Agilent 1290 Infinity II Multicolumn Thermostat

User Manual

Agilent Technologies

Notices

Manual Part Number

G7116-90000 Rev. C

Edition

06/2015

Printed in Germany

Agilent Technologies
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76337 Waldbronn

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CAUTION

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WARNING

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

In This Book

This manual covers the Agilent 1290 Infinity II Multicolumn Thermostat (G7116B).

1 Introduction to the Multicolumn Thermostat

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

2 Site Requirements and Specifications

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

3 Using the Module

This chapter gives instructions on how to use the module.

4 Preparing the Module

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

5 Optimization

This chapter provides information on how to optimize the Multi Column Thermostat.

6 Troubleshooting and Diagnostics

Overview about the troubleshooting and diagnostic features.

7 Error Information

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

8 Test Functions and Calibrations

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

9 Maintenance

This chapter describes the maintenance of the MCT.

10 Parts and Materials for Maintenance

This chapter provides information on parts for maintenance.

11 Identifying Cables

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1 Introduction to the Multicolumn Thermostat

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

Product Description (G7116B)

The Agilent 1290 Infinity II Multicolumn Thermostat (MCT) allows precise column thermostatting over a broad temperature range: from cooling down to 20 degrees below ambient temperature up to 110 °C, providing high flexibility for optimized speed and selectivity of LC separation.

Ultrahigh pressure valves enable a wide range of applications such as column selection from 8 columns in a single MCT, sample preparation for analyte enrichment or matrix removal, alternating column regeneration, etc.

The MCT fits with all 1290 Infinity II modules and can also be combined with modules of the Agilent 1260 and 1290 Infinity Series.

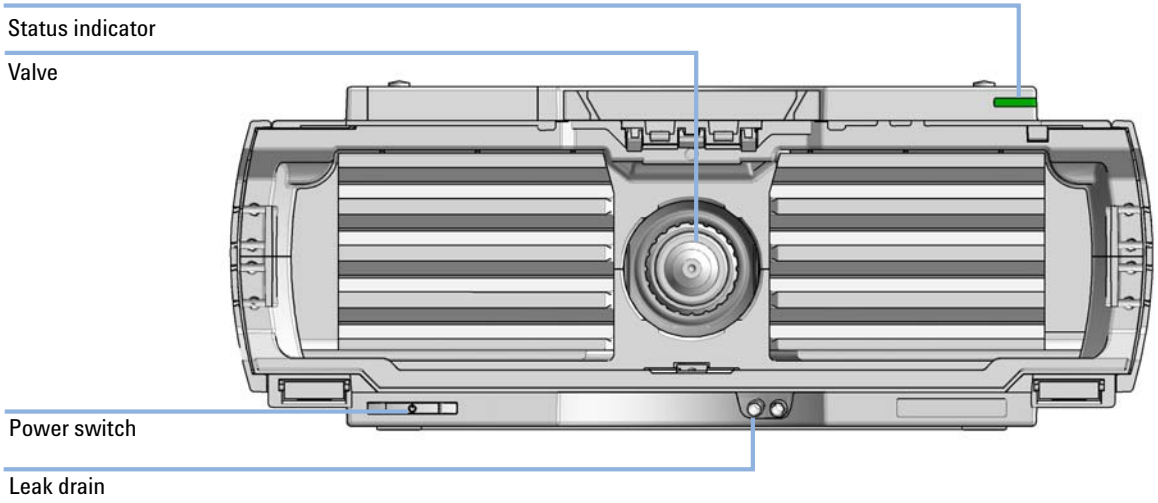


Figure 1 Overview of the Multicolumn Thermostat

Features (G7116B)

- Superior usability with flexible flap positions: open door to 90° (desk function), 180° or even remove door for accessibility.
- Efficient, fast and convenient column exchange through new quick-connect fittings.
- Advanced column capacity for up to 8 columns in a single MCT.
- New Quick-Connect Heat Exchanger for pre-column solvent thermostatting – easily mounted for each of up to 8 columns and optimized for lowe internal volume contribution.
- High application flexibility through Peltier cooling and heating with two independent temperature zones from 20 degree below ambient up to 110 °C.
- Optional valve drive for use of 1200 Infinity Series Quick-Change high pressure valves.
- High temperature precision for reproducible retention times and peak areas.

Column Switching Valve (Optional)

Multicolumn Selection

Advantages

- Increase productivity
- Higher instrument up-time

Quickly change between up to eight different stationary phases for different applications, or use identical stationary phases in columns with different dimensions for either faster run-times (short columns) or higher resolution (long columns) or for loading studies with different internal diameters.

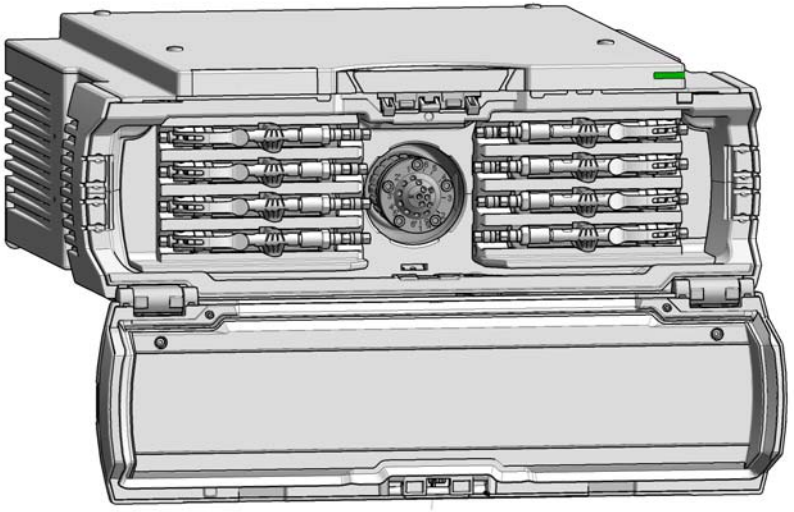


Figure 2 The G7116B 1290 Infinity II Series Multiple Column Thermostat equipped with an 8 Column Selector Valve

Method Development

Advantages:

- Faster method development
- Automated method development possible

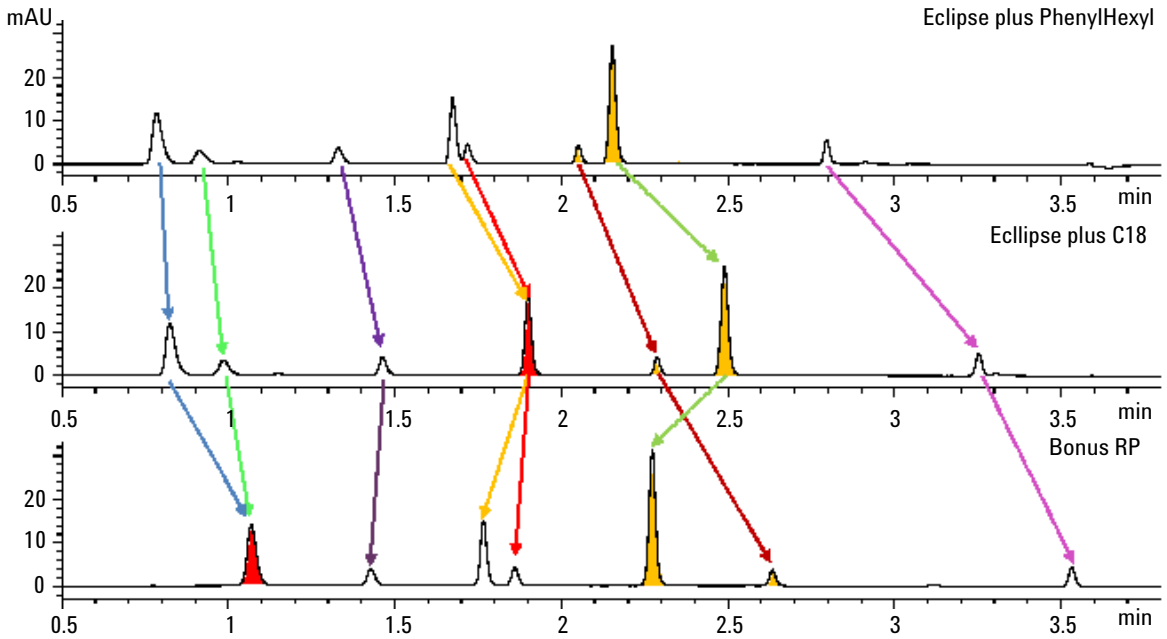


Figure 3 Totally different chromatographic results by using the same sample but three different stationary phases

Typical Applications

NOTE Which ports are interconnected at which valve position strongly depends on the module the valve is installed to. The software user interface will always display the correct situation. A method modification or re-plumbing of the connections is typically required if transferring methods from a G1316A/B/C to a G7116B, G1170A or G4227A.

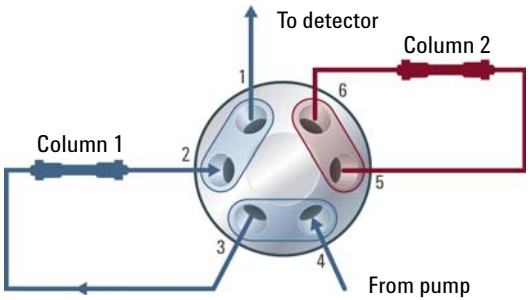
Refer to the table below for further information on which ports are connected at which position.

Modules	Valve	Position 1	Position 2
G1316A/B/C	2pos/6port	1-2	1-6
G7116B, G1170A, G4227A	2pos/6port	1-6	1-2
G1316A/B/C	2pos/10port	1-2	1-10
G7116B, G1170A, G4227A	2pos/10port	1-10	1-2

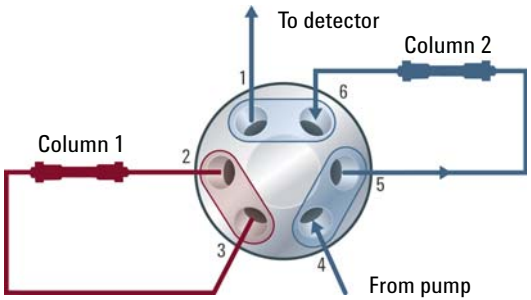
Dual column selection (2pos/6port or 2pos/10port valves)

Advantages:

- Increase productivity
- Higher instrument up-time



Position 1-2

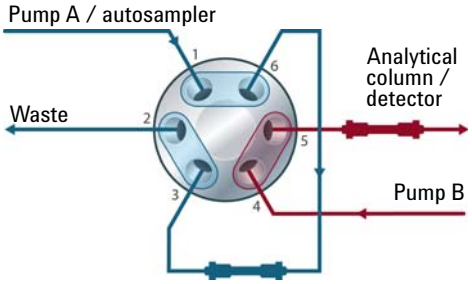


Position 1-6

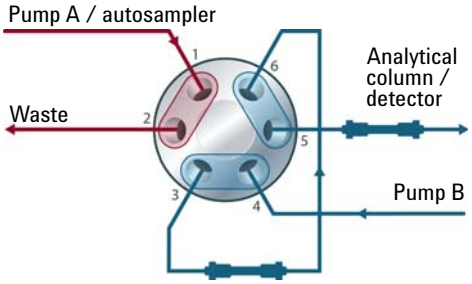
Quickly change between two different stationary phases to check your separation selectivity, or use two identical stationary phases to have the second column immediately available after the first one loses efficiency, for example with complex matrices.

Sample enrichment and sample cleanup (2pos/6port or 2pos/10port valves)

Sample Enrichment

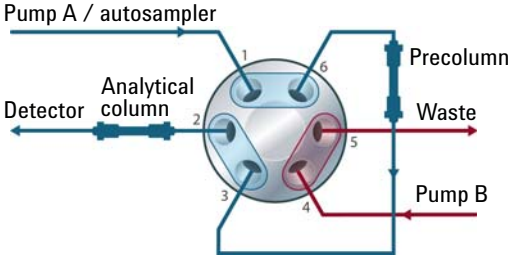


Position 1-6

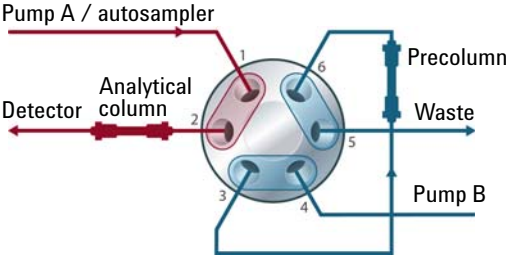


Position 1-2

Sample Cleanup



Position 1-6



Position 1-2

Advantages:

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

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.

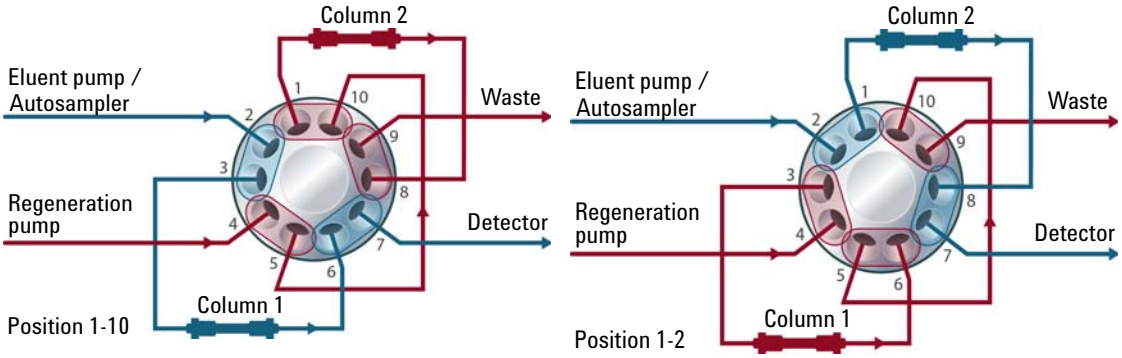
Stripping methods

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 (2pos/10port valves only)

Advantages:

- High sample throughput
- Increased productivity
- High efficiency



Gradient elution is frequently used for fast separation of complex samples in LC. Since the gradient elution requires the column to regenerate before subsequent runs, an automated column regeneration system saves valuable analysis time. Agilent's 2-position/10-port valve for the 1290 Infinity TCC enable the simultaneous analysis of one sample on one LC column while a second, identical column is flushed and equilibrated by an additional regeneration pump. At the end of the run, the valve switches to the second position and the next sample is separated on the previously flushed and equilibrated column, while the first column is now flushed and equilibrated by the regeneration pump. Up to 50 % of analysis time is often required to equilibrate columns. Using alternating column regeneration saves time and provides higher sample throughput.

Leak and Waste Handling

The 1290 Infinity II Series has been designed for safe leak and waste handling. It is important that all security concepts are understood and instructions are carefully followed.

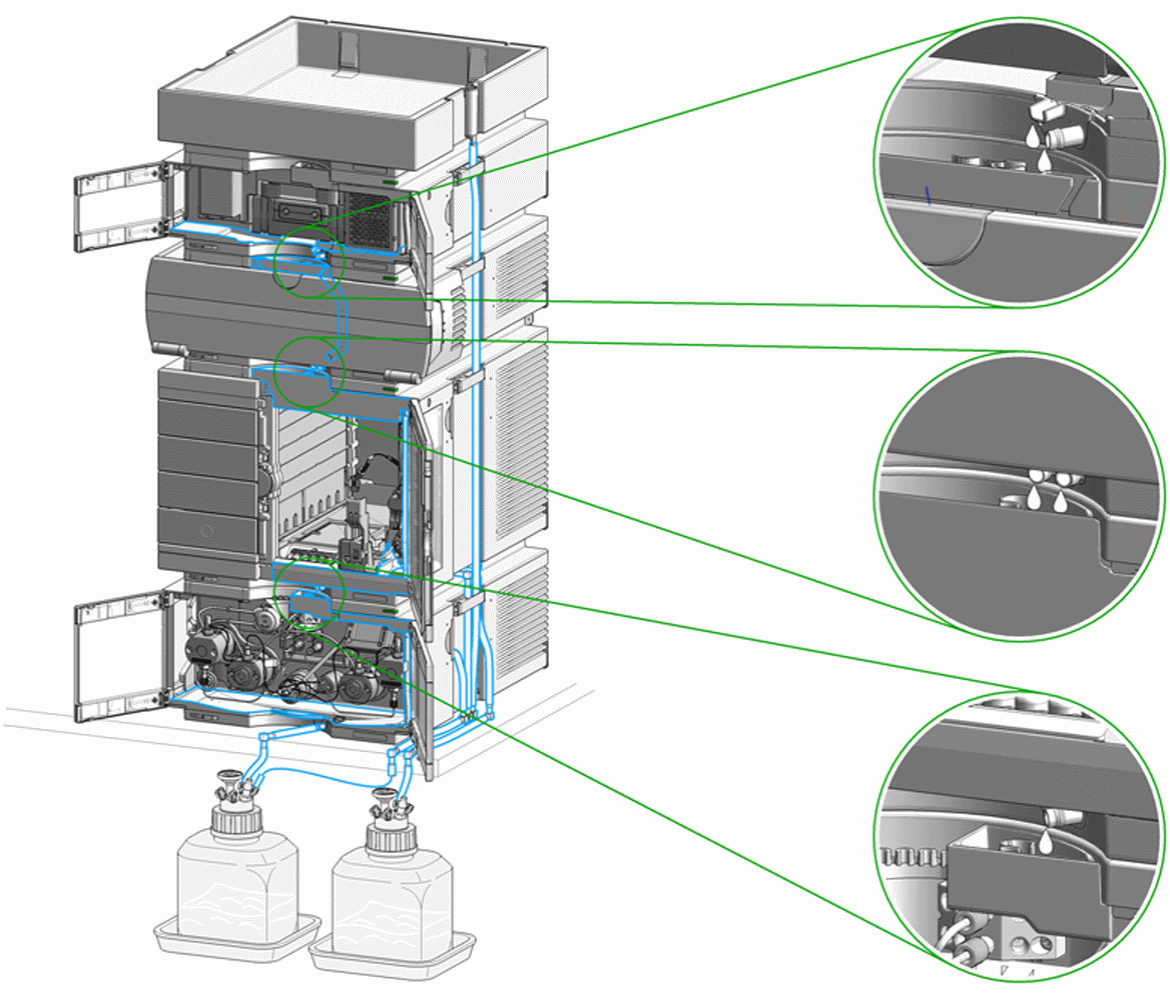


Figure 4 Leak and waste handling concept (overview - typical stack configuration as an example)

The solvent cabinet is designed to store a maximum volume of 8 L solvent. The maximum volume for an individual bottle stored in the solvent cabinet should not exceed 2 L. For details, see the usage guideline for the Agilent 1200 Infinity Series Solvent Cabinets (a printed copy of the guideline has been shipped with the solvent cabinet, electronic copies are available on the Internet).

All leak plane outlets are situated in a consistent position so that all Infinity and Infinity II modules can be stacked on top of each other. Waste tubes are guided through a channel on the right hand side of the instrument, keeping the front access clear from tubes.

The leak plane provides leak management by catching all internal liquid leaks, guiding them to the leak sensor for leak detection, and passing them on to the next module below, if the leak sensor fails. The leak sensor in the leak plane stops the running system as soon as the leak detection level is reached.

Solvent and condensate is guided through the waste channel into the waste container:

- from the detector's flow cell outlet
- from the Multisampler needle wash port
- from the Sample Cooler (condensate)
- from the Seal Wash Sensor
- from the pump's Purge Valve or Multipurpose Valve

The waste tube connected to the leak pan outlet on each of the bottom instruments guides the solvent to a suitable waste container.

NOTE Do not install the waste tubings into the central waste connectors.

Waste Concept

1 Agilent recommends using the 6 L waste can with 1 Stay Safe cap GL45 with 4 ports (5043-1221) for optimal and safe waste disposal. If you decide to use your own waste solution, make sure that the tubes don't immerse in the liquid.

Operating Principle

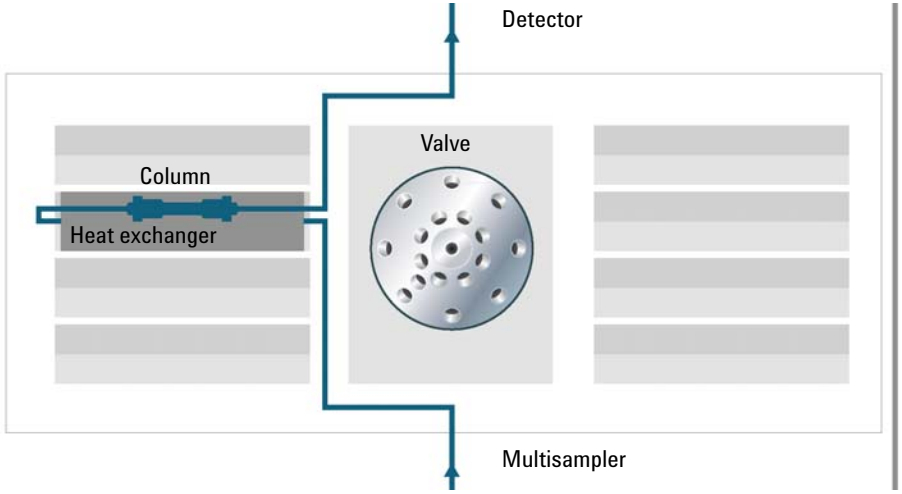


Figure 5 Hydraulic path

The Concept of Heating and Cooling

The design of the multi-column thermostat (MCT) uses Quick Connect Heat Exchangers that are mounted on to the heating and cooling devices with peltier-elements. The solvent entering the Quick Connect Heat Exchangers is heated up or cooled down to a settable temperature before entering the column. A triangular shape of the Quick Connect Heat Exchangers avoids incorrect placement and verifies optimum temperature exchange. Optimum isolation of the heater room offers best temperature stability for the columns. This ensures that the column and the solvent flowing through it are almost at the same temperature. The solvent cools down or heats up on its transfer from the Quick Connect Heat Exchangers to the column inlet. This depends on several factors: flow rate, setpoint temperature, ambient temperature and column dimensions. 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). In a flow-through temperature regulation system, there are necessarily slightly different temperatures at different positions. The actual temperature displayed on the user interface is always the temperature taken at the heating and cooling device.

2
Site Requirements and Specifications

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

Site Requirements

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

Power Considerations

The module power supply has wide ranging capability. It accepts any line voltage in the range described in Table 1 on page 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 unsupplied cables

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

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

- ➔ 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.
- ➔ 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.

WARNING

Power cords

Solvents may damage electrical cables.

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

Bench Space

The module dimensions and weight (see Table 1 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.

NOTE

Some modules in a stack may be heavy, especially if for example in a Multi- or Vialsampler a sample cooler is installed.

Install the stack with the module in an Agilent A-Line Mobile Flex Bench (if available).

Condensation

CAUTION

Condensation within the module

Condensation can damage the system electronics.

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

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

Physical Specifications

Table 1 Physical Specifications

Type	Specification	Comments
Weight	12.5 kg (27.6 lbs)	
Dimensions (height × width × depth)	160 x 435 (472) x 436 mm (6.3 x 17.1 (18.6) x 17.2 inches)	
Line voltage	100 – 240 V~, ± 10 %	Wide-ranging capability
Line frequency	50 or 60 Hz, ± 5 %	
Power consumption	150 VA, 150 W	
Ambient operating temperature	4–55 °C (39–131 °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 (15092 ft)	For storing the module
Safety standards: IEC, EN, CSA, UL	Installation category II, Pollution degree 2	For indoor use only.

Performance Specifications

Table 2 Agilent 1290 Infinity II Multicolumn Thermostat (G7116B) Performance Specifications

Feature	Specification
Operating principle	Dual, independent Peltier-element thermostatted column compartment. Solvent pre-heating and still-air operation for reduction of chromatographic band-broadening under UHPLC-conditions. Up to three devices can be clustered and controlled by a single user interface for additional flexibility[1].
Temperature range	4 °C to 110 °C, (minimum 20 °C below ambient)
Temperature stability	±0.03 °C
Temperature accuracy	±0.5 °C (with calibration)
Temperature precision	0.05 °C
Independent Temperature zones	2 (in single device) up to 6 in clustered configuration[1]
Column capacity	8 columns of 100 mm length plus Quick-Connect fittings or pre-columns 4 columns of 300 mm length plus Quick-Connect fittings or pre-columns Selection of columns by single optional integrated 8-column selection valve (1300 bar) Maximum of 24 columns of 100 mm length plus Quick-Connect fittings or pre-columns 12 columns of 300 mm length plus Quick-Connect fittings or pre-columns with clustering[1] of three devices.
Heat-up/cool-down time	5 min from ambient to 40 °C 10 min from 40 °C to 20 °C <30 min from 25 °C to 100 °C
Solvent heat exchangers	Individually quick-installable for every column. Available at 1 µL (ultra-low dispersion), 1.6 µL (standard) and 3 µL (high-flow) volume.

Table 2 Agilent 1290 Infinity II Multicolumn Thermostat (G7116B) Performance Specifications

Feature	Specification
Valve options	1x integrated valve drive as option 2x external valve drives as option to host user-exchangeable Quick-Change valve heads of different formats, materials and pressure ratings (up to 1300 bar): 2-position/6-port, 2-position/10-port, 6-column selection (6-pos/14-port), 8-column selection (8-pos/18-port). Equipped with tags, valve heads are automatically identified by SW
Communications	Controller-area network (CAN).
Safety and maintenance	Extensive diagnostics, error detection and display (through Instant Pilot control module and Agilent LabAdvisor), leak detection, safe leak handling, leak output signal for shutdown of pumping system. Low voltages in main maintenance areas. Door-open sensor.
GLP	Valve heads carrying tags with serial number, pressure rating, number of switches and valve type.

[1] Availability 2015

NOTE All specifications are valid for distilled water at ambient temperature (25 °C), set point at 40 °C and a stable flow range from 0.2 – 5 mL/min. Equilibration Time: 10 min.

Valve Specifications

Table 3 G4239C, 8-column selector valve kit, 1300 bar

Type	Specification
Liquid contacts	PEEK, Stainless Steel
Port size	Accepts M4 male threaded fittings
Flow passage diameters	Stator: 0.25 mm (0.010 in) Rotor Seal: 0.30 mm (0.012 in)
Port to Port Volume	1.46 µL Pre-column (inlet side of the valve) 1.52 µL Post-column (outlet side of the valve)
Maximum pressure	1300 bar
Comments	Kit contains 1x 8 Column Selector Valve Head and capillary kit

Extended Specifications

The G7116B MCT comes along with one 1.6 µL Low Dispersion Heat Exchanger that is suitable for most applications.

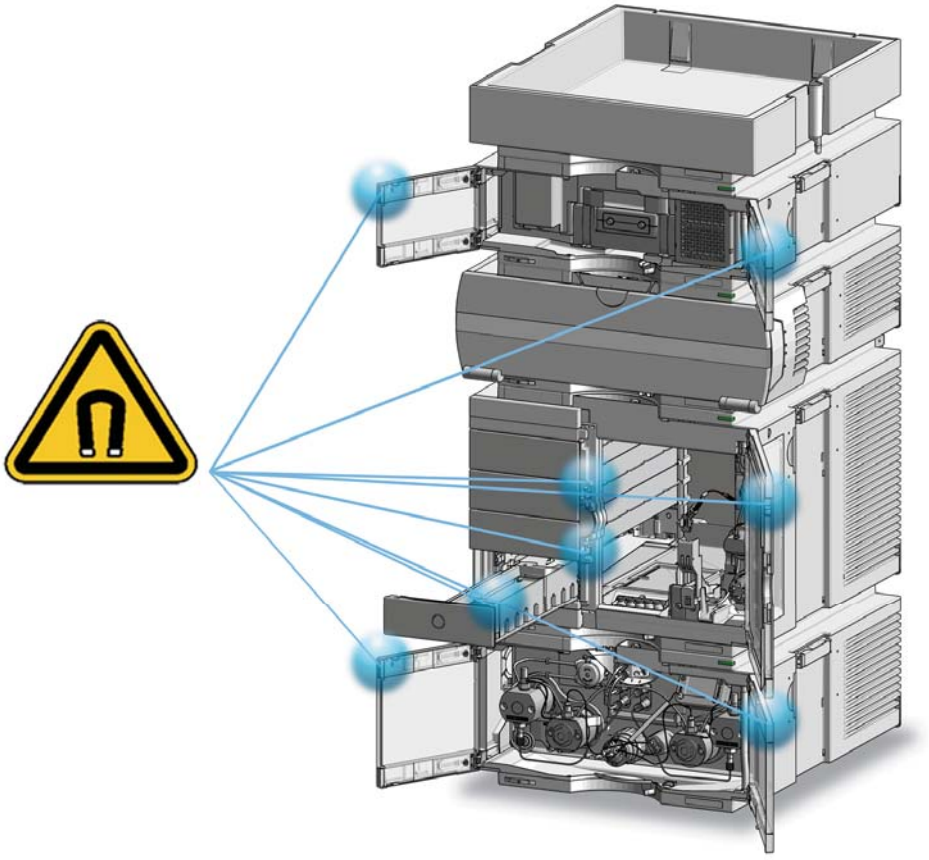
Additional Heater devices are available for optimization regarding better heating performance at higher flow rates (>2.5 mL) or for reducing the dispersion volume for low flow applications.

3
Using the Module

This chapter gives instructions on how to use the module.

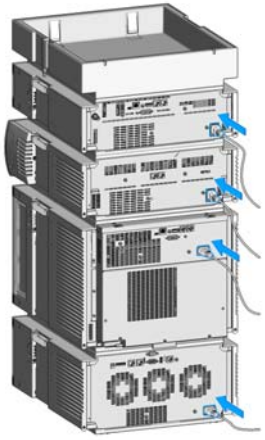
Magnets

1 This stack exemplarily shows the magnets' positions in the modules.



Turn on/off

1



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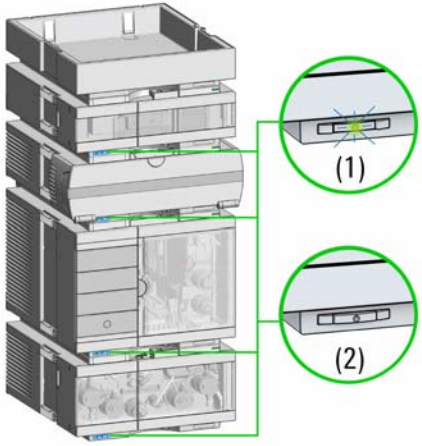
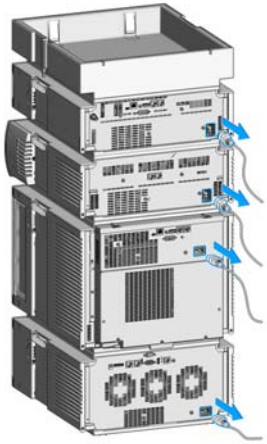


Power switch

(1) On

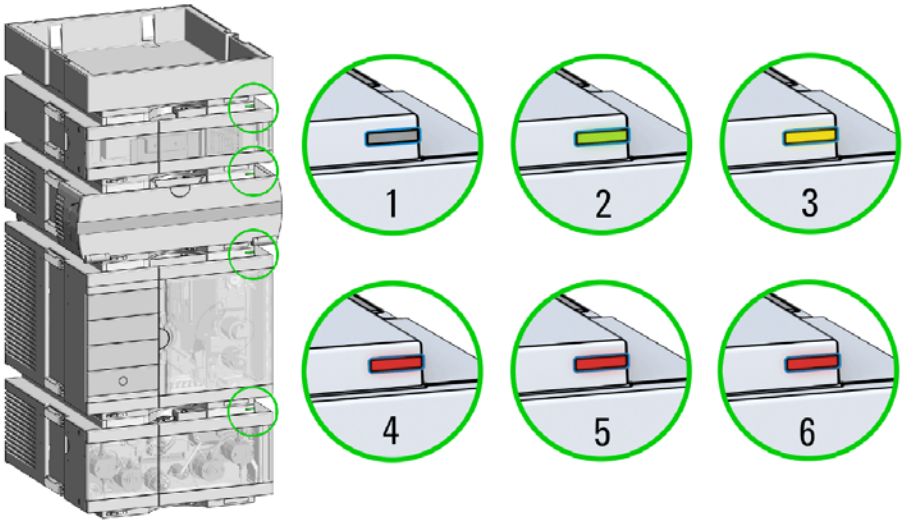
(2) Off

3



Status Indicators

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



Status indicators

1. Idle

2. Run mode

3. Not-ready. Waiting for a specific pre-run condition to be reached or completed.

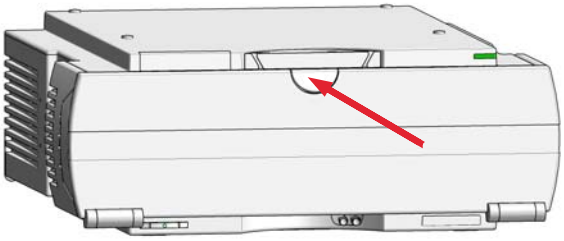
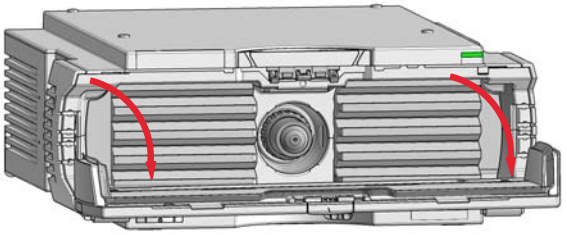
4. Error mode - interrupts the analysis and requires attention (for example a leak or defective internal components).

5. Resident mode (blinking) - for example during update of main firmware.

6. Bootloader mode (fast blinking). Try to re-boot the module or try a cold-start. Then try a firmware update.

Open the Front Door

The front door opens in two angles: 90° and 180°. In the 90° position it can be used as a tray.

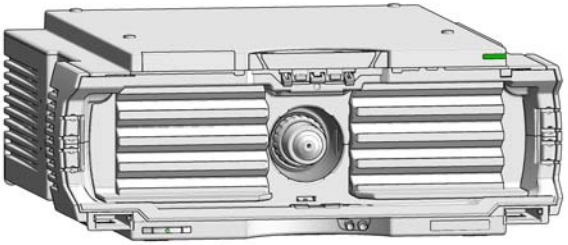
1 Press the release button to open the front door. 	**2** Open the door in a 90° angle to use it as a tray. 

Install Heat Exchanger

Tools required	p/n	Description
	5043-0915	Fitting mounting tool for bio-inert capillaries
OR	5023-2502	Hex driver 1/4 inch, slitted
	8710-0510	Wrench open 1/4 — 5/16 inch

Parts required	p/n	Description
	G7116-60015	Heat Exchanger Assembly 1.6 µL-Z Quick Connect Heatexchanger Standard Flow
	5067-5957	A-Line Quick Connect Assy ST 0.12 x 105 mm from heat exchanger outlet port to column
	G7116-68003	Column Holder Clips (2/Pk) for G7116B

1 Choose one of the possible positions for placing the heat exchanger.



NOTE

Use one of the four central positions if only one column is used.

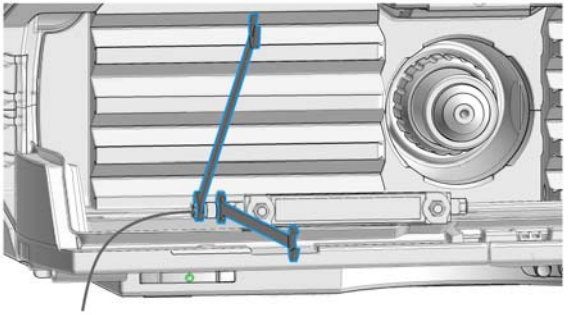
NOTE

Follow the special instructions provided for the A-Line Quick Connect and Quick Turn Fittings.

2 Connect the column connection capillary of the A-Line Quick Connect Fitting to the outlet port of the heat exchanger.

NOTE

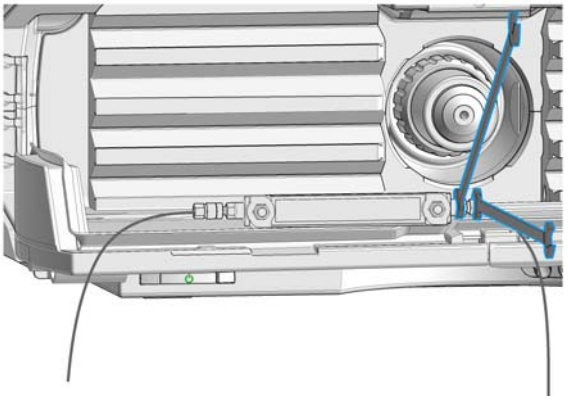
The Pre-Column Heat Exchanger can be damaged if excessive torque is applied to the port. Always use a wrench to counter the Pre-Column Heat Exchanger port while tightening the capillary fitting.



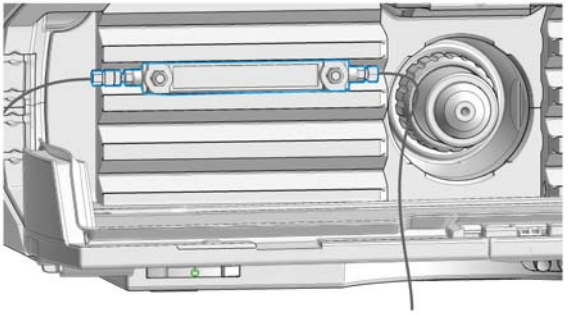
3 Connect the sampler outlet capillary to the inlet port of the heat exchanger.

NOTE

The Pre-Column Heat Exchanger can be damaged if excessive torque is applied to the port. Always use a wrench to counter the Pre-Column Heat Exchanger port while tightening the capillary fitting.



4 Position the heat exchanger as shown.



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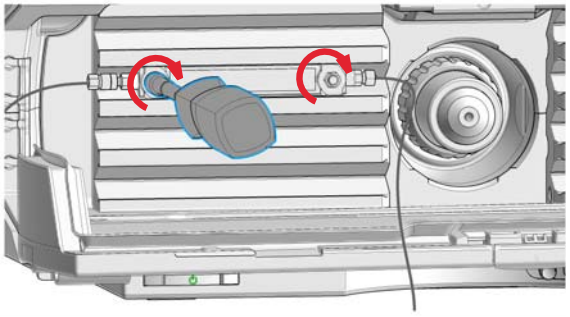

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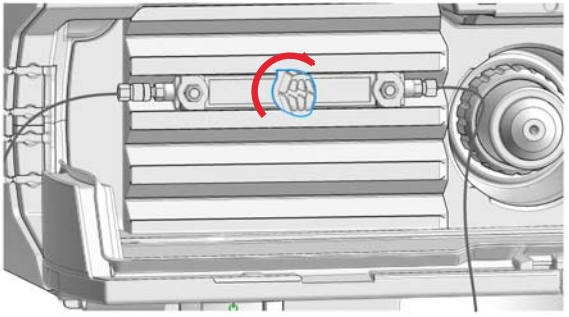


NOTE The column holder clip can be mounted at any free spot on top of the LDHex.

Exchange a Column

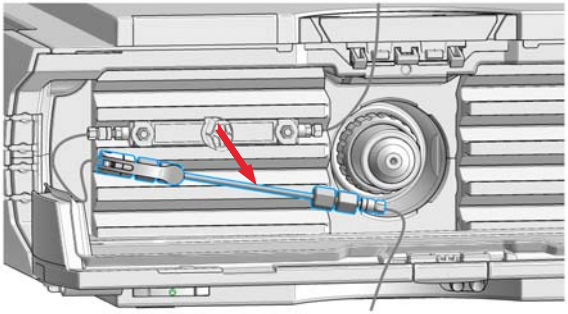
Tools required	p/n	Description
	5043-0915	Fitting mounting tool for bio-inert capillaries
OR	5023-0240	Hex driver, ¼", slitted
	8710-0510	Wrench open 1/4 — 5/16 inch

Parts required	#	p/n	Description
	1	5067-5957	A-Line Quick Connect Assy ST 0.12 x 105 mm (from heat exchanger to column inlet)
	1	5500-1191	Capillary ST 0.12 x 280 mm, long socket (from column outlet to detector flow cell inlet)
	2	5067-5966	A-Line Quick Turn fitting

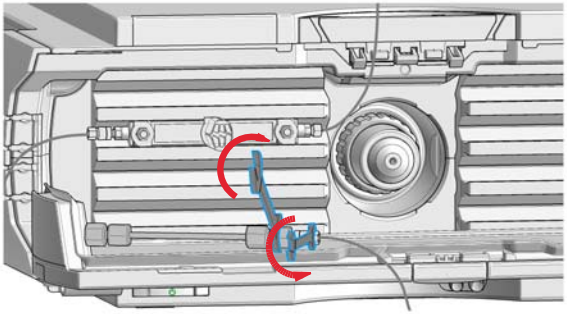
Preparations

- Heat exchanger(s) installed in MCT
- Column holder clip(s) installed to heater block on top of Heat exchanger(s)
- Column inlet capillary connected to heat exchanger outlet

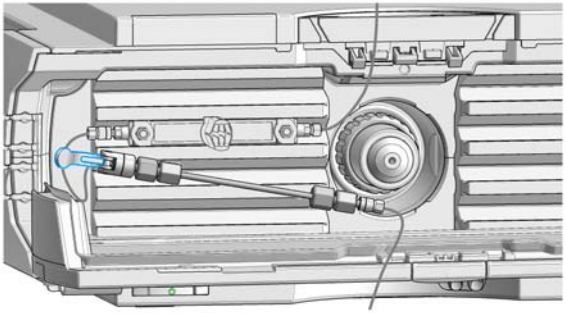
1



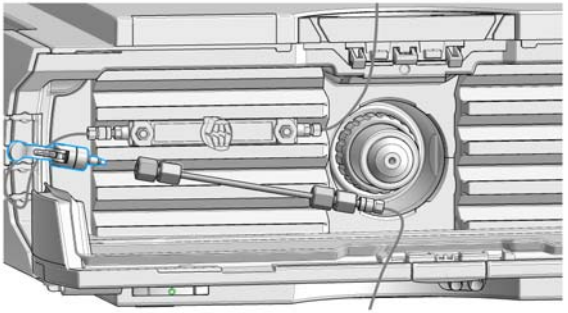
2 Disconnect the A-Line Quick Turn Fitting.



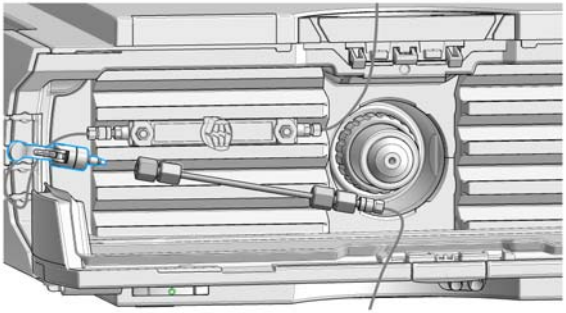
3 Open the lever of the A-Line Quick Connect Fitting.



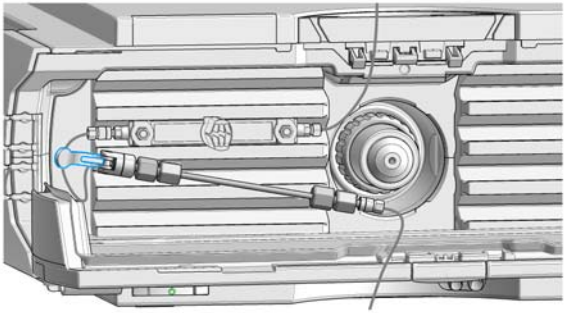
4 Unscrew and remove the Quick Connect Fitting.



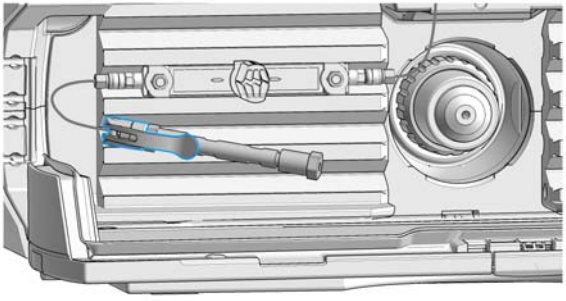
1 Connect the Column Inlet Capillary using the A-Line Quick Connect Fitting.



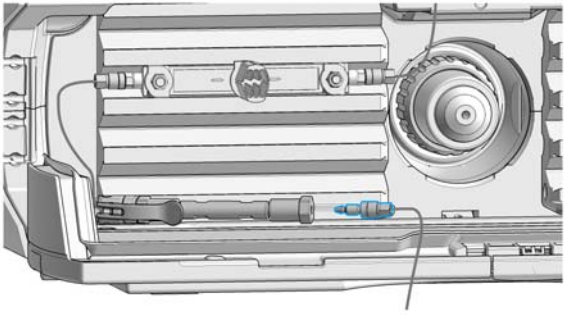
2 Turn the Column onto the Quick Connect Fitting until it is finger tight.



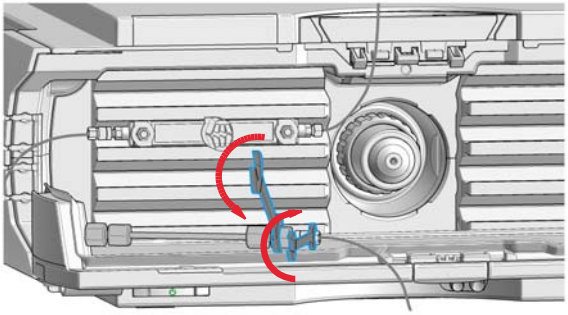
3 Close the lever to make a pressure tight connection.



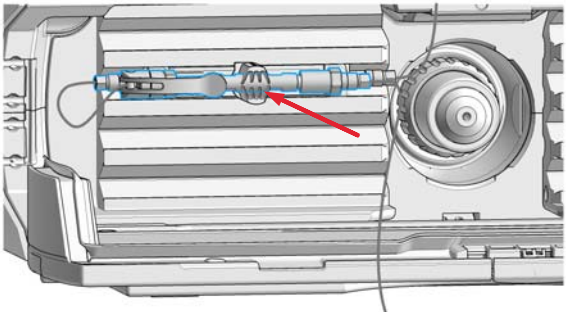
4 Connect the Capillary to detector to the Column Outlet using the A-Line Quick Turn Fitting.



5 Use a wrench to counter the column while tightening the capillary fitting.



6 Position the Column into the Column Holder Clip(s).



Installing Valve Heads

NOTE Following procedures may show the 1290 Infinity TCC. The MCT uses the same valve heads, the valve head installation is the same.

The valve drives are factory-installed in the 1290 Infinity II Multicolumn Thermostat. The valve heads are interchangeable and can be easily mounted.

At the first installation, the transportation lock and the dummy valve have to be removed, see "Remove the Transportation Lock and the Valve Dummy" on page 44. 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.

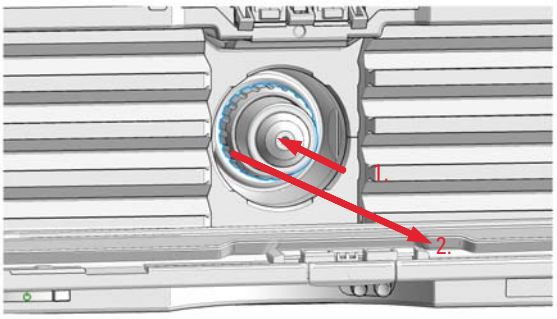
NOTE The valves are mounted on pull-out rails to allow easy installation of capillaries. Push the valve gently into its housing until it snaps into the inner position, push it again and it slides out.

When all capillaries are installed, push the valve back into its housing, see "Install the Valve Head and Connect Capillaries" on page 45.

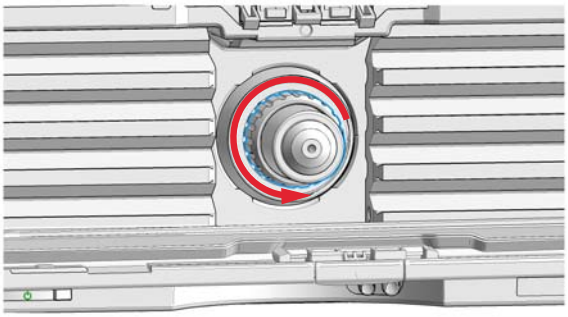
Remove the Transportation Lock and the Valve Dummy

1 When unscrewing the transportation lock, push it back until the last screw is removed - the valve rail is spring-loaded.

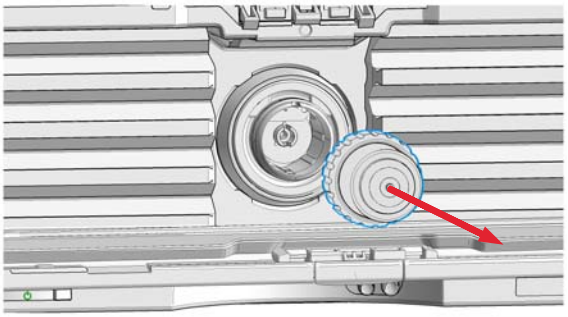
2 Press on the valve dummy to release it (spring-loaded valve rail).



3



4



Install the Valve Head and Connect Capillaries

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 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

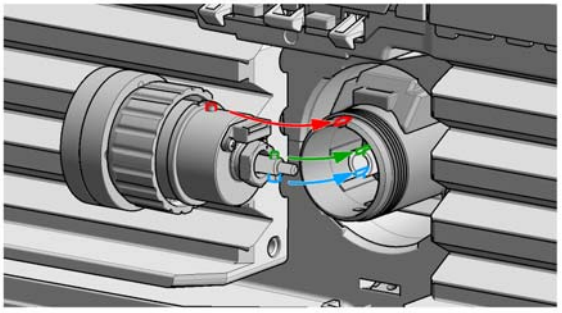
Using a low pressure valve on the high pressure side can damage the valve.

➔ 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.

NOTE

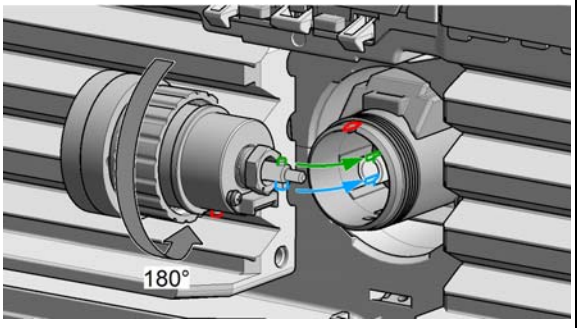
For a correct installation of the valve head, the outside pin (red) must completely fit into the outside groove on the valve drive's shaft (red). A correct installation is only possible if the two pins (green and blue) on the valve head fit into their corresponding grooves on the valve drive's actuator axis. Their match depends on the diameter of the pin and groove.

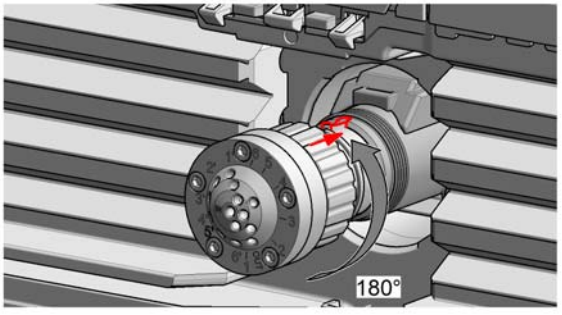
1 Insert the valve head into the valve shaft.



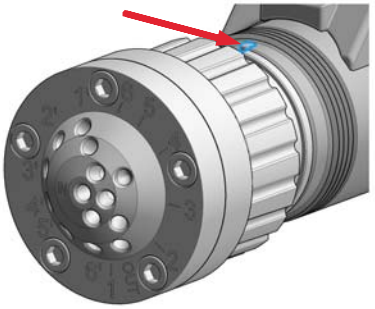
OR

If the outside pin does not fit into the outside groove, you have to turn the valve head until you feel that the two pins snap into the grooves. Now you should feel additional resistance from the valve drive while continue turning the valve head until the pin fits into the groove.





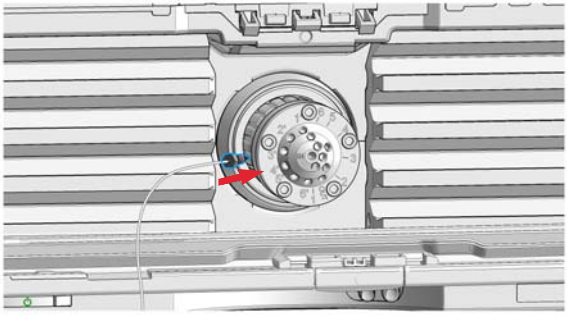
2 When the outer pin is locked into the groove, manually screw the nut onto the valve head.



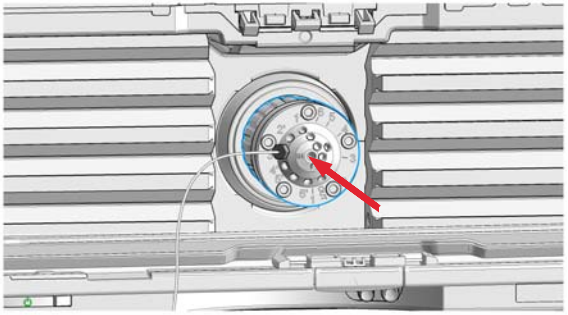
NOTE

Fasten the nut manually. Do not use any tools.

3 Install all required capillary connections to the valve.



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



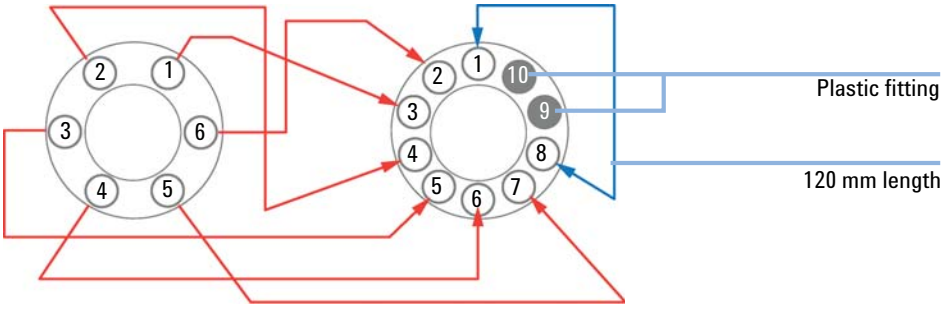
5 Power on or power-cycle your module, so the valve head gets recognized during module initialization.

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. Plug plastic fittings into ports 9 and 10.



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

1 Install the capillaries.

NOTE Use outmost 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.

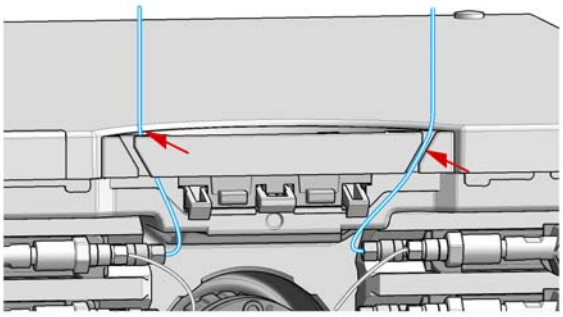
5 Fasten all fittings with a spanner.

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.

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.

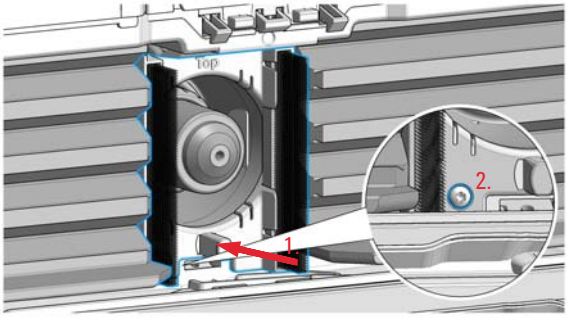
11 Perform a final leak-check.

Install the Divider Assembly

Parts required	p/n	Description
	G7116-60006	Divider Assembly MCT

NOTE The Divider Assembly must be installed if different temperatures are used on the right and the left heater element to separate these two temperature zones.

1 Install the rear part of the Divider Assembly to the center part in between the two heater assemblies by simply pushing it into position and fixing it with the screw in the lower left corner.

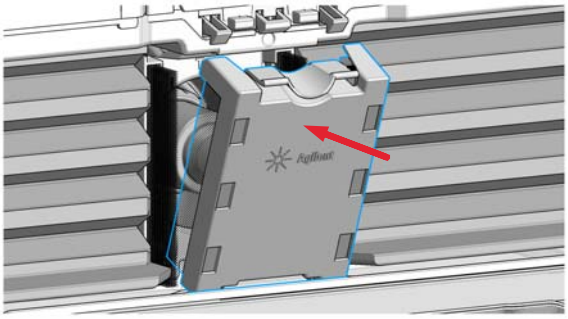


2 Install the valve head if used.

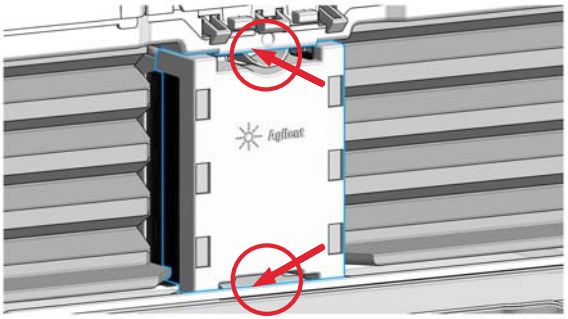
See "Replace Valve Heads" on page 98.

3 Install all capillaries and heat exchangers required.

4 Install the front part of the Divider Assembly by putting it on top.



5 The front plate should be flush with the top and the bottom edge of the MCT housing.



Waste Concept

1 Agilent recommends using the 6 L waste can with 1 Stay Safe cap GL45 with 4 ports (5043-1221) for optimal and safe waste disposal. If you decide to use your own waste solution, make sure that the tubes don't immerse in the liquid.

4
Preparing the Module

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

Leak and Waste Handling

WARNING

Toxic, flammable and hazardous solvents, samples and reagents

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

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

NOTE

Recommendations for Solvent Cabinet

For details, see the usage guideline for the Agilent 1200 Infinity Series Solvent Cabinets.

For correct installation of your system contact your Agilent service representative.

Waste Concept

1 Agilent recommends using the 6 L waste can with 1 Stay Safe cap GL45 with 4 ports (5043-1221) for optimal and safe waste disposal. If you decide to use your own waste solution, make sure that the tubes don't immerse in the liquid.

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.

Material Information

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

Disclaimer

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

PEEK

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

It is stable in a pH range between 1 – 12, 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 aequous halogene solutions, phenol and derivatives (cresols, salicylic acid etc.).

Polyimide

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

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

Polyethylene (PE)

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

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

Tantalum (Ta)

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

Stainless Steel (ST)

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

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

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

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

Diamond-Like Carbon (DLC)

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

Fused silica and Quartz (SiO_2)

Fused silica is used in 1290 Infinity Flow Cells and capillaries. Quartz is used for classical flow cell windows. It is inert against all common solvents and acids except hydrofluoric acid and acidic solvents containing fluorides. It is corroded by strong bases and should not be used above pH 12 at room temperature. The corrosion of flow cell windows can negatively affect measurement results. For a pH greater than 12, the use of flow cells with sapphire windows is recommended.

Gold

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

Zirconium Oxide (ZrO_2)

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

Platinum/Iridium

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

Fluorinated polymers (PTFE, PFA, FEP, FFKM)

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

TFE/PDD copolymer tubings, which are used in all Agilent degassers except 1322A, are not compatible with fluorinated solvents like Freon, Fluorinert, or Vertrel. They have limited life time in the presence of Hexafluoroisopropanol (HFIP). To ensure the longest possible life with HFIP, it is best to dedicate a particular chamber to this solvent, not to switch solvents, and not to let dry out the chamber. For optimizing the life of the pressure sensor, do not leave HFIP in the chamber when the unit is off.

Sapphire, Ruby and Al_2O_3-based ceramics

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

5
Optimization

This chapter provides information on how to optimize the Multi Column Thermostat.

Optimizing the Column Compartment

For best performance results of the multi column compartment:

- Use short connection capillaries and place them close to the heatexchanger. This will reduce heat dissipation and external band-broadening.
- See the *Consumables* sections for additional available heat exchangers with various internal volume to address certain applications in terms of flow rates and dispersion volume optimization.
- Keep the left and right heat exchanger temperature the same unless you do specific applications.

  Use the Divider Assy which is part of the *Accessory Kit* whenever you work with different temperatures on the left and right heater element to verify an optimized separation of both temperature zones. See also "Install the Divider Assembly" on page 50
- Keep the front cover closed during analysis.

6
Troubleshooting and Diagnostics

Overview about the troubleshooting and diagnostic features.

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 65.
- The Agilent ChemStation 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 chromatographic data system. Agilent Lab Advisor helps to manage the lab for high-quality chromatographic results by providing a detailed system overview of all connected analytical instruments with instrument status, Early Maintenance Feedback counters (EMF), instrument configuration information, and diagnostic tests. By the push of a button, a detailed diagnostic report can be generated. Upon request, the user can send this report to Agilent for a significantly improved troubleshooting and repair process.

The Agilent Lab Advisor software is available in two versions:

- Lab Advisor Basic
- Lab Advisor Advanced

Lab Advisor Basic is included with every Agilent 1200 Infinity Series and Infinity II Series pump.

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

The optional Agilent Maintenance Wizard Add-on provides an easy-to-use, step-by-step multimedia guide for performing preventive maintenance on Agilent 1200 Infinity and Infinity II Series instruments.

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

7
Error Information

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

What Are Error Messages

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

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

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

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

General Error Messages

General error messages are generic to all HPLC modules.

Timeout

Error ID: 0062

The timeout threshold was exceeded.

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

Shutdown

Error ID: 0063

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

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

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

Remote Timeout

Error ID: 0070

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

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

Lost CAN Partner

Error ID: 0071

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

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

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

Leak

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 Power Switch 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	Suggested actions
1 Defective leak sensor.	Please contact your Agilent service representative.
2 Leak sensor incorrectly routed, being pinched by a metal component.	Please contact your Agilent service representative.

Compensation Sensor Open

Error ID: 0081

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

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

Probable cause	Suggested actions
1 Loose connection between the power switch board and the main board	Please contact your Agilent service representative.
2 Defective power switch assembly	Please contact your Agilent service representative.

Compensation Sensor Short

Error ID: 0080

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

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

Probable cause	Suggested actions
1 Defective power switch assembly	Please contact your Agilent service representative.
2 Loose connection between the power switch board and the main board	Please contact your Agilent service representative.

MCT Error Messages

These errors are module specific.

VALVE INIT FAILED

Error ID: 32030

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	Suggested actions
1 Defect in cable connection of valve drive control.	Please contact your Agilent service representative.
2 Defect in cable connection of valve actuator encoder reader.	Please contact your Agilent service representative.
3 Defect of valve drive or valve actuator encoder reader.	Please contact your Agilent service representative.

VALVE_FAILED

Error ID: 32031

Switching of the valve failed.

Probable cause	Suggested actions
1 Mechanical problems. Friction too high or blockages on the valve drive's motor or on the valve head.	• Check valve head for correct installation • Try to identify the source of trouble by installing a different valve head if possible • Contact your Agilent service representative.
2 Defective sensor on the valve drive motor	• Check valve head for correct installation • Try to identify the source of trouble (valve head or drive) by installing a different valve head if possible. • Contact your Agilent service representative.

VALVE TAG VIOLATION

Error ID: 32032

Reading the valve tag failed

Probable cause	Suggested actions
1 A valve head has been exchanged (hot-plugged) while the valve drive was still powered on.	• For changing the valve head follow the instructions "Replace Valve Heads." It is important to have the valve switched off for at least 10 s after a new valve head has been installed. • Contact your Agilent service representative.

WAIT TIMEOUT

Error ID: 32044 (left), 32045 (right)

Wait operation for temperature timed out.

Probable cause	Suggested actions
1 Defective heater	Contact your Agilent service representative.
2 Defective main board	Contact your Agilent service representative.

HEATEX OVERTEMP

Error ID: 32080 (left), 32081 (right)

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

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

UHX SENSOR ERROR

Error ID: 32090 (left), 32091 (right)

Upper heat exchanger sensor has an error.

Probable cause	Suggested actions
1 Defective sensor	Please contact your Agilent service representative.
2 Defective cable	Please contact your Agilent service representative.
3 Defective main board	Please contact your Agilent service representative.

LHX SENSOR ERROR

Error ID: 32092 (left), 32093 (right)

Lower heat exchanger sensor has an error.

Probable cause	Suggested actions
1 Defective sensor	Please contact your Agilent service representative.
2 Defective cable	Please contact your Agilent service representative.
3 Defective main board	Please contact your Agilent service representative.

LHS_SENSOR_ERROR

Error ID: 32094 (left), 32095 (right)

Heat sink sensor has an error.

Probable cause	Suggested actions
1 Defective sensor	Please contact your Agilent service representative.
2 Defective cable	Please contact your Agilent service representative.
3 Defective main board	Please contact your Agilent service representative.

PELTIER OVERCURRENT

Error ID: 32098 (left), 32099 (right)

Probable cause	Suggested actions
1 Defective sensor	Please contact your Agilent service representative.
2 Defective main board	Please contact your Agilent service representative.
3 Defective cable	Please contact your Agilent service representative.

LEFT PELTIER ERROR

Error ID: 32096

Left peltier hardware is not operational.

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

RIGHT PELTIER ERROR

Error ID: 32097

Right peltier hardware is not operational.

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

8
Test Functions and Calibrations

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

Tests and Calibrations in Agilent Lab Advisor

Use the tests and diagnostic features provided in the Agilent Lab Advisor software to check if your module is working correctly.

For further details, refer to the Agilent Lab Advisor software help files.

Thermostat Function Test

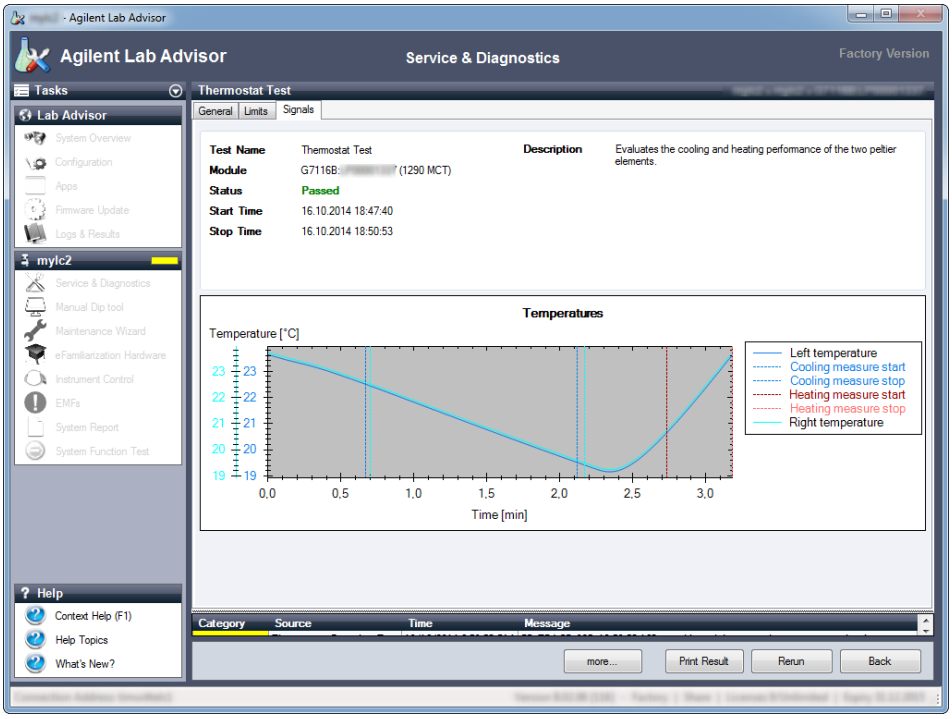
Thermostat Function Test Description

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

The instrument starts the test as soon as the heater temperature is within 5 °C of the current measured ambient temperature. After the start the instrument is cooling down to 4°C below the starting temperature. The cool-down time is used to determine the cooling performance. In the next step the heating performance is calculated by heating up to the test starting temperature.

Thermostat Function Test Result

A typical Thermostat Function Test profile is shown below.


Agilent Lab Advisor
Agilent Lab Advisor
Service & Diagnostics
Factory Version
Tasks
Lab Advisor
System Overview
Configuration
Apps
Firmware Update
Logs & Results
mylc2
Service & Diagnostics
Manual Dip tool
Maintenance Wizard
eFamiliarization Hardware
Instrument Control
EMFs
System Report
System Function Test
Help
Context Help (F1)
Help Topics
What's New?
Thermostat Test
General
Limits
Signals
Test Name
Thermostat Test
Module
G7116B: (1290 MCT)
Status
Passed
Start Time
16.10.2014 18:47:40
Stop Time
16.10.2014 18:50:53
Description
Evaluates the cooling and heating performance of the two peltier elements.
Temperatures
Temperature [°C]
23
22
21
20
19
0,0
0,5
1,0
1,5
2,0
2,5
3,0
Time [min]
Left temperature
Cooling measure start
Cooling measure stop
Heating measure start
Heating measure stop
Right temperature
Category
Source
Time
Message
more...
Print Result
Rerun
Back

System Pressure Test

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

CAUTION

Wrong use of System Pressure Test may damage components.

➔ Do not use higher test max. pressure settings as the lowest rated pressure component in the tests flow path.

NOTE

M4 Blank nut (5067-6141) can be used for plugging ports on column selection valves.

9 Maintenance

This chapter describes the maintenance of the MCT.

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.

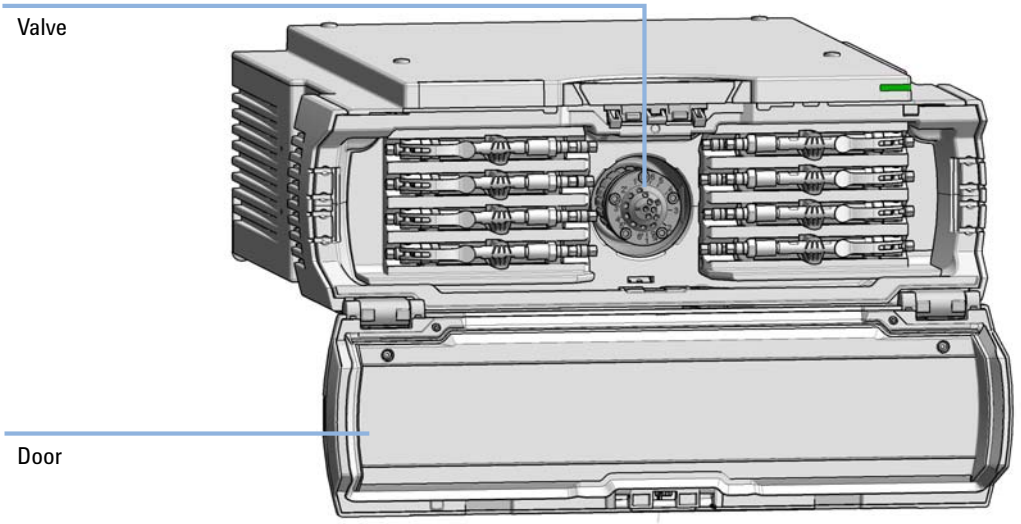


Figure 6 Overview of maintenance parts

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 4 Maintenance procedures

Procedure	Typical Frequency	Notes
"Cleaning the Module" on page 92	If required	
Changing Column Identification Tags	When column performance or new application requires a change	
"Install Heat Exchanger" on page 38	When new application requires a change	
Installing the capillaries	When new application requires a change	
Correcting Leaks	If a leak has occurred	Check for leaks
Replacing Valve Heads	If the valve performance shows indication of leakage or wear	
Preparing the MCT for Transportation	If the MCT shall be transported	
"Replace the Module Firmware" on page 102	If required	

Cleaning the Module

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

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

➔ Do not use an excessively damp cloth during cleaning.

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

Install the Column Identification Option

Parts required	p/n	Description
	G7116-68072	Column ID upgrade kit for MCT

Preparations Power off the instrument.

CAUTION

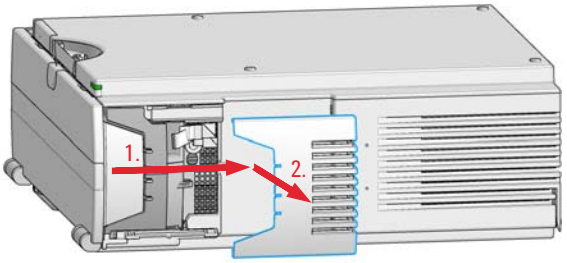
Electronic boards and components are sensitive to electrostatic discharge (ESD).

ESD can damage electronic boards and components.

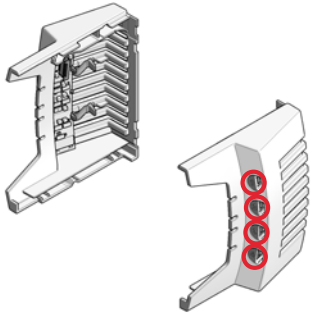
➔ Be sure to hold the column ID modules by the plastic parts, and do not touch the electrical components. Dont't touch the pins of the flex-board connector.

1 Remove any tube guides that potentially are already installed onto the sides of the MCT cover.

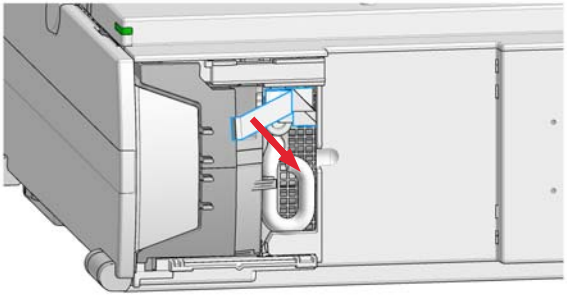
2 Unlock the right and left Side Cover Inserts by pushing them to the rear and put them to the side.



3 Identify the left and right column ID module. The ID slots 1 to 4 are numbered from top to bottom.

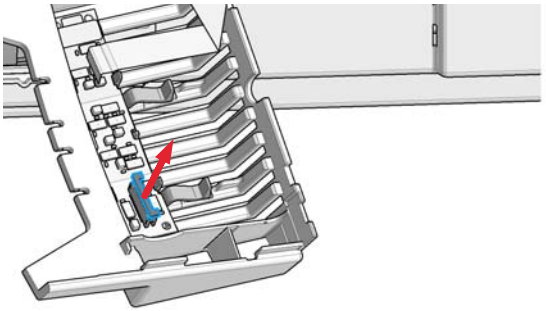


4 Take the end of the pre-installed flex-board connector out of the holder and connect it to the small board in the column ID module.

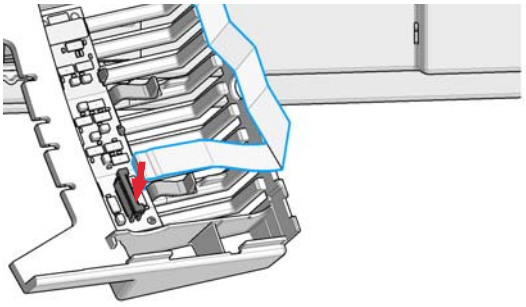


5 Connect the flex cable to the column ID module.

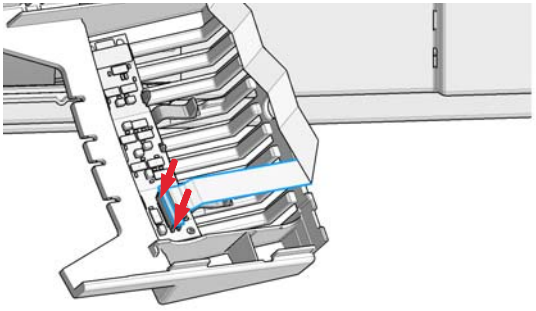
a Open the locking mechanism of the connector by lifting up the frame.



b Push in the cable with the contacts facing to the rear.

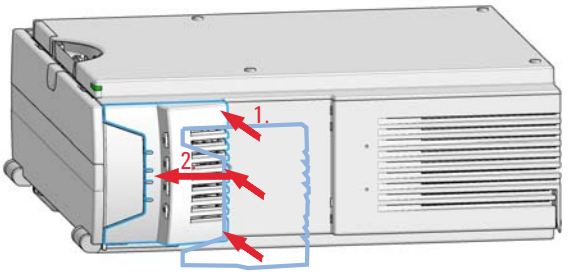


c Close the locking mechanism.



d Verify that the cable is properly attached to the connector without visible offset and repeat above steps if necessary.

6 Attach the column ID module to the MCT cover.



7 Repeat the performed steps 4 to 6 for the column ID module on the other side.

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)

1. Remove the door.
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.
4. Re-install the door.

Maintain the Column Switching Valve

When If valve leaks.

Tools required

Description
Wrench, 1/4 inch (supplied in HPLC Tool-Kit)
Hexagonal key, 9/64 inch (supplied in HPLC Tool-Kit)

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.
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.

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.

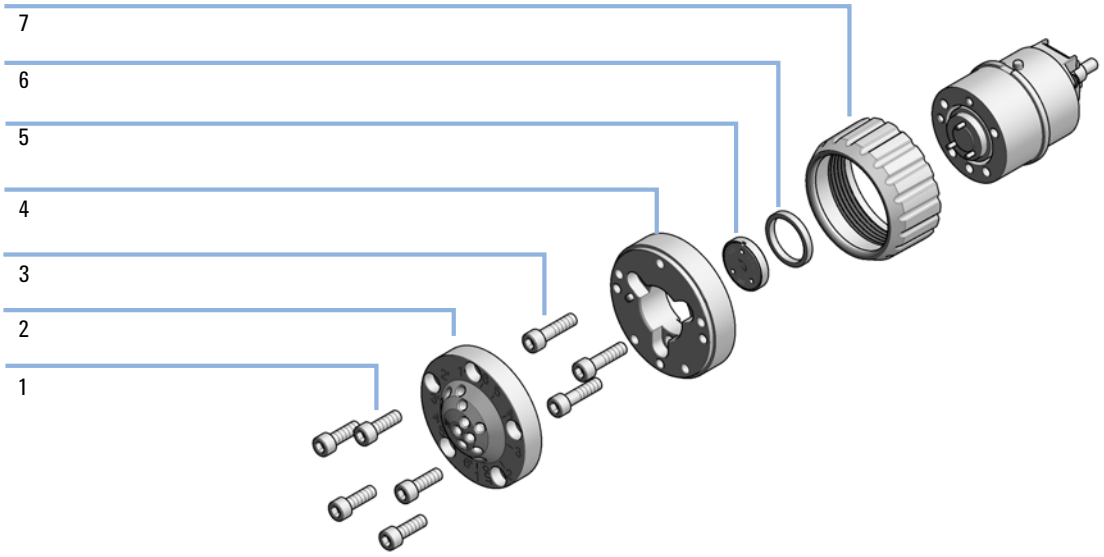


Figure 7 Valve Head Parts (example)

1	Stator screws
2	Stator head assembly
3	Stator ring screws (not available)
4	Stator ring (available for service only)
5	Rotor seal
6	Bearing ring
7	Spanner nut (available for service only)

NOTE

Figure 7 on page 97 illustrates replacement parts for the valve heads, with the 6-column 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 Table 6 on page 112 for identification of the required part numbers.

Replace 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 µl/min range.

Parts required	Description
	Any Agilent Quick Change Valve Head. For details, see "Valve Options Overview" on page 112

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*.

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.

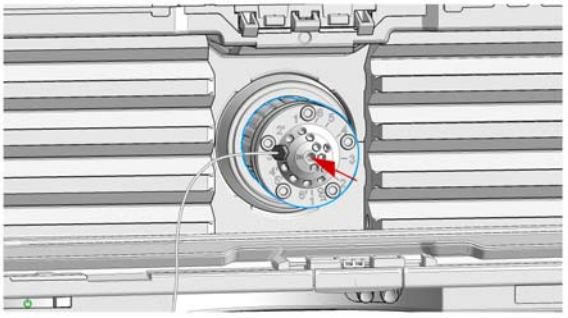
➔ Always install a valve head for operation and storage. For protecting the actuator, a dummy valve head (part of Transportation Lock Kit (G1316-67001)) can be used instead of a functional valve. Do not touch parts inside the actuator.

NOTE

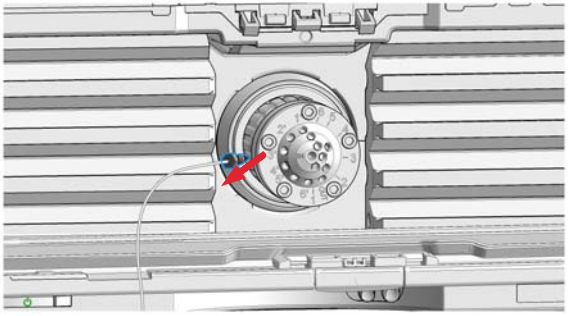
The tag reader reads the valve head properties from the valve head RFID tag during initialization of the module. Valve properties will not be updated, if the valve head is replaced while the module is on. Selection of valve port positions can fail, if the instrument does not know the properties of the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

NOTE

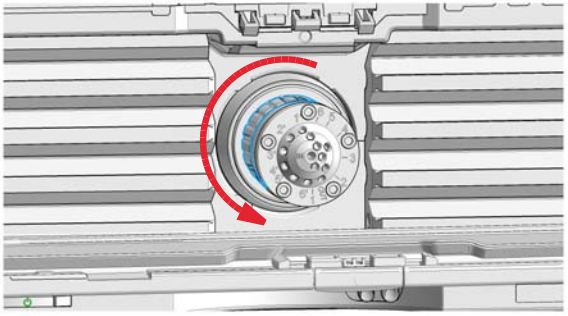
To have the valve correctly recognized by the Agilent Infinity Valve Drive you must have the valve drive powered off for at least 10 seconds.

1 Switch off the module.	**2** Push the valve head for bringing it to its outer position. 

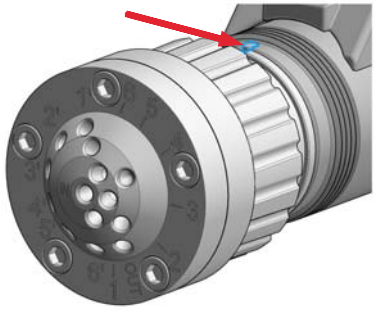
3 Remove all capillary connections from the valve head.



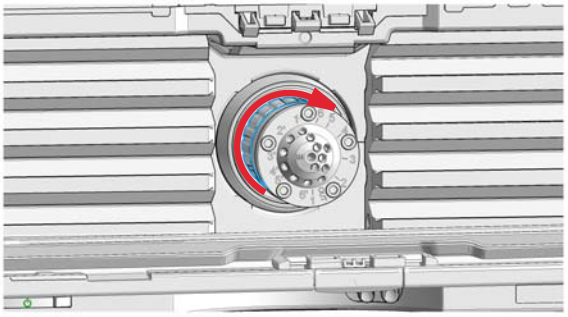
4 Unscrew the valve head.



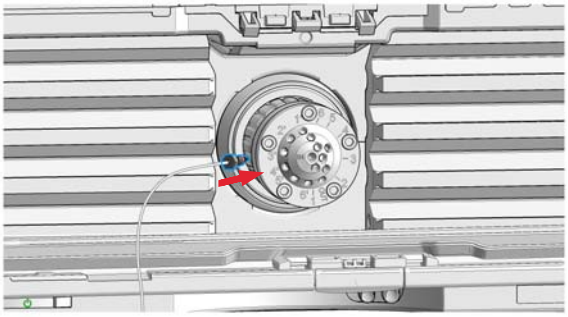
5 Put the new valve head onto the valve drive such that the lobe fits to the groove (see also "Installing Valve Heads" on page 43).



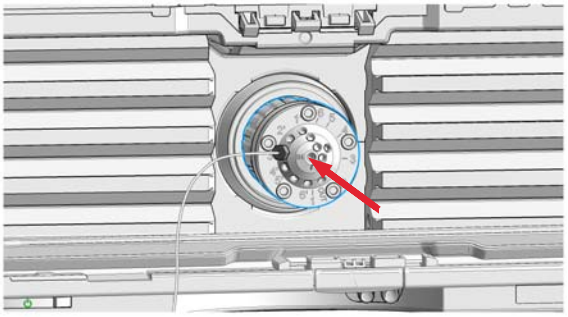
6 Screw the valve head onto the valve drive using the union nut (see also "Installing Valve Heads" on page 43).



7 Install all required capillary connections to the valve.



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



9 Switch on the module.

Prepare the MCT for Transportation

When If an MCT including the Valve Drive Option shall be transported

NOTE The module has been shipped with transportation locks, which must be used for transportation protection.

CAUTION Damage to Internal Parts

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

➔ Install a lock (Transportation Lock Kit).

1 Remove the valve head as described in "Replace Valve Heads" on page 98.

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

3 Fix the Transportation Lock to the MCT.

Replace the Module Firmware

When

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

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

Tools required

	Description
	Agilent Lab Advisor software
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/USB 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.

Module Specific Information

Module is a hosted module and always needs to be connected to a host with matching firmware of same revision.

10
Parts and Materials for Maintenance

This chapter provides information on parts for maintenance.

Plastic Parts

p/n	Description
G7116-60004	Door Kit IF-II-MCT-HE
G7116-40103	Side Cover Left Insert IF-II-MCT
G7116-40106	Side Cover Right Insert IF-II-MCT
G7116-40101	Side Cover Left IF-II-MCT
G7116-40104	Side Cover Right IF-II-MCT
G7116-40100	Base Cover IF-II-MCT
5067-5908	Top Cover

Leak Parts

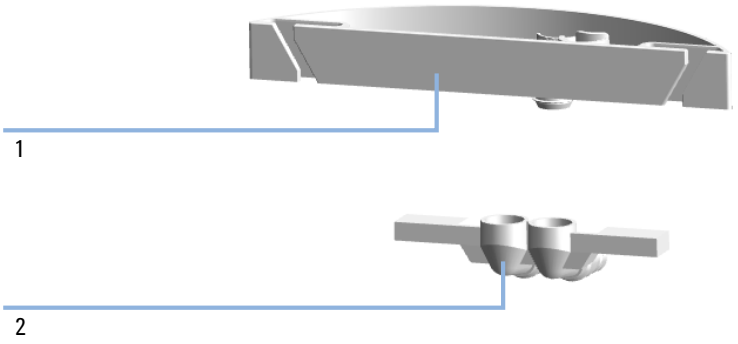


Figure 8 Plastic parts

Item	p/n	Description
1	G7116-40043	Leak Adapter Top TCC 2K
2	G7116-40013	Leak Adapter HITCH TCC

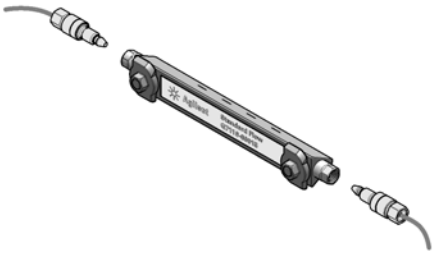
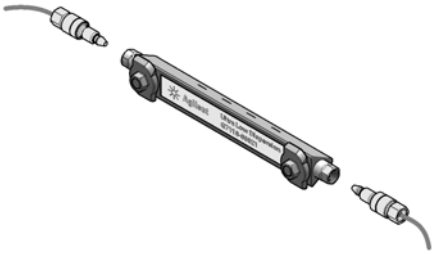
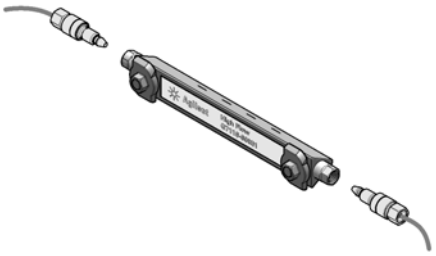
Accessories and Consumables

p/n	Description
G7116-68003	Column Holder Clips (2/Pk) for G7116B
G7116-68004	Column Holder Clamp (2/PK) for Infinity II
5500-1191	Capillary ST 0.12 x 280 mm, long socket Column to detector
G7116-60006	Divider Assembly MCT For separating different temperature zones between left and right heater elements.
5067-5917	Column ID TAG Assembly Blank column ID TAG (Column ID Kit required)

Additional Heater Devices

Blank heater assemblies without capillaries and fittings:

Table 5 Heater devices

Item	Description
	Heat Exchanger Assembly 1.6 µL-Z Quick Connect Heatexchanger Standard Flow (G7116-60015)
	Heat Exchanger 1 µL Quick Connect Heatexchanger Ultra Low Dispersion (G7116-60021) **NOTE** Use A-Line Quick turn fittings to connect to the Quick Connect Heat Exchanger Ultra Low Dispersion.
	Heat Exchanger 3 µL Quick Connect Heatexchanger High Flow (G7116-60031)

A-Line Quick Connect and Quick Turn Fittings

A-Line Quick Connect Fittings

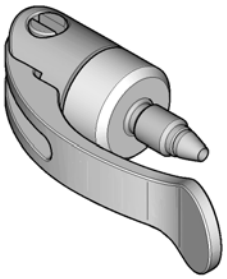


Figure 9 A-Line Quick Connect Fitting

p/n	Description
5067-5957	A-Line Quick Connect Assy ST 0.12 x 105 mm
5067-5958	A-Line Quick Connect Assy ST 0.12 x 150 mm
5067-5959	A-Line Quick Connect Assy ST 0.12 x 220 mm
5067-5960	A-Line Quick Connect Assy ST 0.12x 280 mm
5067-5961	A-Line Quick Connect Assy ST 0.075 x 105 mm
5067-5965	A-Line Quick Connect LC fitting

A-Line Quick Connect Fitting Replacement Capillaries

p/n	Description
5500-1173	A-Line Capillary ST 0.12 mm x 105 mm
5500-1172	A-Line Capillary ST 0.12 mm x 150 mm
5500-1171	A-Line Capillary ST 0.12 mm x 220 mm
5500-1170	A-Line Capillary ST 0.12 mm x 280 mm
5500-1174	A-Line Capillary ST 0.075 mm x 105 mm

A-Line Quick Turn Fitting

Figure 10 A-Line Quick Turn Fitting

p/n	Description
5067-5966	A-Line Quick Turn fitting

Capillaries for use with the A-Line Quick Turn Fitting

p/n	Description
5500-1188	Capillary ST 0.12 mm x 105 mm
5500-1189	Capillary ST 0.12 x 150 mm, long socket
5500-1190	Capillary ST 0.12 mm x 200 mm
5500-1191	Capillary ST 0.12 x 280 mm, long socket
5500-1192	Capillary ST 0.12 mm x 500 mm
5500-1193	Capillary ST 0.17 mm x 105 mm
5500-1194	Capillary ST 0.17 mm x 150 mm
5500-1195	Capillary ST 0.17 mm x 200 mm
5500-1196	Capillary ST 0.17 mm x 280 mm
5500-1197	Capillary ST 0.17 mm x 500 mm
5500-1198	Capillary ST 0.075 mm x 105 mm

Valve Options and Parts

p/n	Description
G1353D	Valve drive upgrade kit for MCT
	Mounting clips for External Valve drive

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 table (Table 6 on page 112) for identification of the required part numbers.

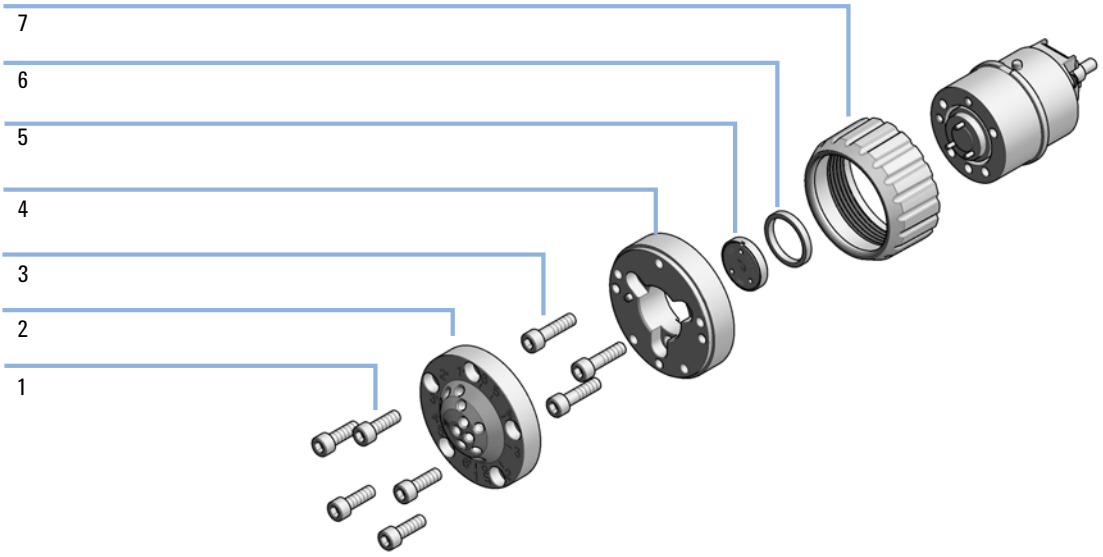


Figure 11 Valve Head Parts (example)

1	Stator screws
2	Stator head assembly
3	Stator ring screws (not available)
4	Stator ring (available for service only)
5	Rotor seal
6	Bearing ring
7	Spanner nut (available for service only)

Valve Options Overview

Table 6 Replacement parts standard valve heads

Valve Head	Rotor Seal	Stator Head	Stator Screws	Stator Ring
5067-4233 8 Column Selector 1300 bar	5068-0200 (PEEK)	5068-0199	5068-0089	n.a.

Column ID Parts

p/n	Description
G7116-68072	Column ID upgrade kit for MCT
5067-5917	Column ID TAG Assembly

11
Identifying Cables

This chapter provides information on cables used with the Agilent 1200 Infinity Series modules.

Cable Overview

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

Analog cables

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

Remote cables

p/n	Description
5188-8029	ERI to general purpose
5188-8044	Remote Cable ERI – ERI
5188-8045	Remote Cable APG – ERI
5061-3378	Remote Cable to 35900 A/D converter
01046-60201	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)

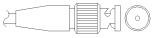
RS-232 cables (not for FUSION board)

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

USB cables

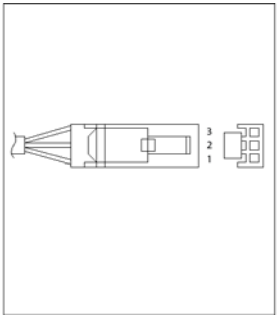
p/n	Description
5188-8050	USB A M-USB Mini B 3 m (PC-Module)
5188-8049	USB A F-USB Mini B M OTG (Module to Flash Drive)

Analog Cables

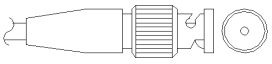


One end of these cables provides a BNC connector to be connected to Agilent modules. The other end depends on the instrument to which connection is being made.

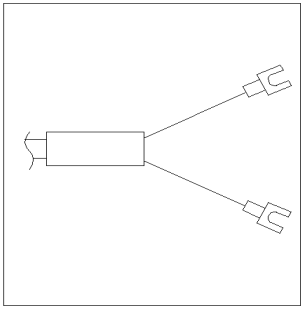
Agilent Module to 35900 A/D converters

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

Agilent Module to BNC Connector

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

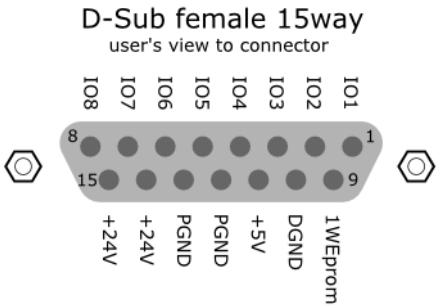
Agilent Module to General Purpose

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

Remote Cables

ERI (Enhanced Remote Interface)

5188-8029 ERI to general purpose

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

5188-8044 ERI to ERI (Connector D_Subminiature 15 pin)

Table 7 5188-8044 ERI to ERI

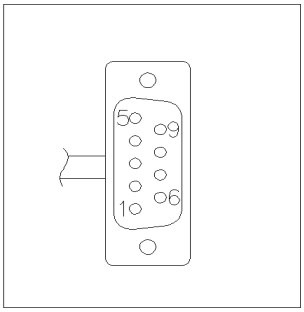
p/n 5188-8044	Pin (ERI)	Signal	Pin (ERI)	Active (TTL)
	10	GND	10	
	1	Start Request	1	Low
	2	Stop	2	Low
	3	Ready	3	High
	5	Power on	5	High
	4	Future	4	
	6	Shut Down	6	Low
	7	Start	7	Low
	8	Prepare	8	Low
	Ground	Cable Shielding	NC	

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

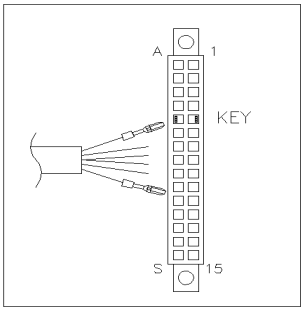
p/n 5188-8045	Pin (ERI)	Signal	Pin (APG)	Active (TTL)
	10	GND	1	
	1	Start Request	9	Low
	2	Stop	8	Low
	3	Ready	7	High
	5	Power on	6	High
	4	Future	5	
	6	Shut Down	4	Low
	7	Start	3	Low
	8	Prepare	2	Low
	Ground	Cable Shielding	NC	

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

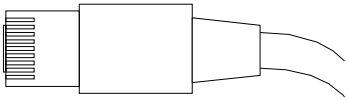
Agilent Module to Agilent 35900 A/D Converters

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

Agilent Module to General Purpose

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

CAN/LAN Cables



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

CAN Cables

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

LAN Cables

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

RS-232 Cables

p/n	Description
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

USB

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

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

12
Hardware Information

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

Firmware Description

The firmware of the instrument consists of two independent sections:

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

Resident System

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

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

Main System

Its properties are:

- the complete communication capabilities (CAN, LAN, USB and RS-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 the following tools (latest version should be used):

- Agilent Lab Advisor software with files on the hard disk (*)
- Firmware Update Tool with local files on the hard disk (*)
- Instant Pilot (G4208A) with files on a USB Flash Disk

(*) Required tools, firmware and documentation are available from the Agilent web:
http://www.chem.agilent.com/_layouts/agilent/downloadFirmware.aspx?whid=69761

The file naming conventions are:

PPPP_RVVV_XXX.dlb, where

PPPP is the product number, for example, 1315B for the G1315B DAD,

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

VVV is the revision number, for example 650 is revision 6.50,

XXX is the build number of the firmware.

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

NOTE

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

Main and resident firmware must be from the same set.

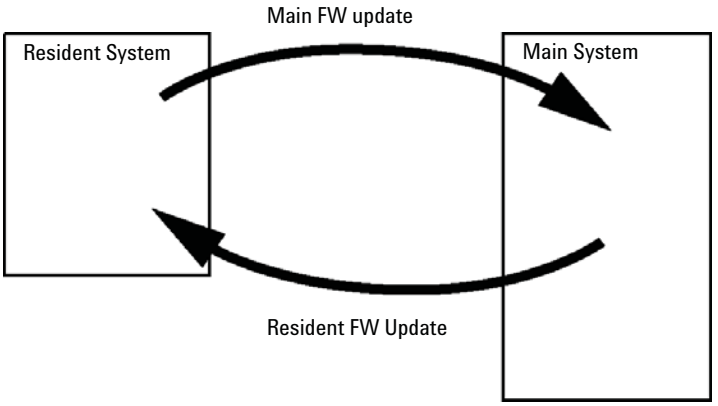


Figure 12 Firmware Update Mechanism

NOTE

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

Some modules can be re-branded (e.g. G1314C to G1314B) to allow operation in specific control software environments. In this case the feature set of the target type 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 ERI/REMOTE connector may be used in combination with other analytical instruments from Agilent Technologies if you want to use features such as start, stop, common shutdown, prepare, and so on.
- With the appropriate software, the LAN connector may be used to control the module from a computer through a LAN connection. This connector is activated and can be configured with the configuration switch.
- With the appropriate software, the USB connector may be used to control the module from a computer through a USB connection.
- The power input socket accepts a line voltage of 100 – 240 VAC ± 10 % with a line frequency of 50 or 60 Hz. Maximum power consumption varies by module. There is no voltage selector on your module because the power supply has wide-ranging capability. There are no externally accessible fuses because automatic electronic fuses are implemented in the power supply.

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

Rear View of the Module

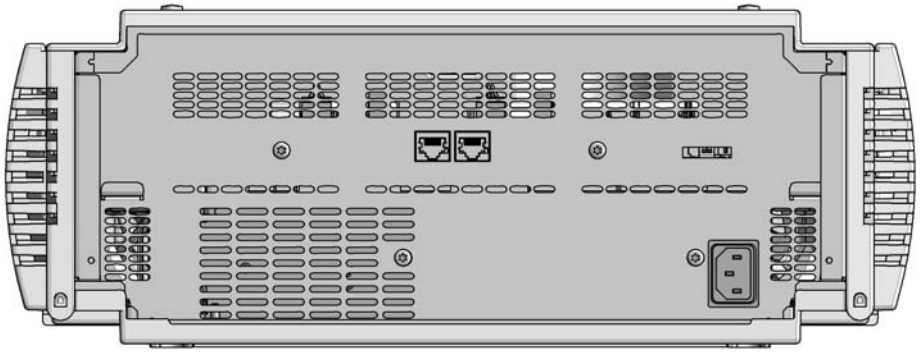


Figure 13 Rear view of the Multicolumn Thermostat G7116B

Information on Instrument Serial Number

Serial Number Information 1200 Series and 1290 Infinity

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

CCYWWSSSSS	Format
CC	country of manufacturing • DE = Germany • JP = Japan • CN = China
YWW	year and week of last major manufacturing change, e.g. 820 could be week 20 of 1998 or 2008
SSSSS	real serial number

Serial Number Information 1260 Infinity

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

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

Interfaces

The Agilent 1200 Infinity Series II modules provide the following interfaces:

Table 8 Agilent 1200 Infinity II Series Interfaces

Module	CAN	USB	LAN (on-board)	RS-232	Analog	APG (A) / ERI (E)	Special
Pumps							
G7104A Flexible Pump	2	No	Yes	Yes	1	A	
G7120A High Speed Pump	2	No	Yes	Yes	1	A	
Samplers							
G7129A/B ALS	2	Yes	Yes	No	No	E	
G7167A/B Multisampler	2	Yes	Yes	No	No	E	
Detectors							
G7114A/B VWD	2	Yes	Yes	No	1	E	
G7117A/B DAD	2	Yes	Yes	No	1	E	
G7115A/B DAD	2	Yes	Yes	No	1	E	
Others							
G7116B MCT	2	No	No	No	No	No	Requires a HOST module via CAN

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

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

Overview Interfaces

CAN

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

LAN

The modules have either an interface slot for 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.

USB

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

Analog Signal Output

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

Remote (ERI)

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

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

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

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

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

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

Table 9 ERI signal distribution

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

Special Interfaces

There is no special interface for this module.

ERI (Enhanced Remote Interface)

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

ERI Description

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

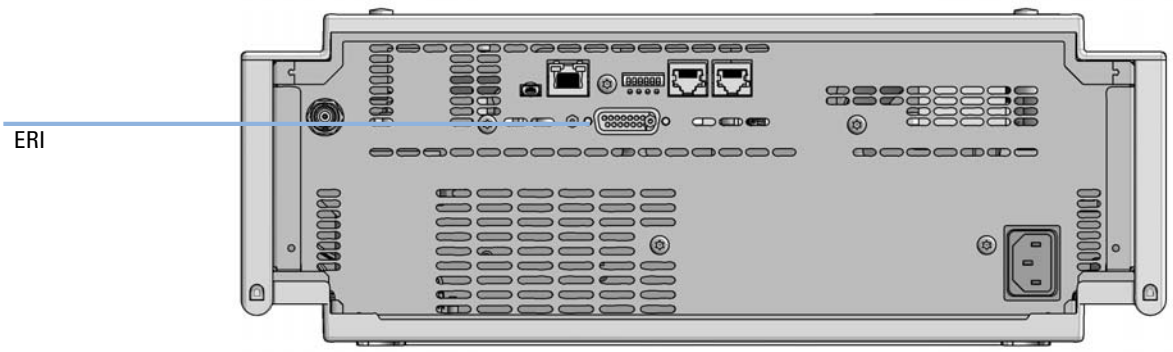
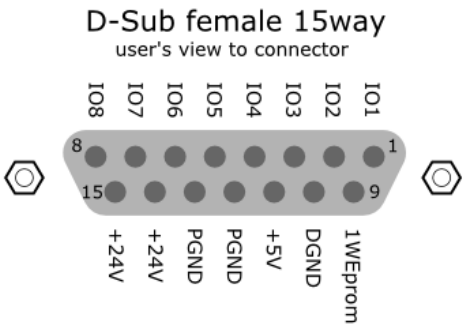


Figure 14 Location of the ERI interface (example shows a G7114A/B VWD)



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

IO (Input/Output) Lines

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

1-Wire Data (Future Use)

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

5V Distribution (Future Use)

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

24V Distribution (Future Use)

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

USB (Universal Serial Bus)

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

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

2-bit Configuration Switch

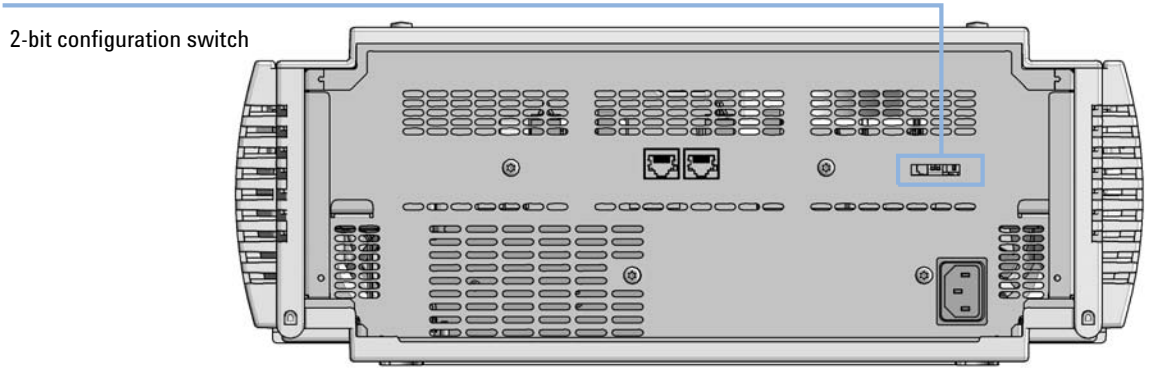


Figure 15 Location of Configuration Switch

Table 10 2 Switch Dip Settings for G7116B

Mode Select	1	2
Default	0	0
Coldstart	0	1
Boot resident	1	0
Not supported	1	1
(0 = up, 1 = down)		

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.

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.

Lamp Type	Counter Reset	Comment
lamp with RFID tag	NO	
lamp without RFID tag	YES	via Lab Advisor or Instant Pilot

The detector provides the following EMF counters:

- Deuterium Lamp On-Time
- Number of UV lamp ignitions

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.

NOTE This function is only available via Agilent Lab Advisor or Instant Pilot.

13
Appendix

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

General Safety Information

General Safety Information

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

WARNING

Ensure the proper usage of the equipment.

The protection provided by the equipment may be impaired.

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

Safety Standards

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

General

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

Before Applying Power

WARNING

Wrong voltage range, frequency or cabling

Personal injury or damage to the instrument

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

NOTE

Note the instrument's external markings described under "Safety Symbols" on page 150.

Ground the Instrument

WARNING

Missing electrical ground

Electrical shock

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

Do Not Operate in an Explosive Atmosphere

WARNING

Presence of flammable gases or fumes

Explosion hazard

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

Do Not Remove the Instrument Cover

WARNING

Instrument covers removed

Electrical shock

➔ Do Not Remove the Instrument Cover

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

Do Not Modify the Instrument

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

In Case of Damage

WARNING

Damage to the module

Personal injury (for example electrical shock, intoxication)

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

Solvents

WARNING

Toxic, flammable and hazardous solvents, samples and reagents

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

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

Safety Symbols

Table 11 Symbols

	The apparatus is marked with this symbol when the user should refer to the instruction manual in order to protect risk of harm to the operator and to protect the apparatus against damage.
	Indicates dangerous voltages.
	Indicates a protected ground terminal.
	The apparatus is marked with this symbol when hot surfaces are available and the user should not touch it when heated up.
	Cooling unit is designed as vapor-compression refrigeration system. Contains fluorinated greenhouse gas (refrigerant) according to the Kyoto protocol. For specifications of refrigerant, charge capacity, carbon dioxide equivalent (CDE), and global warming potential (GWP) see instrument label.
	Confirms that a manufactured product complies with all applicable European Community directives. The European Declaration of Conformity is available at: http://regulations.corporate.agilent.com/DoC/search.htm
	Manufacturing date.
	Power symbol indicates On/Off. The apparatus is not completely disconnected from the mains supply when the power switch is in the Off position

Table 11 Symbols

	Pacemaker Magnets could affect the functioning of pacemakers and implanted heart defibrillators. A pacemaker could switch into test mode and cause illness. A heart defibrillator may stop working. If you wear these devices keep at least 55 mm distance to magnets. Warn others who wear these devices from getting too close to magnets.
	Magnetic field Magnets produce a far-reaching, strong magnetic field. They could damage TVs and laptops, computer hard drives, credit and ATM cards, data storage media, mechanical watches, hearing aids and speakers. Keep magnets at least 25 mm away from devices and objects that could be damaged by strong magnetic fields.
	Indicates a pinching or crushing hazard
	Indicates a piercing or cutting hazard.

WARNING

A WARNING

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

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

CAUTION

A CAUTION

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

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

Refrigerant

The refrigerant HFC- 134a is used only in the Agilent Infinity II Sample Cooler.

Table 12 Physical properties of refrigerant HFC-134a

Molecular weight	102
Critical temperature	101.1 °C
Critical pressure	40.6 bar
Boiling point	-26.5 °C

WARNING

Refrigerant

Refrigerant HFC-134a is known as a safe refrigerant, however accidents can occur if it is handled incorrectly. For this reason, the following instructions must be observed:

- ➔ Avoid contact with liquid refrigerant HFC-134a. At atmospheric pressure HFC-134a evaporates at approximately -26 °C and causes frost bite.
- ➔ After skin contact, rinse the affected area with water.
- ➔ After eye contact, rinse the eye(s) with plenty of water for at least 15 minutes and consult a doctor.
- ➔ HFC-134a must not be allowed to escape in enclosed areas. Although HFC-134a is not toxic, there is a danger of suffocation as gaseous refrigerant is heavier than air.
- ➔ Please observe the following first aid instructions. After inhalation, move the affected person to fresh air, keep him warm and allow him to rest. If necessary, he should be supplied with oxygen. If he has stopped breathing or is breathing erratically, he should be given artificial respiration. In the case of cardiac arrest, carry out heart massage. Send for a doctor immediately.
- ➔ Moreover, it must be noted that HFC-134a must always be extracted from the system and collected. It must never be discharged into the atmosphere on environmental grounds (greenhouse effect).

CAUTION

General hazards and improper disposal

Improper disposal of the media and components used pollutes the environment.

- ➔ The breakdown of the sample cooler unit must be carried out by specialist refrigeration company.
- ➔ All media must be disposed of in accordance with national and local regulations.
- ➔ Please contact your local Agilent Service Center in regard to safe environmental disposal of the appliance or check www.agilent.com for more info.

Waste Electrical and Electronic Equipment Directive

Abstract

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

NOTE

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

Product Category:

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

NOTE

Do not dispose of in domestic household waste

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

Radio Interference

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

Test and Measurement

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

Sound Emission

Manufacturer's Declaration

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

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

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

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In This Book

This manual contains technical reference information about the Agilent 1290 Infinity II Multicolumn Thermostat (G7116B).

The manual describes the following:

- Introduction,
- requirements and specifications,
- using and optimizing,
- troubleshooting and diagnose,
- maintenance
- parts identification,
- hardware information,
- safety and related information.

Printed in Germany
06/2015

G7116-90000
Rev. C

Agilent Technologies