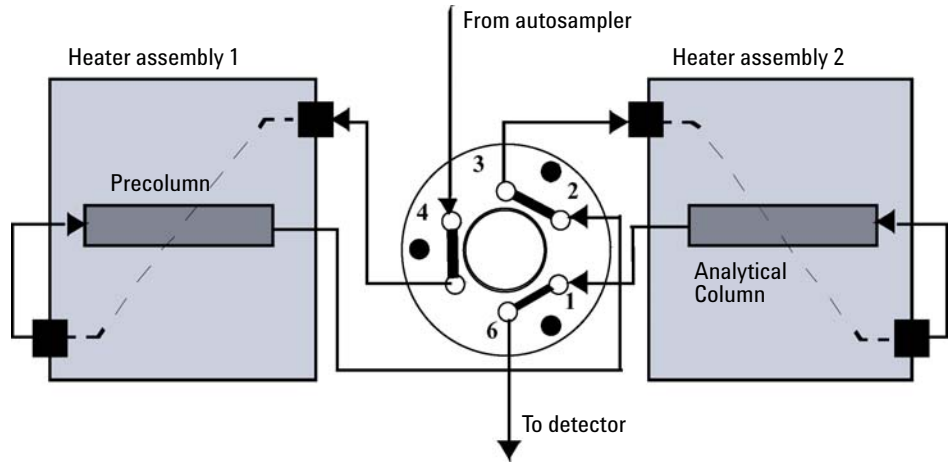


Figure 6 Precolumn Back-flushing

Typical Applications

Dual column selection

2pos/6port valve (G4231A/B) and 2pos/10port valve (G4232A/B/C)

Advantages:

- Increase productivity
- Higher instrument up-time
- Faster method scouting

Quickly change between two different stationary phases to check your separation selectivity, or use two identical stationary phases to have the second column immediately available after the first one loses efficiency, for example with complex matrices.

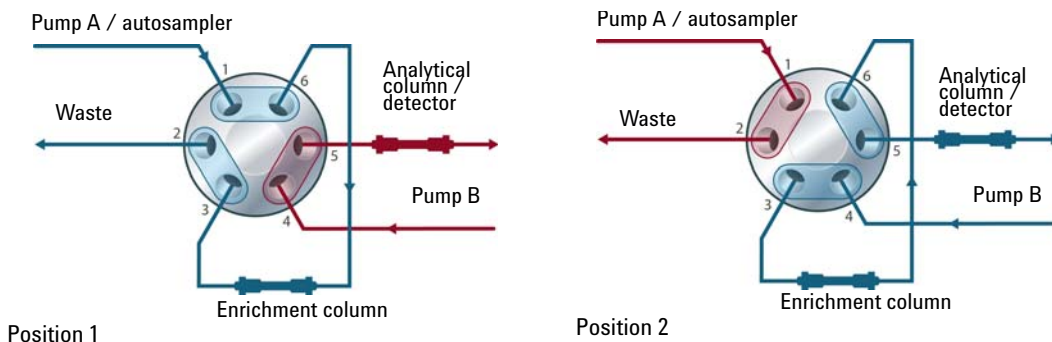
Sample Enrichment and Sample Cleanup

2pos/6port valve (G4231A/B) and 2pos/10port valve (G4232A/B/C)

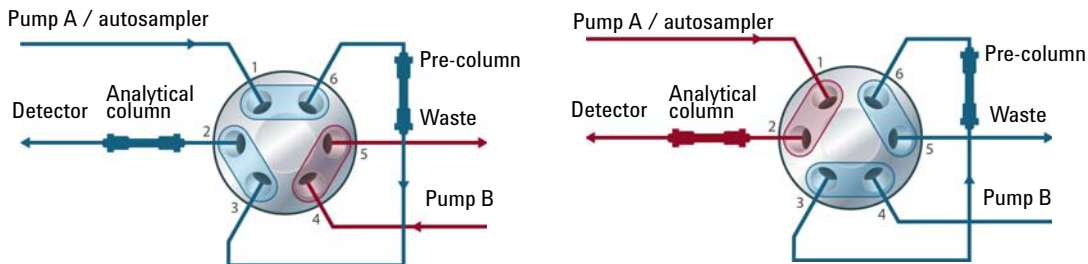
Advantages:

- Easy automation of sample preparation
- Higher reproducibility
- Increased productivity and sensitivity

Sample Enrichment



Sample Cleanup



Position 1

Position 2

Sample cleanup is essential for samples with complex matrices, such as biological fluids, food extracts and waste water. Before injection into a LC or LC/MS system, the sample matrix must be separated from the analytes of interest. Otherwise, contaminants can disrupt separation and detection or even damage the analytical column.

Enrichment methods

Enrichment methods are the technique of choice to obtain highest sensitivity and to remove the sample matrix in such applications as proteomics, drug metabolism and environmental trace analysis. The analytes are retained and concentrated onto the pre-column, while the sample matrix is passed to waste. After the valve switch, a second pump backflushes the analytes out of the pre-column onto the separation column. This allows injection of large volumes onto the pre-column, significantly expanding sensitivity in the range of ten to several thousands.

Stripping methods

Stripping methods handle analytes and matrices in the opposite way to enrichment methods. Matrix components are retained on the pre-column while the analytes pass through to the separation column. After the valve switches, an additional pump backflushes the matrix components out of the pre-column to waste, while the analytes are separated on the main column. Backflushing prepares the pre-column for the next injection.

Alternating Column Regeneration

Only 2pos/10port valve (G4232A/B/C)

Advantages:

- High sample throughput
- Increased productivity
- High efficiency

Alternating column regeneration is a convenient way to increase the sample throughput. The Agilent 1200 Infinity Series 2 position/ 10 port valves can be used to increase the efficiency in laboratories running large amounts of samples. Gradient elution is a common technique for separation of complex samples in liquid chromatography, which requires column regeneration before the subsequent run is started. Using alternating column regeneration valuable time for the analysis is saved. Core of the alternating column regeneration is the Agilent 1200 Infinity Series 2 position / 10 port valves, which allows simultaneous analysis on one column while a second identical column is flushed and equilibrated.

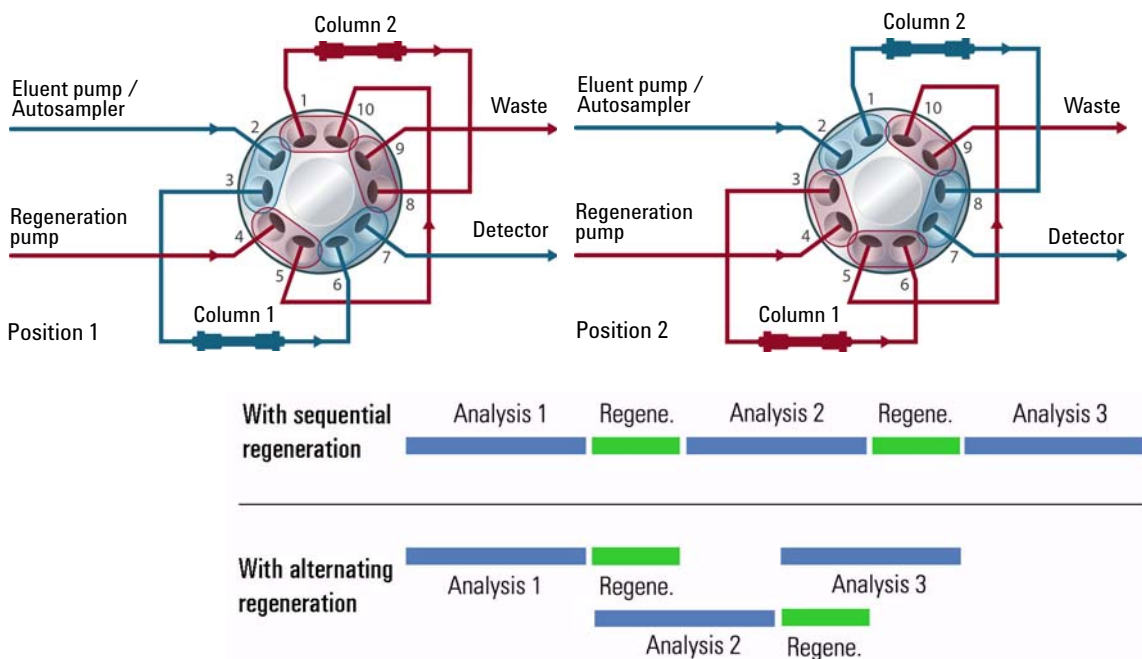


Figure 7 Alternate Column Regeneration (Time Scheme)

Bio-inert Materials

For the Agilent 1260 Infinity Bio-inert LC system, Agilent Technologies uses highest quality materials in the flow path (also referred to as wetted parts), which are widely accepted by life scientists, as they are known for optimum inertness to biological samples and ensure best compatibility with common samples and solvents over a wide pH range. Explicitly, the complete flow path is free of stainless steel and free of other alloys containing metals such as iron, nickel, cobalt, chromium, molybdenum or copper, which can interfere with biological samples. The flow downstream of the sample introduction contains no metals whatsoever.

Table 2 Bio-inert materials used in Agilent 1260 Infinity Systems

Module	Materials
Agilent 1260 Infinity Bio-inert Quaternary Pump (G5611A)	Titanium, gold, platinum-iridium, ceramic, ruby, PTFE, PEEK
Agilent 1260 Infinity Bio-inert High-Performance Autosampler (G5667A)	Upstream of sample introduction: <ul style="list-style-type: none"> • Titanium, gold, PTFE, PEEK, ceramic Downstream of sample introduction: <ul style="list-style-type: none"> • PEEK, ceramic
Agilent 1260 Infinity Bio-inert Manual Injector (G5628A)	PEEK, ceramic
Agilent 1260 Infinity Bio-inert Analytical Fraction Collector (G5664A)	PEEK, ceramic, PTFE
Bio-inert Flow Cells:	
Standard flow cell bio-inert, 10 mm, 13 μ L, 120 bar (12 MPa) for MWD/DAD, includes Capillary Kit Flow Cells BIO (p/n G5615-68755) (G5615-60022) (for Agilent 1260 Infinity Diode Array Detectors DAD G1315C/D)	PEEK, ceramic, sapphire, PTFE
Max-Light Cartridge Cell Bio-inert (10 mm, V(s) 1.0 μ L) (G5615-60018) and Max-Light Cartridge Cell Bio-inert (60 mm, V(s) 4.0 μ L) (G5615-60017) (for Agilent 1200 Infinity Series Diode Array Detectors DAD G4212A/B)	PEEK, fused silica
Bio-inert flow cell, 8 μ L, 20 bar (pH 1–12) includes Capillary Kit Flow Cells BIO (p/n G5615-68755) (G5615-60005) (for Agilent 1260 Infinity Fluorescence Detector FLD G1321B)	PEEK, fused silica, PTFE

1 Introduction to the Column Compartment

Bio-inert Materials

Table 2 Bio-inert materials used in Agilent 1260 Infinity Systems

Module	Materials
Bio-inert heat-exchanger G5616-60050 (for Agilent 1290 Infinity Thermostatted Column Compartment G1316C)	PEEK (steel-cladded)
Bio-inert Valve heads	G4235A, G5631A, G5639A: PEEK, ceramic (Al ₂ O ₃ based)
Bio-inert Connection capillaries	Upstream of sample introduction: <ul style="list-style-type: none">• Titanium Downstream of sample introduction: <ul style="list-style-type: none">• Agilent uses stainless-steel-cladded PEEK capillaries, which keep the flow path free of steel and provide pressure stability to more than 600 bar.

NOTE

To ensure optimum bio-compatibility of your Agilent 1260 Infinity Bio-inert LC system, do not include non-inert standard modules or parts to the flow path. Do not use any parts that are not labeled as Agilent “Bio-inert”. For solvent compatibility of these materials, see [“Solvent information for parts of the 1260 Infinity Bio-inert LC system”](#) on page 36.



2 Site Requirements and Specifications

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



Site Requirements

Power Considerations

The module power supply has wide ranging capability. It accepts any line voltage in the range described in [Table 3](#) on page 27. Consequently there is no voltage selector in the rear of the module. There are also no externally accessible fuses, because automatic electronic fuses are implemented in the power supply.

WARNING

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

→ Connect your instrument to the specified line voltage only.

WARNING

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

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

→ Always unplug the power cable before opening the cover.

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

CAUTION

Inaccessible power plug.

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

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

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

Power Cords

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

WARNING

Absence of ground connection or use of unspecified power cord

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

- Never operate your instrumentation from a power outlet that has no ground connection.
 - Never use a power cord other than the Agilent Technologies power cord designed for your region.
-

WARNING

Use of unsupplied cables

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

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

WARNING

Unintended use of supplied power cords

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

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

Bench Space

The module dimensions and weight (see [Table 3](#) on page 27) 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 will damage the system electronics.

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

Physical Specifications

Table 3 Physical Specifications

Type	Specification	Comments
Weight	11.2 kg (22 lbs)	
Dimensions (height × width × depth)	140 x 345 x 435 mm (5.5 x 13.5 x 17 inches)	
Line voltage	100 – 240 VAC, ± 10 %	Wide-ranging capability
Line frequency	50 or 60 Hz, ± 5 %	
Power consumption	320 VA / 150W / 512 BTU	Maximum
Ambient operating temperature	0–55 °C (32–131 °F)	
Ambient non-operating temperature	-40 – 70 °C (-40 – 158 °F)	
Humidity	< 95 % r.h. at 40 °C (104 °F)	Non-condensing
Operating altitude	Up to 2000 m (6562 ft)	
Non-operating altitude	Up to 4600 m (15091 ft)	For storing the module
Safety standards: IEC, CSA, UL	Installation category II, Pollution degree 2	For indoor use only.

Performance Specifications

Table 4 Performance Specifications Thermostatted Column Compartment

Type	Specification	Comments
Temperature range	10 degrees below ambient to 100 °C up to 80 °C: flow rates up to 5 ml/min up to 100 °C: flow rates up to 2.5 ml/min	
Temperature stability	± 0.05 °C	
Temperature accuracy	± 0.8 °C ± 0.5 °C	With calibration
Column capacity	Three 30 cm	
Warm-up/cool-down time	5 min from ambient to 40 °C 10 min from 40 – 20 °C	
Dead volume	1.6 µl low dispersion heat exchanger 3 µl left heat exchanger 6 µl right heat exchanger	i.d. 0.12 mm (capillary kit available) i.d. 0.17 mm (standard)
Communications	Controller-area network (CAN), RS-232C, APG Remote: ready, start, stop and shut-down signals, LAN via other modules	
Safety and maintenance	Extensive support for troubleshooting and maintenance is provided by the Instant Pilot, Agilent Lab Advisor, and the Chromatography Data System. Safety-related features are leak detection, safe leak handling, leak output signal for shutdown of pumping system, and low voltages in major maintenance areas.	
GLP features	Column-identification module for GLP documentation of column type	
Housing	All materials recyclable.	

NOTE

All specifications are valid for distilled water at ambient temperature (25 °C), set point at 40 °C and a flow range from 0.2–5 ml/min.

Valve Specifications

Table 5 G4230A Method Dev. Valve Kit, 8 Pos. / 9 port, 600 bar

Type	Specification
Liquid contacts	PEEK, Stainless Steel
Port size	Accepts 10 – 32 male threaded fittings
Flow passage diameters	Stator - 0.28 mm (0.011 in), Rotor Seal - 0.31 mm (0.012 in)
Port to Port Volume	2.21 µL
Maximum pressure	600 bar
Comments	Kit contains 2x 8 Pos. / 9 port, 600 bar valve heads

Table 6 G4230B Method Dev. Valve Kit, 8 Pos. / 9 port, 1200 bar

Type	Specification
Liquid contacts	Vespel, Stainless Steel
Port size	Accepts 10 – 32 male threaded fittings
Flow passage diameters	Stator - 0.28 mm (0.011 in), Rotor Seal - 0.31 mm (0.012 in))
Port to Port Volume	0.55 µL
Maximum pressure	1200 bar
Comments	Kit contains 1x 8 Pos. / 9 port, 1200 barr and 1 x 8 Pos. / 9 port , 600 bar valve head

Table 7 G4231A Agilent 1290 Series, 2 Position / 6 Port valve head, 600bar

Type	Specification
Liquid contacts	PEEK, Stainless Steel
Port size	Accepts 10-32 male threaded fittings
Flow passage diameters	Stator - 0.38 mm (0.015 in), Rotor Seal - 0.30 mm (0.012 in)
Port to Port Volume	0.51 µL
Maximum pressure	600 bar

2 Site Requirements and Specifications

Valve Specifications

Table 8 G4231B Agilent 1290 Series, 2 Position / 6 Port valve head, 1200bar

Type	Specification
Liquid contacts	Vespel, Stainless Steel
Port size	Accepts 10-32 male threaded fittings
Flow passage diameters	Stator - 0.38 mm (0.015 in), Rotor Seal- 0.30 mm (0.012 in)
Port to Port Volume	0.51 μ L
Maximum pressure	1200 bar

Table 9 G4232A Agilent 1290 Series, 2 Position / 10 Port micro valve head , 600bar

Type	Specification
Liquid contacts	PEEK, Stainless Steel
Port size	Accepts M4 male threaded fittings
Flow passage diameters	-0.20 mm (0.0108 in)
Port to Port Volume	89 nL
Maximum pressure	600 bar

Table 10 G4232B Agilent 1290 Series, 2 Position / 10 Port valve head, 1200bar

Type	Specification
Liquid contacts	Vespel, Stainless Steel
Port size	Accepts 10-32 male threaded fittings
Flow passage diameters	Stator - 0.15 mm (0.006 in), Rotor Seal - 0.20 mm (0.008 in)
Port to Port Volume	0.22 μ L
Maximum pressure	1200 bar

Table 11 G4232C Agilent 1290 Series, 2 Position / 10 Port valve head , 600bar

Type	Specification
Liquid contacts	PEEK, Stainless Steel
Port size	Accepts 10-32 male threaded fittings
Flow passage diameters	Stator - 0.15 mm (0.006 in), Rotor Seal- 0.20 mm (0.008 in)
Port to Port Volume	0.16 μ L
Maximum pressure	600 bar

Table 12 G4234A, 6 Column Selection Valve, 600bar

Type	Specification
Liquid contacts	PEEK, Stainless Steel
Port size	Accepts M4 male threaded fittings
Flow passage diameters	0.25 mm (0.010 in)
Port to Port Volume	0.51 μ L (pre-column volume) 1.28 μ L (post-column volume)
Maximum pressure	600 bar

Table 13 G4234B, 6 Column Selection Valve, 1200bar

Type	Specification
Liquid contacts	PEEK, Stainless Steel
Port size	Accepts M4 male threaded fittings
Flow passage diameters	0.25 mm (0.010 in)
Port to Port Volume	0.51 μ L (pre-column volume) 1.28 μ L (post-column volume)
Maximum pressure	1200 bar

2 Site Requirements and Specifications

Valve Specifications

Table 14 G4235A, Solvent Selection valve head (bio-inert), 200 bar

Type	Specification
Liquid contacts	PEEK
Port size	Accepts 10 – 32 male threaded fittings
Flow passage diameters	1.00 mm (0.040 in)
Port to Port Volume	16.4 μ L
Maximum pressure	200 bar

Table 15 G4236A, 2D-LC Valve Kit, 1200 bar

Type	Specification
Liquid contacts	Vespel
Port size	Accepts 10 – 32 male threaded fittings
Flow passage diameters	0.20 mm (0.008 in)
Port to Port Volume	0.27 μ L (via inner groove) 0.24 μ L (via outer groove)
Maximum pressure	1200 bar

Table 16 G5631A, Bio-inert 2pos/6port Valve Head

Type	Specification
Liquid contacts	PEEK, Ceramic
Port size	Accepts 10 – 32 male threaded fittings
Flow passage diameters	0.38 mm (0.015 in) Stator 0.30 mm (0.012 in) Rotor Seal
Port to Port Volume	1.71 μ L
Maximum pressure	600 bar

Table 17 G5632A, Bio-inert 2pos/10port Valve Head

Type	Specification
Liquid contacts	PEEK, Ceramic
Port size	Accepts 10 – 32 male threaded fittings
Flow passage diameters	0.38 mm (0.015 in) Stator 0.30 mm (0.012 in) Rotor Seal
Port to Port Volume	1.71 μ L
Maximum pressure	600 bar

Table 18 G5639A, Bio-inert 4 Column Selector

Type	Specification
Liquid contacts	PEEK, Ceramic
Port size	Accepts 10 – 32 male threaded fittings
Flow passage diameters	0.25 mm (0.010 in)
Port to Port Volume	0.51 μ L (pre.column volume) 1.33 μ L (post.column volume)
Maximum pressure	600 bar

Extended Specifications on G1316C

The 1290 Infinity Thermostatted Column Compartment (G1316C) is usable from 10 °C below ambient up to 80 °C for flow ranges up to 5 ml/min and up to 100 °C for flow ranges up to 2.5 ml/min. Additional heating devices are available for the G1316C to reduce the risk of additional dispersion at low flow rates, see [Figure 8](#) on page 34. These devices can be installed in any position in the column compartment, see “[Availability of heater devices](#)” on page 56.

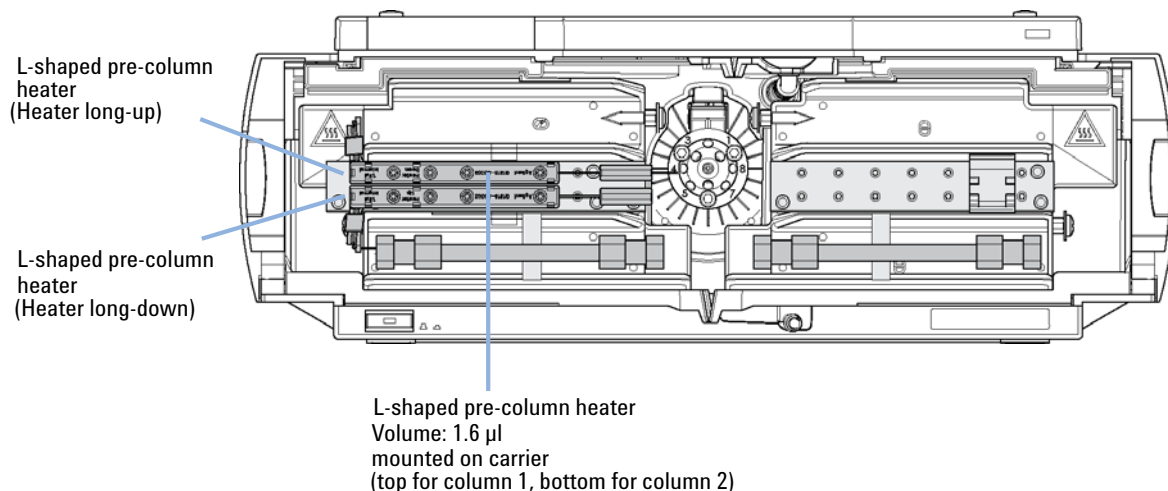


Figure 8 New additional heater devices

The standard column compartment is equipped with a 3 μ l and 6 μ l heater or cooler. Both can be set at the same or different temperature. To reduce the delay volume, a kit (“[Standard Accessory Kit](#)” on page 155) has been set up for installing a small heater with 1.6 μ l internal delay volume.

NOTE

If the additional heater devices are used as shown in [Figure 8](#) on page 34, the column identification system cannot be used. If the column identification system is required, fix the heater devices in the upper or lower locations or fix them right/left of the current location.

Solvent Information

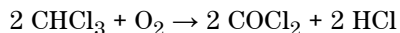
Observe the following recommendations on the use of solvents.

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

Solvent compatibility for stainless steel in standard LC systems

Stainless steel is inert against many common solvents. It is stable in the presence of acids and bases in the pH range specified for standard HPLC (pH 1 – 12.5). It can be corroded by acids below pH 2.3 . In general following solvents may cause corrosion and should be avoided with stainless steel:

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



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

- Chromatographic grade ethers, which can contain peroxides (for example, THF, dioxane, di-isopropylether) such ethers should be filtered through dry aluminium oxide which adsorbs the peroxides.

2 Site Requirements and Specifications

Solvent Information

- 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.

Solvent information for parts of the 1260 Infinity Bio-inert LC system

For the Agilent 1260 Infinity Bio-inert LC system, Agilent Technologies uses highest quality materials (see “[Bio-inert Materials](#)” on page 21) in the flow path (also referred to as wetted parts), which are widely accepted by life scientists, as they are known for optimum inertness to biological samples, and ensure best compatibility to common samples and solvents over a wide pH range. Explicitly, the complete flow path is free from stainless steel and free from other alloys containing metals such as iron, nickel, cobalt, chromium, molybdenum or copper, which can interfere with biological samples. The flow downstream of the sample introduction contains no metals whatsoever.

However, there are no materials that combine suitability for versatile HPLC instrumentation (valves, capillaries, springs, pump heads, flow cells etc.) with complete compatibility with all possible chemicals and application conditions. This section recommends the preferred solvents. Chemicals that are known to cause issues should be avoided, or exposure should be minimized, for example, for short-term cleaning procedures. After potentially aggressive chemicals have been used, the system should be flushed with compatible standard HPLC solvents.

PEEK

PEEK (Polyether-Ether Ketones) combines excellent properties with regard to biocompatibility, chemical resistance, mechanical and thermal stability and is therefore the material of choice for biochemical instrumentation. It is stable in the specified pH range, and inert to many common solvents. There is still a number of known incompatibilities with chemicals such as chloroform, methylene chloride, THF, DMSO, strong acids (nitric acid > 10 %, sulphuric acid > 10 %, sulfonic acids, trichloroacetic acid), halogenes or aqueous halogene solutions, phenol and derivatives (cresols, salicylic acid etc.).

When used above room temperature, PEEK is sensitive to bases and various organic solvents, which can cause it to swell. As normal PEEK capillaries are very sensitive to high pressure, especially under such conditions, Agilent uses stainless-steel clad PEEK capillaries to keep the flow path free of steel and to ensure pressure stability to at least 600 bar. If in doubt, consult the available literature about the chemical compatibility of PEEK.

Titanium

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. Reducing 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 $\mu\text{m}/\text{year}$. At room temperature, titanium is resistant to concentrations of about 5 % sulfuric acid (about pH 0.3). The addition of nitric acid to hydrochloric or sulfuric acids significantly reduces corrosion rates. 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 %.

Fused silica

Fused silica is inert against all common solvents and acids except hydrofluoric acid. 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 (a mixture of concentrated hydrochloric and nitric acid).

Zirconium Oxide

Zirconium Oxide (ZrO_2) 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.

PTFE

PTFE (polytetrafluorethen) is inert to almost all common acids, bases and solvents. There are no documented incompatibilities for HPLC applications.

Sapphire, Ruby and Al₂O₃-based ceramics

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

Data above were collected from external resources and are meant as a reference. Agilent cannot guarantee the completeness and correctness of such information. Information can also not be generalized due to catalytic effects of impurities like metal ions, complexing agents, oxygen etc. Most data available refers to room temperature (typically 20 – 25 °C, 68 – 77 °F). If corrosion is possible, it usually increases at higher temperatures. If in doubt, consult additional resources.



3 Installing the Module

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



Unpacking the module

Damage to the module

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

CAUTION

"Defective on arrival" problems

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

- Notify your Agilent sales and service office about the damage.
- An Agilent service representative will inspect the instrument at your site and initiate appropriate actions.

Delivery Checklist

Table 19 Column Compartment Delivery Checklist

Description	Quantity
Thermostatted column compartment	1
Power cable	1
CAN cable	1
Column switching valve	optional
User Manual (on User Documentation DVD)	1
Accessory kit (see "Accessory Kits" on page 155)	1

Optimizing the Stack Configuration

If your column compartment is part of an Agilent 1290 Infinity system, you can ensure optimum performance by installing the following configuration. This configuration optimizes the system flow path, ensuring minimum delay volume.

For installations of the G1316C as part of the Method Development Solution, please refer to the Agilent 1200 Infinity Series Method Development System - System Manual (G4230-90002).

One Stack Configuration

Ensure optimum performance by installing the modules of the Agilent 1290 Infinity Binary LC System in the following configuration (See [Figure 9](#) on page 42 and [Figure 10](#) on page 43). This configuration optimizes the flow path for minimum delay volume and minimizes the bench space required.

The Agilent 1290 Infinity Binary Pump should always be installed at the bottom of the stack.

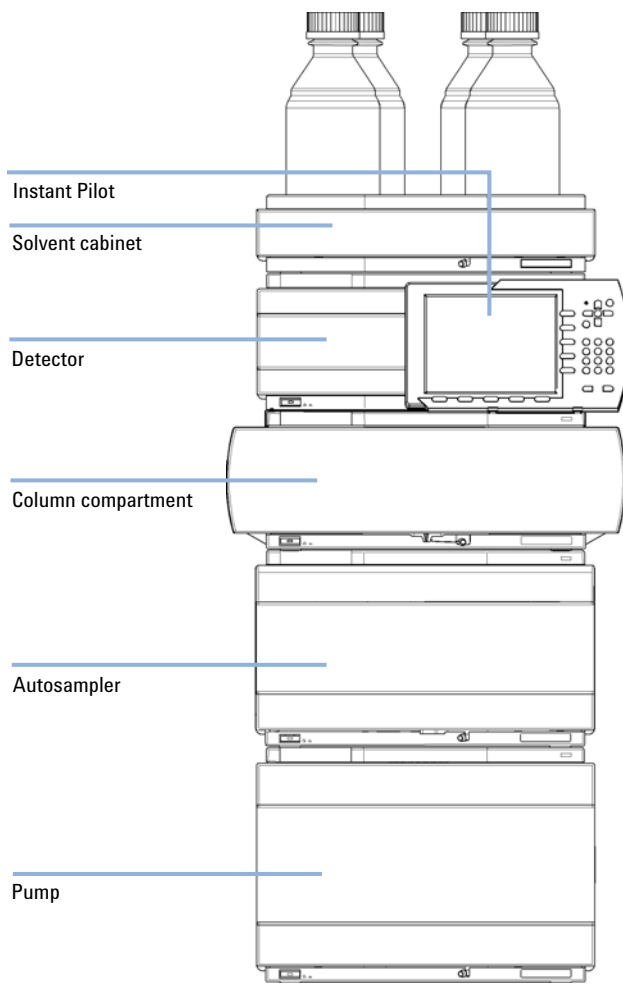


Figure 9 Recommended stack configuration for 1290 Infinity with binary pump (front view)

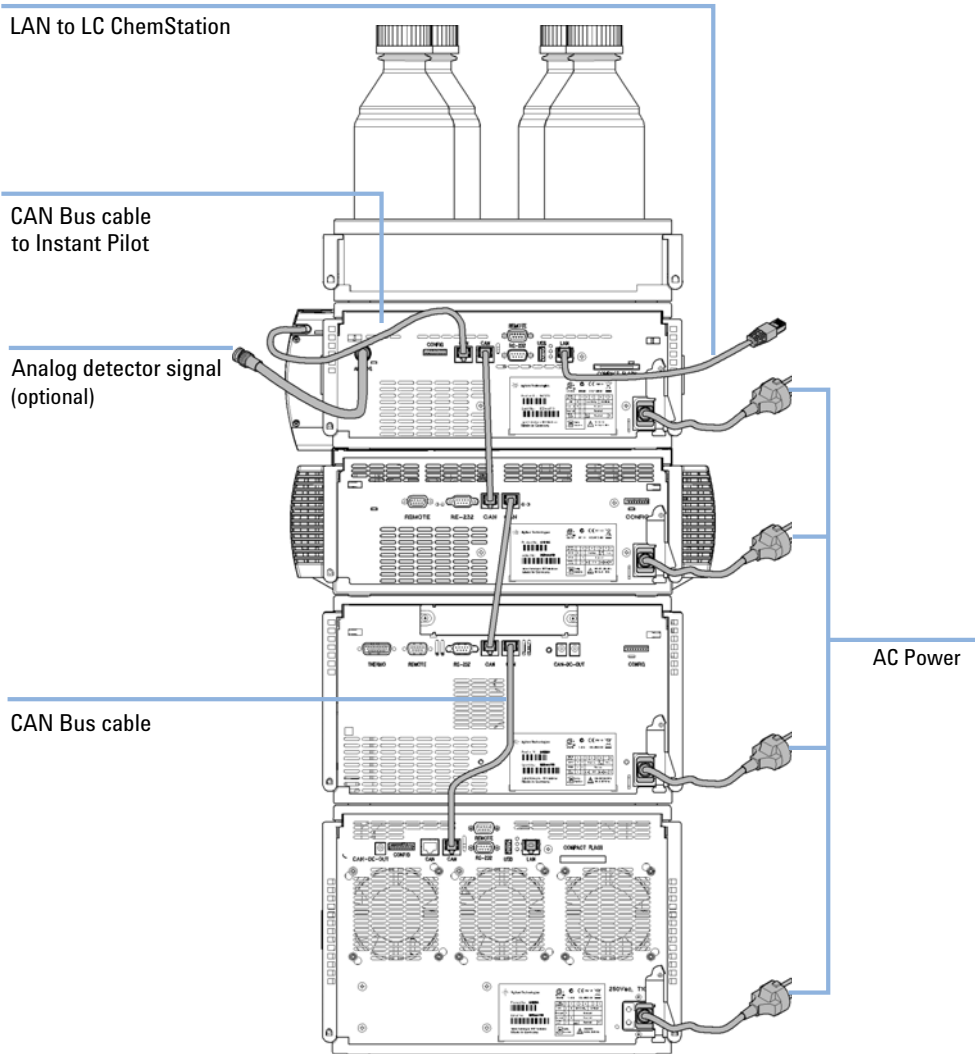


Figure 10 Recommended stack configuration 1290 Infinity with binary pump (rear view)

Two Stack Configuration

In case the autosampler thermostat is added to the system, a two-stack configuration is recommended, which places both heavy modules (1290 Infinity pump and thermostat) at the bottom of each stack and avoids high stacks. Some users prefer the lower height of this arrangement even without the autosampler thermostat. A slightly longer capillary is required between the pump and autosampler. (See [Figure 11](#) on page 44 and [Figure 12](#) on page 45).

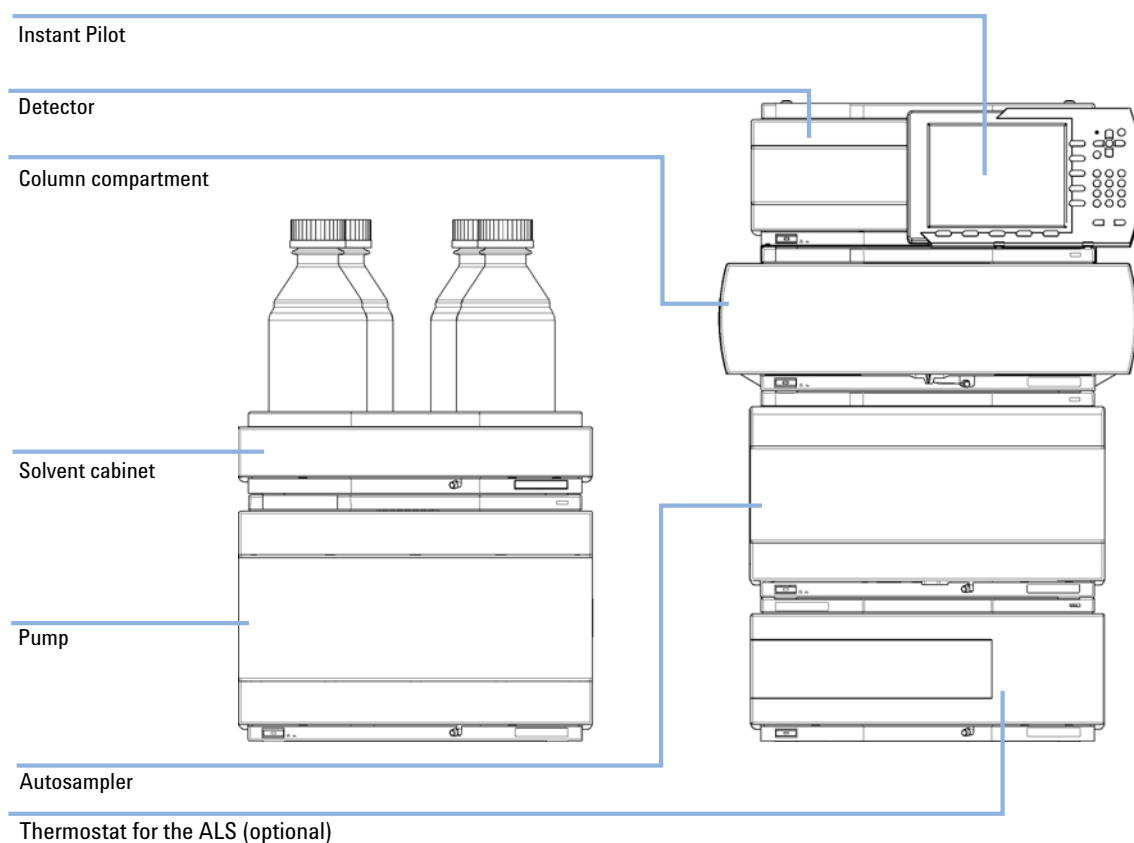


Figure 11 Recommended two stack configuration for 1290 Infinity with binary pump (front view)

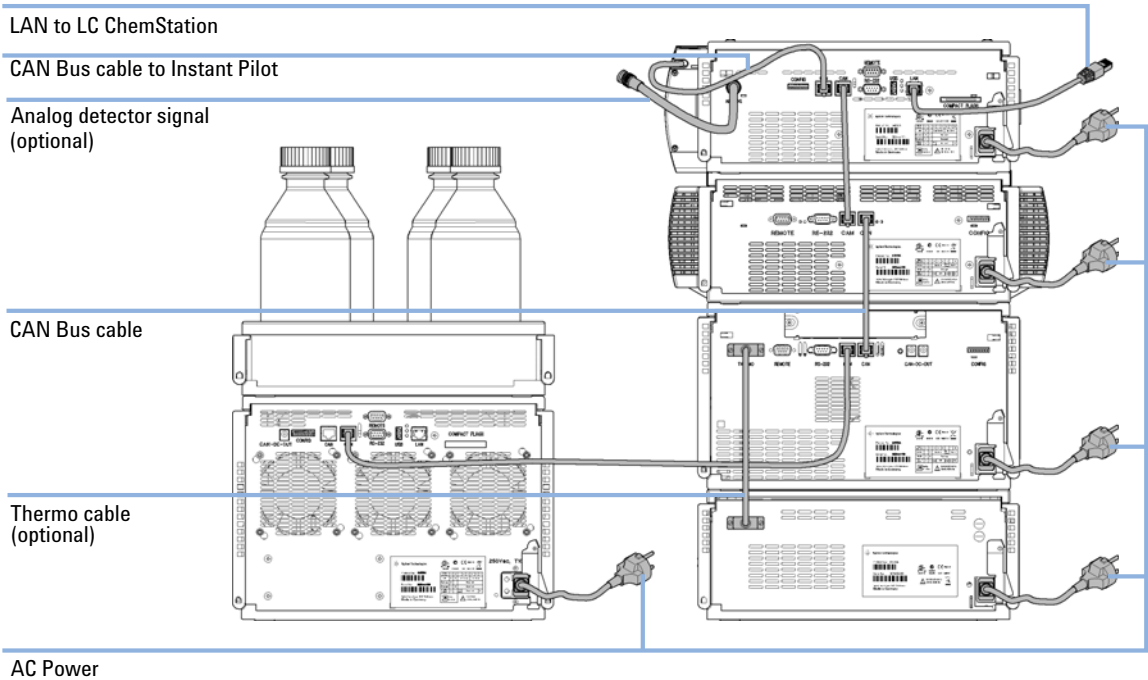


Figure 12 Recommended two stack configuration for 1290 Infinity with binary pump (rear view)

Installing the Column Compartment

Parts required	#	Description
	1	Column compartment
	1	Power cord, for other cables see text below

Preparations

- Locate bench space.
- Provide power connections.
- Unpack the column compartment.

CAUTION

"Defective on arrival" problems

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

- Notify your Agilent sales and service office about the damage.
- An Agilent service representative will inspect the instrument at your site and initiate appropriate actions.

CAUTION

The valve actuator contains sensitive optical parts, which need to be protected from dust and other pollutions. Pollution of these parts can impair the accurate selection of valve ports and therefore bias measurement results.

- Always install a valve head for operation and storage. For protecting the actuator, a dummy valve head (part of Transportation Lock Kit (G1316-67001)) can be used instead of a functional valve. Do not touch parts inside the actuator.

NOTE

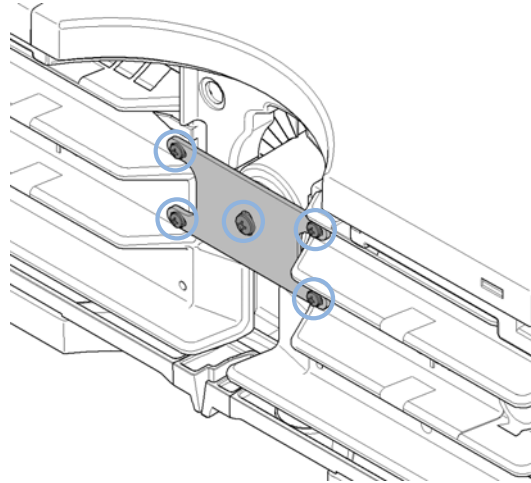
The tag reader reads the valve head properties from the valve head RFID tag during initialization of the module. Valve properties will not be updated, if the valve head is replaced while the module is on.

Selection of valve port positions can fail, if the instrument does not know the properties of the installed valve.

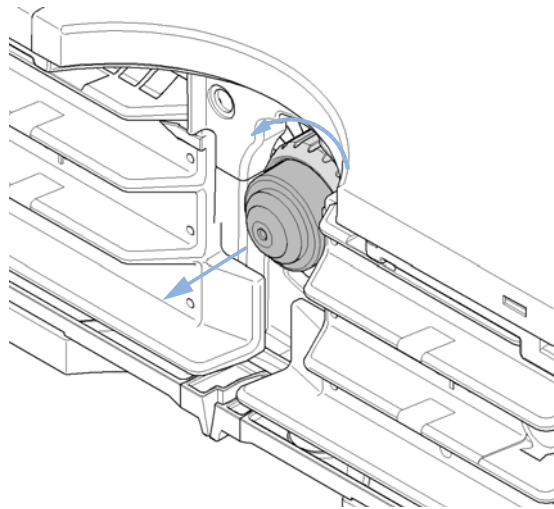
Always switch off the instrument when replacing the valve head.

If the Thermostatted Column Compartment includes the valve drive option, it is shipped with a transportation lock, which needs to be removed during installation.

- 1 Remove the 5 screws, which hold the lock in position.



- 2 Remove the dummy valve head by unscrewing the cap nut and removing it from the valve drive.



- 3 Place the module on the bench in a horizontal position.

3 Installing the Module

Installing the Column Compartment

- 4 Ensure the power switch at the front of the column compartment is OFF.

Status indicator
green/yellow/red

Line power switch
with green light

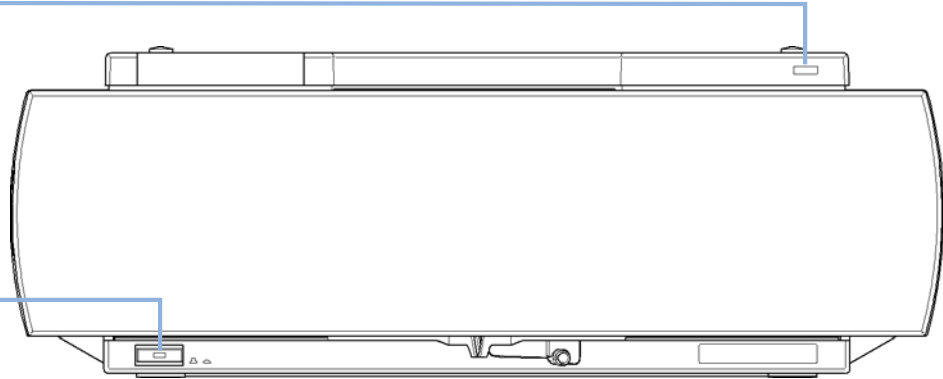


Figure 13 Front View of the Thermostatted Column Compartment

- 5 At the rear of the module move the security lever to its maximum right position.

NOTE

Modules with sheet metal kits manufactured after 2011 are delivered without security lever.

- 6 Connect the power cable to the power connector at the rear of the module. The security lever will prevent that the cover is opened while the power cord is connected to the module.

7 Connect the required interface cables to the rear of the module.

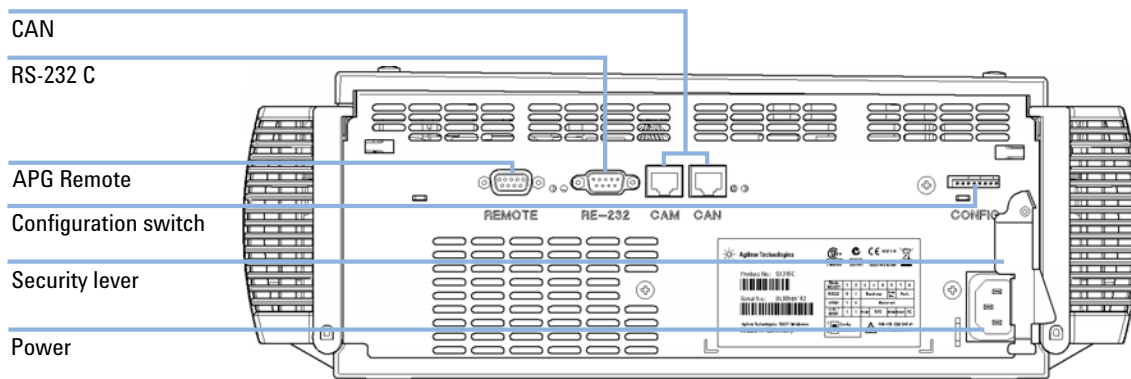


Figure 14 Rear view of the module

NOTE

Modules with sheet metal kits manufactured after 2011 are delivered without security lever.

- 8** If Agilent ChemStation is the controller, connect the LAN connection to the LAN interface in the detector.
- 9** Connect the APG remote cable (optional) for non-Agilent instruments.
- 10** Turn on the power by pushing the button at the lower left hand side of the module.

The power button stays pressed in and the status LED should be green.

NOTE

When the line power button stands out and the green light is off, the module is turned off.

NOTE

The module was shipped with default configuration settings. For changing these settings, refer to section *Setting the 8-bit configuration switch*.

Installing Valve Heads

Installing the Valve Heads

The valve drives are factory-installed in the 1290 Infinity Thermostatted Column Compartment , in the 1290 Infinity Flexible Cube, and in the 1290 Infinity Universal Valve Drive. The valve heads are interchangeable and can be easily mounted.

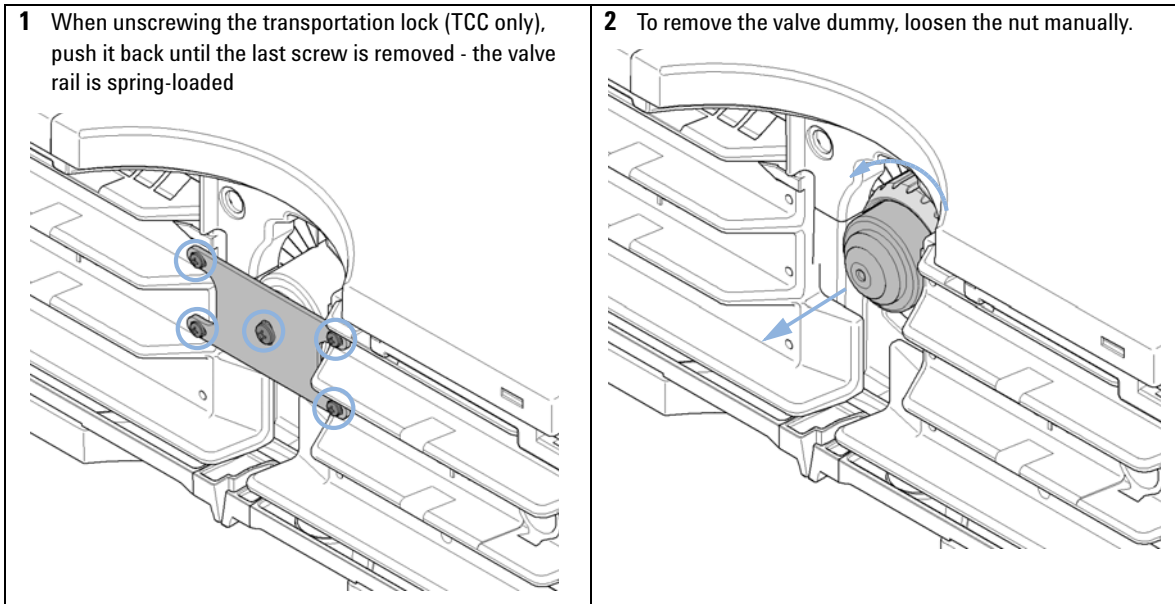
At the first installation, the transportation lock (TCC only) and the dummy valve have to be removed, see [“Removing the Transportation Lock and the Valve Dummy”](#) on page 51. The valve heads can be installed by mounting the valve heads onto the valve drives and fastening the nut manually (do not use any tools).

Be sure that the guide pin snaps into the groove of the valve drive thread. The valves are mounted on pull-out rails to allow easy installation of capillaries. Push the valve gently into its housing until it snaps into the inner position, push it again and it slides out. If all capillaries are installed, push the valve back into its housing, see [“Installing the Valve Head and Connecting Capillaries”](#) on page 52.

Removing the Transportation Lock and the Valve Dummy

The following procedure demonstrates the necessary steps for installing the valve head to the valve drive of a TCC.

For the installation of a valve head to a G1170A Infinity Valve Drive you can ignore the steps that describe the TCC features of the transportation lock and spring loaded valve drive.



Installing the Valve Head and Connecting Capillaries



For bio-inert modules use bio-inert parts only!

CAUTION

The valve actuator contains sensitive optical parts, which need to be protected from dust and other pollutions. Pollution of these parts can impair the accurate selection of valve ports and therefore bias measurement results.

- Always install a valve head for operation and storage. For protecting the actuator, a dummy valve head (part of Transportation Lock Kit (G1316-67001)) can be used instead of a functional valve. Do not touch parts inside the actuator.

CAUTION

Column Damage or Bias Measurement Results

Switching the valve to a wrong position can damage the column or bias measurement results.

- Fit the lobe to the groove to make sure the valve is switched to the correct position.

CAUTION

Valve Damage

Using a low pressure valve on the high pressure side can damage the valve.

- When using multiple column compartments as part of a method development solution, make sure that the high pressure valve head is connected to the autosampler and the low pressure valve head is connected to the detector.

CAUTION

Sample degradation and contamination of the instrument

Metal parts in the flow path can interact with the bio-molecules in the sample leading to sample degradation and contamination.

- For bio-inert applications, always use dedicated bio-inert parts, which can be identified by the bio-inert symbol or other markers described in this manual.
- Do not mix bio-inert and non-inert modules or parts in a bio-inert system.

NOTE

The tag reader reads the valve head properties from the valve head RFID tag during initialization of the module. Valve properties will not be updated, if the valve head is replaced while the module is on. Selection of valve port positions can fail, if the instrument does not know the properties of the installed valve.

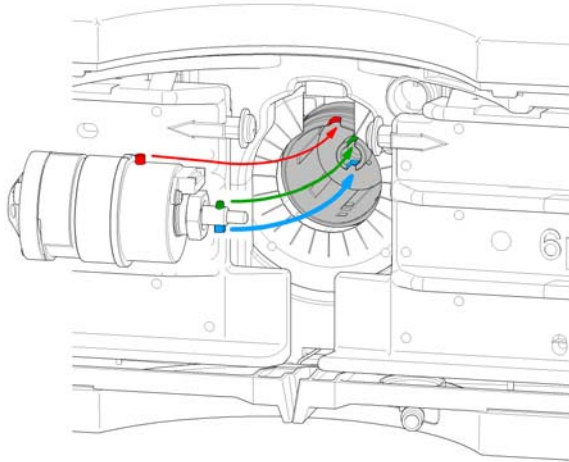
NOTE

To have the valve correctly recognized by the Agilent Infinity valve drive you must have the valve drive powered off for at least 10 s.

3 Installing the Module

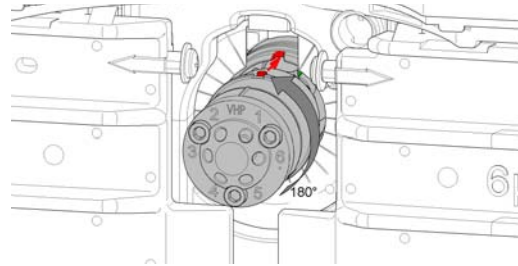
Installing Valve Heads

- 1** The two different pins (blue & green) on the valve shaft must fit into the corresponding grooves of the actuator axis. The outside pin (red) must fit into the outside groove.

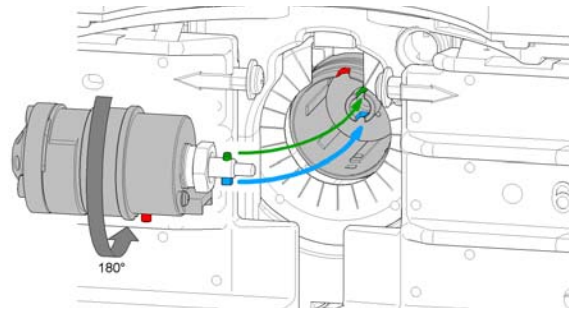


2

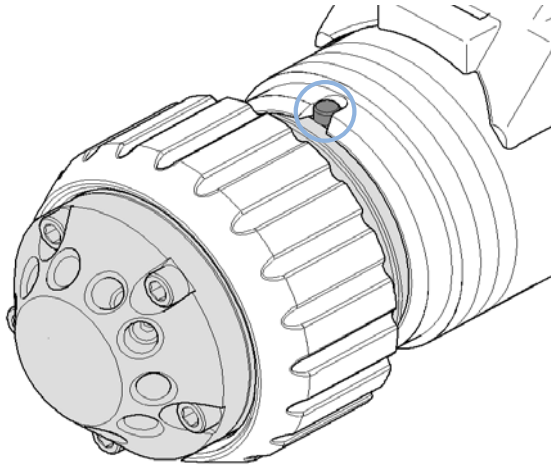
- a** It can be possible that you have to turn the valve head until the outside pin completely locks in. While turning the valve you should feel some resistance from the drive. Otherwise the pins on the valve shaft are not properly fitted into the corresponding adapters on the valve drive.



- b** It can be possible that you have to turn the valve head until the outside pin completely locks in. While turning the valve you should feel some resistance from the drive. Otherwise the pins on the valve shaft are not properly fitted into the corresponding adapters on the valve drive.



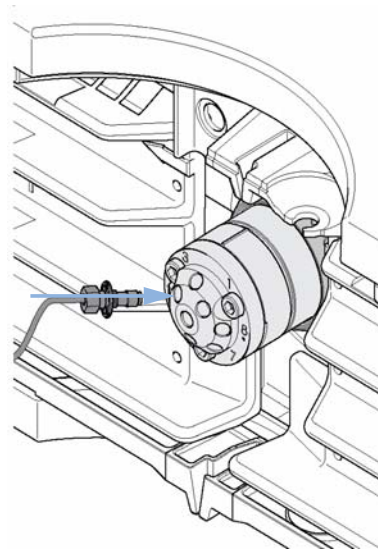
- 3 When the outer pin is locked into the groove, manually screw the nut onto the valve head.



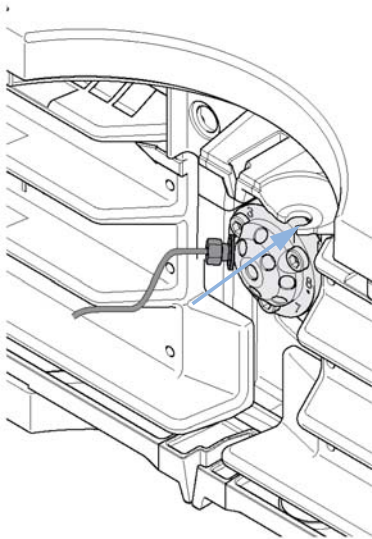
NOTE

Fasten the nut manually. Do not use any tools.

- 4 Install all required capillary connections to the valve.



- 5 Push the valve head until it snaps in and stays in the rear position. (TCC only)



- 6 Power on or power-cycle your module, so the valve head gets recognized during module initialization.

NOTE

Power Off the Infinity valve drive for at least 10 s.

Installation of Heater Devices

Availability of heater devices

Additional to the built-in heat exchangers, external heater devices with a small internal volume for low dispersion applications are available. The delivered low dispersion heat exchanger should always be used to minimize dispersion. It can be mounted in different locations. Additionally available valve kits will have as many additional low dispersion heat exchangers as columns are supported.

NOTE

Depending on the application, these heater devices can be fixed at various places. Information about the usage of these heater devices can be found in the Agilent 1290 Infinity LC System - System Manual and Quick Reference (G4220-90301).

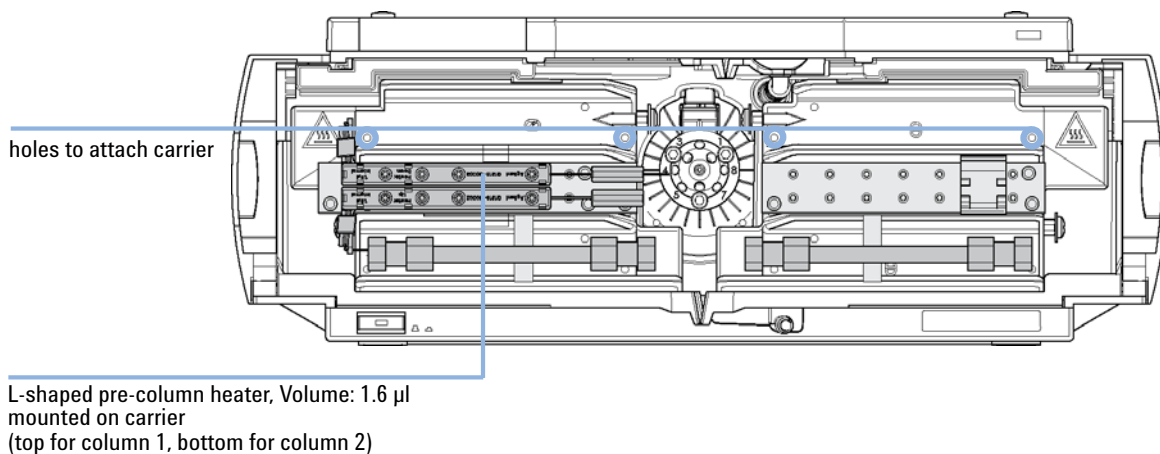


Figure 15 Installation points for heat exchanger

NOTE

If the additional heat exchangers are used as shown in this figure, the column identification system cannot be used. If the column identification system is required, fix the heater devices in the upper or lower locations or right/left of the current location.

Installation of Heater Devices

For the G1316C, an additional heat exchanger can be installed on the Carrier for heat exchanger (G1316-89200) using 3 screws (Screw 2.5 mm hex (0515-1052), included to part number for carrier) as shown in [Figure 16](#) on page 57.

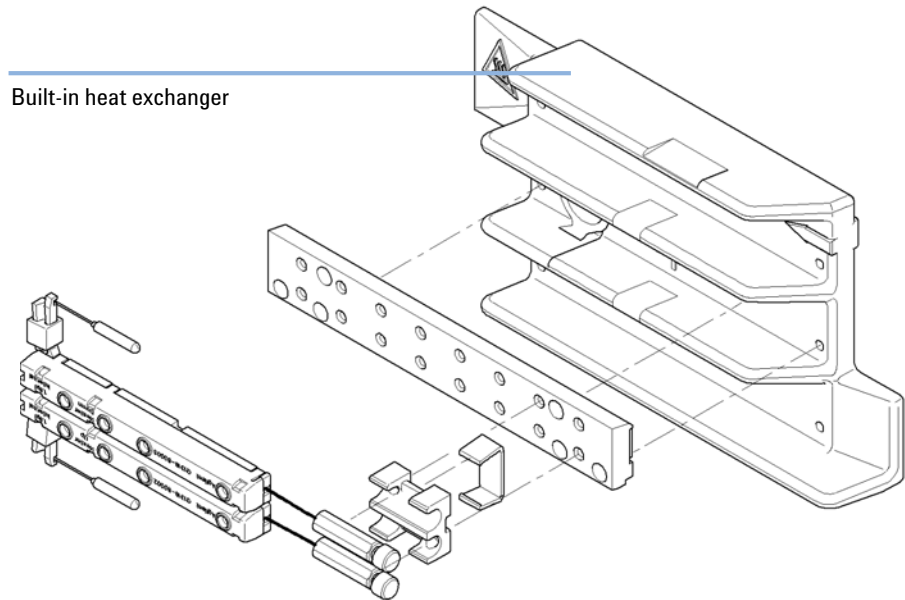


Figure 16 Installing the low dispersion heat exchangers

Installation of the Bio-Inert Solvent Heating Devices in the 1290 Infinity Thermostatted Column Compartment (G1316C)

BIO inert For bio-inert modules use bio-inert parts only!

In this note the installation of the Bio-Inert Solvent Heating Devices (9 μ L internal volume, 600 bar max pressure) (G5616-60050) into the Agilent 1290 Infinity TCC (G1316C) is described. The additional solvent heating devices can be arranged in the G1316C in various locations depending on the application needs. Some examples are shown in [Figure 17](#) on page 58.

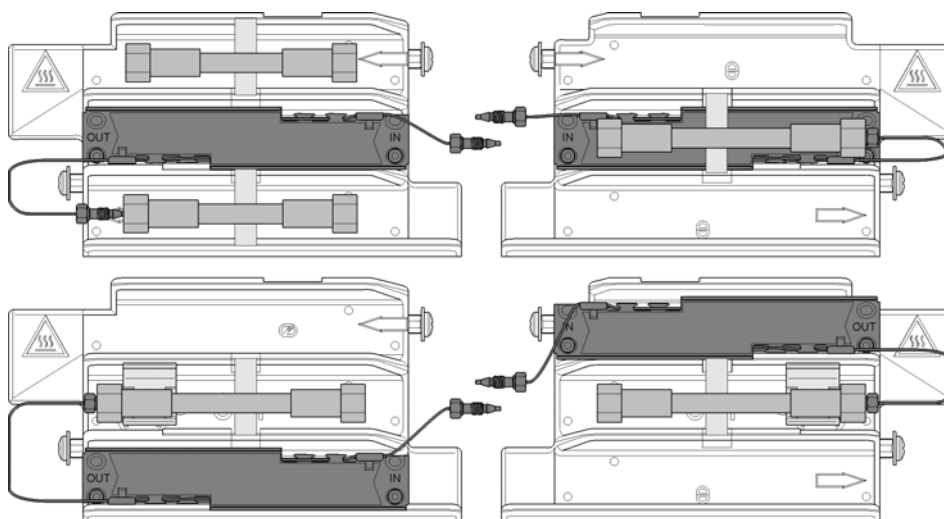


Figure 17 Arrangements of the bio-inert solvent heating devices in the 1290 Series TCC (G1316C)

NOTE

If the solvent heating devices are installed in the central position on the TCC's heat exchangers as shown in [Figure 17](#) on page 58, the column identification system cannot be used.

The solvent heating devices are mounted directly onto the TCC's heat exchangers.

NOTE

Don't forget to remove the protection foil from the heating transfer pad at the rear of the solvent heating device before installation.

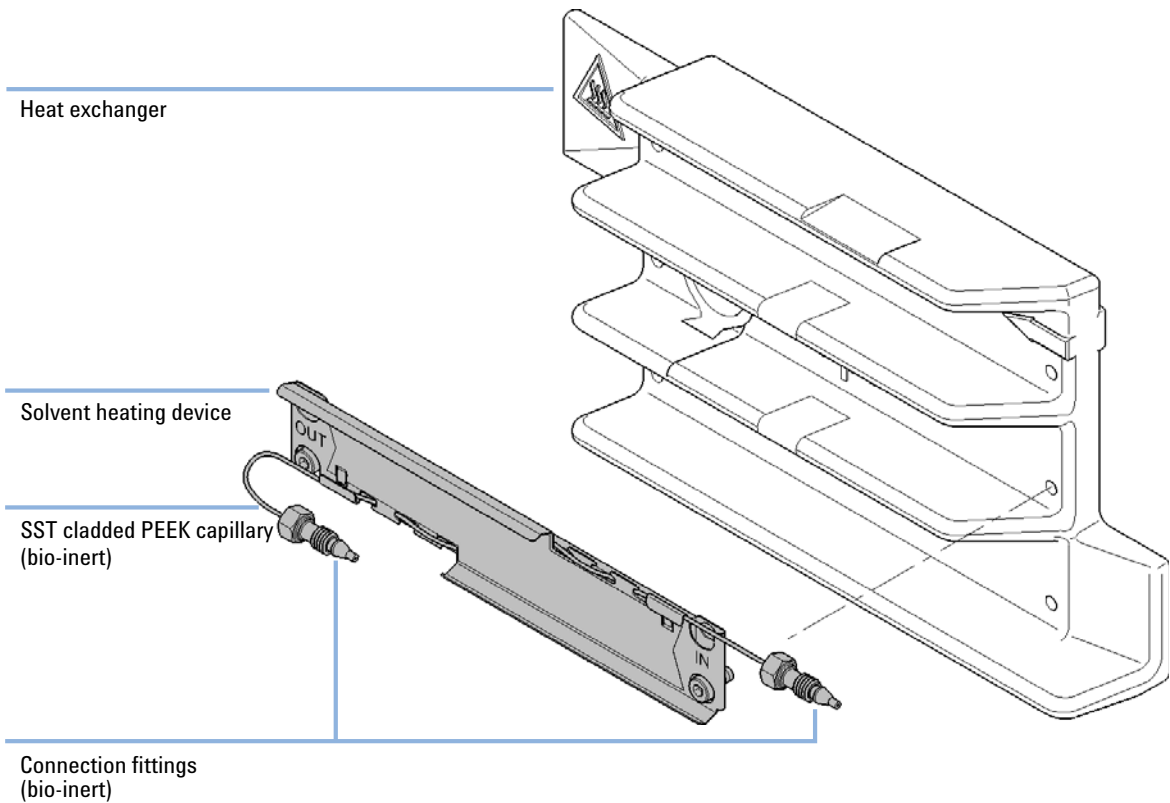


Figure 18 Installing the solvent heating device

CAUTION

Strong force/torque will damage SST clad PEEK capillaries
Be careful when installing stainless steel clad PEEK capillaries.

- Follow the instructions given in the technical note Installation of Stainless Steel Clad PEEK Capillaries. (G5611-90120).

Flow Connections of the Column Compartment

Flow Connections Using Low Dispersion Heat Exchangers

Parts required	#	Description
	1	Other modules
	1	Parts from Accessory Kit
	1	Two wrenches 1/4 – 5/16 inch for capillary connections

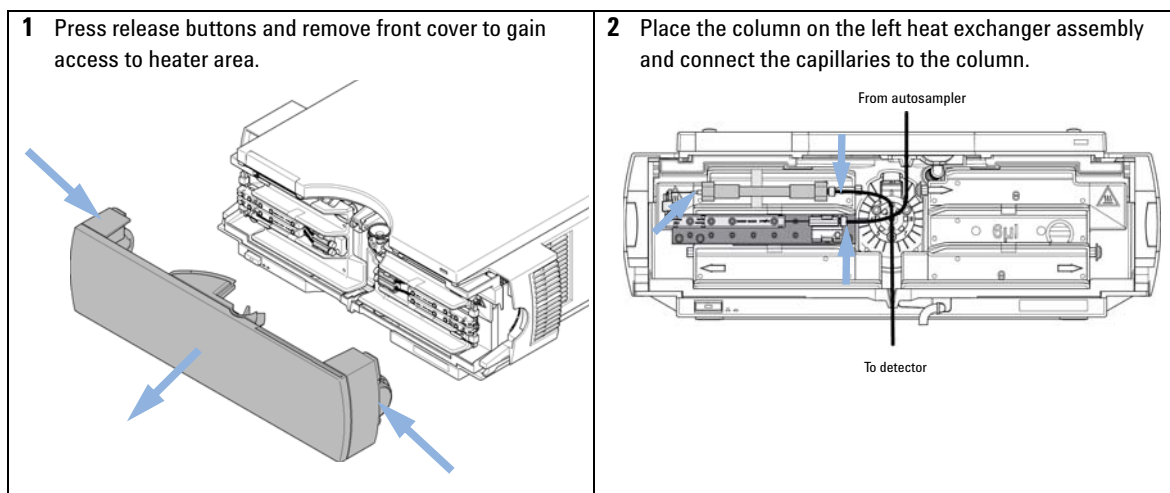
- Preparations**
- Install the column compartment
 - Install the additional heat exchangers

WARNING

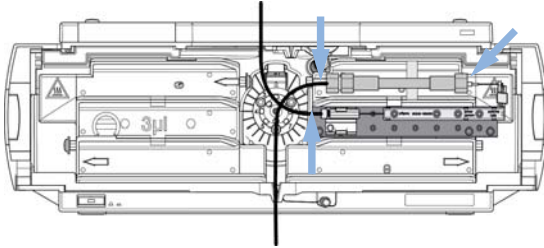
Toxic, flammable and hazardous solvents, samples and reagents

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.



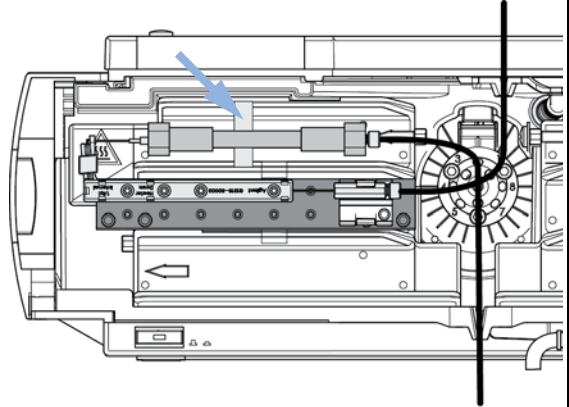
- 3** Or place the column on the right heat exchanger assembly and connect the capillaries to the column.



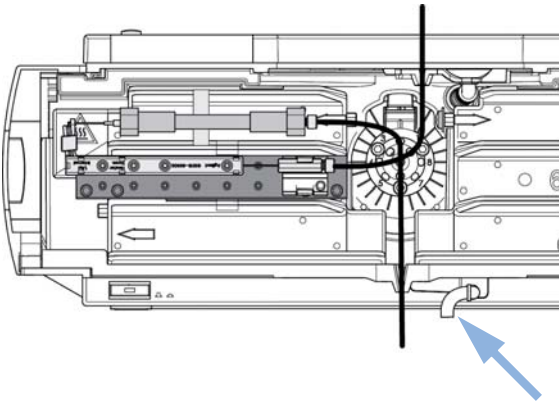
NOTE

See “Column Switching Valve (Optional)” on page 15 on how to connect the column selection valve.

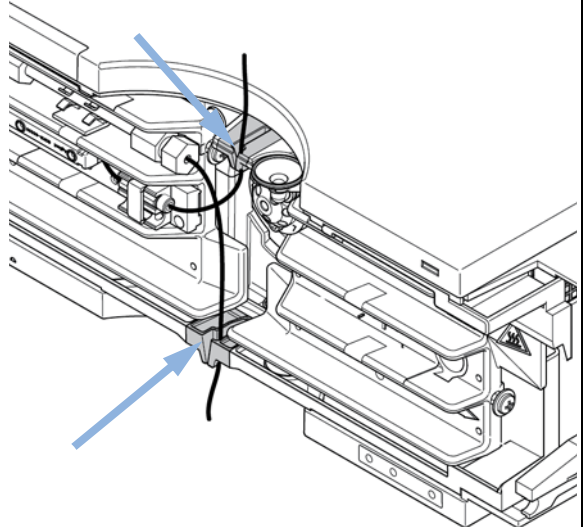
- 4** Fix the column with the column clip from the accessory kit.



- 5** If the column compartment is not part of an Agilent LC system, or if an Agilent autosampler is located on top, connect the corrugated tubing to the waste outlet.



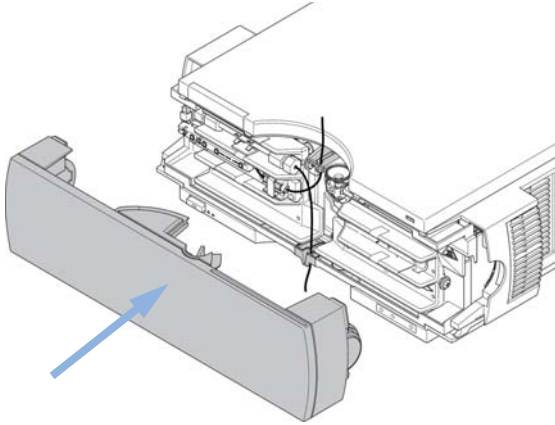
- 6** Route tubings from modules above through the openings in the funnel holder (top) and the plastic bottom part. Remove small plastic plugs first.



3 Installing the Module

Flow Connections of the Column Compartment

7 Put the front cover back in place.



The installation of the column compartment has now been completed.

NOTE

Always operate the TCC with the front cover in place for proper thermostating conditions and to protect the column area against strong drafts from the outside.

Flow Connections Using the Built-in Heat Exchangers

For applications that are not critical regarding very low dispersion volumes, e.g. when using 4.6 mm i.d. columns, the built-in heat exchangers may be used.

Parts required	#	Description
	1	Other modules
	1	Parts from Accessory Kit
	1	Two wrenches 1/4 – 5/16 inch for capillary connections

Preparations Install the column compartment

WARNING

Toxic, flammable and hazardous solvents, samples and reagents

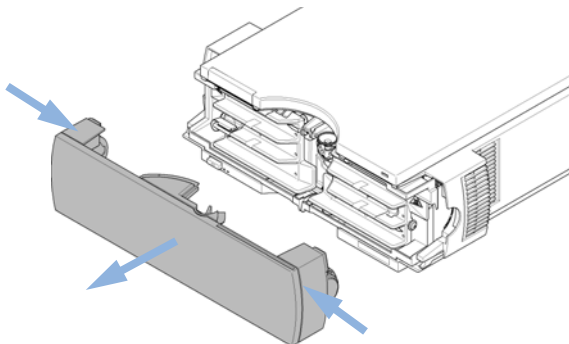
The handling of solvents, samples and reagents can hold health and safety risks.

- 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.
-

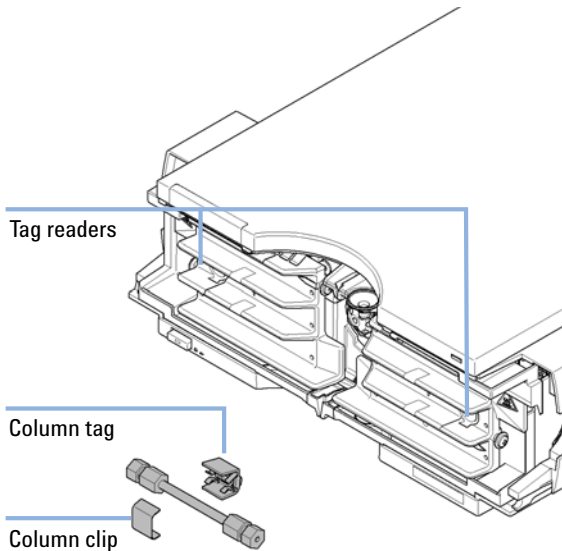
3 Installing the Module

Flow Connections of the Column Compartment

- 1 Press release buttons and remove front cover to gain access to heater area.



- 2 The column compartment is equipped with a column-identification system that can read column tags.



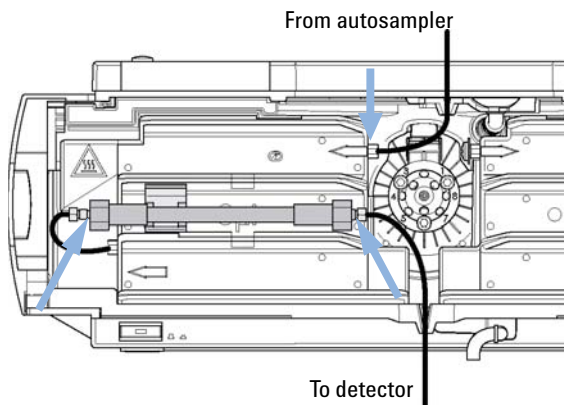
NOTE

For more information on column identification, see [“Column-Identification System”](#) on page 13.

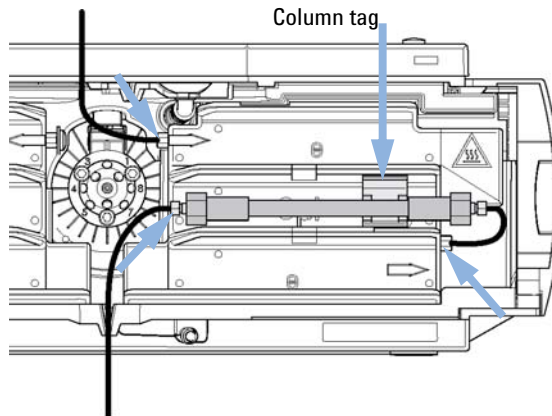
NOTE

The internal volumes of the heat exchanger assemblies comprise a volume of 3 μl (left) and 6 μl (right). The internal capillary diameter is 0.17 mm.

- 3** Place the column on the left heat exchanger assembly and connect the capillaries to the column.



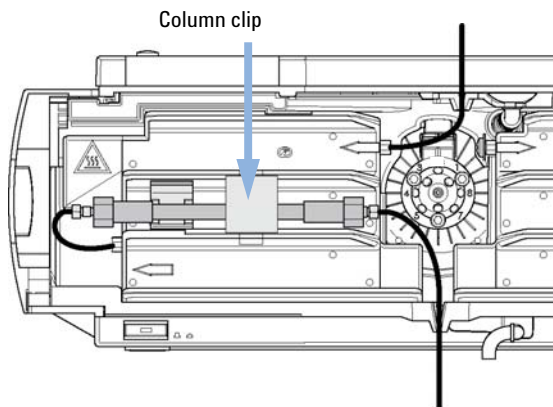
- 4** Or place the column on the right heat exchanger assembly and connect the capillaries to the column. Optionally place the column tag in front of the tag reader.



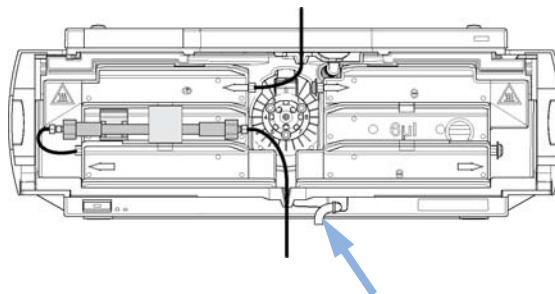
NOTE

See “[Column Switching Valve \(Optional\)](#)” on page 15 on how to connect the column selection valve.

- 5** Fix the column with the column clip from the accessory kit.



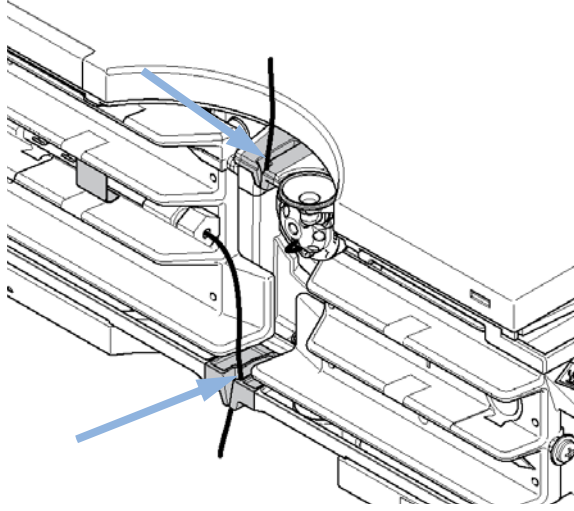
- 6** If the column compartment is not part of an Agilent LC system, or if an Agilent autosampler is located on top, connect the corrugated tubing to the waste outlet.



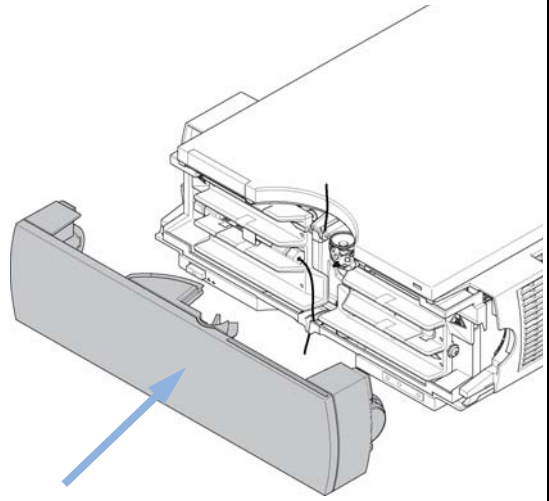
3 Installing the Module

Flow Connections of the Column Compartment

7 Route tubings from modules above through the openings in the funnel holder (top) and the plastic bottom part. Remove small plastic plugs first.



8 Put the front cover back in place.



The installation of the column compartment has now been completed.

NOTE

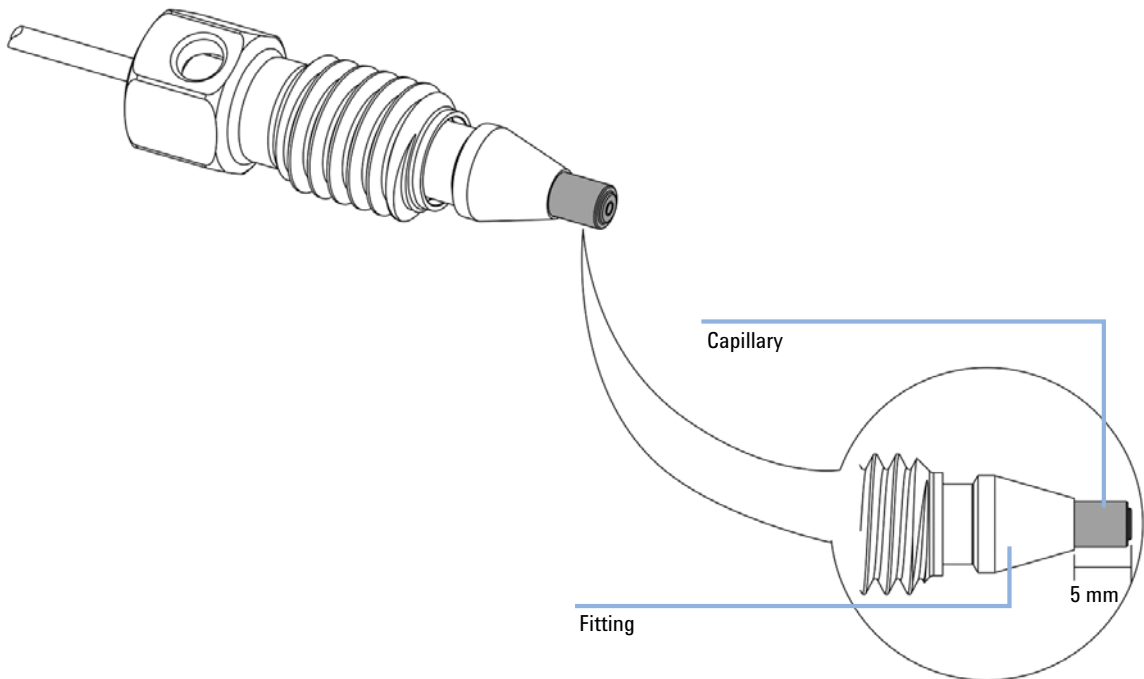
Always operate the TCC with the front cover in place for proper thermostating conditions and to protect the column area against strong drafts from the outside.

Installing Capillaries

NOTE

For installation of stainless steel clad PEEK capillaries (used in modules delivered before January 2013), please follow procedure as described in the Appendix of the *Agilent 1260 Infinity Bio-inert Quaternary LC System Manual*.

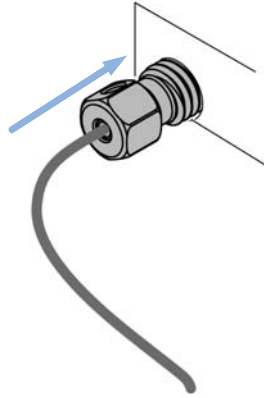
- 1 Slide the fitting on the capillary. Let the capillary jut out 5 mm.



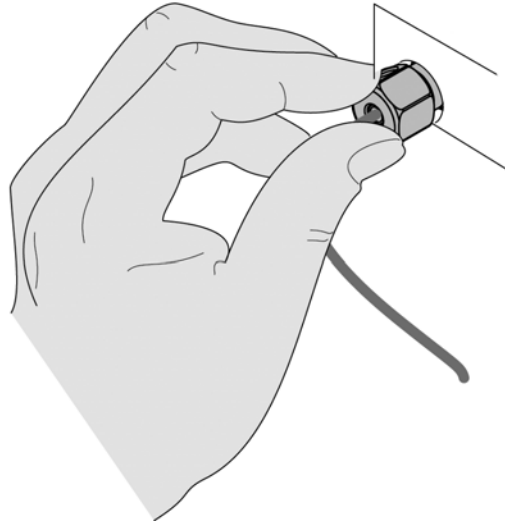
3 Installing the Module

Installing Capillaries

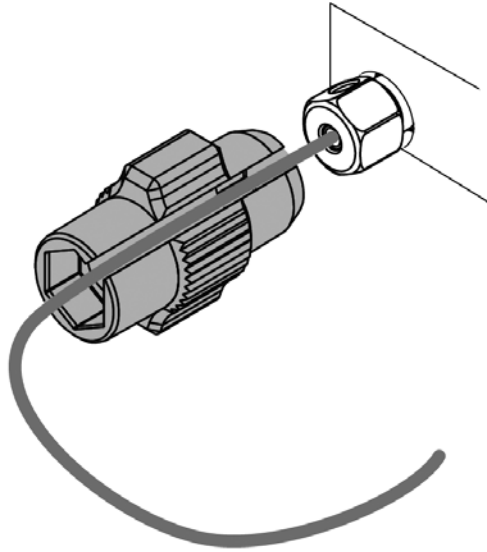
- 2 Insert the fitting to the receiving port and push the capillary to the bottom of the port.



- 3 Finger tighten the nut into the port until snug.



- 4 Use Fitting mounting tool (5043-0915) or a 5 mm hex wrench for fixing the fitting (maximum torque 0.8 Nm).



Placing Columns

Column-Identification Tag

When correctly placed on the heat exchanger, the distance between the column identification tag and the tag reader is 1 – 2 mm. This is the optimum distance for proper function. The identification tag can be easily removed from the column.

NOTE

For columns with small diameter, a cable tie wrap should be used to fix the column identification tag to the column. Assure that the tie wrap does not block the front cover.

NOTE

The tag needs to be placed differently, depending on whether the column is installed at the left or right heat exchanger, see [Figure 19](#) on page 70 and [Figure 20](#) on page 71. The Agilent logo should always be at front.

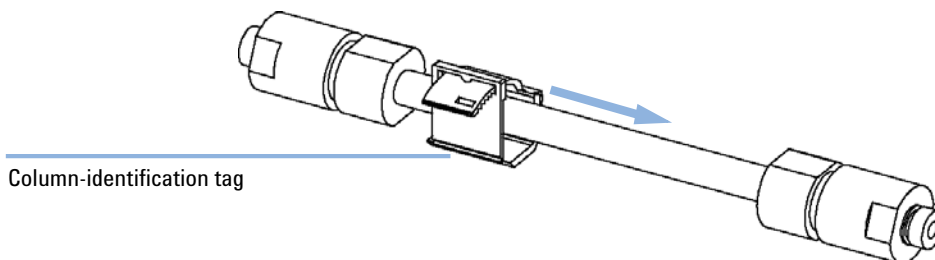


Figure 19 Column-Identification Tag for Left Heat Exchanger

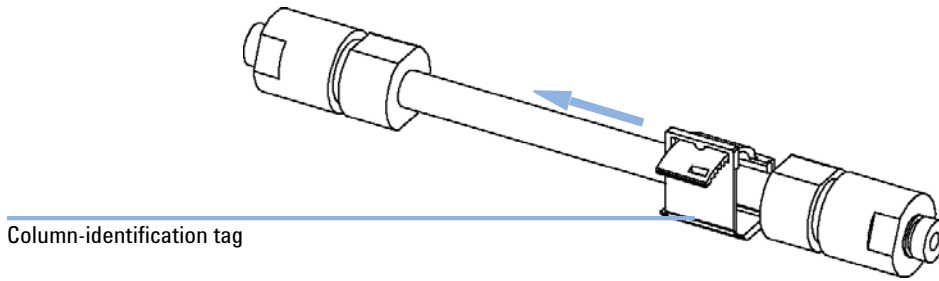


Figure 20 Column-Identification Tag for Right Heat Exchanger

Column Clip

For better positioning of the column on the heat exchanger a column clip is available (see “[Accessory Kits](#)” on page 155).

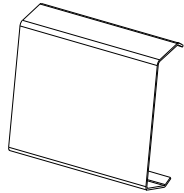
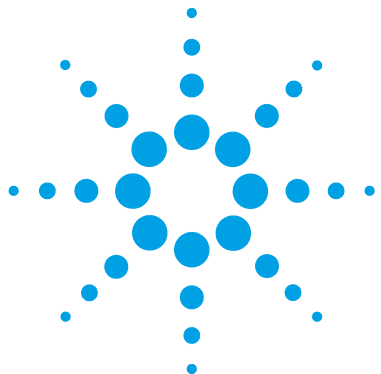


Figure 21 Column clip

3 **Installing the Module** **Placing Columns**



4 How to optimize the Column Compartment

Optimizing the Column Compartment	74
Using Additional Heater Devices	75
Delay Volume and Extra-Column Volume	76
Delay Volume	76
Extra-Column Volume	77
How to Configure the Optimum Delay Volume	78
How to Achieve Higher Injection Volumes	79
How to Achieve High Throughput	80

This chapter provides information on how to optimize the thermostatted column compartment.



Optimizing the Column Compartment

For best performance results of the column compartment:

- Use short connection capillaries and place them close to the heat exchanger. This will reduce heat dissipation and external band-broadening.
- Use the left heat exchanger for small volume columns, for example, 2 – 3 mm i.d. columns at flow rates of less than 200 $\mu\text{L}/\text{min}$.
- Use the low dispersion heat exchanger to minimize peak dispersion and delay volume.
- For even lower band-broadening, the heat exchanger can be by-passed and the column is placed well between the heat exchanger fins.
- Keep the left and right heat exchanger temperature the same unless you do specific applications.
- Assure that the front cover is always closed.

Using Additional Heater Devices

The optimization, installation, interconnection, and specific settings when using additional heating devices are described in the Agilent 1290 Infinity LC System - System Manual and Quick Reference (G4220-90301).

Delay Volume and Extra-Column Volume

The *delay volume* is defined as the system volume between the point of mixing in the pump and the top of the column.

The *extra-column volume* is defined as the volume between the injection point and the detection point, excluding the volume in the column.

Delay Volume

In gradient separations, this volume causes a delay between the mixture changing in the pump and that change reaching the column. The delay depends on the flow rate and the delay volume of the system. In effect, this means that in every HPLC system there is an additional isocratic segment in the gradient profile at the start of every run. Usually the gradient profile is reported in terms of the mixture settings at the pump and the delay volume is not quoted even though this will have an effect on the chromatography. This effect becomes more significant at low flow rates and small column volumes and can have a large impact on the transferability of gradient methods. It is important, therefore, for fast gradient separations to have small delay volumes, especially with narrow bore columns (e.g., 2.1 mm i.d.) as often used with mass spectrometric detection.

The delay volume in a system includes the volume in the pump from the point of mixing, connections between pump and autosampler, volume of the flow path through the autosampler and connections between autosampler and column.

Extra-Column Volume

Extra-column volume is a source of peak dispersion that will reduce the resolution of the separation and so should be minimized. Smaller diameter columns require proportionally smaller extra-column volumes to keep peak dispersion at a minimum.

In a liquid chromatograph the extra-column volume will depend on the connection tubing between the autosampler, column and detector; and on the volume of the flow cell in the detector. The extra-column volume is minimized with the Agilent 1290 Infinity/Agilent 1260 Infinity LC system due to the narrow-bore (0.12 mm i.d.) tubing, the low-volume heat exchangers in the column compartment and the Max-Light cartridge cell in the detector.

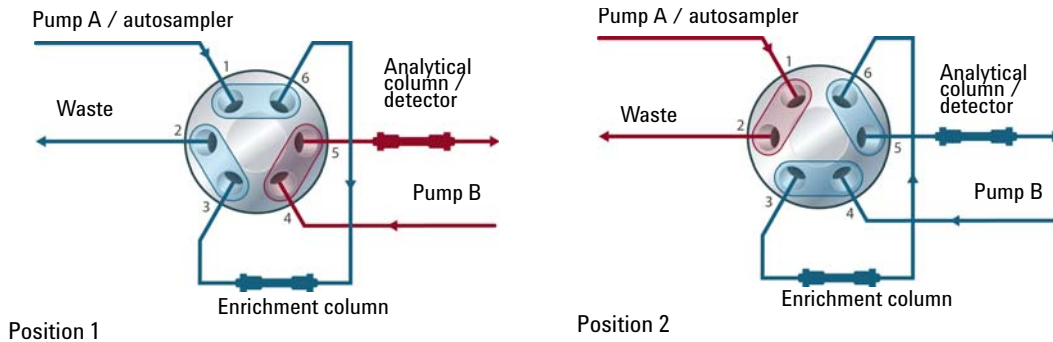
How to Configure the Optimum Delay Volume

To minimize peak dispersion and delay volume in the thermostatted column compartment the low dispersion heat exchanger must be installed. The low dispersion heat exchanger is part of the capillary kits recommended for low dispersion applications. The common capillary kit also includes narrow 0.12 mm i.d. capillaries. The built-in 3 μ l and 6 μ l heat exchangers are for backwards compatibility and should only be used in case a conventional method needs to be run on the system even though in this case also the low dispersion heat exchanger could be used.

How to Achieve Higher Injection Volumes

One way to achieve larger injections is to use a trapping column selected by a switching valve to capture and concentrate the injection before switching it, i.e. injecting it, onto an analytical column, see “[Sample Enrichment](#)” on page 79. The valve can be conveniently located in the thermostatted column compartment or in the flexible cube.

Sample Enrichment



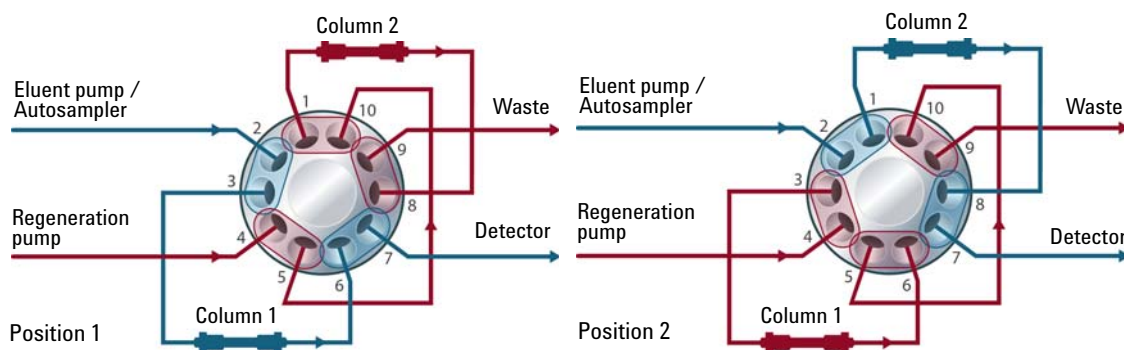
How to Achieve High Throughput

The column equilibration step can be a significant part of the cycle time. Typically the column needs flushing with three to five times the column volume to stabilize it ready for the next injection and this can be 50 % or more of the separation time in some applications. It is an essential process but can be taken out of the cycle time by using automated alternating column regeneration.

For this the following apparatuses are required (available at the local Agilent sales representative):

- A special valve drive (available as accessory kit G1353B)
For installation, please contact your Agilent service representative
- A second analytical column identical to the first
- A second pump

As one column is being used in the separation run, the other column is being flushed with the starting composition of the mobile phase gradient and to start the next injection the newly re-equilibrated column is switched into the analytical flow path. The two columns then alternate in this way for the whole sequence of injections. The second pump is only required to flush an isocratic mixture through the column and so can be a simpler pump than the 1290 Infinity pumps. For instance a 1200 Series isocratic pump would be sufficient to perform this task. The setup is illustrated in [Table](#) on page 80.





5 Troubleshooting and Diagnostics

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Status indicators 83

Power Supply Indicator 83

Module Status Indicator 84

Available Tests vs User Interfaces 85

Agilent Lab Advisor Software 86

Overview about the troubleshooting and diagnostic features.



Overview of the Module's Indicators and Test Functions

Status Indicators

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

Error Messages

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

Thermostat Diagnostic Test

The thermostat diagnostic test evaluates the heating and cooling efficiency of the two peltier elements.

Temperature Calibration and Verification

The temperature calibration and verification procedure enables the instrument temperature to be measured against an external, calibrated measuring device. Normally, temperature calibration is not required throughout the lifetime of the instrument. However, in order to comply with local regulatory requirements, calibration and verification may be required.

The following sections describe these functions in detail.

Status indicators

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



Figure 22 Location of Status indicators

Power Supply Indicator

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

Module Status Indicator

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

- When the status indicator is *OFF* (and power switch light is on), the module is in a *prerun* condition, and is ready to begin an analysis.
- A *green* status indicator, indicates the module is performing an analysis (*run* mode).
- A *yellow* indicator indicates a *not-ready* condition. The module is in a not-ready state when it is waiting for a specific condition to be reached or completed (for example, immediately after changing a set point), or while a self-test procedure is running.
- An *error* condition is indicated when the status indicator is *red*. An error condition indicates the module has detected an internal problem which affects correct operation of the module. Usually, an error condition requires attention (e.g. leak, defective internal components). An error condition always interrupts the analysis.

If the error occurs during analysis, it is propagated within the LC system, i.e. a red LED may indicate a problem of a different module. Use the status display of your user interface for finding the root cause/module of the error.

- A *blinking* indicator indicates that the module is in resident mode (e.g. during update of main firmware).
- A *fast blinking* indicator indicates that the module is in a low-level error mode. In such a case try to re-boot the module or try a cold-start (see “[Special Settings](#)” on page 193). Then try a firmware update (see “[Replacing the Module Firmware](#)” on page 143). If this does not help, a main board replacement is required.

Available Tests vs User Interfaces

- Depending on the user interface, the available tests and the screens/reports may vary (see chapter "*Test Functions and Calibrations*").
- Preferred tool should be the Agilent Lab Advisor software, see "[Agilent Lab Advisor Software](#)" on page 86.
- The Agilent ChemStation B.04.02 and above may not include any maintenance/test functions.
- Screenshots used within these procedures are based on the Agilent Lab Advisor software.

Agilent Lab Advisor Software

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

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

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

The Instrument Utilities is a basic version of the Lab Advisor with limited functionality required for installation, use and maintenance. No advanced repair, troubleshooting and monitoring functionality is included.



6 Error Information

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



What Are Error Messages

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

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

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

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

General Error Messages

General error messages are generic to all G HPLC modules.

Timeout

Error ID: 0062

The timeout threshold was exceeded.

Probable cause

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

Suggested actions

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

Shutdown

Error ID: 0063

An external instrument has generated a shutdown signal on the remote line. The module continually monitors the remote input connectors for status signals. A LOW signal input on pin 4 of the remote connector generates the error message.

Probable cause

- 1 Leak detected in another module with a CAN connection to the system.
- 2 Leak detected in an external instrument with a remote connection to the system.
- 3 Shut-down in an external instrument with a remote connection to the system.
- 4 The degasser failed to generate sufficient vacuum for solvent degassing.

Suggested actions

- Fix the leak in the external instrument before restarting the module.
- Fix the leak in the external instrument before restarting the module.
- Check external instruments for a shut-down condition.
- Check the vacuum degasser for an error condition. Refer to the *Service Manual* for the degasser or the 1260 pump that has the degasser built-in.

Remote Timeout

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

- 1 Not-ready condition in one of the instruments connected to the remote line.
- 2 Defective remote cable.
- 3 Defective components in the instrument showing the not-ready condition.

Suggested actions

- Ensure the instrument showing the not-ready condition is installed correctly, and is set up correctly for analysis.
- Exchange the remote cable.
- Check the instrument for defects (refer to the instrument's documentation).

Lost CAN Partner

Error ID: 0071

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

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

Probable cause

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

Suggested actions

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

Leak

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 Condensation.	Use a higher temperature setpoint.
2 Loose column fittings.	Ensure all fittings are tight.
3 Broken capillary.	Exchange defective capillaries.
4 Leaking column-switching valve seal.	Exchange the valve seal.

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 main board.	Please contact your Agilent service representative.
2 Defective leak sensor.	Please contact your Agilent service representative.
3 Leak sensor incorrectly routed, being pinched by a metal component.	Please contact your Agilent service representative.

Leak Sensor Short

Error ID: 0082

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

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

Probable cause

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

Suggested actions

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

TCC Error Messages

These errors are module specific.

Compensation Sensor Open

Error ID: 0081

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

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

Probable cause

- 1 Defective main board.

Suggested actions

Please contact your Agilent service representative.

Compensation Sensor Short

Error ID: 0080

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

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

Probable cause

- 1 Defective main board.

Suggested actions

Please contact your Agilent service representative.

Left Fan Failed

Error ID: 2829

The left cooling fan in the column compartment has failed.

The hall sensor on the fan shaft is used by the TCC board to monitor the fan speed. If the fan speed falls below 2 revolutions/second for longer than 5 s, the error message is generated.

Probable cause

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

Suggested actions

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

Right Fan Failed

Error ID: 2830

The right cooling fan in the column compartment has failed.

The hall sensor on the fan shaft is used by the TCC board to monitor the fan speed. If the fan speed falls below 2 revolutions/second for longer than 5 s, the error message is generated.

Probable cause

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

Suggested actions

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

Open Cover

Error ID:

The top foam has been removed.

The sensor on the TCC board detects when the top foam is in place. If the foam is removed, the fans and peltier elements are switched OFF, and the error message is generated.

Probable cause

- 1 The top foam was removed during operation.
- 2 Foam not activating the sensor.

Suggested actions

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

Cover Violation

Error ID: 2833

The column compartment was switched on with the top cover and foam open.

The sensor on the CCM board detects if the top foam is in place. If the column compartment is switched on with the foam removed, the processor switches OFF the peltier elements after a short delay, and the error message is generated.

Probable cause

- 1 The column compartment was switched on with the top cover and foam removed.

Suggested actions

- Please contact your Agilent service representative.

Left Temperature Timeout

Error ID: 2811

The temperature of the left heat exchanger did not reach the temperature setpoint within the timeout threshold.

Probable cause

- 1 Defective left heater assembly.
- 2 Defective TCC board.

Suggested actions

Please contact your Agilent service representative.

Please contact your Agilent service representative.

Right Temperature Timeout

Error ID: 2812

The temperature of the right heat exchanger did not reach the temperature setpoint within the timeout threshold.

Probable cause

- 1 Defective right heater assembly.
- 2 Defective TCC board.

Suggested actions

Please contact your Agilent service representative.

Please contact your Agilent service representative.

Defective Temperature Sensor

Error ID: 2821

One of the temperature sensors has failed.

The TCC board monitors the signal from the sensor continually. If the signal is missing or out of range, the error message is generated.

Defective Temperature Sensor 0: left column.

Defective Temperature Sensor 1: left heat sink.

Defective Temperature Sensor 2: right column.

Defective Temperature Sensor 3: right heat sink.

Defective Temperature Sensor 4: ambient-correction sensor (located on left flex board).

Probable cause	Suggested actions
1 Flex board not connected (only if all left or right sensor error messages appear simultaneously).	Please contact your Agilent service representative.
2 Defective heater assembly.	Please contact your Agilent service representative.
3 Defective TCC board.	Please contact your Agilent service representative.

Heater Profile

Error ID:

Heater Profile 0: left heater.

Heater Profile 2: right heater.

The temperature warm-up (or cooling) profile of the heater is incorrect.

When the temperature setpoint is changed, the heater begins heating (or cooling) the column heat exchanger. During this time, the processor monitors the temperature change, and checks if the temperature profile is changing in the correct direction. If the temperature is not changing as expected, the error message is generated.

Probable cause

- 1 Defective heater assembly.
- 2 Defective TCC board.

Suggested actions

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

Column Temperature

Error ID: 2836

The temperature of the column heat exchanger has exceeded the maximum limit.

Column Temperature 0: left heater.

Column Temperature 2: right heater.

For safety reasons, the maximum column heat-exchanger temperature is 105 °C. If an electronic failure occurs which causes the heater to heat continually, the current is switched off when the temperature exceeds 105 °C, and the error message is generated.

Probable cause

- 1 Defective heater assembly.
- 2 Defective TCC board.

Suggested actions

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

Heatsink Temperature

Error ID: 2837

The temperature of the Peltier heatsink has exceeded the maximum limit.

Heatsink Temperature 0: left heater.

Heatsink Temperature 2: right heater

The maximum temperature of the Peltier heatsink is 70 °C. If an electronic failure occurs which causes the heatsink to reach 70 °C, the current is switched OFF and the error message is generated.

Probable cause	Suggested actions
1 Defective heater assembly.	Please contact your Agilent service representative.
2 Defective TCC board.	Please contact your Agilent service representative.

Defective Heater Circuit

Error ID: 2860

The electronic circuit for control of the heater assemblies is defective.

The processor checks the function of the heater circuits continually. If a defect is detected in the control circuit, the processor switches OFF the heater (peltier) assemblies, and the error message is generated.

Probable cause	Suggested actions
1 Defective TCC board.	Please contact your Agilent service representative.

Valve failed to initialize

Error ID: 2875

During initialization, the valve actuator turns until the encoder reads the reference index position. An error is generated, if the reference index cannot be found within a given time.

Probable cause

- 1 Defect in cable connection of valve drive control.
- 2 Defect in cable connection of valve actuator encoder reader.
- 3 Defect of valve drive or valve actuator encoder reader.

Suggested actions

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

Unknown/Unsupported Valve detected

Error ID: 2872

After powering on, the RFID tag of the valve head is read out. An error is generated, if the RFID tag does not contain valid information. The RFID can be damaged if the instrument is power cycled during a write access of the tag.

Probable cause

- 1 RFID tag contains invalid information.

Suggested actions

- Replace valve head, see "[Valve Options Overview](#)" on page 153.

Door sensor HW failure

Error ID: 2873

This error is generated, if a front door is detected while the front door sensor has been disabled during the self-test.

Probable cause

- 1 Defect in cable connection of door sensor to main board.
- 2 Door sensor defective.

Suggested actions

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

Valve RFID access failure

Error ID: 2874

The valve tag reader fails reading or writing the RFID tag of the valve head.

Probable cause

- 1 Defect in cable connection of valve tag reader to main board.
- 2 Valve head not installed correctly.
- 3 RFID tag defective.
- 4 Valve tag reader is damaged.

Suggested actions

- Please contact your Agilent service representative.
- Review installation of valve head, see [“Installing the Valve Head and Connecting Capillaries”](#) on page 52.
- Replace valve head, see [“Replacing Valve Heads”](#) on page 136
- Please contact your Agilent service representative.

6 Error Information

TCC Error Messages



7 Test Functions and Calibrations

Thermostat Function Test 104

Pressure Test 106

Temperature Calibration 107

 Temperature Calibration Procedure 108

 Calibration Problems 109

 Installing the Temperature Sensor 109

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



Thermostat Function Test

Thermostat Function Test Description

The **Thermostat Function Test** is used to evaluate the cooling and heating performance of the two peltier elements.

When the test is started, both heat exchangers are cooled initially to 25 °C. This temperature is held for 12 seconds, and then the setpoint is changed to 20 °C. The time required to reach 20 °C is a measure of the cooling efficiency of the peltier elements. At 3.5 minutes, the setpoint is changed to 30 °C, and both elements begin heating. The time required to reach 30 °C is a measure of heating efficiency.

Thermostat Function Test Result

A typical **Thermostat Function Test** profile is shown in [Figure 23](#) on page 104.

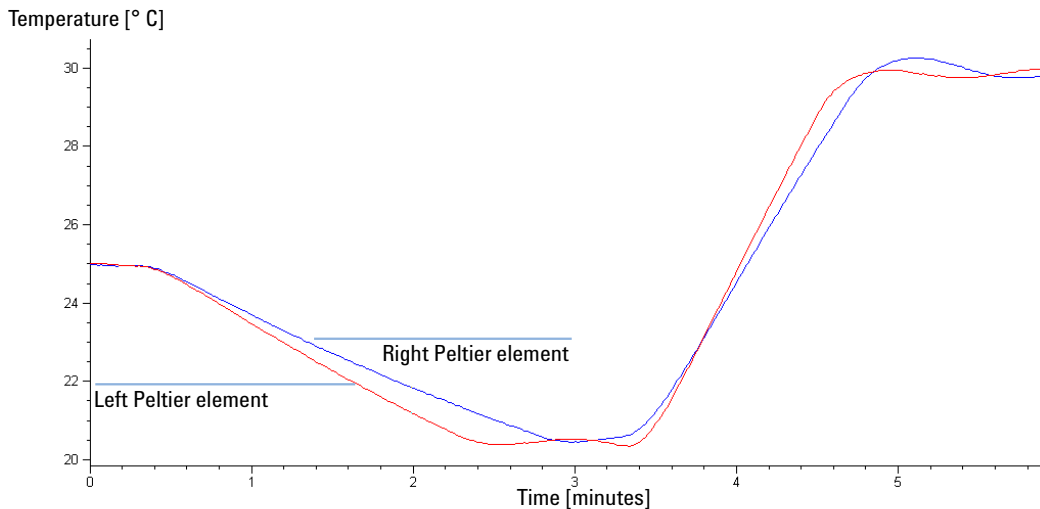


Figure 23 Typical **Thermostat Function Test** Profile

Evaluating the Thermostat Function Test

During the cooling phase, the Peltier elements should cool at a rate of >2 °C/minute. During the heating phase, the temperature change should be >3 °C/minute. Defective thermostat components may cause cooling or heating rates to fall outside these limits.

Pressure Test

For running a **Pressure Test**, please refer to the corresponding pump manual. The **Pressure Test** may be used for testing the tightness of a valve installed in the TCC or Flex Cube.

CAUTION

Wrong use of **Pressure Test** may damage valve.

The current implementation of the **Pressure Test** automatically uses the maximum pressure generated by the pump used in the system.

- Do not use the test for modules having a lower maximum pressure than the pump as this will damage the valve. For example do not use 400 bar valve in a TCC or Flex Cube in combination with a 600 bar pump.
-

Temperature Calibration

Temperature Calibration Principle

The actual temperatures of the column heat exchangers (left and right) depend on the column setpoint temperature. For setpoint temperatures above 36 °C, the heat exchangers are heated to a temperature slightly above the setpoint temperature. Conversely, for setpoint temperatures below 36 °C, the heat exchangers are kept at a temperature slightly below the setpoint temperature. This fine temperature correction compensates for the small amount of heat exchange through the instrument housing, and ensures the column is always kept at the setpoint temperature.

At 36 °C, the column setpoint and heat-exchanger temperatures are equal (temperature cross-over point). This is the temperature at which a calibrated measuring device can be used to calibrate the column thermostat.

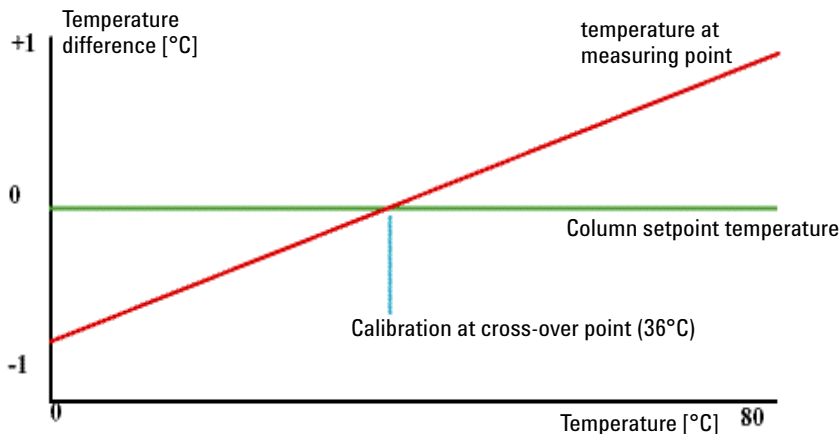


Figure 24 1-Point Calibration at the Temperature Cross-Over Point

The column thermostat is calibrated correctly when the measured temperature (using the external measuring device, “[Temperature Calibration Procedure](#)” on page 108) and the cross-over temperature (36 °C) of both heat exchangers (left and right) are within a range of ± 0.5 °C.

Temperature Calibration Procedure

Tools required	Description
	Temperature measuring device (see note below)
Parts required	# Description
	1 Calibrated temperature measuring device

NOTE

For the measuring and calibration process Agilent Technologies recommends a thermometer with 0.1 °C precision. Contact the local Agilent Technologies support representative for ordering information.

NOTE

The figures in this procedure refer to a specific type of temperature sensor (Heraeus, Quat340, quartz surface-temperature measurement sensor). Other sensors may require a different fixing.

- 1 Install the temperature sensor (“[Installing the Temperature Sensor](#)” on page 109).
- 2 Select the Column-Compartment Temperature Calibration mode in the user interface.
- 3 Wait for the temperature to stabilize at the calibration temperature (36 °C).
- 4 Measure the temperature of the heat exchanger.
- 5 If the measured temperature deviates by more than ± 0.5 °C from the actual temperature, enter the measured value in the measured-temperature field for the left heat exchanger.
- 6 Install the sensor at the measurement point on the right heat exchanger. Repeat the calibration procedure for the right heat exchanger.

NOTE

Limits

After calibration, the measured temperature and the calibration temperature should be within ± 0.5 °C. The maximum deviation which can be adjusted is ± 1.6 °C. If the measured value and the calibration value differ by more than ± 1.6 °C, this is an indication that a problem exists, “[Calibration Problems](#)” on page 109.

Calibration Problems

If the temperature cannot be calibrated, check the following:

- Has the thermostat front cover been closed correctly?
- Is the measuring device functioning correctly, and is calibrated according to the manufacturers instructions?

Hardware Failures

Probable hardware failures that can lead to a failed calibration procedure are:

- Defective or wrongly calibrated measuring device.
- Defective heater assembly.
- Defective ambient-temperature sensor.
- Defective CCM board.

Installing the Temperature Sensor

Installation of the temperature sensor is required for the temperature calibration and temperature verification procedures.

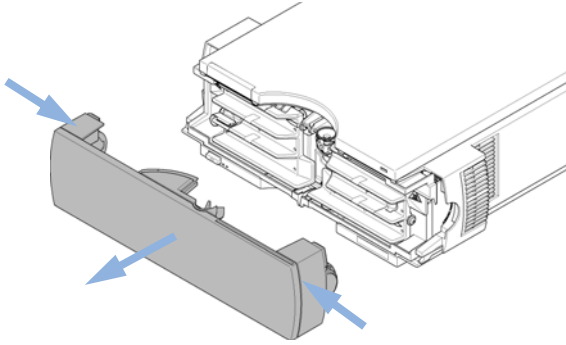
NOTE

The figures below refer to a specific type of temperature sensor (Heraeus, Quat340, quartz surface-temperature measurement sensor). Other sensors may require a different fixing.

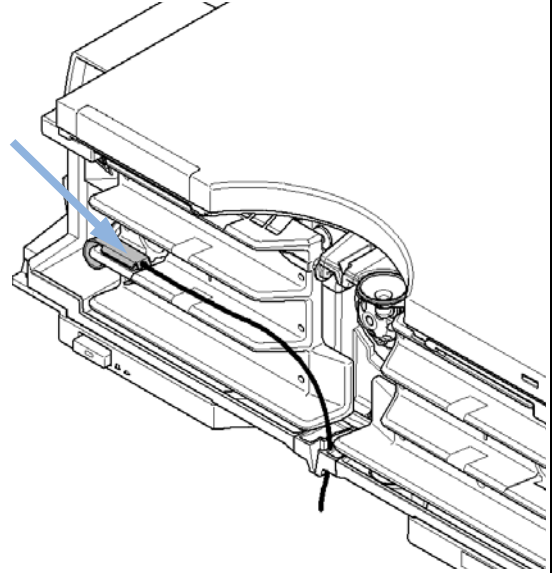
7 Test Functions and Calibrations

Temperature Calibration

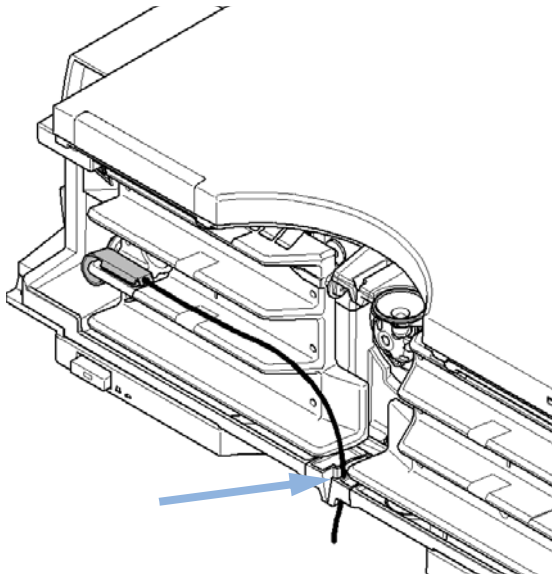
1 Remove the front cover.



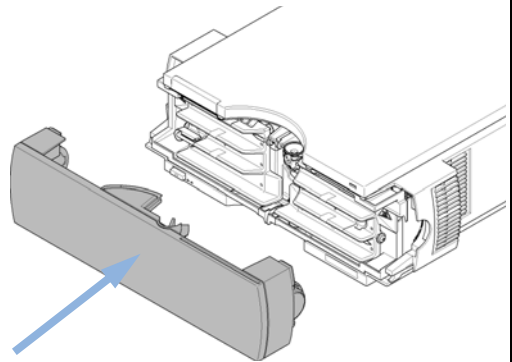
2 Install the temperature sensor at the measurement position on the left heat exchanger.



3 Route the sensor wire through the slit in the leak tray.



4 Re-install the front cover.





8 Maintenance

Introduction to Maintenance and Repair	112
Cautions and Warnings	113
Overview of Maintenance	115
Cleaning the Column Compartment	116
Changing Column Identification Tags	117
Adding Heater Devices	119
Installing the capillaries	124
Correcting Leaks	131
Replacing Head Parts of Column Switching Valve	133
Replacing Valve Heads	136
Preparing the Column Compartment for Transportation	140
Replacing the Module Firmware	143

This chapter describes the maintenance tasks for the TCC. If the instrument needs repair please contact your Agilent service representative.



Introduction to Maintenance and Repair

The module is designed for easy maintenance. The most frequent maintenances such as maintaining valve heads (if optional valve drive is installed) or replacing low dispersion heat exchangers can be done from the front with module in place in the system stack.

NOTE

There are no serviceable parts inside.

Do not open the module.

Cautions and Warnings


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

Hot heat exchangers 

The column compartment has two heat exchanger assemblies that might be hot.

- Allow them to cool down before starting repairs.
-

WARNING

Electrical shock

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

- Do not remove the cover of the module.
 - Only certified persons are authorized to carry out repairs inside the module.
-

WARNING

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

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

- Always unplug the power cable before opening the cover.
 - Do not connect the power cable to the instrument while the covers are removed.
-

WARNING

Personal injury or damage to the product

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

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

CAUTION

Safety standards for external equipment

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

CAUTION

Sample degradation and contamination of the instrument

Metal parts in the flow path can interact with the bio-molecules in the sample leading to sample degradation and contamination.

- For bio-inert applications, always use dedicated bio-inert parts, which can be identified by the bio-inert symbol or other markers described in this manual.
 - Do not mix bio-inert and non-inert modules or parts in a bio-inert system.
-

Overview of Maintenance

The following pages describe maintenance procedures (simple repairs) that can be done without opening the main cover.

Table 20 Maintenance Procedures

Procedure	Typical Frequency	Notes
"Cleaning the Column Compartment" on page 116	If required	
"Changing Column Identification Tags" on page 117	When column performance or new application requires a change	
"Adding Heater Devices" on page 119	When new application requires a change	
"Installing the capillaries" on page 124	When new application requires a change	
"Correcting Leaks" on page 131	If a leak has occurred	Check for leaks
"Replacing Valve Heads" on page 136	If the valve performance shows indication of leakage or wear	
"Preparing the Column Compartment for Transportation" on page 140	If the TCC shall be transported	
"Replacing the Module Firmware" on page 143	If required	

Cleaning the Column Compartment

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.
-

Changing Column Identification Tags

The column compartment is equipped with a column-identification system, that stores column specific information. Two identification tag readers are incorporated in the heat exchanger assemblies.

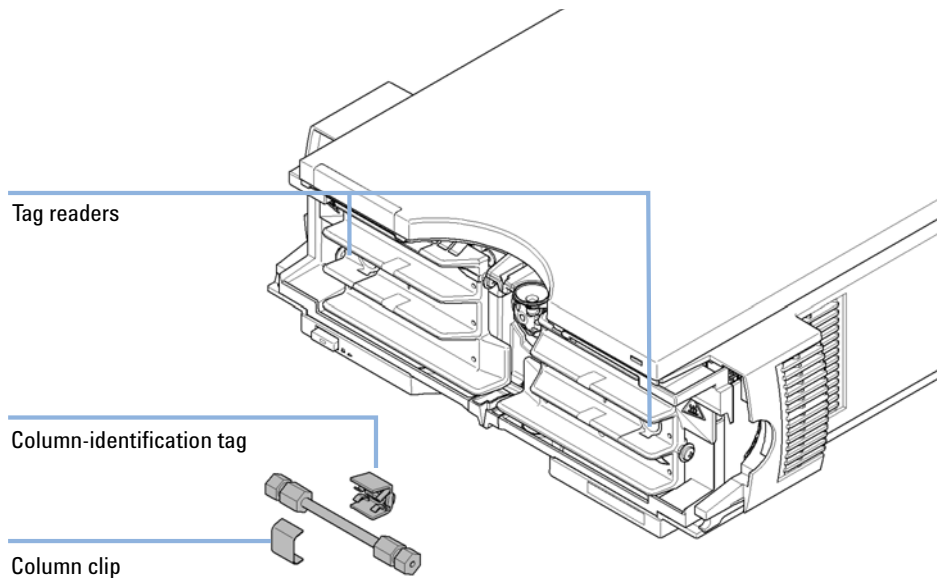


Figure 25 Column-Identification System

When If column is used on the opposite heat exchanger or a tag is added to a new column.

Parts required	#	p/n	Description
	1	5062-8588	Column identification tag (1x), re-order (3/pk)

- 1 The identification tag can be easily removed from the column.
- 2 The tag needs to be placed differently, depending on whether the column is installed at the left or right heat exchanger, see [Figure 26](#) on page 118 and [Figure 27](#) on page 118. The Agilent logo should always be at front.

8 Maintenance

Changing Column Identification Tags

When correctly placed on the heat exchanger, the distance between tag and tag reader is 1 – 2 mm. This is the optimum distance for proper function.

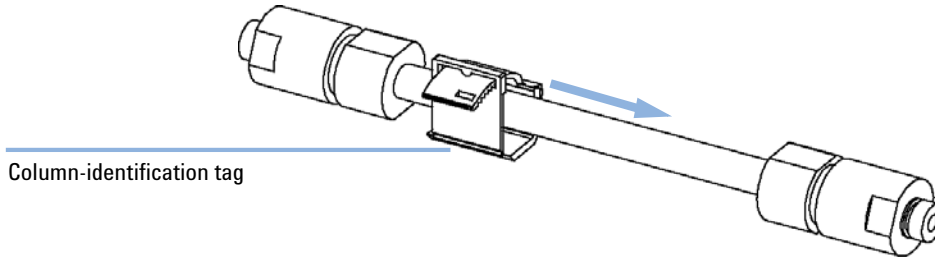


Figure 26 Column-Identification Tag for Left Heat Exchanger

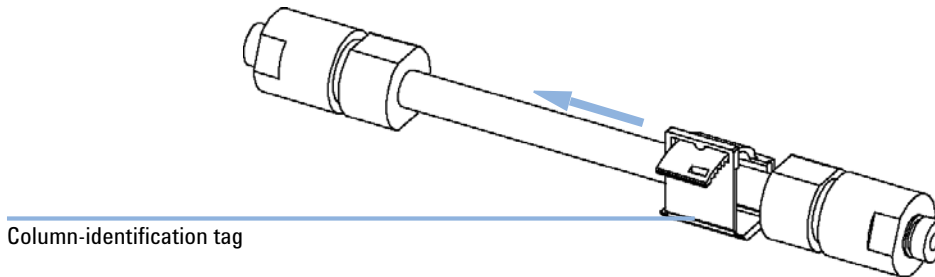


Figure 27 Column-Identification Tag for Right Heat Exchanger

- 3 For columns with small diameter, a cable tie wrap should be used to fix the column identification tag to the column. Assure that the tie wrap does not block the front cover.

Adding Heater Devices

The additional heater devices can be arranged in the G1316C in various locations depending on the application needs. Some examples are shown below.

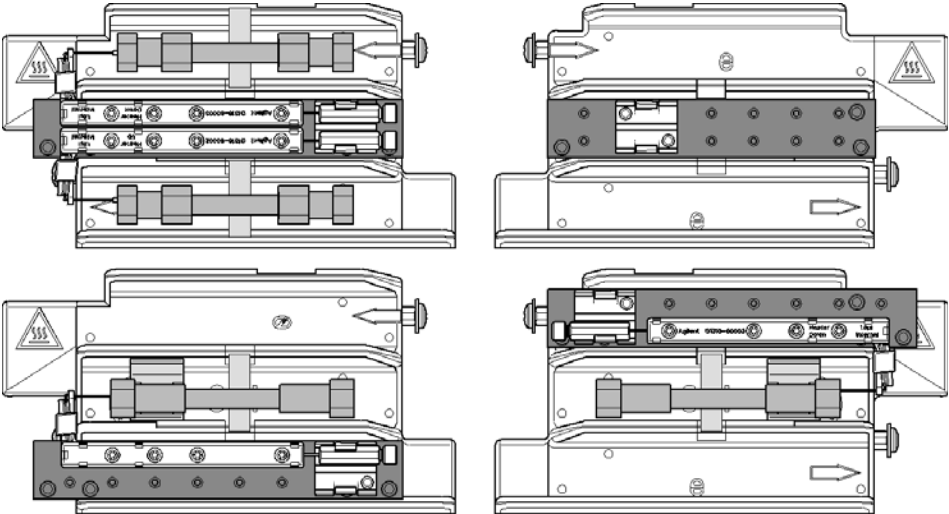


Figure 28 Arrangements of Heater and Cooling Devices

8 Maintenance

Adding Heater Devices

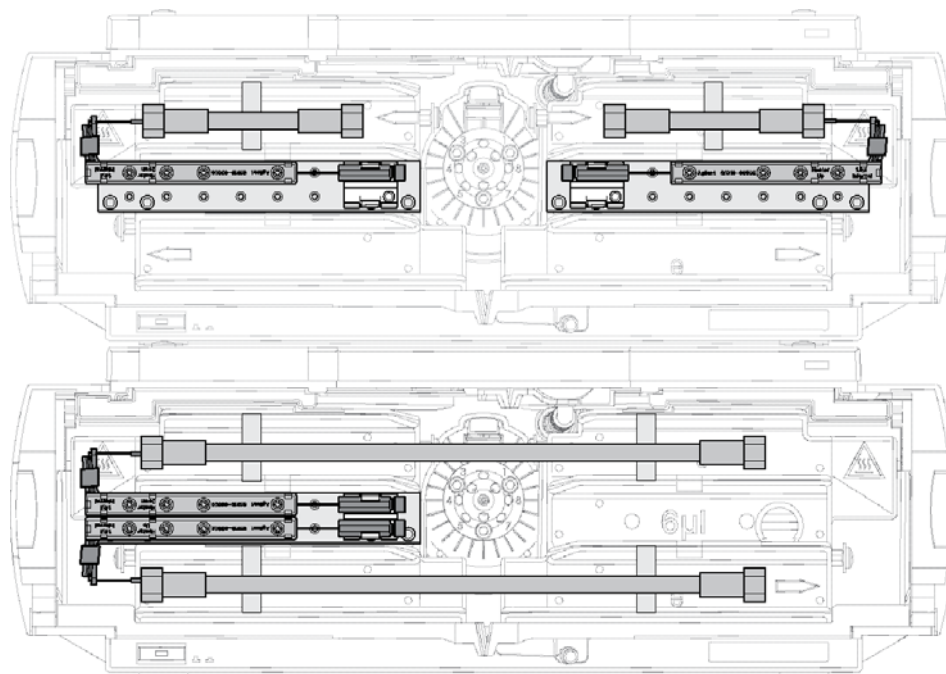


Figure 29 Typical positions of the low dispersion heat exchangers

NOTE

If the additional heater devices are used as shown above, the column identification system cannot be used. If the column identification system is required, fix the heater devices in the upper or lower locations or fix them right/left of the current location.

The heater devices are mounted on a carrier that can be fitted to the left and/or right heat exchangers.

Installing the Low Dispersion Heat Exchangers

The positions of the low dispersion heat exchangers (Heater long-up (0.12 mm i.d., 1.6 μ L internal volume) (G1316-80002) or Heater long-down (0.12 mm i.d., 1.6 μ L internal volume) (G1316-80003)) depend very much on the desired application and columns you want to use with your system. For two long columns (> 100 mm) the carrier (Carrier for heat exchanger (G1316-89200)) and the heat exchangers must be installed in a middle position. In case you are going to use columns of maximum 100 mm length it is advised to place two carriers with one heat exchanger each at the left and the right side of the column compartment (see [Figure 29](#) on page 120). To use the column tag readers the carriers must be installed either in the top or bottom positions.

The carriers for the low-dispersion heat exchangers must be attached to the standard built-in heat exchangers of the TCC (see [Figure 30](#) on page 122). Remove the protective foil from the gray thermal conductive foil of the carrier and fasten the three screws. Mount the fitting holder assembly (Fitting holder assy, includes following items: Fitting fork, fitting clip, screws (pack of 4) (G1316-68706)) on the carrier. The fitting clips hold the capillary unions from the low dispersion heat exchangers and make plumbing of capillaries much easier. Finally, attach the low dispersion heat exchanger. It is important to fix them tightly so that a good thermal conductivity is achieved. The columns are held by color-coded clips (Column clip set, 8 colors (5042-9918)) for more convenient installation; mark the nuts of the capillaries attached to the columns as well with color code tags (small rings) to easily follow the flow paths in your system.

Fixing the Low Dispersion Heat Exchangers

For the G1316C, additional heat exchanger devices can be installed on the carrier Carrier for heat exchanger (G1316-89200) using 3 screws (Screw 2.5 mm hex (0515-1052), included to part number for carrier) as shown in figure below.

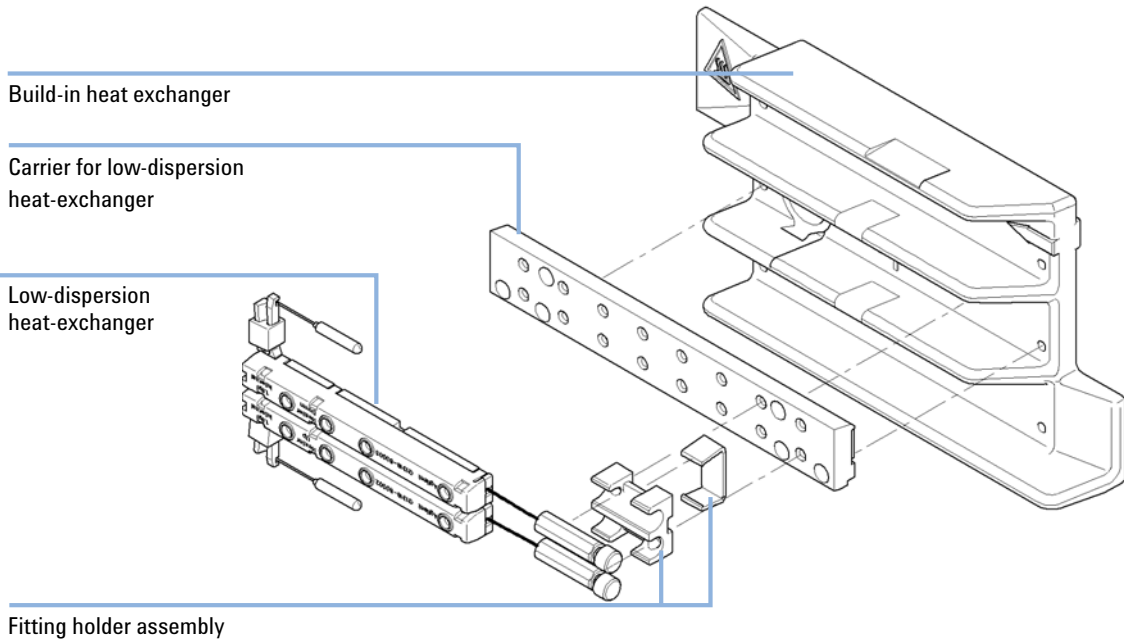


Figure 30 Installing the low dispersion heat exchangers

Choose Compatible Fittings

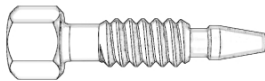
For the heater device inlet capillary choose fittings which are compatible to your column.

NOTE

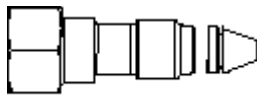
The Very High Pressure Fitting is pressure tight up to 1200bar.

Do not overtighten the fitting at installation. Finger tighten the nut into the port until snug. Then use the wrench and apply about 1/4 of a revolution. (Torque ~ 1.0 – 1.2 Nm)

Very High Pressure Fitting, removable (5067-4738) for swagelock compatible columns



Swagelock compatible columns (5065-4454, pack of 10, with ferrules)



Fitting screw long

Figure 31 Fitting type depends on column type

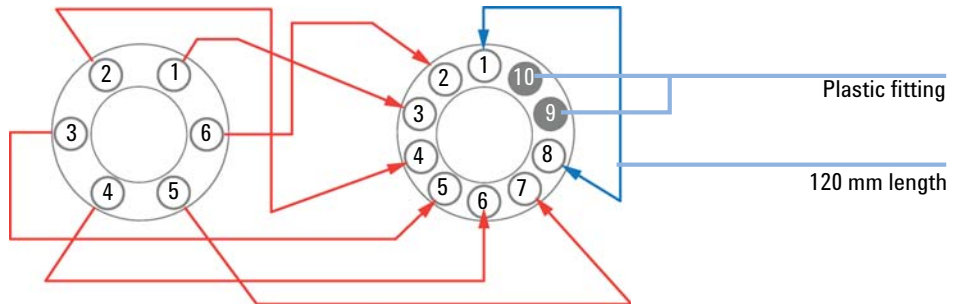
Installing the capillaries

Installing the capillaries

The 2pos/10port valve can be used here in the same way as a 2pos/6port valve; just follow the re-routing diagram below.

Map the ports from the 2pos/6port valve to the corresponding ports of the 2pos/10port valve according to the red arrows. For example, mount the capillary connected to port 6 (2pos/6port) at port 2 instead.

Connect port 1 and port 8 with a 120 mm length capillary (0.12 mm i.d. or 0.17 mm i.d. depending on the capillary kit) (5067-4652). Plug Plastic fittings (0100-1259) into ports 9 and 10.



Parts required	#	p/n	Description
	1	5067-4646	Capillary kit
	1	G4231B	2pos/6port valve
	1	G4232B	2pos/10port valve

Preparations Identify the required capillaries in your capillary kits ("[Capillary kit PN 5067-4646](#)" on page 158)

NOTE

Use utmost care to avoid any void volumes caused by poor connections.

- 1 Install the capillaries depending on your application:
 - Dual column selection, see “[Configuration for dual-column selection](#)” on page 127
 - Sample Enrichment, see “[Configuration for sample enrichment](#)” on page 128
 - Sample Clean-up, see “[Configuration for sample clean-up](#)” on page 129
 - Alternating Column Regeneration (only 2pos/10port valve), see “[Configuration for alternating column regeneration](#)” on page 130

NOTE

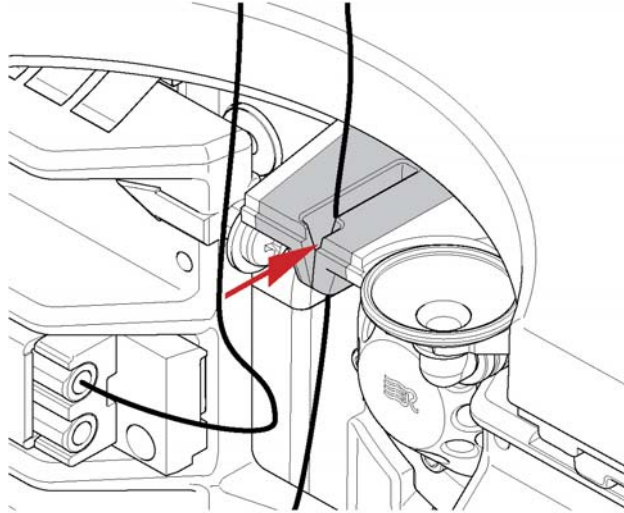
Use utmost care to avoid any void volumes caused by poor connections.

- 2 Connect the capillaries connected directly to a column and fasten them immediately with a spanner.
- 3 Finger-tighten all remaining capillaries.
- 4 Clip the unions into the corresponding clips of the low dispersion heat exchangers.
- 5 Fasten all fittings with a spanner.
- 6 Starting from position one through six (ten, respectively), fasten the fittings on the heat exchanger.
- 7 Fasten all fittings on attached modules (autosampler, detector, additional pumps). Fit all unused valve ports with a plastic plug.
- 8 Push the valves into the rear positions.

8 Maintenance

Installing the capillaries

- 9 Place the capillaries that go to another module or waste into the capillary guides to prevent squeezing them when closing the front cover.



- 10 Stow any excess lengths of the capillaries.
- 11 Perform a final leak-check.

Configurations and Capillary Set-up Configuration for dual-column selection

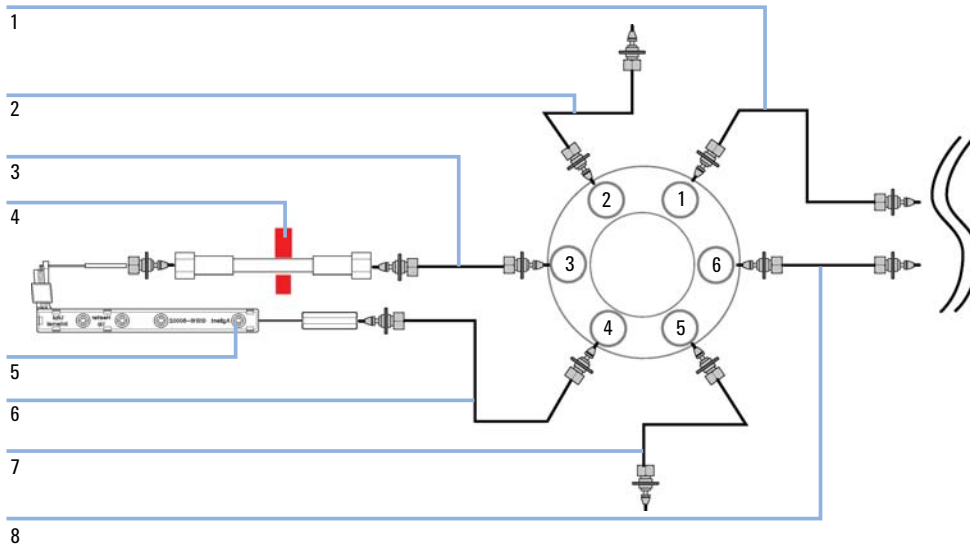


Figure 32 Installing the capillaries for a dual-column selection set-up (column and heat exchanger of the second position are omitted)

1	150 mm length (column length up to 100 mm), 280 mm length (column length > 100 mm) From column Not pre-swaged on column-side!
2	200 mm length to detector
3	150 mm length (column length up to 100 mm), 280 mm length (column length > 100 mm) From column Not pre-swaged on column-side!
4	Column with color code clip
5	Low dispersion heat exchanger or built-in 3 μ L/6 μ L heat exchanger and 90 mm length capillary to column
6	90 mm length to heat exchanger
7	Built-in 3 μ L/6 μ L heat exchanger and 90 mm length capillary to column
8	90 mm length to heat exchanger

Pos.1: Connection between Ports 1-6 , 4-5, 2-3 , active Column 1 = left

Pos. 2: Connection between Ports 1-2, 3-4, 5-6 active Column 2 = right

Example shows setup with flow directed 1290 typical from bottom to top.

Flow direction from top to bottom needs switch of connected capillaries at ports 5 and 2. Also

column inlet connections needed to be switched with outlet connections. Port 4 to 3 and 6 to 1.)

Configuration for sample enrichment

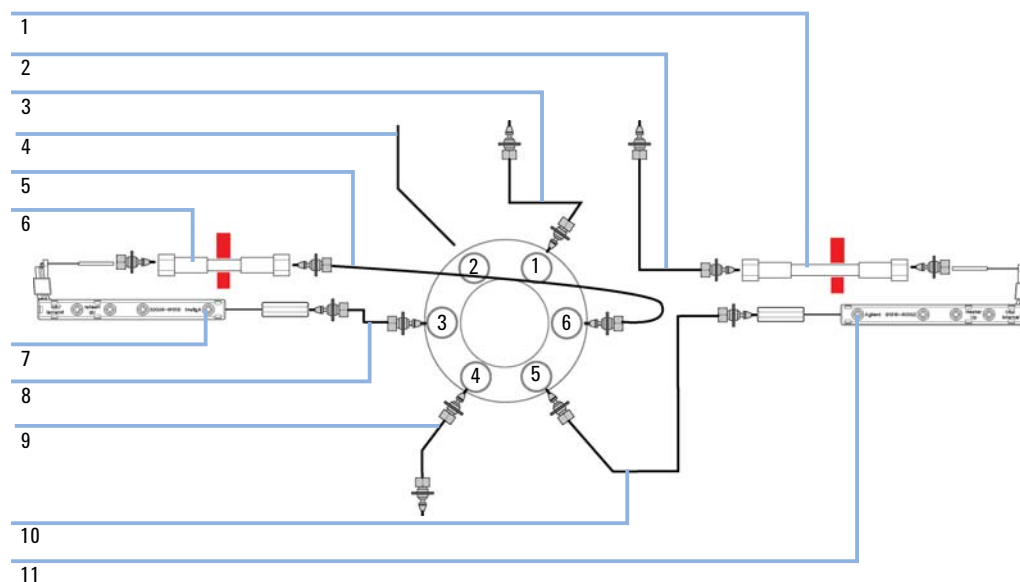


Figure 33 Installing the capillaries for a sample enrichment set-up

1	Analytical column with color code clip
2	280 mm length (column length > 100 mm) from analytical column to detector Not pre-swaged on column-side!
3	340 mm length from autosampler and loading pump
4	To waste
5	150 mm length (column length up to 100 mm), 280 mm length (column length > 100 mm) From column Not pre-swaged on column-side!
6	Enrichment column with color code clip
7	Low dispersion heat exchanger or build-in 3 µL/6 µL heat exchanger and 90 mm length capillary to column
8	90 mm length to heat exchanger
9	700 mm length (0.17 mm ID) from analytical pump
10	90 mm length to heat exchanger
11	Low dispersion heat exchanger or build-in 3 µL/6 µL heat exchanger and 90 mm length capillary to column

Pos.1: Connection between ports 1-6 , 4-5, 2-3 , active column 1 = left (enrichment column)
Pos. 2: Connection between ports 1-2, 3-4, 5-6 active column 2 = right (analytical colum)

Configuration for sample clean-up

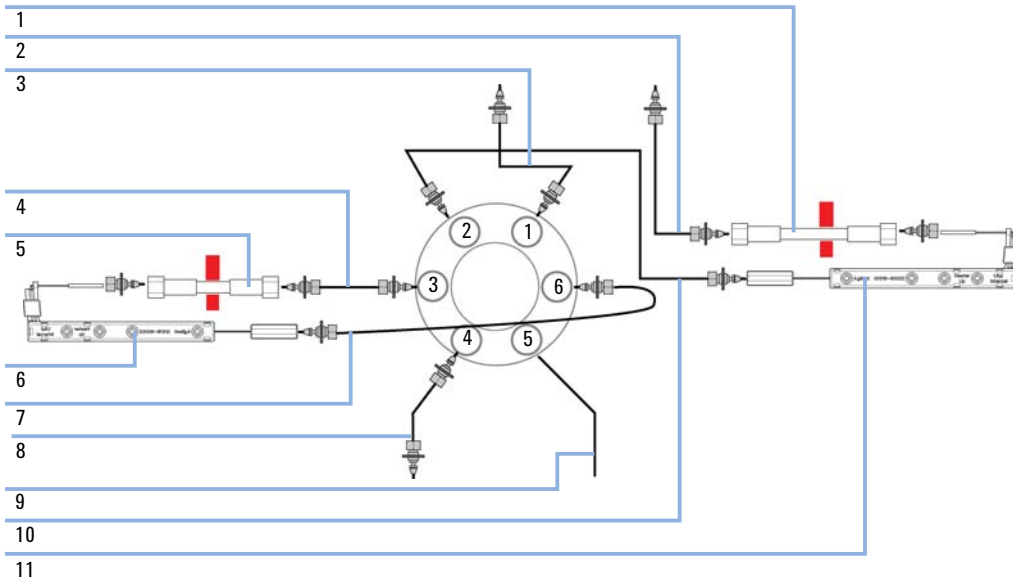


Figure 34 Installing the capillaries for a sample clean-up set-up

1	Analytical column with color code clip
2	280 mm length (column length > 100 mm) from analytical column to detector Not pre-swaged on column-side!
3	340 mm length from autosampler and loading pump
4	150 mm length (column length up to 100 mm), 280 mm length (column length > 100 mm) From column Not pre-swaged on column-side!
5	Pre-column with color code clip
6	Low dispersion heat exchanger or build-in 3 μ L/6 μ L heat exchanger and 90 mm length capillary to column
7	90 mm length to heat exchanger
8	700 mm length (0.17 mm ID) from analytical pump
9	To waste
10	90 mm length to heat exchanger
11	Low dispersion heat exchanger or build-in 3 μ L/6 μ L heat exchanger and 90 mm length capillary to column
Pos.1: Connection between ports 1-6, 4-5, 2-3, active column 1 = left (Pre-column)	
Pos. 2: Connection between Ports 1-2, 3-4, 5-6 active column 2 = right (analytical column)	

Configuration for alternating column regeneration

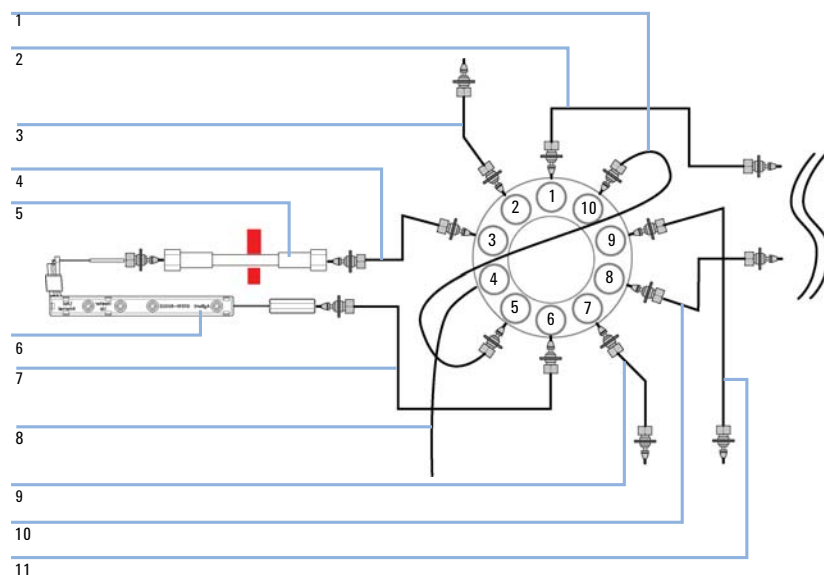


Figure 35 Installing the capillaries for alternating column regeneration (column and heat exchanger of the second position are omitted)

1	Valve-Valve connector, 120 mm length
2	150 mm length (column length up to 100 mm), 280 mm length (column length > 100 mm) From column Not pre-swaged on column-side!
3	200 mm length to detector
4	150 mm length (column length up to 100 mm), 280 mm length (column length > 100 mm) From column Not pre-swaged on column-side!
5	Column with color code clip
6	Low dispersion heat exchanger or build-in 3 μ L/6 μ L heat exchanger and 90 mm length capillary to column
7	90 mm length to heat exchanger
8	To waste
9	From autosampler
10	700 mm length (0.17 mm ID) from regeneration pump
11	90 mm length to heat exchanger

Pos.1: Connection between ports 1-10 , 2-3, 4-5, 6-7, 8-9 active column 1 = left / regenerating column = right
Pos. 2: Connection between ports 1-2, 3-4, 5-6, 7-8, 9-10 active column 2 = right / regenerating column = left

Correcting Leaks

When If a leakage has occurred at the heat exchanger or at the capillary connections or at the column switching valve.

Tools required	Description
	Tissue
	Pipette
	Wrench, 1/4 – 5/16 inch (for capillary connections)

NOTE

Depending on the column position or the use of additional heat-exchanger assemblies, the view of [Figure 36](#) on page 132 may vary.

- 1 Remove the front cover.
- 2 Use a pipette and tissue to dry the leak sensor area.
- 3 Observe the capillary connections and the column switching valve for leaks and correct, if required.

8 Maintenance

Correcting Leaks

- 4 Re-install the front cover.

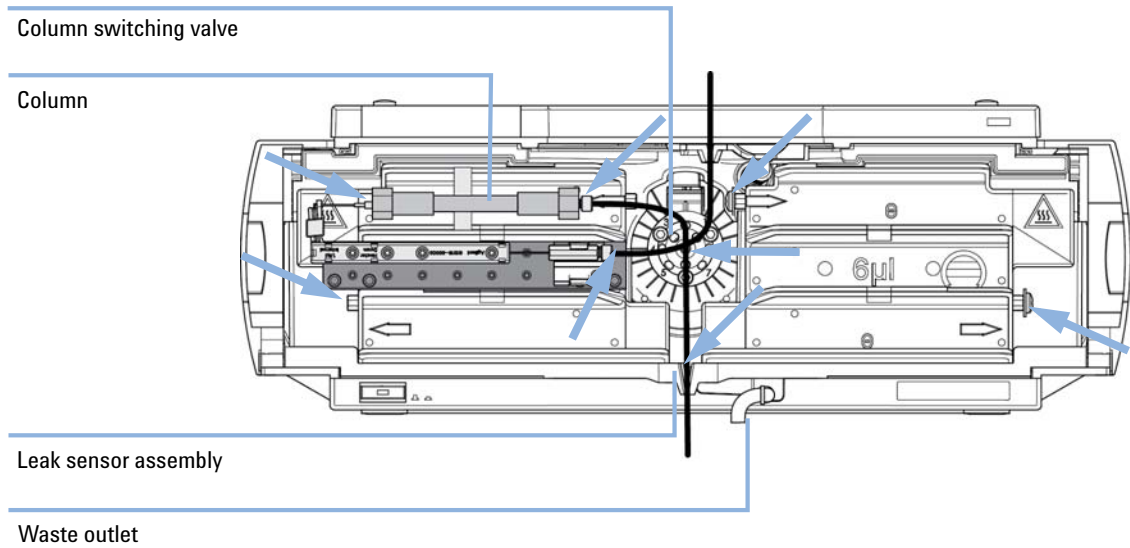


Figure 36 Possible Leak Areas

Replacing Head Parts of Column Switching Valve

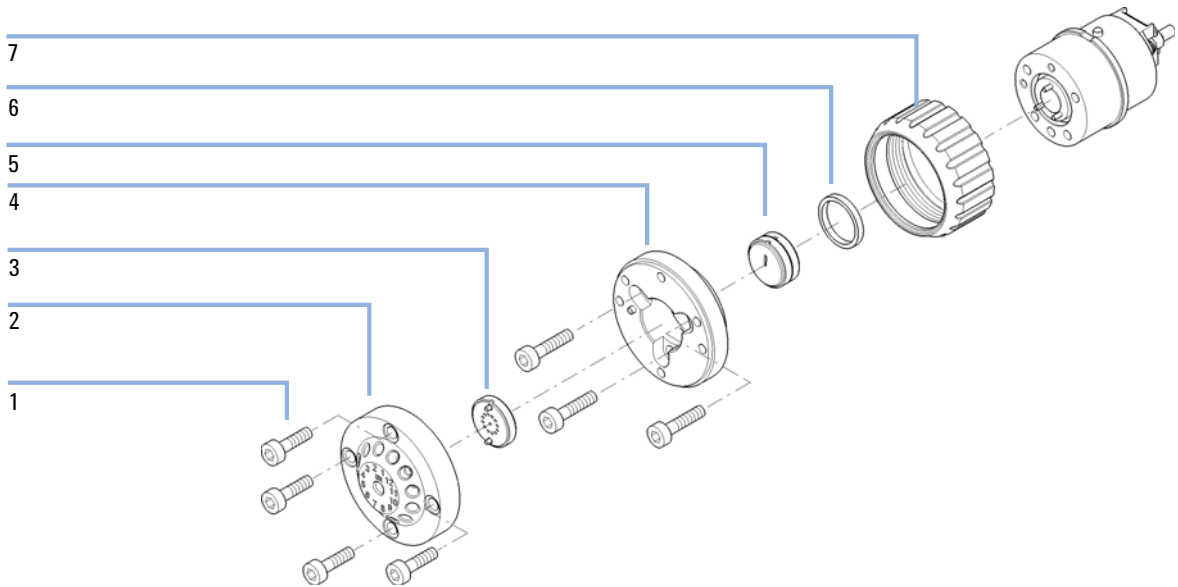


Figure 37 Valve Head Parts (example shows a 5067-4159 valve head)

1	Stator screws
2	Stator head assembly
3	Stator face assembly
4	Stator ring (available for service only)
5	Rotor seal
6	Bearing ring (P/N 1534-4045)
7	Spanner nut (P/N 5068-0106, available for service only)

When If valve leaks.

Tools required

Description

Wrench, 1/4 inch

Hexagonal key, 9/64 inch

8 Maintenance

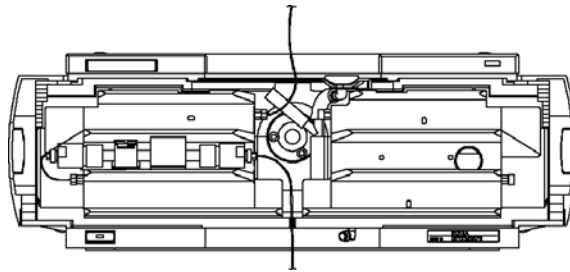
Replacing Head Parts of Column Switching Valve

NOTE

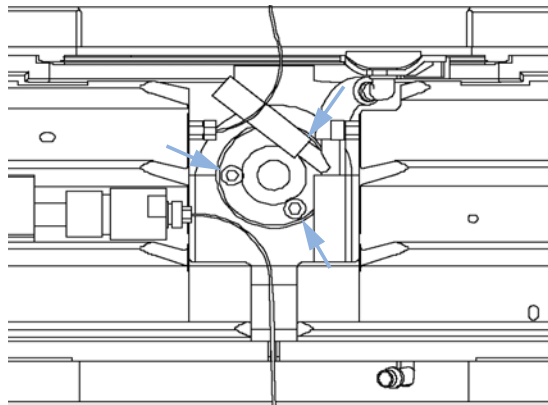
Figure 37 on page 133 illustrates replacement parts for the valve heads, with the 12Pos/13Port Selector valve as an example. The valves can vary in their appearance and do not necessarily include all of the illustrated parts. Neither, every spare part is available for each flavor of the valve.

Use the tables (Table 24 on page 153/Table 25 on page 154) for identification of the required part numbers.

- 1 Remove capillaries from ports.



- 2 Loosen each fixing stator screw two turns at a time. Remove bolts from head.



- 3 Remove the stator head (and stator face if applicable).
- 4 Remove the stator ring.
- 5 Remove the rotor seal (and isolation seal if damaged or contaminated).
- 6 Install the new isolation seal (if required). Ensure the metal spring inside the ring faces towards the valve body.
- 7 Install the new rotor seal.

Replacing Head Parts of Column Switching Valve

- 8 Replace the stator ring. Ensure the stator ring is flush with the valve body.
- 9 Place the new (if required) stator face in place on the stator head. Reinstall the stator head.
- 10 Insert the stator screws in the stator head. Tighten the screws alternately two turns at a time until the stator head is secure.
- 11 Reconnect the pump capillaries to the valve ports. Slide the waste tube into the waste holder in the leak tray.

CAUTION

Wrong use of **Pressure Test** may damage valve.

The current implementation of the **Pressure Test** automatically uses the maximum pressure generated by the pump used in the system.

- Do not use the test for modules having a lower maximum pressure than the pump as this will damage the valve. For example do not use 400 bar valve in a TCC or Flex Cube in combination with a 600 bar pump.

-
- 12 Perform a **Pressure Test** to ensure the valve is pressure tight.

Replacing Valve Heads

Several optional valve heads are available, which can be installed and exchanged easily.

Micro valves offer small internal volumes for minimum peak broadening, ideal for low flow rates in the nl/min and μ l/min range.



For bio-inert modules use bio-inert parts only!

Parts required

Description

Any Agilent Quick Change Valve Head.
For details, see ["Valve Options Overview"](#) on page 153

WARNING

Toxic, flammable and hazardous solvents, samples and reagents

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

- Be sure that no solvent can drop out of the solvent connections when removing them from your valve head.
- 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.

CAUTION

Valve Damage

Using a low pressure valve on the high pressure side can damage the valve.

- When using multiple column compartments as part of a method development solution, make sure that the high pressure valve head is connected to the autosampler and the low pressure valve head is connected to the detector.

NOTE

For details, please refer to the Agilent 1200 Infinity Series Method Development System - System Manual (G4230-90002).

CAUTION

Column Damage or Bias Measurement Results

Switching the valve to a wrong position can damage the column or bias measurement results.

→ Fit the lobe to the groove to make sure the valve is switched to the correct position.

CAUTION

The valve actuator contains sensitive optical parts, which need to be protected from dust and other pollutions. Pollution of these parts can impair the accurate selection of valve ports and therefore bias measurement results.

→ Always install a valve head for operation and storage. For protecting the actuator, a dummy valve head (part of Transportation Lock Kit (G1316-67001)) can be used instead of a functional valve. Do not touch parts inside the actuator.

NOTE

The tag reader reads the valve head properties from the valve head RFID tag during initialization of the module. Valve properties will not be updated, if the valve head is replaced while the module is on.

Selection of valve port positions can fail, if the instrument does not know the properties of the installed valve.

NOTE

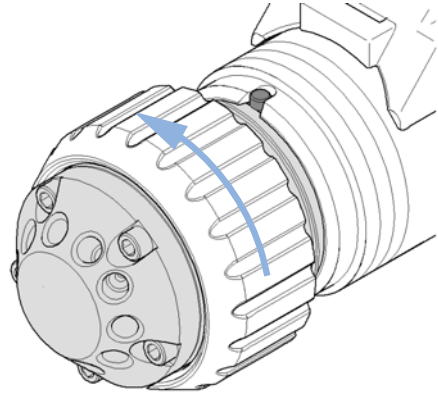
To have the valve correctly recognized by the Agilent Infinity Valve Drive you must have the valve drive powered off for at least 10 seconds.

8 Maintenance

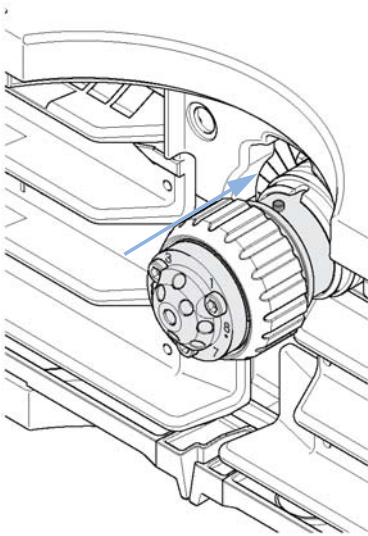
Replacing Valve Heads

- 1 Switch off the module.
- 2 Push the valve head for bringing it to its outer position (TCC only).
- 3 Remove all capillary connections from the valve head

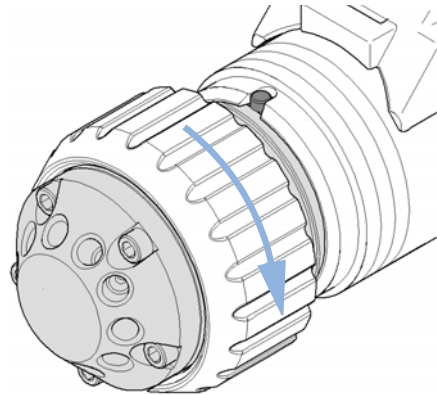
- 4 Unscrew the valve head.



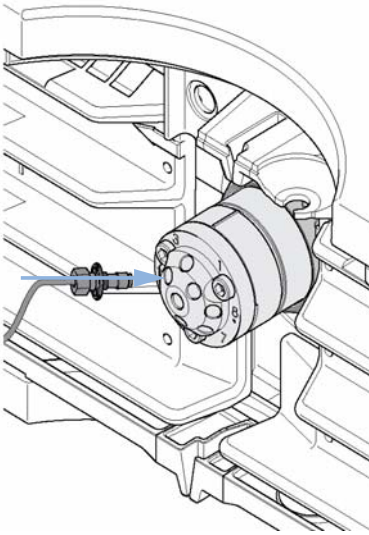
- 5 Put the new valve head onto the valve drive such that the lobe fits to the groove (see also "Installing the Valve Heads" on page 50).



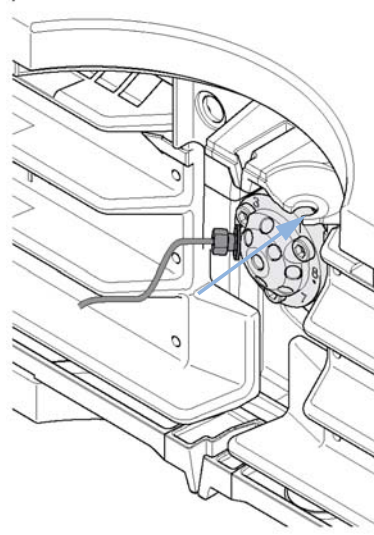
- 6 Screw the valve head onto the valve drive using the union nut (see also "Installing the Valve Heads" on page 50).



7 Install all required capillary connections to the valve head.



8 Push the valve head until it snaps in and stays in the rear position.



9 Switch on the module.

8 Maintenance

Preparing the Column Compartment for Transportation

Preparing the Column Compartment for Transportation

When If a Thermostatted Column Compartment including the Valve Drive Option shall be transported

Tools required **Description**
Screwdriver, Pozidriv #1 PT3

Parts required	#	p/n	Description
	1	G1316-67001	Transportation Lock Kit

NOTE

The module has been shipped with transportation locks, which must be used for transportation protection. Transportation Lock Kit (G1316-67001) can be re-ordered.

CAUTION

Damage to Internal Parts

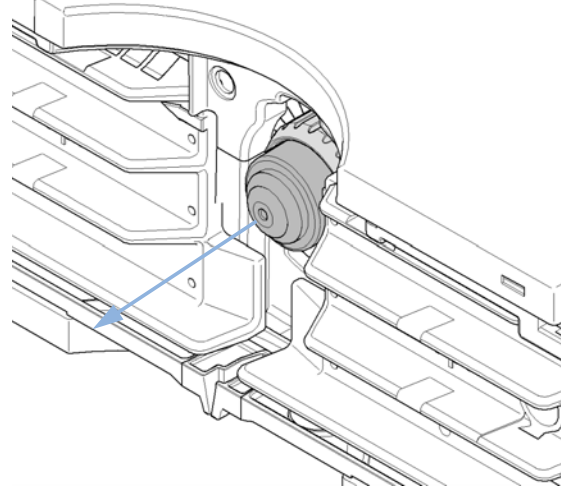
Mechanical shocks for example when being transported by car or shipped by post.

→ Install a lock (Transportation Lock Kit).

Preparing the Column Compartment for Transportation

1 Remove the valve head as described in “Replacing Valve Heads” on page 136.

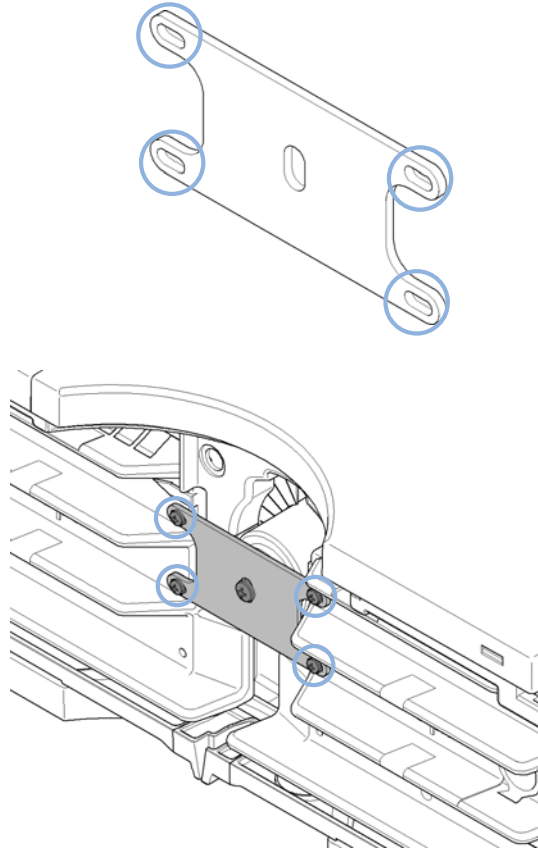
2 Replace the valve head by the transportation valve head. Bring the transportation valve head to the outer position.



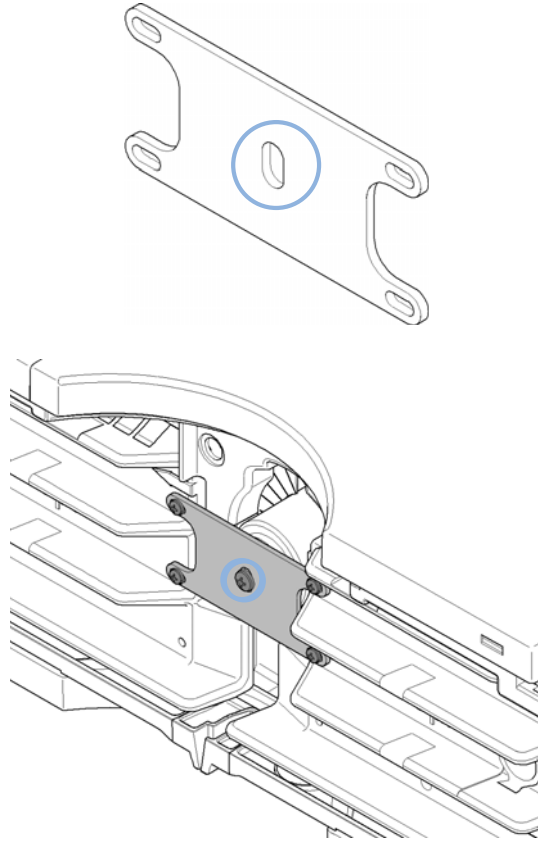
8 Maintenance

Preparing the Column Compartment for Transportation

- 3** Use Screw M3x8 (pack of 4) (0515-0897) for fixing the Lock plate (G1316-03701) to the heat exchangers in the outer positions of the plate.



- 4** Use a Screw M4 (2680-0128) for fixing the lock plate to the Transportation valve head (G1316-40002) in the central position of the plate. Put the spring washer (not shown) between the screw and the lock plate.



Replacing 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
	LAN/RS-232 Firmware Update Tool
OR	Agilent Lab Advisor software
OR	Instant Pilot G4208A (only if supported by module)

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

Preparations Read update documentation provided with the Firmware Update Tool.

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

- 1** Download the required module firmware, the latest LAN/RS-232 FW Update Tool and the documentation from the Agilent web.
 - http://www.chem.agilent.com/_layouts/agilent/downloadFirmware.aspx?whid=69761
- 2** For loading the firmware into the module follow the instructions in the documentation.

Table 21 Module Specific Information (G1316C)

Initial firmware (main and resident)	A.06.10
Compatible with 1100/1200 series modules	All other modules must have firmware revision A.06.1x or B.06.1x or above (main and resident). Otherwise the communication will not work.
Conversion to / emulation	N/A

8 Maintenance

Replacing the Module Firmware



9

Parts and Materials for Maintenance

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Standard Accessory Kit	155
Low Dispersion Capillary Kit for G1316C	156
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This chapter provides information on parts for maintenance.



Plastic Parts

Item	p/n	Description
1	G1316-68754	Front cover
2	5042-9964	Name plate for Agilent 1290 series

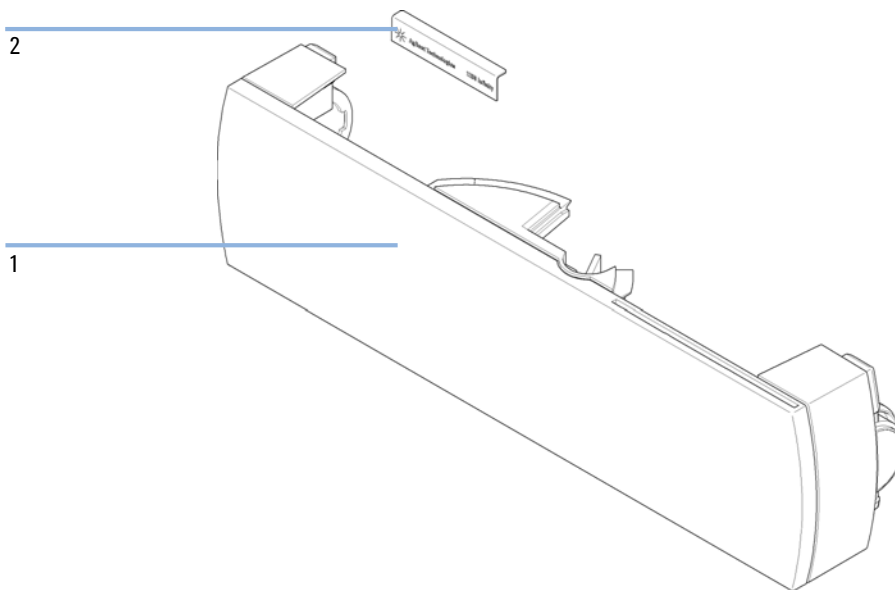


Figure 38 Plastic Parts

Leak Parts

Item	p/n	Description
1	G1316-67000	Leak tube kit includes following items: Funnel holder G1316C, tubing-flex polyethylene, leak funnel
2	G1316-42303	Capillary guide

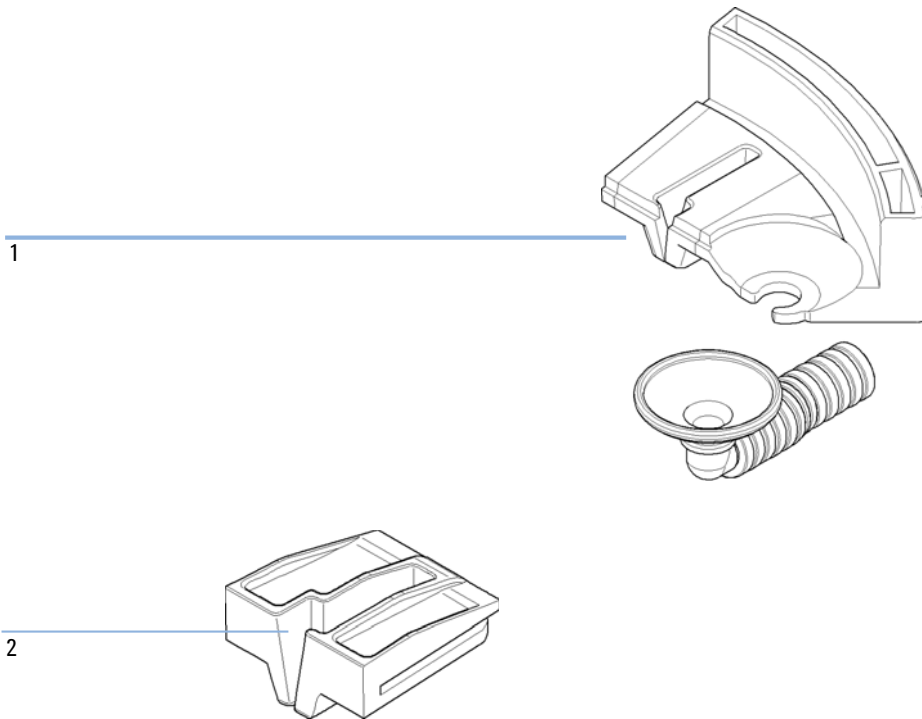


Figure 39 Leak Parts

Heater and Cooling Devices

The use of these heater devices is described in Agilent 1200 Series Multi-Method and Method Development System - System Manual (G4230-90001), and in the Agilent G4231B and G4232B Valve Kit - Instructions (G4232-90003).

Table 22 Heater Devices

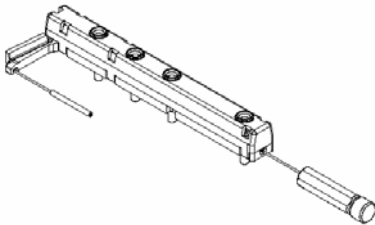
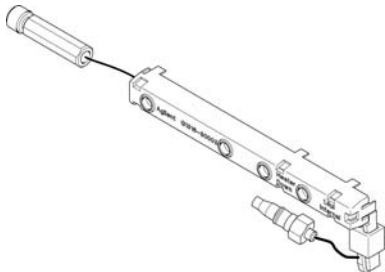
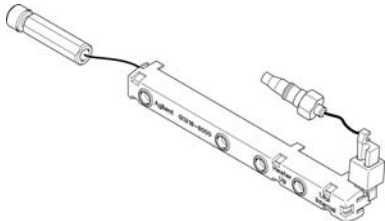
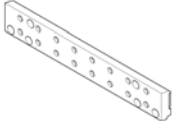
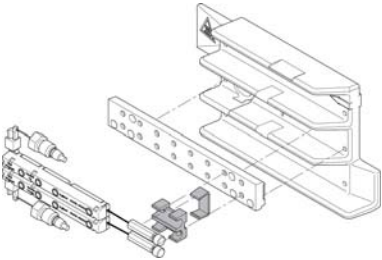
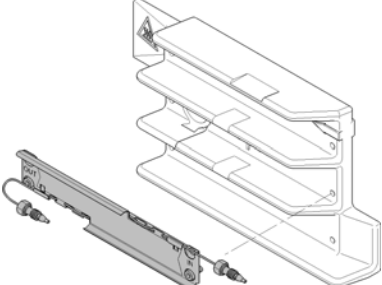
Item	Description
	<p>Heater long-up (0.12 mm i.d., 1.6 µL internal volume) (G1316-80002) Part of Capillary kit (5067-4646). For fittings see Table 23 on page 150.</p>
	<p>Heat Exchanger Long Up 0.075 mm, nom. Volume 1.0 µL (G1316-80012)</p>
	<p>Heater long-down (0.12 mm i.d., 1.6 µL internal volume) (G1316-80003) Part of Capillary kit (5067-4646). For fittings see Table 23 on page 150.</p>
	<p>Heat Exchanger Long Down 0.075 mm (nom. 1.0 µL) (G1316-80013)</p>
	<p>Column clip set, 8 colors (5042-9918)</p>

Table 22 Heater Devices

Item	Description
	Carrier for heat exchanger TCC SL Plus (G1316-89200)
	Fitting holder assembly (G1316-68706)
	Bio-Inert Solvent Heating Devices (9 µL internal volume, 600 bar max pressure) (G5616-60050)

9 Parts and Materials for Maintenance

Heater and Cooling Devices

Table 23 TCC Heater Fittings

Item	Description
9	Plastic fittings (0100-1259)
7	Very high pressure removable fitting (5067-4738)
8	Fitting screw long ¹
5	Ferrule back ¹
6	Ferrule front ¹

¹ included in kit Fitting screw long (5065-4454)

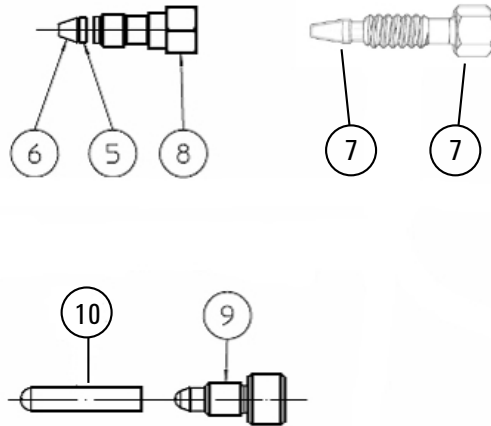
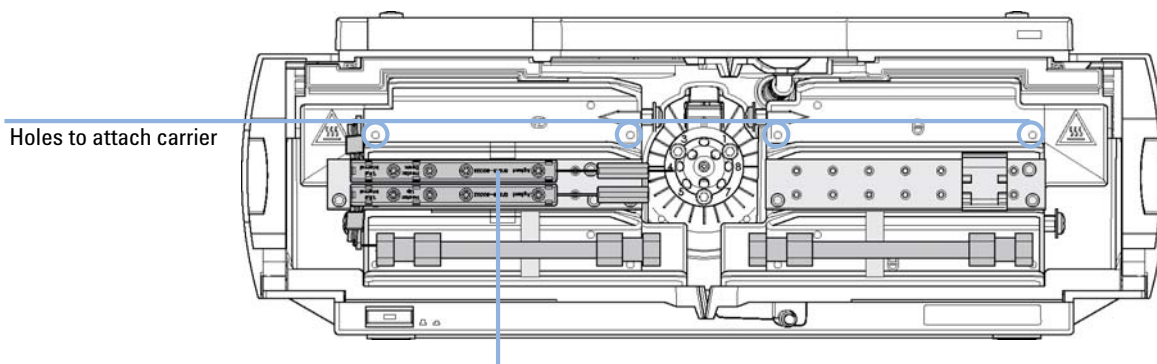


Figure 40 TCC Heater Fittings



L-shaped pre-column heater, volume: 1.6 μ L
mounted on carrier
(top for column 1, bottom for column 2)

Figure 41 Heater Devices for G1316C

Valve Options Overview

Valve Head Parts

NOTE

The figure below illustrates replacement parts for the valve heads, with the 12Pos/13Port Selector valve as an example. The valves can vary in their appearance and do not necessarily include all of the illustrated parts. Neither, every spare part is available for each flavor of the valve.

Use the tables ([Table 24](#) on page 153/[Table 25](#) on page 154) for identification of the required part numbers.

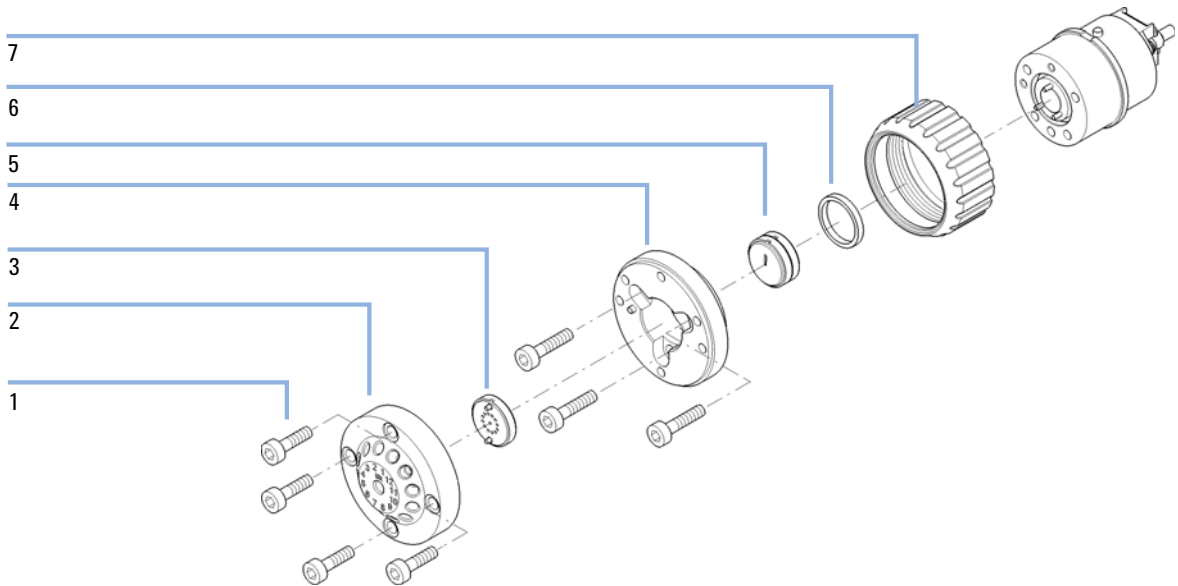


Figure 42 Valve Head Parts (example shows a 5067-4159 valve head)

1	Stator screws
2	Stator head assembly
3	Stator face assembly
4	Stator ring (available for service only)
5	Rotor seal
6	Bearing ring (P/N 1534-4045)
7	Spanner nut (P/N 5068-0106, available for service only)

Valve Options Overview

This overview gives a summary of the main parts and assemblies. More details are available with each valve option in this chapter.

Table 24 Replacement Parts Standard Valve Heads

Valve Head	Rotor Seal	Stator Head	Stator Screws (10/Pack)	Stator Ring
5067-4107 8 Pos/ 9 Port, 600 bar	5067-4111 (PEEK)	5068-0001	1535-4857	5068-0120
5067-4121 8 Pos/ 9 Port, 1200 bar	5068-0002 (Vespel)	5068-0001	1535-4857	5068-0120
5067-4137 2 Pos/6 Port, 600 bar	0101-1409 (PEEK)	0101-1417	1535-4857	5068-0120
5067-4117 2 Pos/6 Port, 1200 bar	5068-0008 (Vespel)	5068-0006	1535-4857	5068-0120
5067-4144 2 Pos/10Port, 600 bar, micro	0101-1415 (PEEK)	0101-1421	5068-0054	n.a.
5067-4118 2 Pos/10 Port, 1200 bar	5068-0012 (Vespel)	5068-0011	5068-0019	n.a
5067-4145 2 Pos/10Port, 600 bar	0101-1415 (PEEK)	5068-0165	5068-0019	n.a
5067-4146 6 Column Selector, 600 bar	5068-0076 (PEEK)	5068-0077	5068-0089	n.a
5067-4142 6 Column Selector, 1200 bar	5068-0067 (Vespel)	5067-0077	5068-0089	n.a

9 Parts and Materials for Maintenance

Valve Options Overview

Table 25 Replacement Parts Bio-Inert Valve Heads

Valve Head	Rotor Seal	Stator Head	Stator Face	Stator Screws (10/Pack)	Stator Ring
5067-4148 2 Pos/6 Port, 600 bar, bio-inert	0101-1409 (PEEK)	5068-0060	0100-1851	5068-0020	5068-0020
5067-4132 2 Pos/10Port, 600 bar, bio-inert	5068-0041 (PEEK)	5068-0040	5068-0095	5068-0059	n.a.
5067-4134 4 Column Selector, 600 bar, bio-inert	5068-0045 (PEEK)	5068-0044	5068-0093	5068-0059	n.a.
5067-4159 12 Pos/13Port, Selector, 200 bar, bio-inert	0101-1288 (PEEK)	5068-0097	0101-1288	5068-0059	n.a.

Accessory Kits

The accessory kits contain accessories and tools needed for installation and maintenance.

Standard Accessory Kit

The standard accessory kit is always delivered with the instrument. You might want to order one of the following items if you choose to re-install the instrument at a later time.

Accessory kit (G1316-68765)

p/n	Description
5063-6527	Tubing assembly, i.d. 6 mm, o.d. 9 mm, 1.2 m (to waste)
5181-1516	CAN cable, Agilent module to module, 0.5 m
G1316-01202 (2x)	Column clamp
G1316-87300	Capillary, 0.17 x 90 mm 1/16 in male/male
G1316-87321	Capillary column-heat exchanger 105 mm lg, 0.17 mm i.d.
G1316-87323	Capillary column-heat exchanger 170 mm lg, 0.17 mm i.d.

Low Dispersion Capillary Kit for G1316C

Capillary Kit 5067-4633

p/n	Description
0100-0043	ST front ferrule
0100-0044	ST back ferrule
0100-2086	Nut seal-tight (pack of 2)
5021-1822	Flexible tubing, 280 mm
G1156-22401	Fitting Screw long
G1316-68706	Fitting holder assy, includes following items: Fitting fork, fitting clip, screws (pack of 4)
G1316-89200	Carrier for heat exchanger
G1316-80003	Heater long-down (0.12 mm i.d., 1.6 μ L internal volume)

List of Capillary and Column Kits for Method Development Systems

The following kits are available for method development. For more detailed information refer to Agilent 1200 Series Multi-Method and Method Development System - System Manual (G4230-90001).

p/n	Description
5067-4601	Solvent selection tubing kit, 4 solvents
5067-1595	Method development capillary kit, low dispersion, short column
5067-1596	Method development capillary kit, low dispersion, long column
5067-1597	Method development capillary kit, general purpose
5190-1431	RRHT Selectivity Method Development Kit, 2.1 mm i.d.
5190-1432	RRHT pH Method Development Kit, 2.1 mm i.d.
5190-1433	RRHT Selectivity Method Development Kit, 4.6 mm i.d.
5190-1434	RRHT pH Method Development Kit, 4.6 mm i.d.
5190-1435	Rapid Resolution Selectivity Method Development Kit
5190-1436	Rapid Resolution pH Method Development Kit

Capillary kit PN 5067-4646

The capillary kit PN 5067-4646 contains the following parts:

p/n	Description
5067-4647	Capillary ST 0.12 mm x 340 mm S/SX Autosampler to Valve
5067-4648	Capillary ST 0.17 mm x 700 mm S/SX Pump to valve (ACR only)
5067-4649 (2x)	Capillary ST 0.12 mm x 90 mm S/SX Valve to heat exchanger
5067-4650 (2x)	Capillary ST 0.12 mm x 150 mm SL/SX short column to valve
5067-4651 (2x)	Capillary ST 0.12 mm x 280 mm SL/SX Long Column to Valve
5067-4652	Capillary ST 0.12 mm x 120 mm SX/SX Valve to Valve (bypass)
5067-4653	Capillary ST 0.12 mm x 200 mm S/SX Valve to Detector
0890-1713	Tube PTFE, 2 m Valve to Waste
G1316-80002	Heat Exchanger Long-Up, 1.6 µL
G1316-80003	Heat Exchanger Long-Down, 1.6 µL
G1316-89200 (2x)	Carrier for heat exchanger TCC SL Plus
G1316-68706 (2x)	Fitting holder assembly
5042-9918	Column clip set, eight colors
0100-1259 (4x)	Plastic fitting

Capillary kit PN 5067-4682

The capillary kit PN 5067-4682 contains the following parts:

p/n	Description
5067-4684	Capillary ST 0.12 mm x 340 mm S/SX Autosampler to Valve
5067-4648	Capillary ST 0.17 mm x 700 mm S/SX Pump to valve (ACR only)
5067-4685 (2x)	Capillary ST 0.12 mm x 90 mm S/SX Valve to heat exchanger
5067-4686 (2x)	Capillary ST 0.12 mm x 150 mm SX/SX short column to valve
5067-4687	Capillary ST 0.12 mm x 280 mm SX/SX long column to valve
5067-4688	Capillary ST 0.12 mm x 120 mm SX/SX valve to valve (bypass)
5067-4689	Capillary ST 0.12 mm x 200 mm S/SX valve to detector
0890-1713	Tube PTFE, 2 m valve to waste
G1316-80002	Heat Exchanger Long-Up, 1.6 µL
G1316-80003	Heat Exchanger Long-Down, 1.6 µL
G1316-89200 (2x)	Carrier for heat exchanger TCC SL Plus
G1316-68706 (2x)	Fitting holder assembly
0100-1259 (4x)	Plastic fitting
5042-9918	Column clip set, eight colors

Capillary kit PN 5067-4730

The capillary kit PN 5067-4730 contains the following parts:

p/n	Description
5067-4723	Capillary ST 0.17 mm x 340 mm S/SX Autosampler to Valve
5067-4648	Capillary ST 0.17 mm x 700 mm S/SX Pump to valve (ACR only)
5067-4724 (4x)	Capillary ST 0.17 mm x 90 mm S/SX Valve to heat exchanger and heat exchanger to column
5067-4720 (2x)	Capillary ST 0.17 mm x 150 mm SL/SX short column to valve
5067-4722 (2x)	Capillary ST 0.17 mm x 280 mm SL/SX long column to valve
5067-4719	Capillary ST 0.17 mm x 120 mm SX/SX valve to valve (bypass)
5067-4721	Capillary ST 0.17 mm x 200 mm S/SX valve to detector
0890-1713	Tube PTFE, 2 m valve to waste
5042-9918	Column clip set, eight colors

Capillary kit PN 5067-4729

The capillary kit PN 5067-4729 contains the following parts:

p/n	Description
5067-4744	Capillary ST 0.12 mm x 340 mm SL/M Autosampler to Valve
5067-4745	Capillary ST 0.11 mm x 500 mm S/M Sampler (dual stack) to Valve
5067-4735 (8x)	Capillary ST 0.11 mm x 130 mm LS/M Valve to heat exchanger and column to valve
5067-4737	Capillary ST 0.17 mm x 150 mm M/M Valve to Valve (bypass)
5067-4746	Capillary ST 0.12 mm x 250 mm SV/M Valve to Detector
8710-1534	Wrench, 4 mm both ends, open end
5022-6503	Flexible PEEK tubing 450 mm, 0.4 mm i.d. Valve to Waste
G4240-43200	PEEK fitting special for Chip-LC
G1316-80002 (2x)	Heat Exchanger Long-Up, 1.6 µL
G1316-80003 (2x)	Heat Exchanger Long-Down, 1.6 µL
G1316-89200 (2x)	Carrier for heat exchanger TCC SL Plus
G1316-68706	Fitting holder assembly
5042-9918	Column clip set, eight colors

Accessories

The Transportation Lock Kit (G1316-67001) has been delivered with the instrument. You will need this kit to prepare the TCC for transportation.

Transportation Lock Kit (G1316-67001)

p/n	Description
G1316-03701	Lock plate
2680-0128	Screw M4
0515-0897	Screw M3x8 (pack of 4)
	Spring Washer
G1316-40002	Transportation valve head



10 Identifying Cables

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This chapter summarizes information on all cables.



Cable Overview

NOTE

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

Analog cables

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

Remote cables

p/n	Description
03394-60600	Agilent module to 3396A Series I integrators 3396 Series II / 3395A integrator, see details in section " Remote Cables " on page 168
03396-61010	Agilent module to 3396 Series III / 3395B integrators
5061-3378	Remote Cable
01046-60201	Agilent module to general purpose

BCD cables

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

CAN cables

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

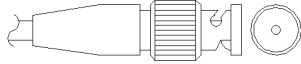
LAN cables

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

RS-232 cables

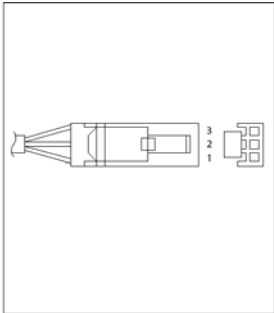
p/n	Description
G1530-60600	RS-232 cable, 2 m
RS232-61601	RS-232 cable, 2.5 m Instrument to PC, 9-to-9 pin (female). This cable has special pin-out, and is not compatible with connecting printers and plotters. It's also called "Null Modem Cable" with full handshaking where the wiring is made between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

Analog cables

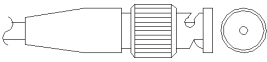


One end of these cables provides a BNC connector to be connected to Agilent modules. The other end depends on the instrument to which connection is being made.

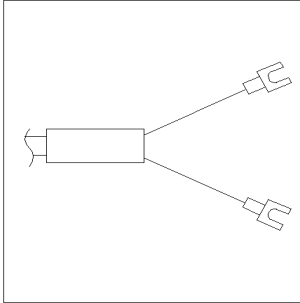
Agilent Module to 3394/6 Integrators

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

Agilent Module to BNC Connector

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

Agilent Module to General Purpose

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

Remote Cables



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

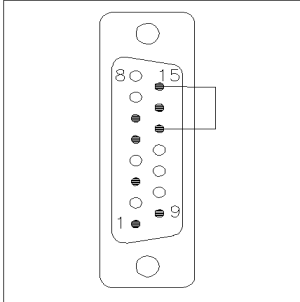
Agilent Module to 3396A Integrators

p/n 03394-60600	Pin 3396A	Pin Agilent module	Signal Name	Active (TTL)
<p>A diagram of the Agilent module connector, a vertical rectangular component with a central row of pins. Pins 1, 3, 5, 7, and 9 are labeled on the left side, and pins 13 and 15 are labeled on the right side.</p>	9	1 - White	Digital ground	
	NC	2 - Brown	Prepare run	Low
	3	3 - Gray	Start	Low
	NC	4 - Blue	Shut down	Low
	NC	5 - Pink	Not connected	
	NC	6 - Yellow	Power on	High
	5,14	7 - Red	Ready	High
	1	8 - Green	Stop	Low
	NC	9 - Black	Start request	Low
	13, 15		Not connected	

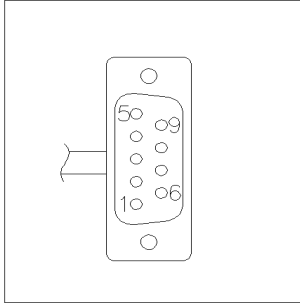
Agilent Module to 3396 Series II / 3395A Integrators

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

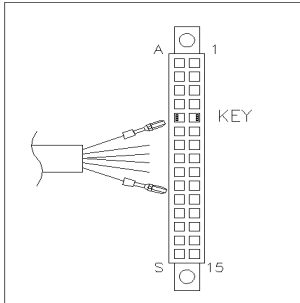
Agilent Module to 3396 Series III / 3395B Integrators

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

Agilent Module to Agilent 35900 A/D Converters

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

Agilent Module to General Purpose

p/n 01046-60201	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

BCD Cables



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

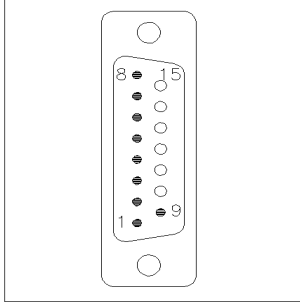
Agilent Module to General Purpose

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

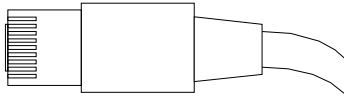
10 Identifying Cables

BCD Cables

Agilent Module to 3396 Integrators

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

CAN Cable



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 Cable Kit

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

Agilent Module to Printer

p/n	Description
5181-1529	Cable Printer Serial & Parallel, is a SUB-D 9 pin female vs. Centronics connector on the other end (NOT FOR FW UPDATE). For use with G1323 Control Module.

10 Identifying Cables

Agilent Module to Printer



11 Hardware Information

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This chapter describes the TCC 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 and RS-232C)
- memory management
- ability to update the firmware of the 'main system'

Main System

Its properties are:

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

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

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

Firmware Updates

Firmware updates can be done using your user interface:

- PC and Firmware Update Tool with local files on the hard disk
- Instant Pilot (G4208A) with files from a USB Flash Disk
- Agilent Lab Advisor software B.01.03 and above

The file naming conventions are:

PPPP_RVVV_XXX.dlb, where

PPPP is the product number, for example, 1315AB for the G1315A/B DAD,

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

VVV is the revision number, for example 102 is revision 1.02,

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.

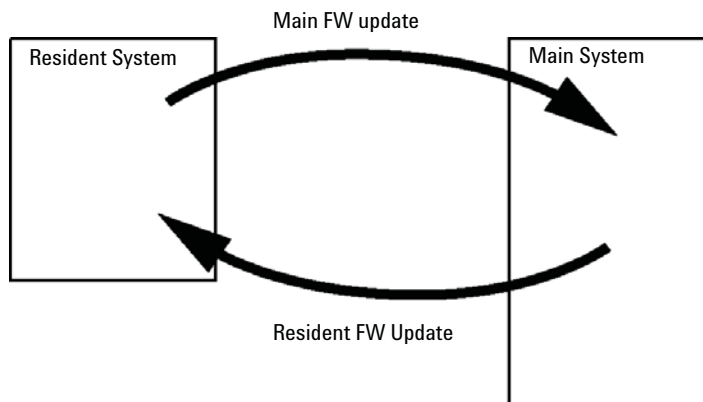


Figure 43 Firmware Update Mechanism

11 Hardware Information

Firmware Description

NOTE

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

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

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

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

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

Electrical Connections

- The CAN bus is a serial bus with high speed data transfer. The two connectors for the CAN bus are used for internal module data transfer and synchronization.
- One analog output provides signals for integrators or data handling systems.
- The REMOTE connector may be used in combination with other analytical instruments from Agilent Technologies if you want to use features such as start, stop, common shut down, prepare, and so on.
- With the appropriate software, the RS-232C connector may be used to control the module from a computer through a RS-232C connection. This connector is activated and can be configured with the configuration switch.
- The power input socket accepts a line voltage of 100 – 240 VAC \pm 10 % with a line frequency of 50 or 60 Hz. Maximum power consumption varies by module. There is no voltage selector on your module because the power supply has wide-ranging capability. There are no externally accessible fuses, because automatic electronic fuses are implemented in the power supply.

NOTE

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

Serial Number Information

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

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

Rear view of the module

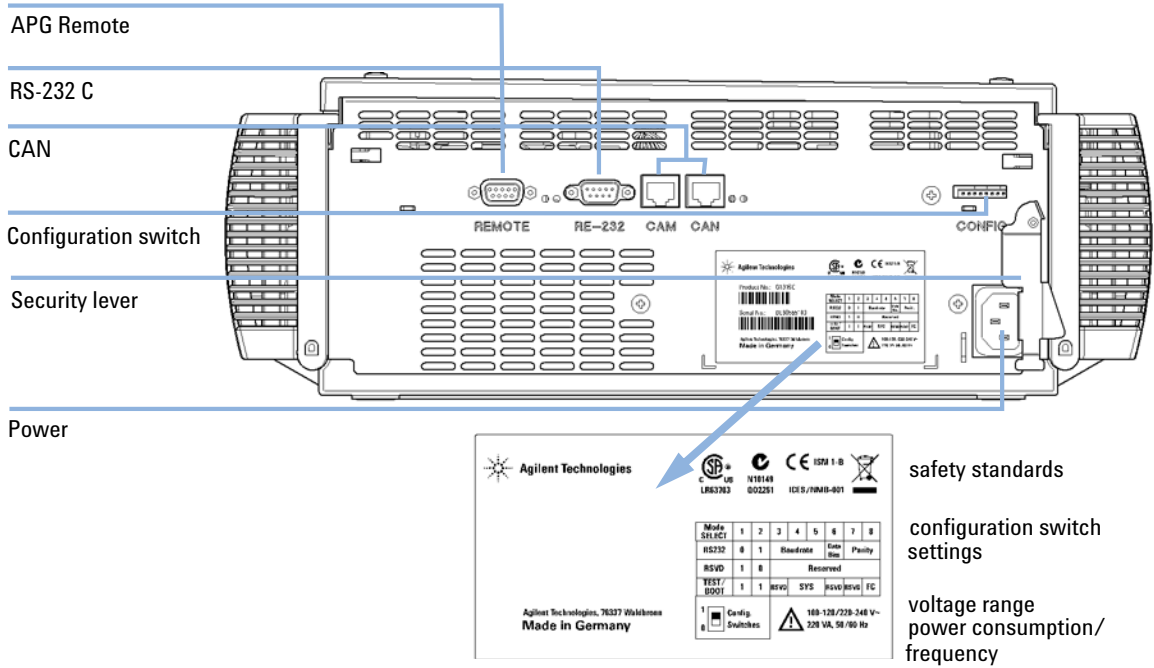


Figure 44 Rear view of the module

Interfaces

The Agilent 1200 Infinity Series modules provide the following interfaces:

Table 26 Agilent 1200 Infinity Series Interfaces

Module	CAN	LAN/BCD (optional)	LAN (on-board)	RS-232	Analog	APG Remote	Special
Pumps							
G1310B Iso Pump	2	Yes	No	Yes	1	Yes	
G1311B Quat Pump							
G1311C Quat Pump VL							
G1312B Bin Pump							
K1312B Bin Pump Clinical Ed.							
G1312C Bin Pump VL							
1376A Cap Pump							
G2226A Nano Pump							
G5611A Bio-inert Quat Pump							
G4220A/B Bin Pump	2	No	Yes	Yes	No	Yes	CAN-DC- OUT for CAN slaves
G4204A Quat Pump							
G1361A Prep Pump	2	Yes	No	Yes	No	Yes	CAN-DC- OUT for CAN slaves
Samplers							
G1329B ALS	2	Yes	No	Yes	No	Yes	THERMOSTAT for G1330B/K1330B
G2260A Prep ALS							
G1364B FC-PS	2	Yes	No	Yes	No	Yes	THERMOSTAT for G1330B/K1330B
G1364C FC-AS							
G1364D FC- μ S							CAN-DC- OUT for CAN slaves
G1367E HiP ALS							
K1367E HiP ALS Clinical Ed.							
G1377A HiP micro ALS							
G2258A DL ALS							
G5664A Bio-inert FC-AS							
G5667A Bio-inert Autosampler							
G4226A ALS	2	Yes	No	Yes	No	Yes	
Detectors							
G1314B VWD VL	2	Yes	No	Yes	1	Yes	
G1314C VWD VL+							
G1314E/F VWD	2	No	Yes	Yes	1	Yes	
K1314F Clinical Ed.							
G4212A/B DAD	2	No	Yes	Yes	1	Yes	
K4212B DAD Clinical Ed.							

Table 26 Agilent 1200 Infinity Series Interfaces

Module	CAN	LAN/BCD (optional)	LAN (on-board)	RS-232	Analog	APG Remote	Special
G1315C DAD VL+ G1365C MWD G1315D DAD VL G1365D MWD VL	2	No	Yes	Yes	2	Yes	
G1321B FLD K1321B FLD Clinical Ed.	2	Yes	No	Yes	2	Yes	
G1362A RID	2	Yes	No	Yes	1	Yes	
G4280A ELSD	No	No	No	Yes	Yes	Yes	EXT Contact AUTOZERO
Others							
G1170A Valve Drive	2	No	No	No	No	No	1
G1316A/C TCC K1316C TCC Clinical Ed.	2	No	No	Yes	No	Yes	
G1322A DEG K1322A DEG Clinical Ed.	No	No	No	No	No	Yes	AUX
G1379B DEG	No	No	No	Yes	No	Yes	
G4225A DEG K4225A DEG Clinical Ed.	No	No	No	Yes	No	Yes	
G4227A Flex Cube	2	No	No	No	No	No	CAN-DC- OUT for CAN slaves 1
G4240A CHIP CUBE	2	Yes	No	Yes	No	Yes	CAN-DC- OUT for CAN slaves THERMOSTAT for G1330A/B (NOT USED), K1330B

¹ Requires a HOST module with on-board LAN (e.g. G4212A or G4220A with minimum firmware 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
- REMOTE connector as interface to other Agilent products
- Analog output connector(s) for signal output

Overview Interfaces

CAN

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

LAN

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

NOTE

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

RS-232C (Serial)

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

NOTE

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

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

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

Table 27 RS-232C Connection Table

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

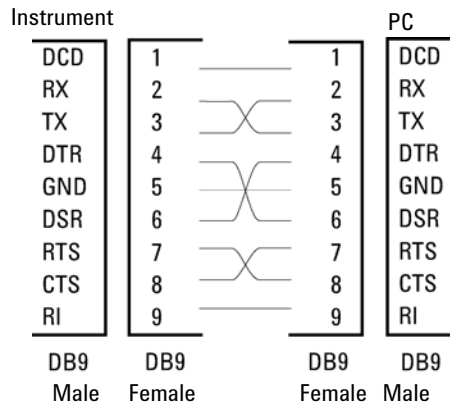


Figure 45 RS-232 Cable

Analog Signal Output

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

APG Remote

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

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

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

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

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

NOTE

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

Table 28 Remote Signal Distribution

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

Special Interfaces

There is no special interface for this module.

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

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

This module does not have its own on-board LAN interface. It can be controlled through the LAN interface of another module, and a CAN connection to that module.

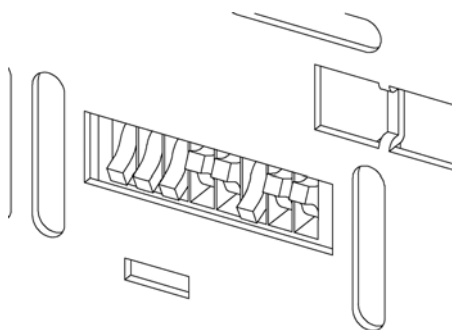


Figure 46 Configuration switch (settings depend on configured mode)

All modules without on-board LAN:

- default should be ALL DIPS DOWN (= best settings)
 - Bootp mode for LAN and
 - 19200 baud, 8 data bit / 1 stop bit with no parity for RS-232
- DIP 1 DOWN and DIP 2 UP allows special RS-232 settings
- for boot/test modes DIPS 1+2 must be UP plus required mode

NOTE

For normal operation use the default (best) settings.

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

NOTE

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

NOTE

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

Table 29 8-bit Configuration Switch (without on-board LAN)

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

NOTE

The LAN settings are done on the LAN Interface Card G1369B/C. Refer to the documentation provided with the card.

Communication Settings for RS-232C

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

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

Table 30 Communication Settings for RS-232C Communication (without on-board LAN)

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

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

11 Hardware Information

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

Table 31 Baudrate Settings (without on-board LAN)

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

Table 32 Data Bit Settings (without on-board LAN)

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

Table 33 Parity Settings (without on-board LAN)

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

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

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

Special Settings

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

Boot-Resident

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

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

Table 34 Boot Resident Settings (without on-board LAN)

Mode Select	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
TEST/BOOT	1	1	0	0	1	0	0	0

Forced Cold Start

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

CAUTION

Loss of data

Forced cold start erases all methods and data stored in the non-volatile memory. Exceptions are 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, a forced cold start has been completed.

Table 35 Forced Cold Start Settings (without on-board LAN)

Mode Select	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
TEST/BOOT	1	1	0	0	1	0	0	1

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 Hardware Information

Instrument Layout



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



General Safety Information

Safety Symbols

Table 36 Safety Symbols

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

WARNING

A WARNING

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

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

CAUTION

A CAUTION

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

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

General Safety Information

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

WARNING

Ensure the proper usage of the equipment.

The protection provided by the equipment may be impaired.

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

Safety Standards

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

Operation

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

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

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

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

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

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

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

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

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

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

Abstract

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

NOTE

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

Product Category:

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



NOTE

Do not dispose off in domestic household waste

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

Lithium Batteries Information

WARNING

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

Danger of explosion if battery is incorrectly replaced.

- Discharged Lithium batteries shall be disposed off locally according to national waste disposal regulations for batteries.
 - Replace only with the same or equivalent type recommended by the equipment manufacturer.
-



WARNING

Lithiumbatteri - Eksplosionsfare ved fejlagtig håndtering.

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

- Lever det brugte batteri tilbage til leverandøren.
-

WARNING

Lithiumbatteri - Eksplosionsfare.

Ved udskiftning benyttes kun batteri som anbefalt av apparatfabrikanten.

- Brukt batteri returneres apparatleverandøren.
-

NOTE

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

Radio Interference

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

Test and Measurement

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

Sound Emission

Manufacturer's Declaration

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

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

- Sound Pressure $L_p < 70$ 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>

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In This Book

The manual contains technical reference information about the Agilent 1290 Infinity Thermostatted Column Compartment.

This manual describes the following:

- introduction and specifications,
- installation,
- using and optimizing,
- troubleshooting and diagnose,
- maintenance,
- parts identification,
- safety and related information.

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