1290 Infinity II Valve Drive and Valve Heads

Agilent InfinityLab LC Series

User Manual

Notices

Document Information

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CAUTION

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

WARNING

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

In This Guide…

This manual covers the following:

- Agilent InfinityLab LC Series 1290 Infinity II Valve Drive (G1170A)
- Agilent InfinityLab Quick Change Valves

1 Introduction to the Agilent 1290 Infinity II Valve Drive and InfinityLab LC Series Valves

This chapter gives an introduction to the module, instrument overview and internal connectors

2 Site Requirements and Specifications

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

3 Installing the Module

This chapter gives information about the installation of the valve drive and the valve heads.

4 Using the Module

This chapter provides information on how to use the module.

5 Troubleshooting and Diagnostics

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

6 Error Information

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

7 Maintenance

This chapter gives you an overview and instructions about the possible maintenance and repair procedures that can be performed by the user.

8 Parts and Materials

This chapter provides information on parts and materials.

9 Identifying Cables

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

10 Hardware Information

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

11 Appendix

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

Contents

1 Introduction to the Agilent 1290 Infinity II Valve Drive and InfinityLab LC Series Valves

This chapter gives an introduction to the module, instrument overview and internal connectors

Overview of the Valve Drive

The Agilent 1290 Infinity II Valve Drive (G1170A) is a part of the InfinityLab LC Series. This is a valve drive delivered without a specific valve head. To be used in a HPLC system it is required to add a valve head to this device. It is compatible with all currently available Agilent InfinityLab Quick Change Valves (see Table 1 on page 13)

It includes the following features:

- Built-in power supply
- Leak handling with a leak pane and a leak sensor underneath the valve head
- User exchangeable valve heads (Agilent InfinityLab Quick Change Valves)
- Valve type and pressure detected by RFID tag
- Flexible mounting bracket, for left- or right-side mounting on LC stacks or at the Agilent Column Organizer (G1383A).

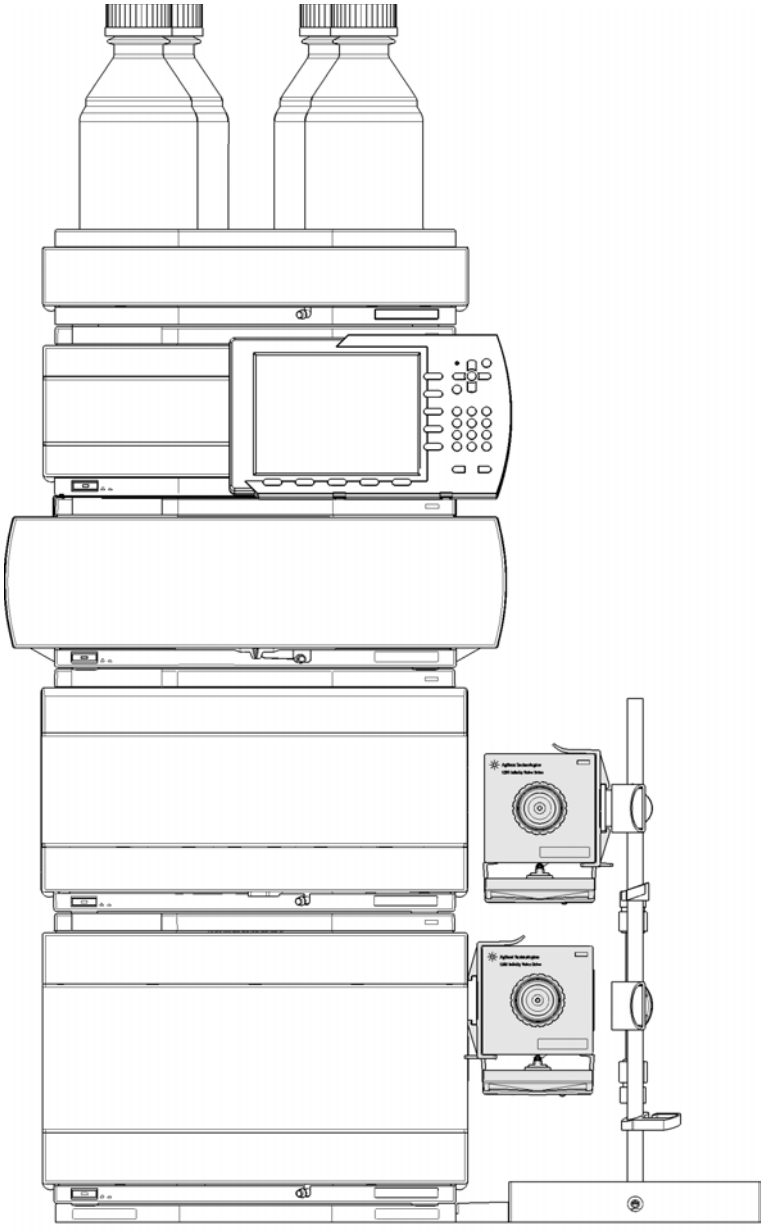


Figure 1 Mounting Examples for 1290 Infinity II Valve Drive

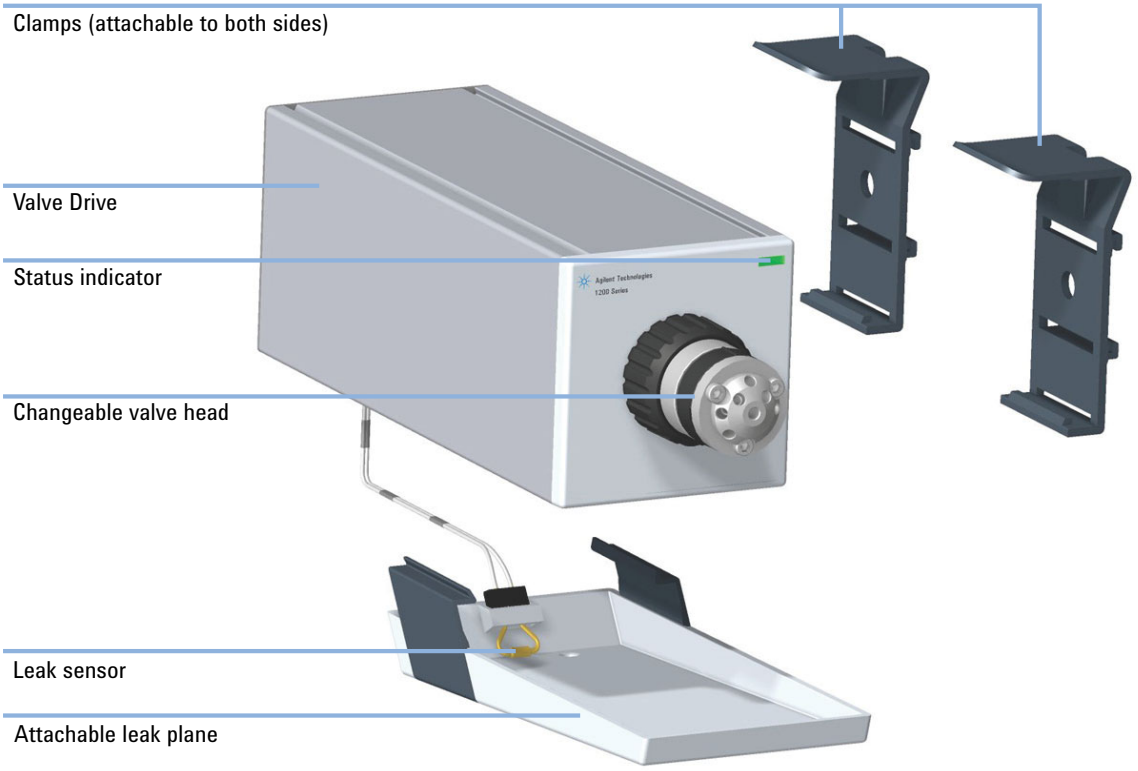


Figure 2 Overview of 1290 Infinity II Valve Drive

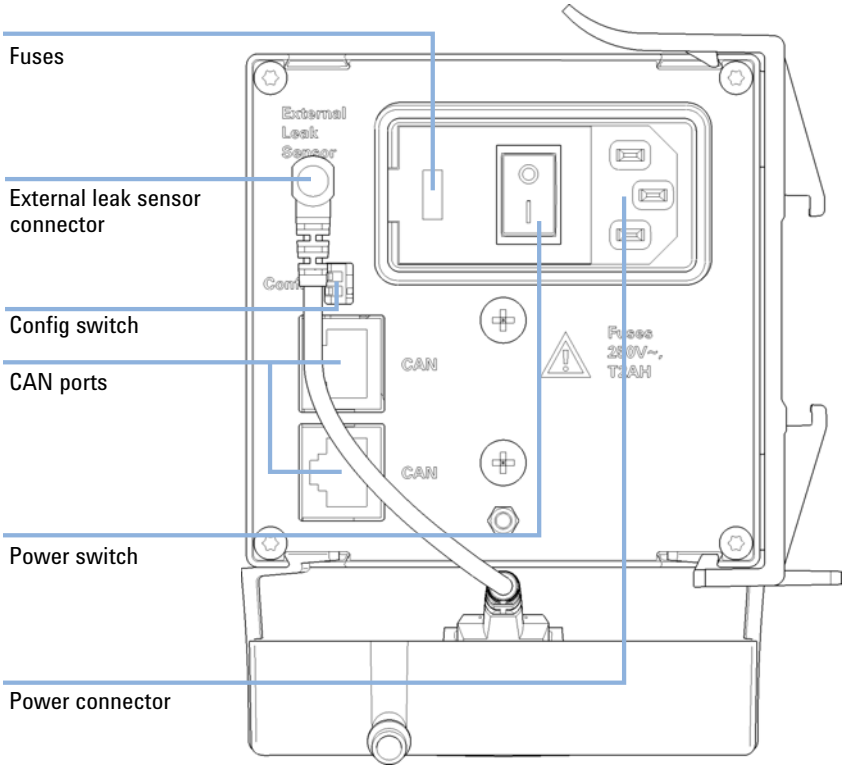


Figure 3 Rear View of 1290 Infinity II Valve Drive

Overview of the Agilent InfinityLab Quick Change Valves

The Agilent InfinityLab Quick Change Valves can be installed in the Multicolumn Thermostat (G7116A/B), the 1290 Infinity Flexible Cube (G4227A) and in the 1290 Infinity II Valve Drive (G1170A).

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

For 1290 Infinity II Bio LC modules, use bio / bio-compatible parts only.
Do not mix parts between 1260 Infinity II Bio-Inert LC modules and 1290 Infinity II Bio LC modules.

Table 1 Overview of the available Agilent Quick Change Valve Kits

Valve Kit PN	Pressure [bar]	Positions	Ports	Typical Application
G4231A	800	2	6	Any two-way switching, e.g. between two detectors, between waste and detector, between two columns
G4231C	1300	2	6	
G4232C	800	2	10	Anything a 2-position/6-port valve can do plus alternating column regeneration.
G4232D	1300	2	10	
G4234A	800	6	14	6 column selection
G4234C	1300	6	14	

Overview of the Agilent InfinityLab Quick Change Valves

Table 1 Overview of the available Agilent Quick Change Valve Kits

Valve Kit PN	Pressure [bar]	Positions	Ports	Typical Application
G4235A	210	12	13	Solvent selection or fractionation
G4237A	800	4	10	4 column selection
G4239C	1300	8	18	8 column selection
G5631A	600	2	6	Bio-inert, same as G4231A
G5632A	600	2	10	Bio-inert, anything a 2-position/6-port valve can do plus alternation column regeneration
G5639A	600	4	10	Bio-inert 4 column selection
G5641A	1300	2	10	Bio, anything a 2-position/6-port valve can do plus alternation column regeneration

Typical Applications

Agilent InfinityLab Quick Change Valves support a variety of valve applications. They can be mounted to an external 1290 Infinity II Valve Drive (G1170A) or a Multicolumn Thermostat (G7116A/B).

Examples of typical applications are:

- Dual and multiple column selection
- Sample enrichment and sample cleanup
- Alternating column regeneration
- Solvent selection

Dual and Multiple Column Selection

Dual Column Selection

Advantages:

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

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

Multiple Column Selection

With the 6-column selection valve (G4234A/C) and the capillary kit for column selection you can set up your system for use with up to 6 columns as displayed in Figure 4 on page 16. Or you can use the system with 5 columns and one flow path for flushing the system. This setup allows you to switch between columns for faster method development. The multicolumn setup might also be used, if several operators are sharing the system.

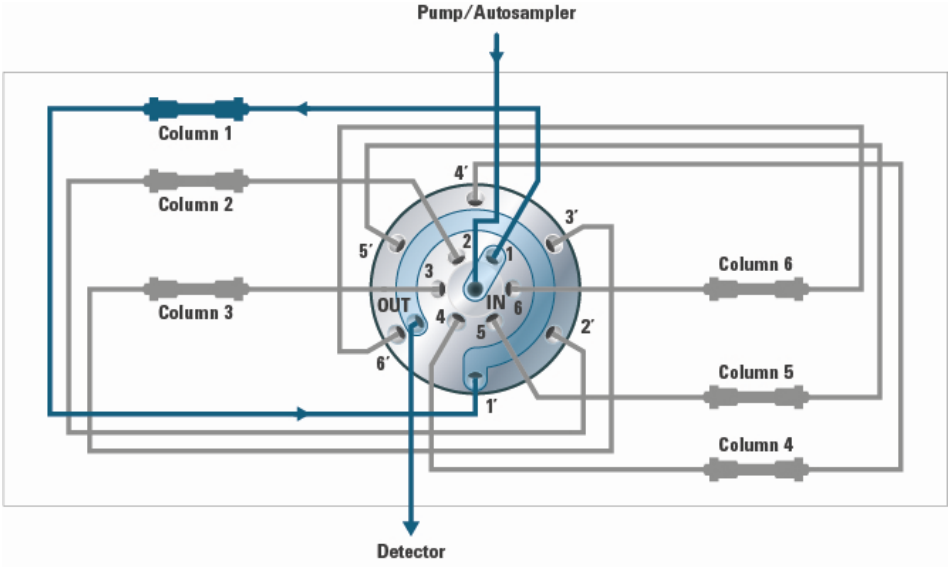
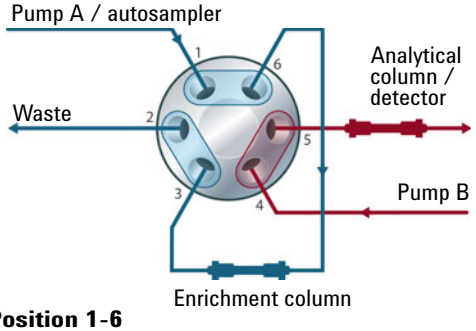


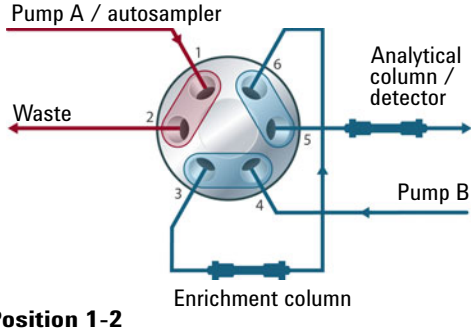
Figure 4 Multiple Column Selection (Example of Schematic Setup for 6-Column Selector)

Sample Enrichment and Sample Cleanup

Sample Enrichment

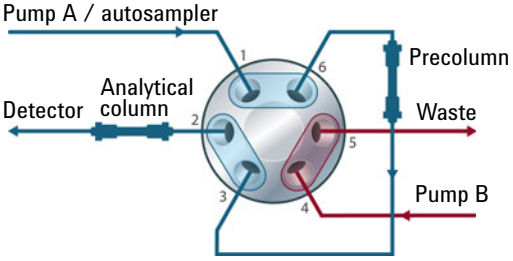


Position 1-6

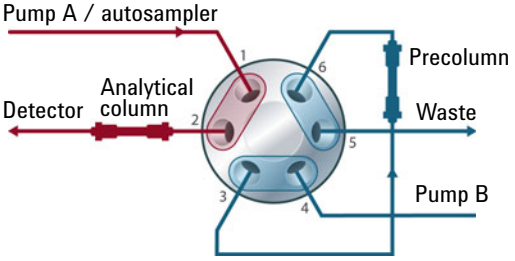


Position 1-2

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 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 techniques of choice to obtain highest sensitivity and to remove the sample matrix. The analytes are retained and concentrated onto the precolumn, while the sample matrix is passed to waste. After the valve switch, a second pump backflushes the analytes out of the precolumn onto the separation column. This allows injection of large volumes onto the precolumn, significantly expanding sensitivity in the range of ten to several thousands.

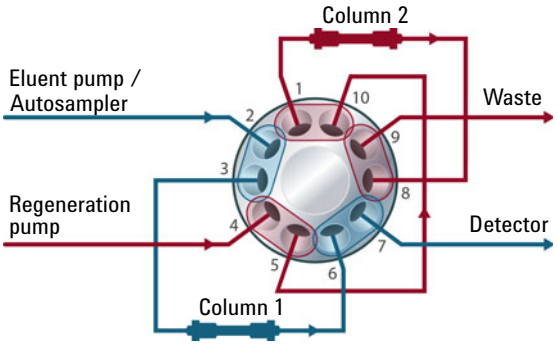
Sample cleanup

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

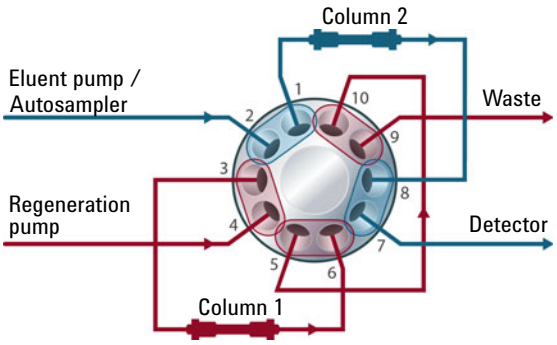
Alternating Column Regeneration

Advantages:

- High sample throughput
- Increased productivity
- High efficiency



Position 1-10



Position 1-2

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 InfinityLab Quick Change 2-position/10-port valve enables the simultaneous analysis of one sample on one LC column while an extra regeneration pump flushes and equilibrates a second, identical column. 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. Meanwhile, the regeneration pump flushes and equilibrates the first column. Up to 50 % of analysis time is often required to equilibrate columns. Using alternating column regeneration saves time and provides higher sample throughput.

Solvent Selection

The 12-position/13-port solvent selection valve (G4235A) can be used for solvent selection (flow rate < 10 mL/min) as illustrated in Figure 5 on page 20. It offers automated access to 12 different eluents.

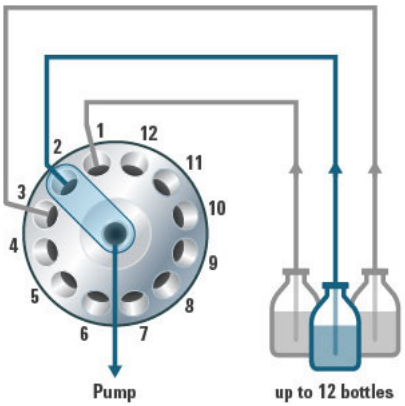


Figure 5 Solvent Selection (Schematic Setup)

Leak and Waste Handling

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

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 Infinity II 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 or Sample Thermostat (condensate)
- from the pump's Seal Wash Sensor (if applicable)
- from the pump's Purge Valve or Multipurpose Valve

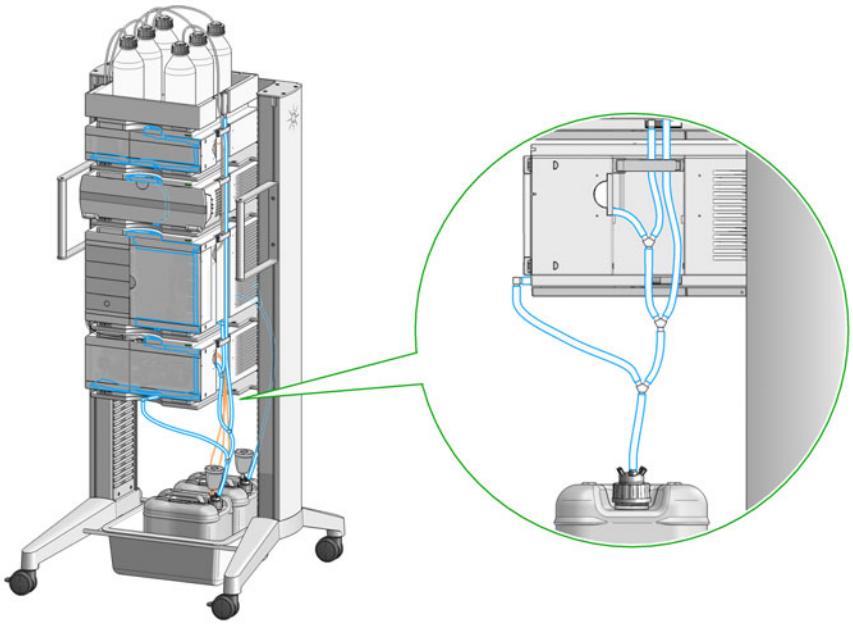


Figure 6 Infinity II Leak Waste Concept (Flex Bench installation)

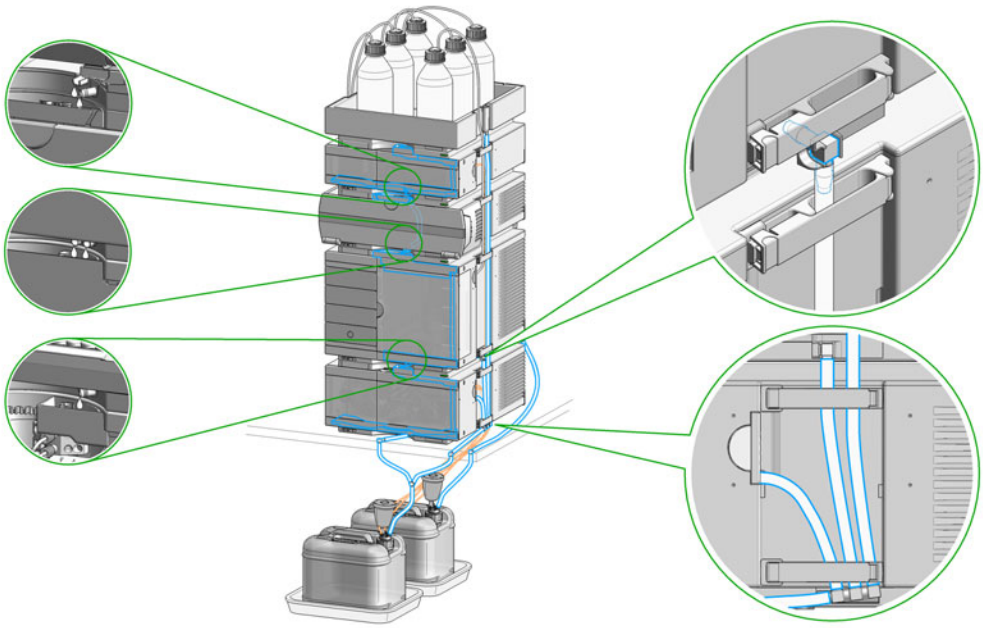


Figure 7 Infinity II Single Stack Leak Waste Concept (bench installation)

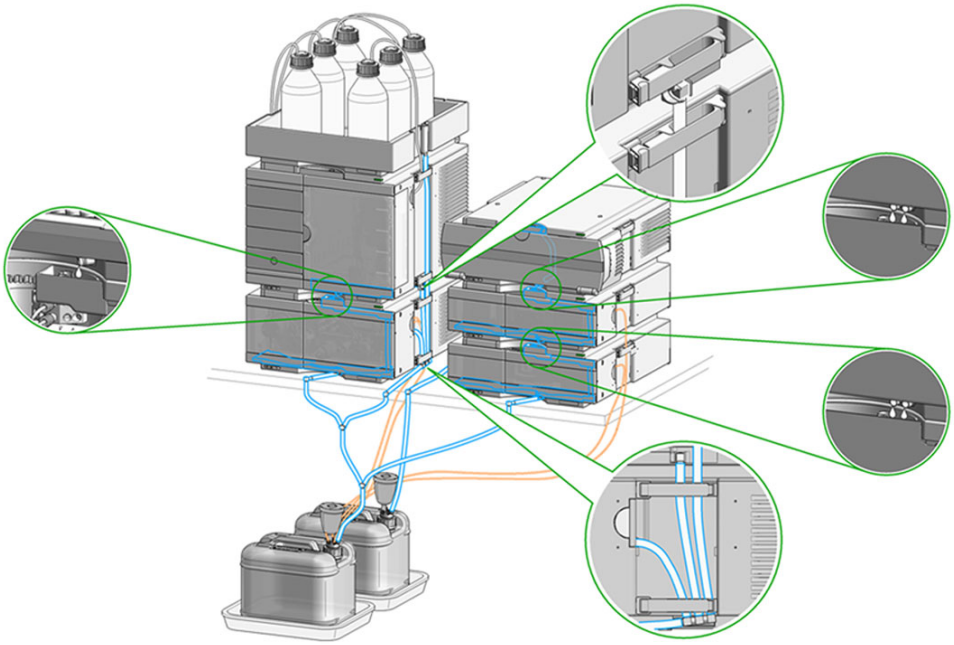


Figure 8 Infinity II Two Stack Leak Waste Concept (bench installation)

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

Leak Sensor

CAUTION

Solvent incompatibility

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

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

Waste Concept

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.

2 Site Requirements and Specifications

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

Site Requirements

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

Power Considerations

The module power supply has wide ranging capability. It accepts any line voltage in the range described in Table 2 on page 30. Consequently there is no voltage selector in the rear of the module. There are also no externally accessible fuses, because automatic electronic fuses are implemented in the power supply.

WARNING

Hazard of electrical shock or damage of your instrumentation

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

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

WARNING

Electrical shock hazard

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

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

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

WARNING

Inaccessible power plug.

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

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

Power Cords

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

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

WARNING

Unintended use of power cords

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

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

WARNING

Absence of ground connection

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

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

WARNING

Electrical shock hazard

Solvents may damage electrical cables.

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

Bench Space

The module dimensions and weight (see Table 2 on page 30) 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

Agilent recommends that you install the HPLC instrument in the InfinityLab Flex Bench rack. This option helps to save bench space as all modules can be placed into one single stack. It also allows to easily relocate the instrument to another lab.

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 2 Physical Specifications

Type	Specification	Comments
Weight	1.9 kg (4.3 lbs)	
Dimensions (height × width × depth)	90 x 90 x 300 mm (3.54 x 3.54 x 11.8 inches)	
Line voltage	100 – 240 V~, ± 10 %	Wide-ranging capability
Line frequency	50 or 60 Hz, ± 5 %	
Power consumption	20VA, 4W	
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 3000 m (9842 ft)	
Safety standards: IEC, EN, CSA, UL	Overvoltage category II, Pollution degree 2	For indoor use only
ISM Classification	ISM Group 1 Class B	According to CISPR 11

Performance Specifications

Table 3 Specifications Agilent InfinityLab Quick Change Valves

Kit PN	Valve PN	Description	max. Pressure [bar]	Fittings	Liquid Contact	pH Range
G5641A	5067-6682	2-position/10-port valve head, bio	1300	10-32	PEEK, MP35N	0-14 [1]
G4231A	5067-4282	2-position/6-port valve head	800	10-32	PEEK, ST	0-14[1]
G4231C	5067-4241	2-position/6-port valve head	1300	10-32	PEEK, ST	0-14[1]
G4232C	5067-4283	2-position/10-port valve head	800	10-32	PEEK, ST	0-14[1]
G4232D	5067-4240	2-position/10-port valve head	1300	10-32	PEEK, ST	0-14[1]
G4234A	5067-4284	6-position/14-port valve head	800	M4	PEEK, ST	0-14[1]
G4234C	5067-4273	6-position/14-port valve head	1300	M4	PEEK, ST	0-14[1]
G4235A	5067-4159	12-position/13-port valve head, bio-inert	210	10-32	PEEK, Ceramic	0-14[1]
G4237A	5067-4279	4-position/10-port valve head	800	M4	PEEK, ST	0-14[1]
G4239C	5067-4233	8-position/18-port valve head	1300	M4	PEEK, ST	0-14[1]
G5631A	5067-4148	2-position/6-port valve head, bio-inert	600	10-32	PEEK, Ceramic	0-14[1]
G5632A	5067-4132	2-position/10-port valve head, bio-inert	600	10-32	PEEK, Ceramic	0-14[1]
G5639A	5067-4134	4-position/10-port valve head for columns selection, bio-inert	600	10-32	PEEK, Ceramic	0-14[1]

[1] Incompatible with some mineral acids. For more information see Solvent Information.

Shipping and Storage Temperature: -40 – 80 °C

NOTE Shipping, storing or operating this valve below 0 °C with water in the fluid passages may cause failure of the sealing surfaces.

NOTE Operating valves above their maximum pressure limit will harm them. Please set a corresponding max. pressure limit in your Chromatographic Data System if a valve is positioned in the high pressure path.

3 Installing the Module

This chapter gives information about the installation of the valve drive and the valve heads.

Unpacking the Module

Damaged Packaging

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

CAUTION

"Defective on arrival" problems

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

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

Delivery Checklist

Ensure all parts and materials have been delivered with your module. The delivery checklist is shown below. For parts identification please check the illustrated parts breakdown in "Valve Drive Parts" on page 101. Please report any missing or damaged parts to your local Agilent Technologies sales and service office.

Table 4 Delivery Checklist

Description	Quantity
Universal Valve Drive	1
Valve rail assembly (5067-4634)	Optional
Rail assy for column organizer (5067-1510)	Optional
Agilent LC Hardware Documentation Media (G4800-64500)	1
Power cable	1
LAN Interface Card (G1369-60012)	Optional (required if no proper hosting module is available, see "Interfaces" on page 124)
Accessory Kit (G1170-68705)	1

Accessory Kit

The 1290 Infinity II Valve Drive is shipped with Accessory Kit (G1170-68705) (see "Accessory Kit" on page 105).

Installing the Valve Drive

The 1290 Infinity II Valve Drive can be installed in different ways.

It can be attached to either side of your instrument with the use of the Valve Rail (InfinityLab LC Series, 1260 and 1290 Series Pumps and Detectors, for older modules order new cover kits), or it can be mounted to a G1383A column organizer by using the optional column stand mount.

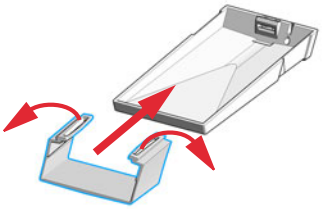
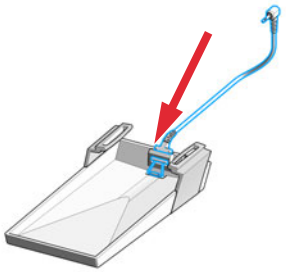
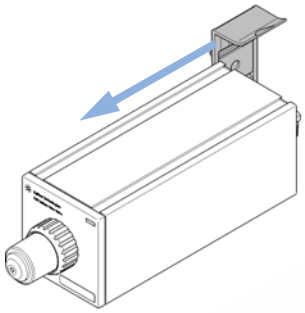
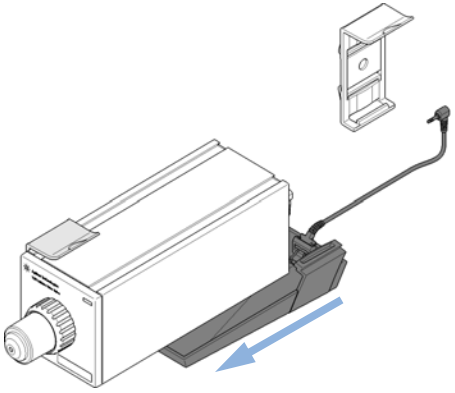
The Universal Valve Drive can also be installed on all Infinity II modules on either sides (5067-5685 Clamp Guide Kit). Installation of the Valve Drive on the G7116A/B requires either 5067-6138 Valve Holder Kit Right or 5067-6139 Valve Holder Kit Left.

Assembling and Installing the Leak Tray and Leak Sensor

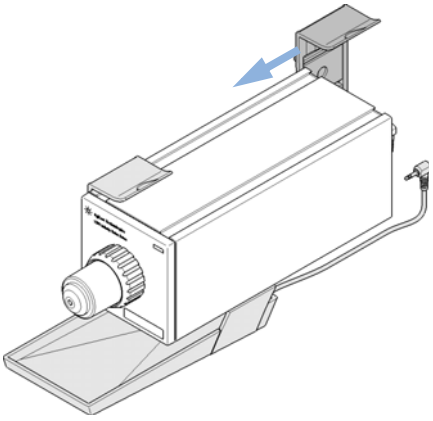
NOTE

Only connect or disconnect the leak sensor while the valve drive is powered off.

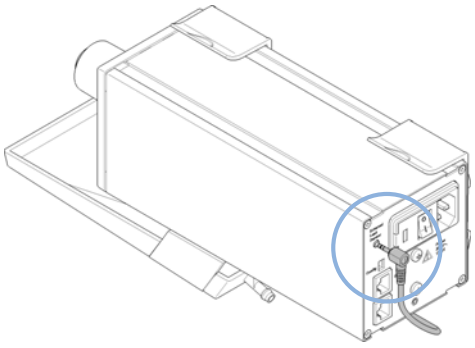
The valve drive must be 'powered off' for at least 10 s to recognize any hardware changes correctly.

1 Attach the leak tray holder to the leak tray. 	**2** Push the leak sensor into its holder. 
3 Slide the first clamp on to one side of the valve drive housing. 	**4** Slide the leak tray onto the bottom of the valve drive. 

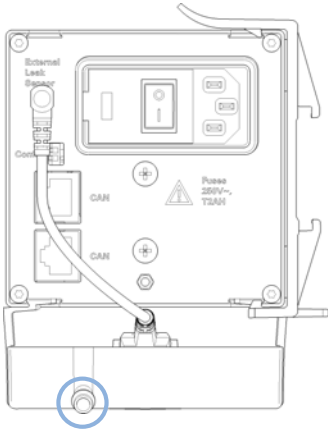
5 Slide the second clamp on to the same side as the first one.



6 Connect the leak sensor cable to the valve drive.



7 Attach the waste tubing to the leak plane and guide it to a proper waste container.



Mounting the Valve Drive to an Instrument by Using a Valve Rail

CAUTION

"Defective on arrival" problems

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

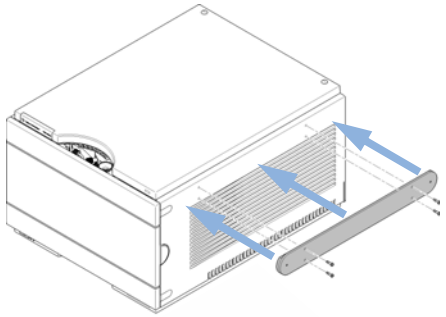
- ✓ **Notify your Agilent sales and service office about the damage.**
- ✓ **An Agilent service representative will inspect the instrument at your site and initiate appropriate actions.**

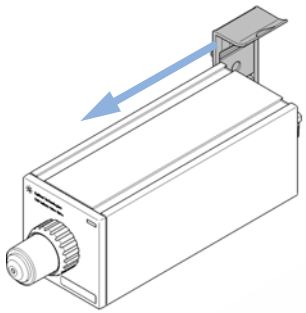
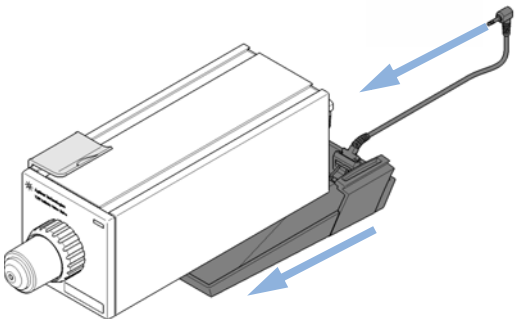
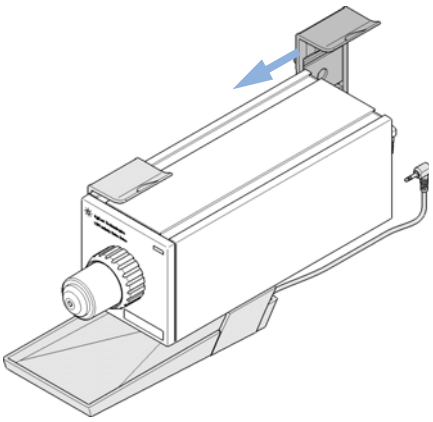
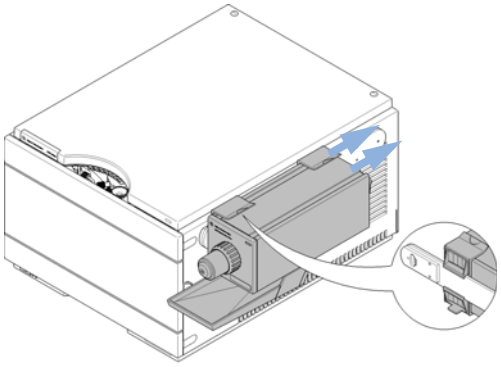
NOTE

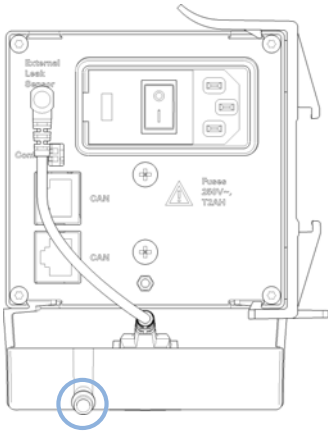
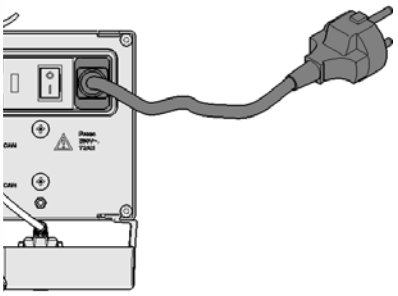
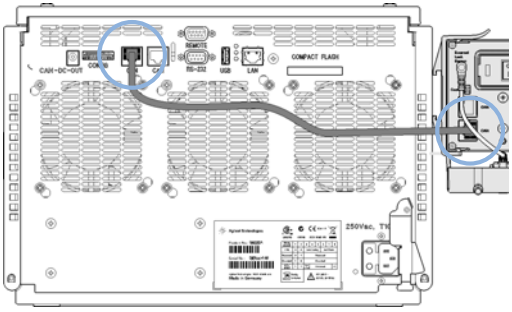
The Installation of the leak tray and the external leak sensor is optional.

If you want to attach the leak tray to the valve drive you need to slide the leak tray on to the valve drive before having both clamps attached to the valve drive.

Mounting the valve to an instrument by using a valve rail

1 Ensure the power switch at the rear of the module is OFF and the power connector is unplugged.	2 Identify the marks for the screws on the side panel of the cabinet assy and screw the valve rail to the side panel of the cabinet. 

3 Slide the first clamp on to one side of the valve drive housing. 	**4** Install the leak tray and leak sensor to the valve. 
5 Slide the second clamp on to the same side as the first one. 	**6** Slide the valve on to the valve rail. 

7 Attach the waste tubing to the leak plane and guide it to a proper waste container. 	**8** Connect the power cable to the power connector at the rear of the module. 
9 Connect the CAN interface connection. 	**10** Power on the module by switching the Power button at the rear of the module if a valve head has been already installed. Otherwise continue with "Installation of the Valve Heads" on page 47.

Mounting the Valve Drive to a G1383A Column Organizer

NOTE

For more information about the column organizer read the G1383-90011 Column Organizer Quick Reference Guide

1. Attach the column stand mount to the column organizer.
2. Attach both clamps to one side of the valve drive.
3. Install the leak tray and leak sensor to the valve.
4. Slide the valve onto the column stand mount.
5. Attach the waste tubing to the leak plane and guide it to a proper waste container.
6. Connect the power cable to the power connector at the rear of the module.
7. Connect the CAN interface connection to one of the CAN ports at the rear of the module.
8. Power on the module by switching the Power button at the rear of the module if a valve head has been already installed. Otherwise continue with "Installation of the Valve Heads" on page 47.

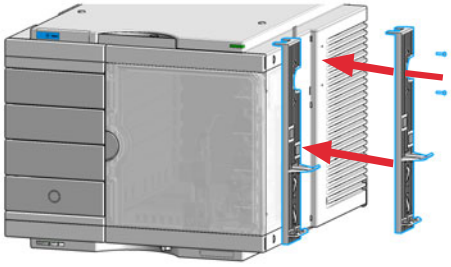
Mounting the Valve Drive as a Part of Online Sample Manager

Parts required

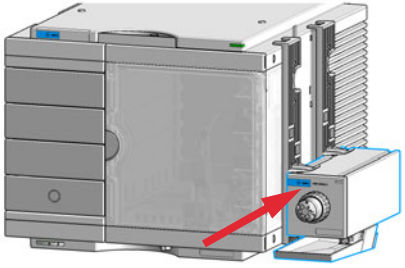
#	p/n	Description
2	G3167-42000	Single Holder UVD Multi Function
4	0515-5869	Screw-Tapping Pan-HD Hexalobular-Recess
1	5063-6527	Tubing, Silicon Rubber, 1.2 m, ID/OD 6/9 mm

Preparations Ensure the power switch at the rear of the module is off and the power connector is unplugged.

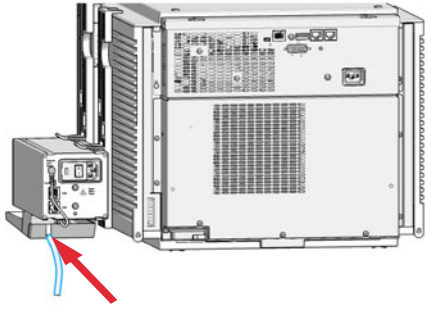
1 Identify the marks for the screws on the side panel of the Sampler and screw the clamps to the side panel of the module.



2 Slide the valve drive into the clamp guides from front to back.



3 Attach the waste tubing to the leak plane and guide it to a proper waste container.

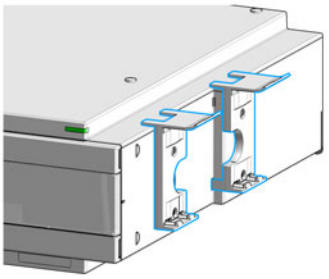


Mounting the Valve Drive to an Infinity II Module (except Multicolumn Thermostat)

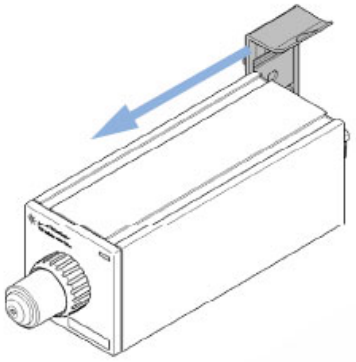
Parts required	p/n	Description
	5067-5685	Clamp Guide Kit-IF-II

1 Ensure the power switch at the rear of the module is OFF and the power connector is unplugged.

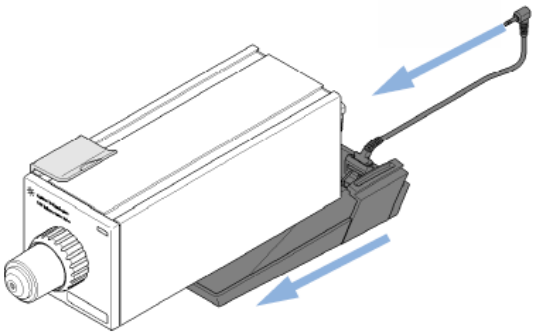
2 Identify the marks for the screws on the side of the Infinity II module cabinet and screw the valve clamps to the side panel of the cabinet using the screws from the kit.



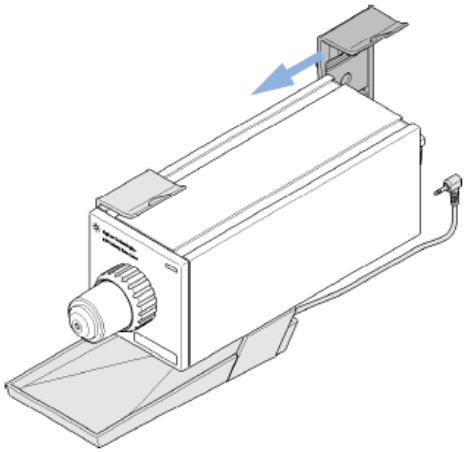
3 Slide the first clamp on to one side of the valve drive housing.



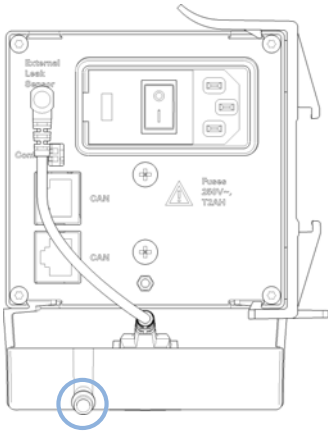
4 Install the leak tray and leak sensor to the valve.



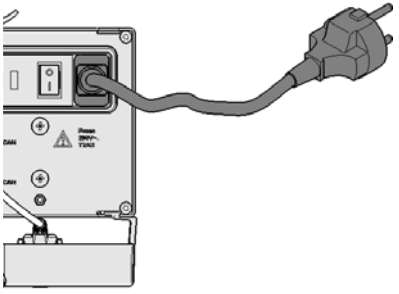
5 Slide the second clamp on to the same side as the first one.



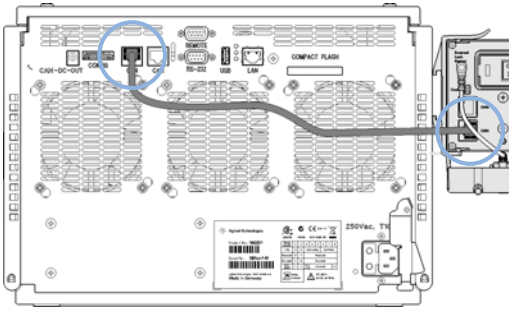
6 Attach the waste tubing to the leak plane and guide it to a proper waste container.



7 Connect the power cable to the power connector and the leak sensor at the rear of the module.



8 Connect the CAN interface connection.



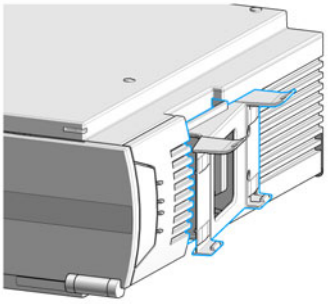
9 Power on the module by switching the Power button at the rear of the module if a valve head has been already installed. Otherwise continue with "Installation of the Valve Heads" on page 47.

Mounting the Valve Drive to a G7116A/B Multicolumn Thermostat

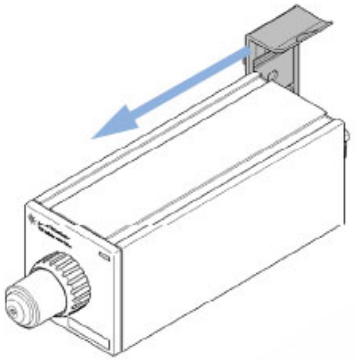
Parts required	#	p/n	Description
	1	5067-6138	Valve Holder Kit Right-IF-II-G
OR	1	5067-6139	Valve Holder Kit Left-IF-II-G

1 Ensure the power switch at the rear of the module is OFF and the power connector is unplugged.

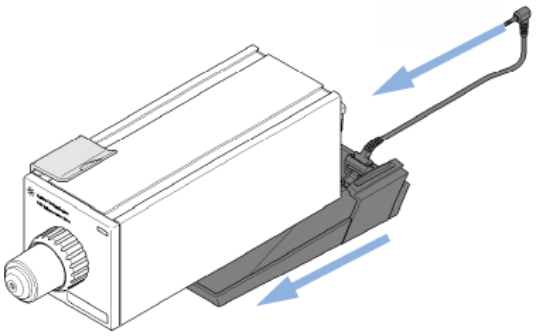
2 Identify the marks for the screws on the side of the Infinity II MCT cabinet and screw the valve clamp to the side panel of the cabinet using the screws from the kit.



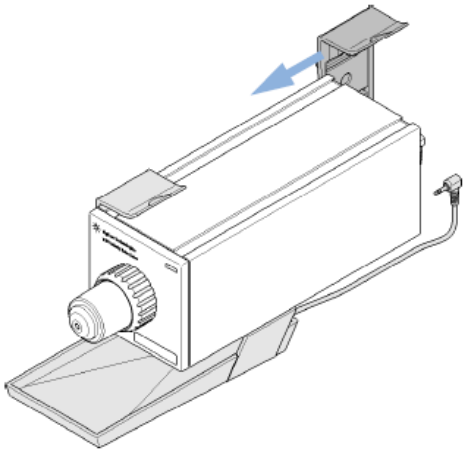
3 Slide the first clamp on to one side of the valve drive housing.



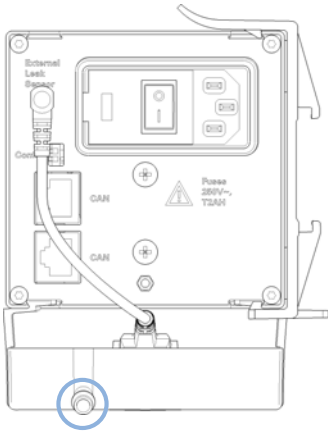
4 Install the leak tray and leak sensor to the valve.



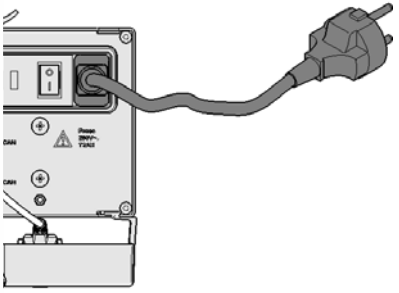
5 Slide the second clamp on to the same side as the first one.



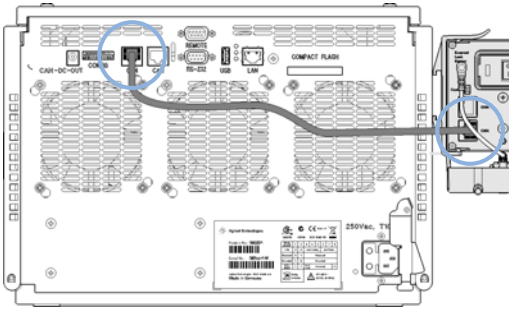
6 Attach the waste tubing to the leak plane and guide it to a proper waste container.



7 Connect the power cable to the power connector and the leak sensor at the rear of the module.



8 Connect the CAN interface connection.



9 Power on the module by switching the Power button at the rear of the module if a valve head has been already installed. Otherwise continue with "Installation of the Valve Heads" on page 47.

Installing the Valve Heads

Installation of the Valve Heads

If ordered, the valve drives are factory-installed in the 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 52. 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 48.

Install the Valve Head and Connect Capillaries

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

For 1290 Infinity II Bio LC modules, use bio / bio-compatible parts only.
Do not mix parts between 1260 Infinity II Bio-Inert LC modules and 1290 Infinity II Bio LC modules.

CAUTION

The valve actuator contains sensitive optical parts, which need to be protected from dust and other pollution. 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 information about the compatibility mode of 800 bar valve heads see Information on RFID Tag Technical Note (01200-90134).

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.

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 allow correct valve identification, power off the valve drive for at least 10 s.

NOTE

For firmware requirements see Information on RFID Tag Technical Note (01200-90134) which is included to each valve head.

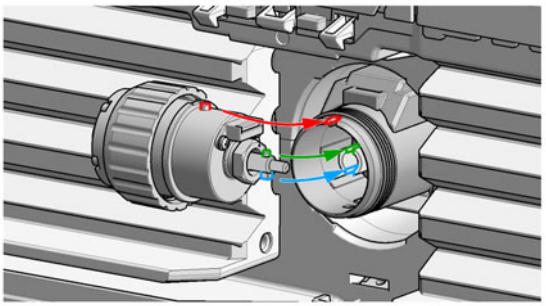
CAUTION

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.

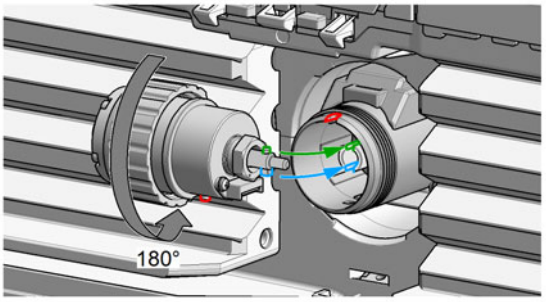
- ✓ **For bio applications, always use dedicated bio parts, which can be identified by the bio-inert symbol or other markers described in this manual.**
- ✓ **Do not mix bio, and non-bio modules or parts in a bio system.**

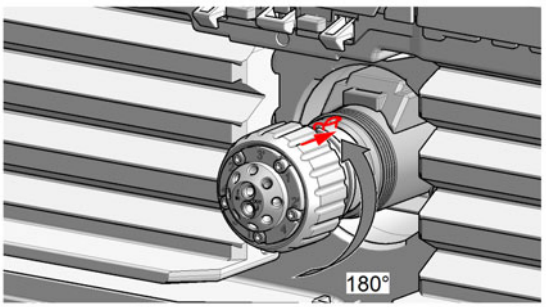
1 Insert the valve head into the valve shaft.



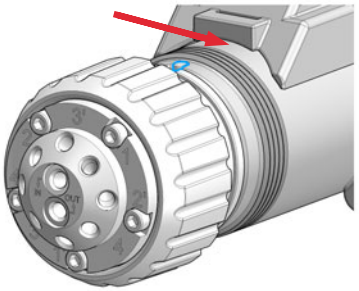
OR

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 continuously turning the valve head until the pin fits into the groove.





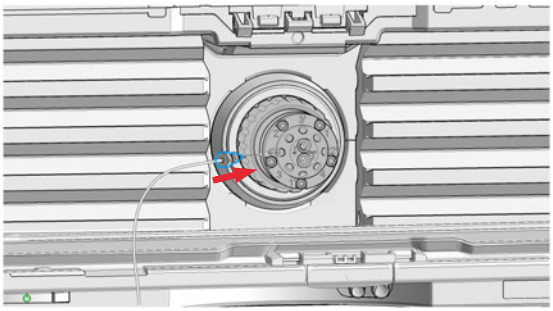
2 When the outer pin is locked into the groove, manually screw the nut onto the valve head.



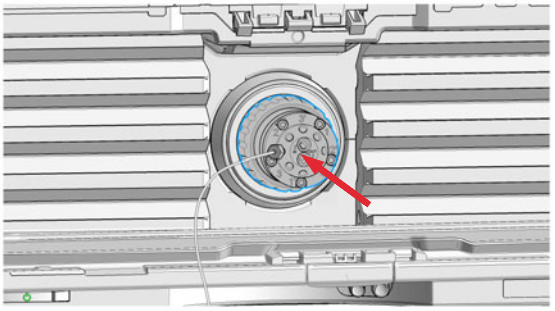
NOTE

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.



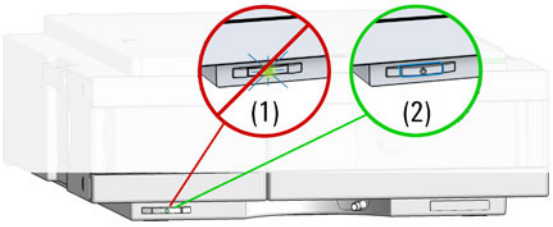
5 Power on or power-cycle your module, so the valve head gets recognized during module initialization.

Remove the Transportation Lock and the Valve Dummy

The following procedure demonstrates the necessary steps for installing the valve head to the valve drive of a Multicolumn Thermostat (MCT).

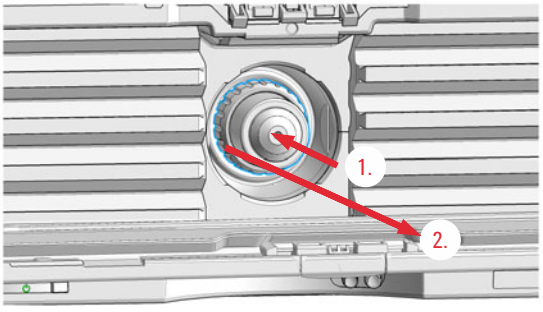
For the installation of a valve head to a G1170A Valve Drive you can ignore the steps that describe the MCT features of the transportation lock and spring loaded valve drive.

1 Switch off the module.

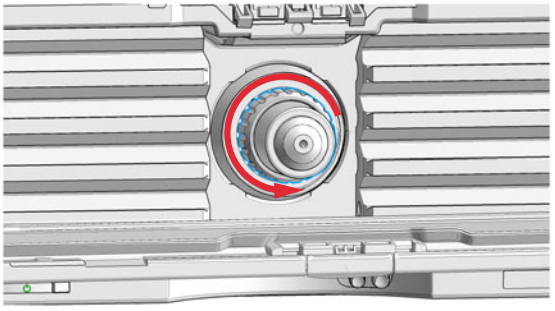


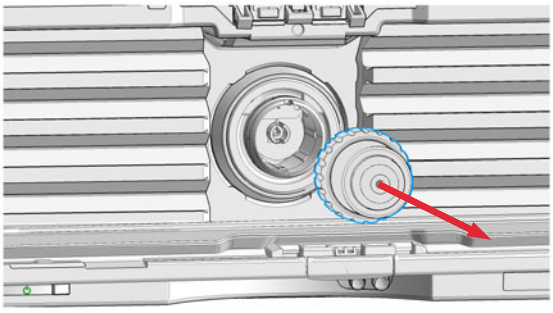
2 When unscrewing the transportation lock, push it back until the last screw is removed - the valve rail is spring-loaded.

3 Press on the valve dummy (1.) to release it (2.) (spring-loaded valve rail).



4 Unscrew the valve dummy.



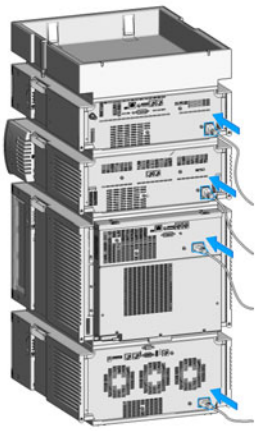
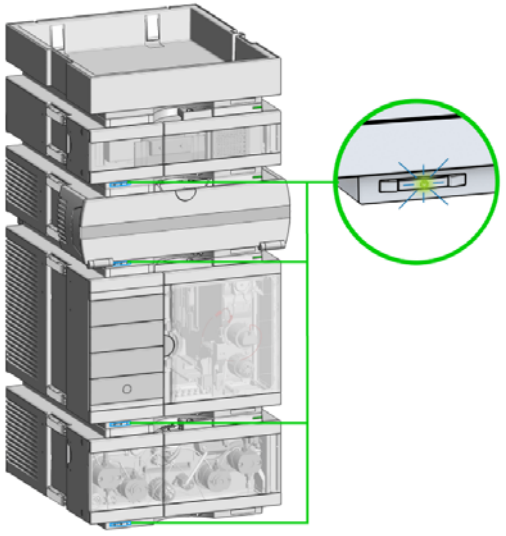
5 Remove the valve dummy from the valve drive. 	

4 Using the Module

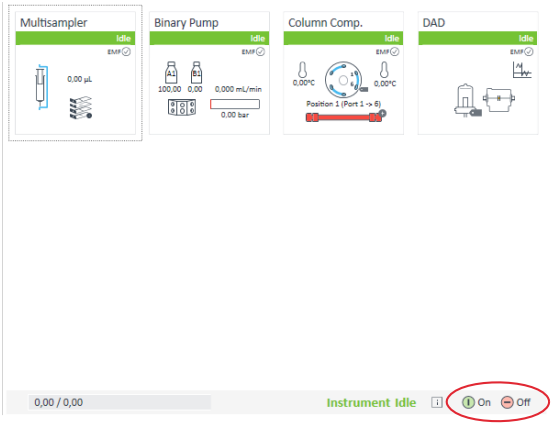
This chapter provides information on how to use the module.

Turn on/off

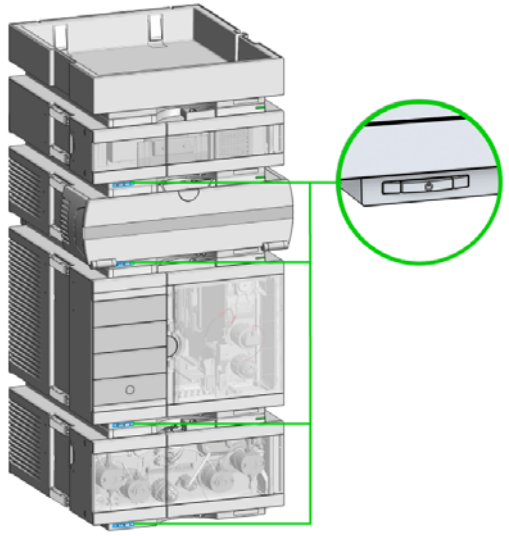
This procedure exemplarily shows an arbitrary LC stack configuration.

1	2
	 Power switch: On

3 Turn instrument **On/Off** with the control software.

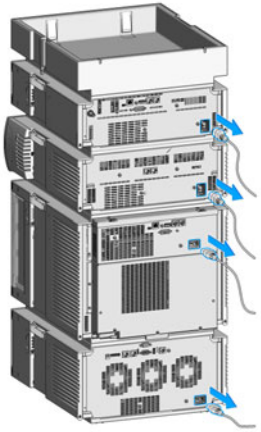


4



Power switch: Off

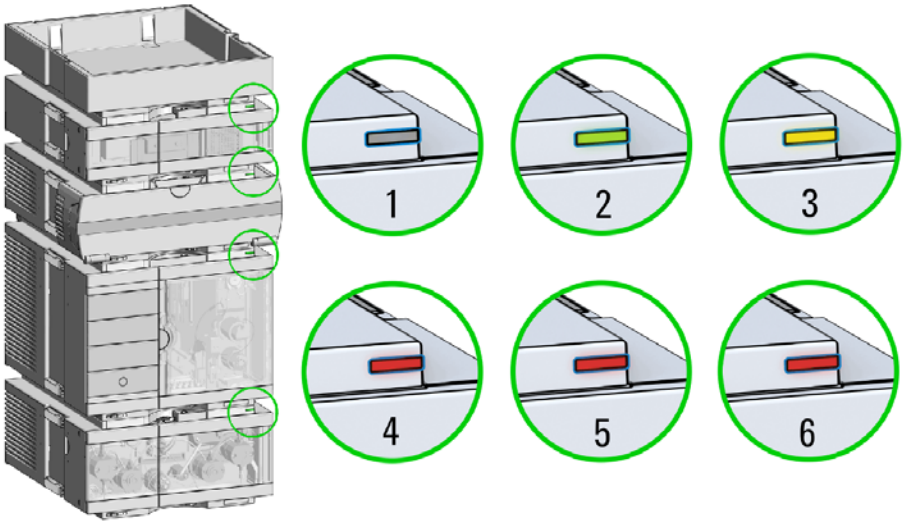
5



Status Indicators

This procedure exemplarily shows an arbitrary LC stack configuration.

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.

Hints for Successful Use

The presence of algae in HPLC systems can cause a variety of problems that may be incorrectly diagnosed as instrument or application problems. Algae grow in aqueous media, preferably in a pH range of 4 – 8. Their growth is accelerated by buffers, for example phosphate or acetate. Since algae grow through photosynthesis, light also stimulates their growth. Even in distilled water, small-sized algae grow after some time.

Instrumental Problems Associated With Algae

Algae deposit and grow everywhere within the HPLC system, causing the followng problems:

- Blocked solvent filters, or deposits on inlet or outlet valves, resulting in unstable flow, composition or gradient problems, or a complete failure of the pump.
- Plugging of small-pore, high-pressure solvent filters, usually placed before the injector, resulting in high system pressure.
- Blockage of PTFE frits, leading to increased system pressure.
- Plugging of column filters, giving high system pressure.
- Dirty flow cell windows of detectors, resulting in higher noise levels (since the detector is the last module in the flow path, this problem is less common).

Solvent Information

Observe the following recommendations on the use of solvents.

- Follow the recommendations for avoiding the growth of algae, see the pump manuals.
- Small particles can permanently block capillaries and valves. Therefore, always filter solvents through 0.22 µm filters.
- Avoid or minimize the use of solvents that may corrode parts in the flow path. Consider specifications for the pH range given for different materials such as flow cells, valve materials etc. and recommendations in subsequent sections.

Recommended Wash Solvents

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

NOTE

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

General Information about Solvent/Material Compatibility

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

Disclaimer

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

MP35N

MP35N is a nonmagnetic, nickel-cobalt-chromium-molybdenum alloy demonstrating excellent corrosion resistance (for example, against nitric and sulfuric acids, sodium hydroxide, and seawater) over a wide range of concentrations and temperatures. In addition, this alloy shows exceptional resistance to high-temperature oxidation. Due to excellent chemical resistance and toughness, the alloy is used in diverse applications: dental products, medical devices, nonmagnetic electrical components, chemical and food processing equipment, marine equipment. Treatment of MP35N alloy samples with 10 % NaCl in HCl (pH 2.0) does not reveal any detectable corrosion. MP35N also demonstrates excellent corrosion resistance in a humid environment. Although the influence of a broad variety of solvents and conditions has been tested, users should keep in mind that multiple factors can affect corrosion rates, such as temperature, concentration, pH, impurities, stress, surface finish, and dissimilar metal contacts.

Polyphenylene Sulfide (PPS)

Polyphenylene sulfide has outstanding stability even at elevated temperatures. It is resistant to dilute solutions of most inorganic acids, but it can be attacked by some organic compounds and oxidizing reagents. Nonoxidizing inorganic acids, such as sulfuric acid and phosphoric acid, have little effect on polyphenylene sulfide, but at high concentrations and temperatures, they can still cause material damage. Nonoxidizing organic chemicals generally have little effect on polyphenylene sulfide stability, but amines, aromatic compounds, and halogenated compounds may cause some swelling and softening over extended periods of time at elevated temperatures. Strong oxidizing acids, such as nitric acid (> 0.1 %), hydrogen halides (> 0.1 %), peroxy acids (> 1 %), or chlorosulfuric acid degrade polyphenylene sulfide. It is not recommended to use polyphenylene sulfide with oxidizing material, such as sodium hypochlorite and hydrogen peroxide. However, under mild environmental conditions, at low concentrations and for short exposure times, polyphenylene sulfide can withstand these chemicals, for example, as ingredients of common disinfectant solutions.

PEEK

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

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

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

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

Polyimide

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

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

Polyethylene (PE)

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

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

Tantalum (Ta)

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

Stainless Steel (SST)

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

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

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

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

Titanium (Ti)

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

Diamond-Like Carbon (DLC)

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

Fused silica and Quartz (SiO_2)

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

Gold

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

Zirconium Oxide (ZrO_2)

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

Platinum/Iridium

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

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

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

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

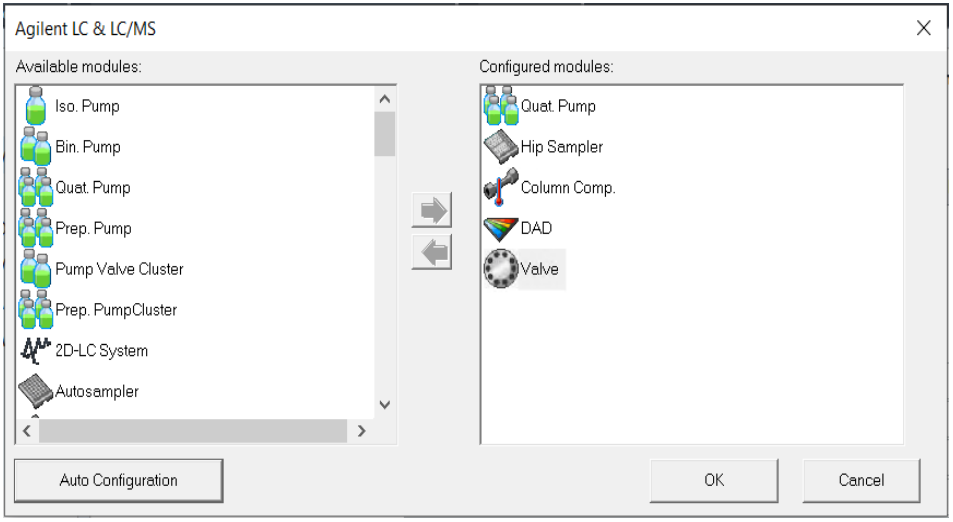
The tubing of the leak sensor is made of PVDF (polyvinylidene fluoride), which is incompatible with the solvent DMF (dimethyl formamide).

Sapphire, Ruby and Al_2O_3-based ceramics

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

Software Configuration

Configuring the Valves in the Software



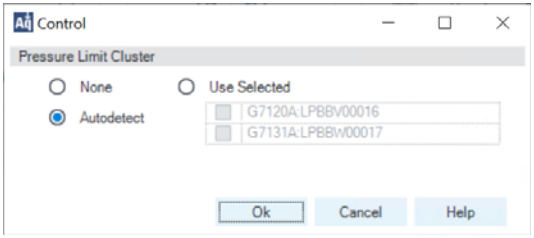
1 Configure your instrument by choosing between available modules.

2 Choose your valve drive(s) from the list of 'Configurable modules'(auto or manual configuration).

NOTE

A valve head needs to be detected from the module before you can configure it in the software. Please refer to "Installation of the Valve Heads" on page 47 for details.

Assign a Pressure Limit Cluster to the Valve



The valve head's RFID Tag holds the information about its maximum pressure. An assigned pressure cluster partner assures that this limit is not exceeded. The maximum pressure information of the valve head will become the new maximum pressure setting of the assigned pressure cluster partner. This helps to avoid damage to the valve head if the maximum pressure of the pump is higher then the valve head's maximum pressure.

1 Open the valve's control menu (right click on the valve's GUI).

2 Assign the valve's pressure partner ('None' or several partners possible).

NOTE

Assigning a Pressure Limit Cluster only works in combination with a 1290 Infinity and 1290 Infinity II pumps.

Possible Method Settings for the Valve

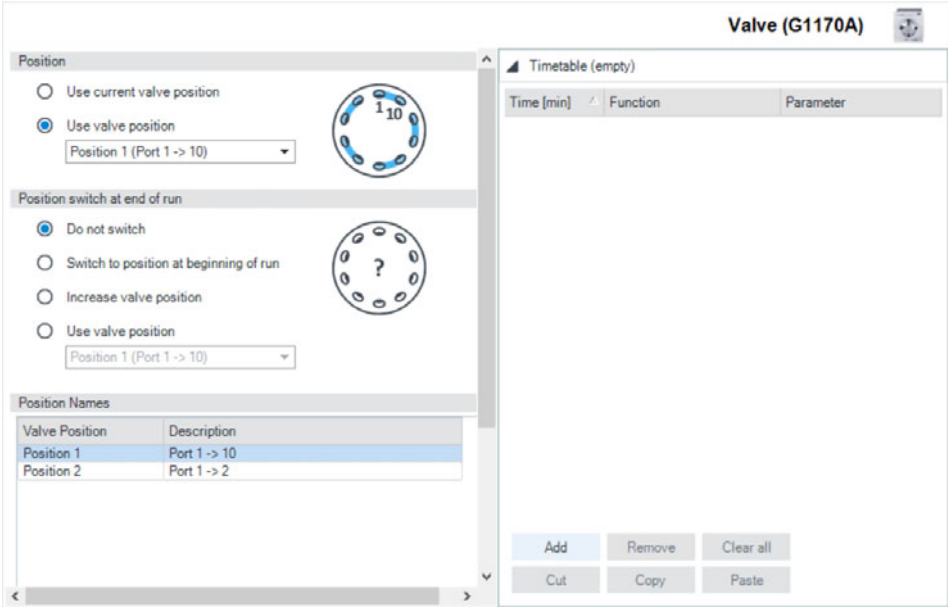


Figure 9 Method settings of a valve installed in the External Valve Drive

After the Agilent 1290 Infinity II Valve Drives and Quick Change Valve Heads have been installed and configured, the valve parameters can be edited in the software. Choose Method by right clicking on the the valve's GUI icon to open the valve method dialog box as displayed Figure 9 on page 68.

Position

When loading a method the valve is switched to the position that is displayed in the Position dropdown box. If you select Use Current, the valve remains in the current position, when a new method is loaded.

If you select a new position in the dropdown box and click OK, the Setup Valve dialog box will be closed and the valve switches to the new position.

Position switch at end of run

Gives you the possibility to define a position the valve is switched to at the end of the run.

Position Names

Define the Position Names that is used for the method report and the instrument actuals. The Position Description is limited to 19 characters.

Time Table

The Time Table can be used to edit and run a valve program during a sequence of sample runs. The Time Table contains 3 columns (Line, Time and Position). The Time Table is limited to 20 lines. The number of selection in the Position column depends on the valve that has been configured.

Position X	Switches the valve to the selected position.
Next Position	Switches to the next available position. If the valve is on the highest position it will switch to position 1.
Insert	Inserts a line in the Time Table above the selected position.
Append	Appends a line at the end of the Time Table.
Cut	Cuts the selected line(s) out of the Time Table and saves it to the clipboard.
Copy	Copies the selected line(s) from the table to the clipboard.
Paste	Pastes line(s) from the Clipboard to the Time Table.

Agilent Local Control Modules

Agilent InfinityLab Companion G7108AA

The Agilent InfinityLab Companion gives you complete control, system monitoring, signal plotting, and diagnostic capabilities for a wide range of LC system modules.

The instrument control solution is available as full package including all hardware and accessories, but can also be used on your own mobile devices like tablets, mobile phones and other electronic equipment.

Combining the conveniences of the Agilent Instant Pilot features with state-of-the-art mobile technology, the Agilent InfinityLab Companion gives you maximum flexibility and ease of use to control and monitor your LC system modules.

Features:

- Complete local control and monitoring of Agilent Infinity II LC modules
- Excellent usability and ease of use through a user interface specifically tailored for mobile devices - simple, intuitive touch-enabled, and visual controllable.
- High flexibility through a modern “Bring your own device” approach. Connection between LC module and mobile device either wireless via Wi-Fi or wired over USB cable (with full package).
- Convenient, ergonomic operation either handheld or attached to a module at the stack with newly developed, secure tablet holder (included in the full package).
- Preconfigured tablet with all required software already installed (included in the full package).
- Centerpiece of the solution is a USB dongle that activates the complete intelligence of the InfinityLab Companion on the instrument stack.

The InfinityLab Companion provides:

- fast and direct control in front of the instrument
- a clear overview of the system status
- control functionalities
- access to method parameters and sequences
- a logbook showing events from the modules
- diagnostic tests

5 Troubleshooting and Diagnostics

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

Overview of the Module's Indicators and Test Functions

Status Indicators

The module is provided with two status indicators which indicate the operational state of the module. The status indicators provide a quick visual check of the operation of the module.

Error Messages

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

6 Error Information

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

What Are Error Messages

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

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

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

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

General Error Messages

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

Timeout

Error ID: 0062

The timeout threshold was exceeded.

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

Shutdown

Error ID: 0063

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

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

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

Remote Timeout

Error ID: 0070

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

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

Lost CAN Partner

Error ID: 0071

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

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

Probable cause	Suggested actions
1 CAN cable disconnected.	• Ensure all the CAN cables are connected correctly. • Ensure all CAN cables are installed correctly.
2 Defective CAN cable.	Exchange the CAN cable.
3 Defective mainboard 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 Loose fittings.	Ensure all fittings are tight.
2 Broken capillary.	Exchange defective capillaries.

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 mainboard.	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 mainboard in the module has failed (open circuit).

The resistance across the temperature compensation sensor (NTC) on the mainboard 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 Defective mainboard.	Please contact your Agilent service representative.

Compensation Sensor Short

Error ID: 0080

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

The resistance across the temperature compensation sensor (NTC) on the mainboard 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 mainboard.	Please contact your Agilent service representative.

Module Specific Error Messages

Initialization of Valve Failed

Error ID: 24000

During the initialization process the motor of the valve drive moves to some special positions depending on the installed valve head. A failure in this process means either that the movement couldn't be performed properly or it was not noticed correctly by the sensor.

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 Defect Sensor on the Valve Drive Motor	• 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.

Valve Switching Failed

Error ID: 24001

The valve drive was not able to operate the valve head correctly. Either due to mechanical reasons or the movement couldn't be detected correctly.

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 Defect Sensor on the Valve Drive Motor	• 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.

Valve Tag Violation

Error ID: 24006

The valve drive identified a different valve head than it had identified during the last initialization.

Probable cause	Suggested actions
1 A valve head has been exchanged (hot-plugged) while the valve drive was still powered on.	Change the valve head. It is important to have the valve switched off for at least 10 s after or before a new valve head has been installed.

NOTE

Soft power-down power supply of the valve drive.

Whenever you want to power cycle the valve drive for a re-boot, it needs to be powered off for at least 10 seconds.

Pressure Cluster Partner Missing

The connection from the valve drive to a defined pressure cluster partner is lost.

Probable cause	Suggested actions
1 Communication issues	Check the CAN cable connections of the modules.
2 Configuration mismatch	Check and correct if necessary the valve configuration and presence of defined pressure cluster partner.

Position Cluster Partner Missing

Probable cause	Suggested actions
1 Communication issues	Check the CAN cable connections of the modules.
2 Configuration mismatch	• Check and correct if necessary the valve configuration and presence of defined position cluster partner. • If the module was moved to another LC stack, perform Firmware Declustering in Service & Diagnostic section of Lab Advisor.

7 Maintenance

This chapter gives you an overview and instructions about the possible maintenance and repair procedures that can be performed by the user.

Introduction to Maintenance

The module is designed for easy maintenance. The most frequent maintenance such as maintaining valve heads can be done from the front with the modules in place in the system stack.

NOTE

There are no serviceable parts inside.

Do not open the module.

Cautions and Warnings

WARNING

Toxic, flammable and hazardous solvents, samples and reagents

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

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

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

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

Overview of Maintenance

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

Table 5 Maintenance Procedures

Procedure	Typical Frequency	Notes
"Cleaning the Module" on page 89	If required	
"Replacing Parts of the Valve Head" on page 90	If the valve performance shows indication of leakage or wear	
"Replacing the Fuses of the Infinity II Valve Drive" on page 92	When a fuse is defect	
"Replacing Valve Heads" on page 94	If the valve performance shows indication of leakage or wear	
"Replacing the Module Firmware" on page 99	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. Avoid using organic solvents for cleaning purposes. They can cause damage to plastic parts.

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.**

NOTE A solution of 70 % isopropanol and 30 % water might be used if the surface of the module needs to be disinfected.

Replacing Parts of the Valve Head

For details about the needed parts and orientation please refer to "Valve Drive Parts" on page 101.

Disassembling and reassembling the valve head

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

For 1290 Infinity II Bio LC modules, use bio / bio-compatible parts only.
Do not mix parts between 1260 Infinity II Bio-Inert LC modules and 1290 Infinity II Bio LC modules.

When

Stator head: Scratches and damage on the inner surface, blockages

Stator face assy: When visibly scratched, or when the valve performance shows indication of leakage or wear

Rotor seal assy: When the valve performance shows indication of leakage or wear

Tools required	Description
	Hex key

Parts required	Description
	Quick Change Valve Head

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.**

1 Use the Hex Key to open and remove the Stator Screws from the Stator Head.

2 Carefully disassemble the necessary Valve Head parts to gain access to the one you want to replace. While doing so please observe the orientation of the parts.

3 Independent of the part you want to replace always inspect all parts for signs of damage.

4 Replace the proposed part.

NOTE

Always mind the correct orientation of the parts and avoid to touch their surfaces.

5 Turn each of the screws an equal amount until they are finger-tight, then tighten them for another half turn.

Replacing the Fuses of the Infinity II Valve Drive

When If the valve drive shows no reaction.

Tools required

Description
Screwdriver

Parts required

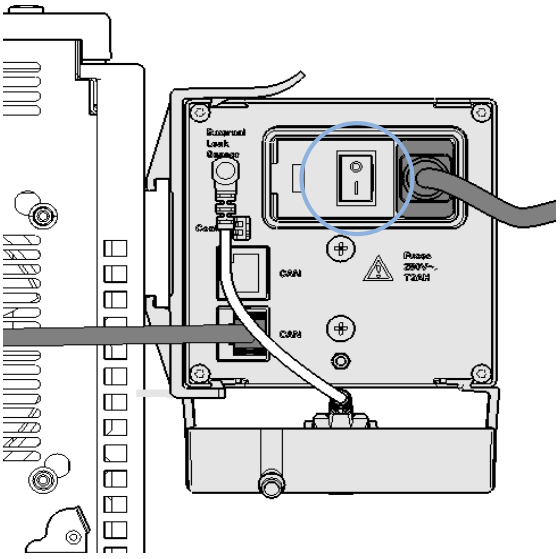
#	p/n	Description
2	2110-1486	Fuse 2 AT250 V

WARNING

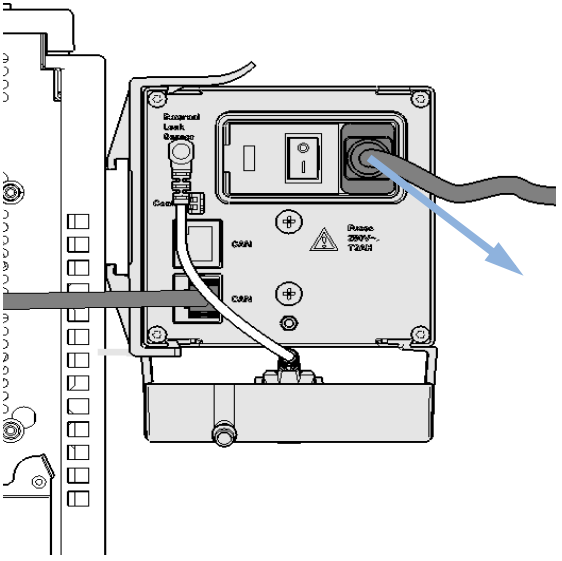
Electrical shock

- ✓ **Disconnect the valve drive from line power before changing a fuse or trying to open the hatch of the power input socket.**
- ✓ **Never re-connect the line power before having the power input socket closed.**

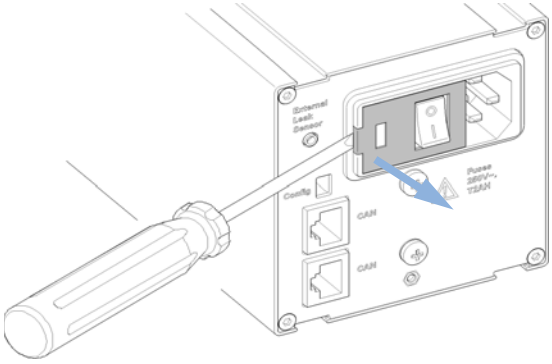
1 Switch off the instrument. The power switch is located at the rear of the valve drive.



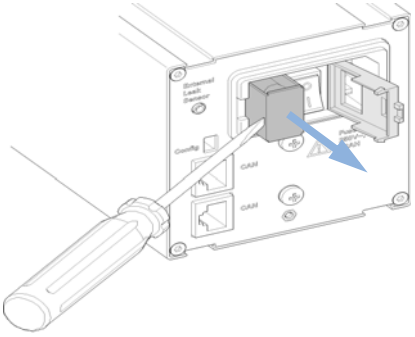
2 Disconnect the power cable from the power input socket.



3 To access the fuse drawer, gently lift the outer plastic housing of the power inlet socket using a flat screwdriver.

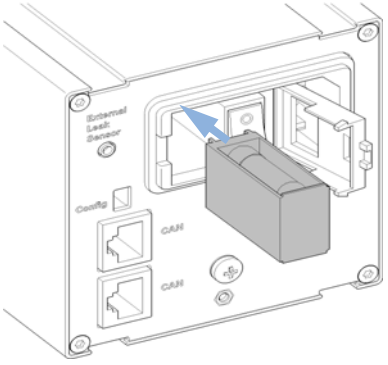


4 Pull out the fuse drawer as shown.

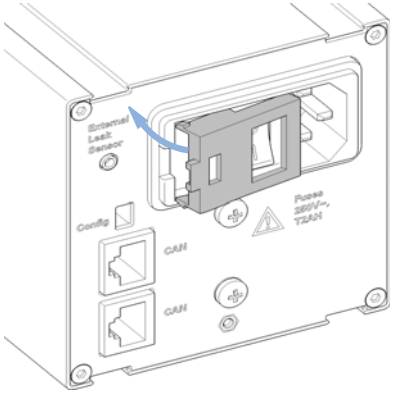


5 Replace the defect fuse(s).

6 Slide in the fuse drawer and push till it fits tightly.



7 Finally, close the fuse drawer housing, reconnect the instrument to the power line and switch it on.



Replacing Valve Heads

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

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

For 1290 Infinity II Bio LC modules, use bio / bio-compatible parts only.
Do not mix parts between 1260 Infinity II Bio-Inert LC modules and 1290 Infinity II Bio LC modules.

Parts required	Description
	Agilent Quick Change Valve Head. For details, see "Valve Options Overview" on page 103

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 *InfinityLab LC Method Development Solutions User Guide* (SD-29000211).

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

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 pollution. 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.**

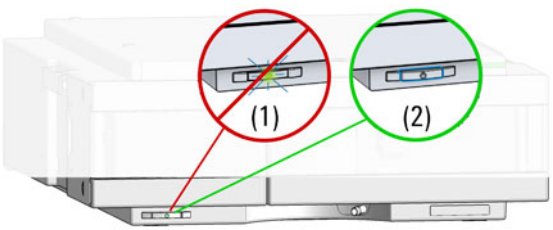
NOTE

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.

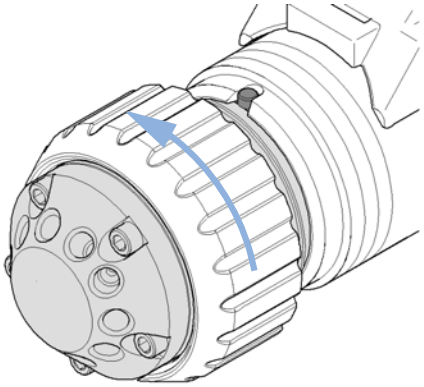
Selection of valve port positions can fail, if the instrument does not know the properties of the installed valve.

NOTE

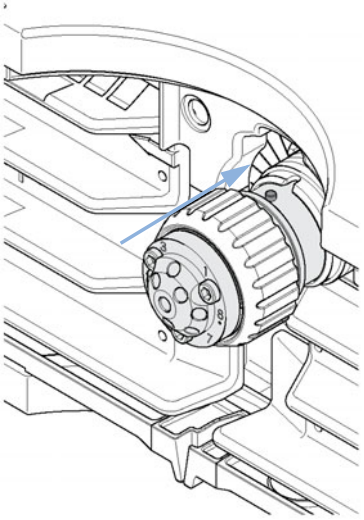
To have the valve correctly recognized by the Agilent Infinity II Valve Drive you must have the valve drive powered off for at least 10 seconds.

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

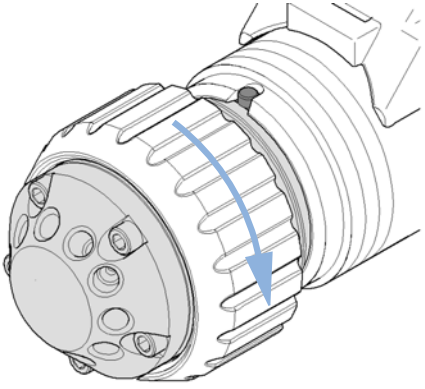
4 Unscrew the nut and remove the valve head.



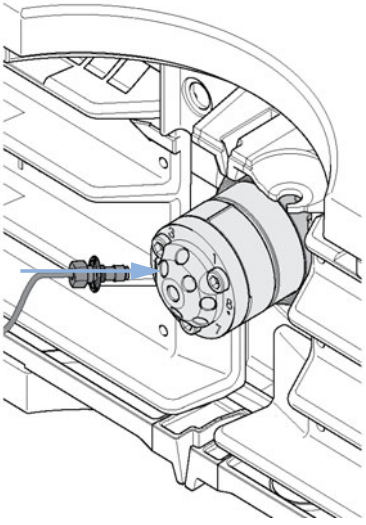
5 Put the new valve head onto the valve drive such that the lobe fits to the groove (see also "Installation of the Valve Heads" on page 47).

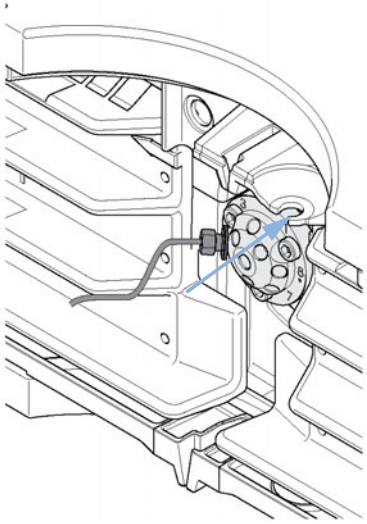
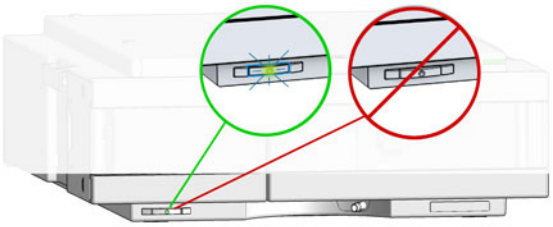


6 Fasten the valve head onto the valve drive using the union nut (see also "Installation of the Valve Heads" on page 47.



7 Install all required capillary connections to the valve head.



8 Push the valve head until it snaps in and stays in the rear position (column compartment only). 	**9** Switch on the module. 

Replacing the Module Firmware

When

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

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

Tools required

Description
Agilent Lab Advisor software

Parts required

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

Preparations

Read update documentation provided with the Firmware Update Tool.

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

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

Module Specific Information

There is no specific information for this module.

8 Parts and Materials

This chapter provides information on parts and materials.

Valve Drive Parts

1290 Infinity Valve Drive Parts

Item	p/n	Description
1	5043-0275	Clamp guide For attaching the valve to a rail assembly
2	5067-4792	Leak sensor assembly External leak sensor
3	5043-0271	Holder leak plane
4	5043-0270	Leak plane
5	5068-0106	Spanner nut
	2110-1486	Fuse 2 AT250 V
6	5067-4634	Valve rail assembly
7	5067-1510	Rail assy for column organizer

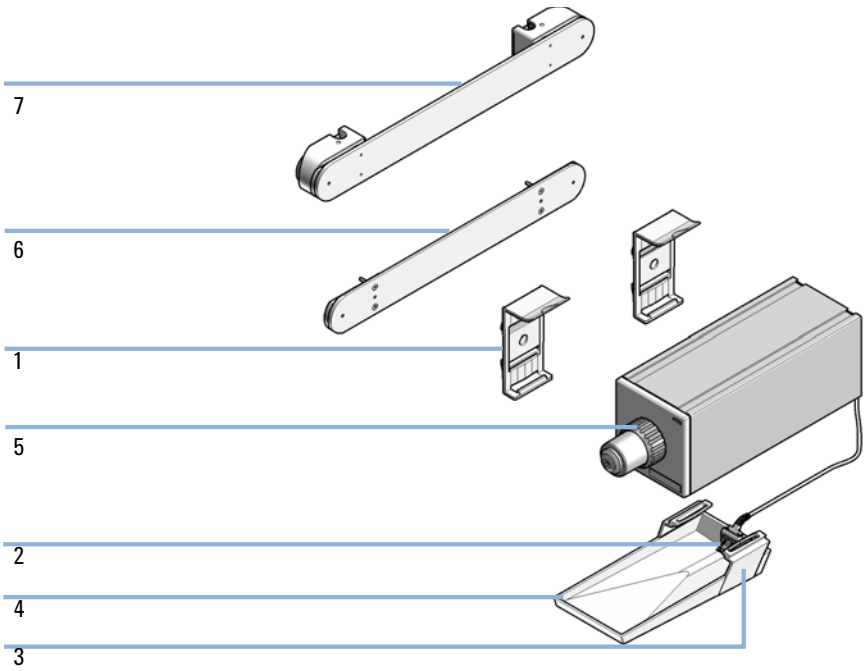


Figure 10 Parts for 1290 Infinity Valve Drive

1290 Infinity II Valve Drive Parts

Item	p/n	Description
1	5067-6138	Valve Holder Kit Right-IF-II-G For G7116A/B
	5067-6139	Valve Holder Kit Left-IF-II-G For G7116A/B (Not shown)
2	5067-5685	Clamp Guide Kit-IF-II
3	5067-4792	Leak sensor assembly External leak plane
4	5043-0271	Holder leak plane
5	5043-0270	Leak plane
6	2110-1486	Fuse 2 AT250 V
7	5063-6527	Tubing, Silicon Rubber, 1.2 m, ID/OD 6/9 mm
8	5181-1519	CAN cable, Agilent module to module, 1 m
9	5500-1156	T-Tube Connector ID6.4
10	5043-0269	Adapter-profile For G1170A (Multiple valve drives can be connnected with adapter profiles)

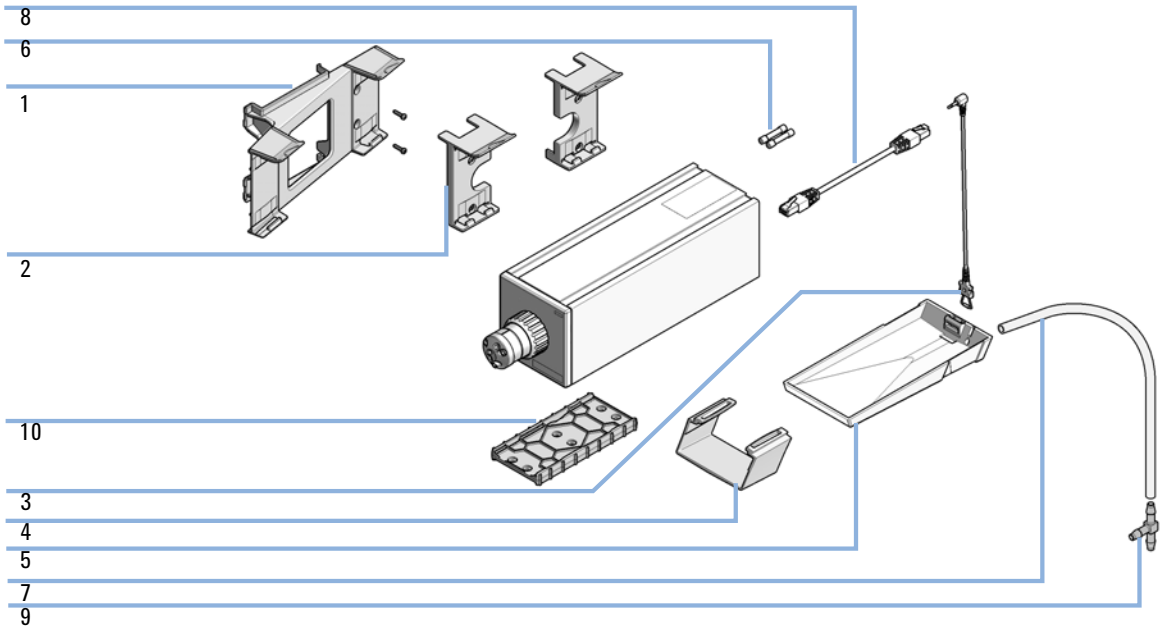


Figure 11 Parts for 1290 Infinity II Valve Drive

Valve Options Overview

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

Table 6 Replacement parts standard valve heads

Valve Head	Rotor Seal	Stator Head	Stator Screws	Stator Ring	Stator Face	Other
5067-4233 8-Position/18-Port Valve 1300 bar	5068-0200 (PEEK)	5068-0199	5068-0089	n.a.		
5067-4241 2-Position/6-Port Valve 1300 bar	5068-0207 (PEEK)	5068-0006	1535-4857	5068-0120		
5067-4240 2-Position/10-Port Valve 1300 bar	5068-0205 (PEEK)	5068-0011	5068-0019	n.a.		
5067-4273 6-Position/14-Port Valve 1300 bar	5068-0242 (PEEK)	5068-0241	5068-0089	n.a.		
5067-4284 6-Position/14-Port Valve 800 bar	5068-0298 (PEEK)	5068-0241	5068-0089	n.a.		
5067-6682 2-Position/10-Port Valve Bio 1300 bar	5068-0205 (PEEK)	5068-0286	5068-0019	n.a.		Bearing ring: 1535-4045
5067-4279 4-Position/10-Port Valve 800 bar	5068-0264 (PEEK)	5068-0263	5068-0019	n.a.	n.a.	Bearing ring: 1535-4045
5067-4282 2-Position/6-Port Valve 800 bar	0101-1409 (PEEK)	0101-1417	1535-4857	5068-0120	n.a.	Bearing ring: 1535-4045

Table 6 Replacement parts standard valve heads

Valve Head	Rotor Seal	Stator Head	Stator Screws	Stator Ring	Stator Face	Other
5067-4148 2-Position/6-Port Bio-Inert Valve 600 bar	0101-1409 (PEEK)	5068-0060	5068-0020 (10/pack)	n.a.	0100-1851 (ceramic)	Bearing ring: 1535-4045
5067-4132 2-Position/10-Port Bio-Inert Valve 600 bar	5068-0041 (PEEK)	5068-0040	5068-0059	n.a.	5068-0095	Bearing ring: 1535-4045
5067-4283 2-Position/10-Port Valve 800 bar	0101-1415 (PEEK)	5068-0165	5068-0019	n.a.	n.a.	Bearing ring: 1535-4045
5067-4134 4-Position/10-Port Bio-Inert Valve 600 bar	5068-0045 (PEEK)	5068-0044	5068-0059	n.a.	5068-0093	Bearing ring: 1535-4045

Accessory Kit

Accessory Kit (G1170-68705)

#	p/n	Description
1	5043-0270	Leak plane
1	5043-0271	Holder leak plane
1	5067-4792	Leak sensor assembly
1	5181-1519	CAN cable, Agilent module to module, 1 m
2	5043-0275	Clamp guide (for Infinity modules)
1	5067-5685	Clamp Guide Kit-IF-II (for Infinity II modules except G7116A/B MCT)
2	2110-1486	Fuse 2 AT250 V
1	5063-6527	Tubing, Silicon Rubber, 1.2 m, ID/OD 6/9 mm
1	5500-1156	T-Tube Connector ID6.4 (not orderable separately)

9 Identifying Cables

This chapter provides information on cables used with the Agilent Infinity and Infinity II 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
5188-8059	ERI-Extension-Cable 1.2 m
5061-3378	Remote Cable to 35900 A/D converter
01046-60201	Agilent module to general purpose
5188-8057	Fraction Collection ERI remote Y-cable

CAN cables

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

LAN cables

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

RS-232 cables (not for FUSION board)

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

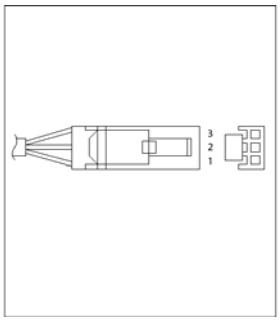
USB cables

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

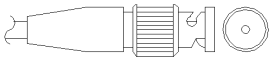
Analog Cables

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

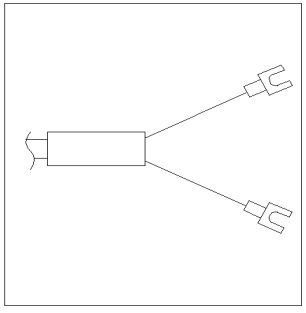
Agilent Module to 35900 A/D converters

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

Agilent Module to BNC Connector

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

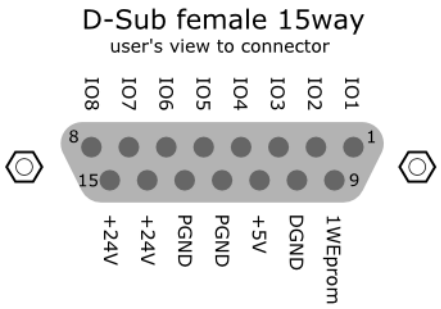
Agilent Module to General Purpose

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

Remote Cables

ERI (Enhanced Remote Interface)

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

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

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

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

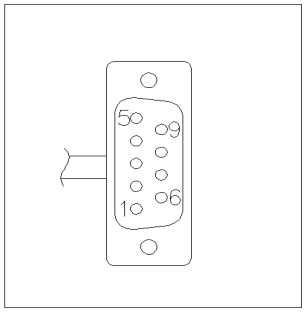
- 5188-8057 ERI to APG and RJ45 (Connector D_Subminiature 15 pin (ERI), Connector D_Subminiature 9 pin (APG), Connector plug Cat5e (RJ45))

Table 7 5188-8057 ERI to APG and RJ45

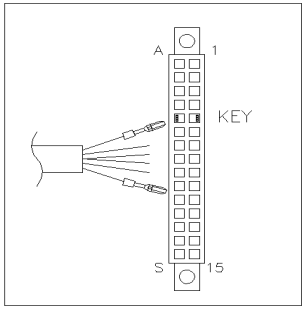
p/n 5188-8057	Pin (ERI)	Signal	Pin (APG)	Active (TTL)	Pin (RJ45)
					
	10	GND	1		5
	1	Start Request	9	High	
	2	Stop	8	High	
	3	Ready	7	High	
	4	Fraction Trigger	5	High	4
	5	Power on	6	High	
	6	Shut Down	4	High	
	7	Start	3	High	
	8	Prepare	2	High	
	Ground	Cable Shielding	NC		

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.

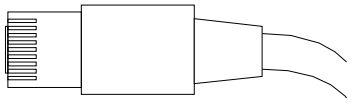
Agilent Module to Agilent 35900 A/D Converters

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

USB

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

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

10 Hardware Information

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

Firmware Description

The firmware of the instrument consists of two independent sections:

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

Resident System

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

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

Main System

Its properties are:

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

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

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

Firmware Updates

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

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

The file naming conventions are:

PPPP_RVVV_XXX.dlb, where

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

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

NOTE

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

Main and resident firmware must be from the same set.

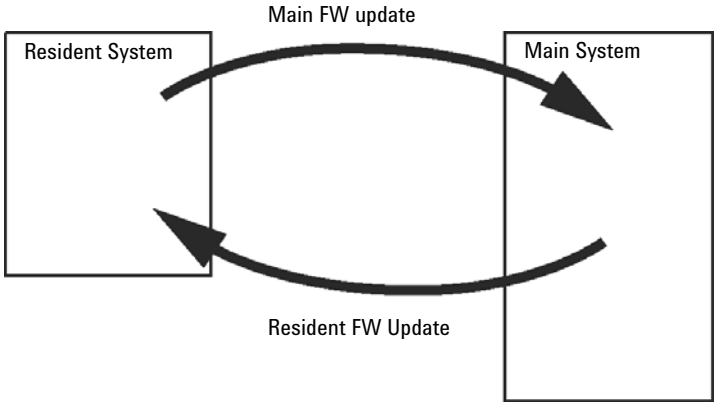


Figure 12 Firmware Update Mechanism

NOTE

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

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

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

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

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

Electrical Connections

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

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

Serial Number Information

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

Front and Rear View of the Module

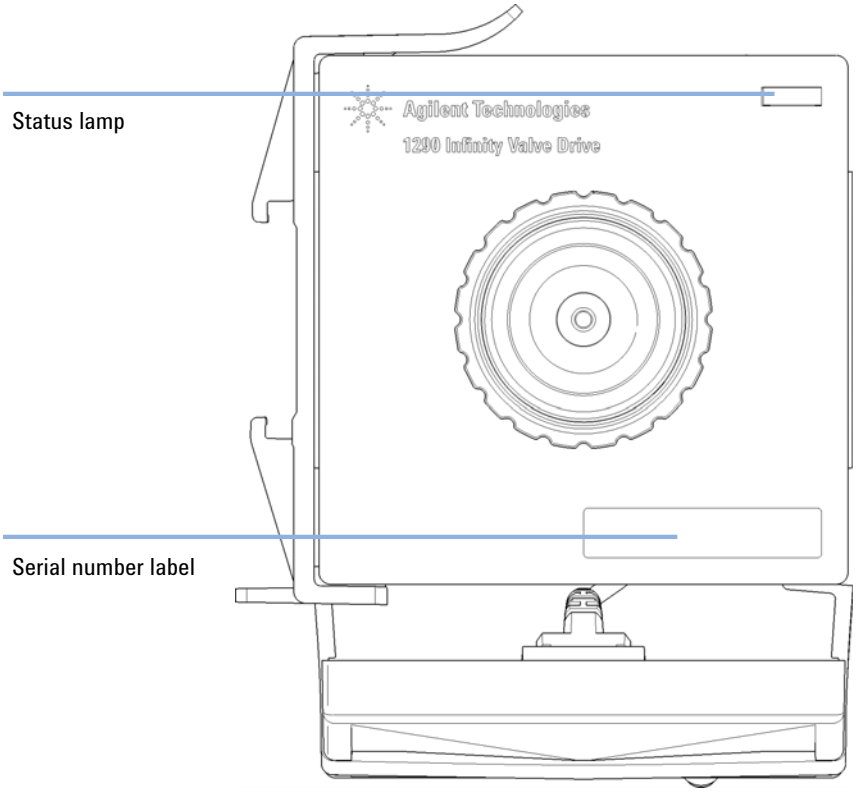


Figure 13 Front View of 1290 Infinity II Valve Drive

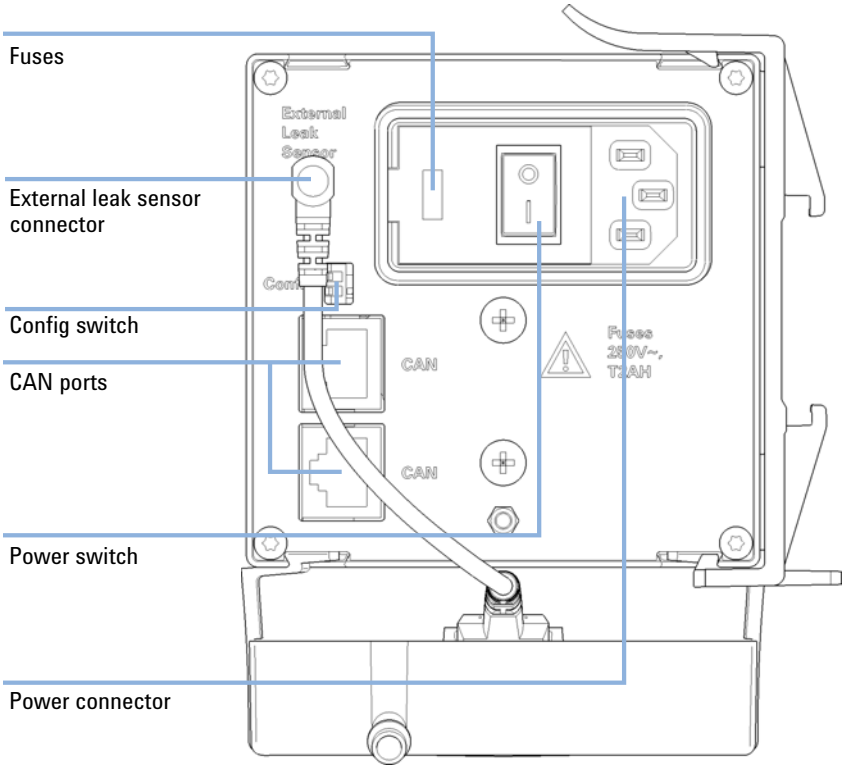


Figure 14 Rear View of 1290 Infinity II Valve Drive

Interfaces

The Agilent InfinityLab LC Series modules provide the following interfaces:

Table 8 Agilent InfinityLab LC Series Interfaces

Module	CAN	USB	LAN (on-board)	RS-232	Analog	APG (A) / ERI (E)	Special
Pumps							
G7104A/C	2	No	Yes	Yes	1	A	
G7110B	2	Yes	Yes	No	No	E	
G7111A/B, G5654A	2	Yes	Yes	No	No	E	
G7112B	2	Yes	Yes	No	No	E	
G7120A, G7132A	2	No	Yes	Yes	1	A	
G7161A/B	2	Yes	Yes	No	No	E	
Samplers							
G7129A/B/C	2	Yes	Yes	No	No	E	
G7167A/B, G7137A, G5668A, G3167A	2	Yes	Yes	No	No	E	
G7157A	2	Yes	Yes	No	No	E	
Detectors							
G7114A/B	2	Yes	Yes	No	1	E	
G7115A	2	Yes	Yes	No	1	E	
G7117A/B/C	2	Yes	Yes	No	1	E	
G7121A/B	2	Yes	Yes	No	1	E	
G7162A/B	2	Yes	Yes	No	1	E	
G7165A	2	Yes	Yes	No	1	E	

Table 8 Agilent InfinityLab LC Series Interfaces

Module	CAN	USB	LAN (on-board)	RS-232	Analog	APG (A) / ERI (E)	Special
Fraction Collectors							
G7158B	2	Yes	Yes	No	No	E	
G7159B	2	Yes	Yes	No	No	E	
G7166A	2	No	No	No	No	No	Requires a host module with on-board LAN with minimum FW B.06.40 or C.06.40, or with additional G1369C LAN Card
G1364E/F, G5664B	2	Yes	Yes	No	No	E	THERMOSTAT for G1330B
Others							
G1170A	2	No	No	No	No	No	
G7116A/B	2	No	No	No	No	No	Requires a host module with on-board LAN or with additional G1369C LAN Card.
G7122A	No	No	No	Yes	No	A	
G7170B	2	No	No	No	No	No	Requires a host module with on-board LAN with minimum FW B.06.40 or C.06.40, or with additional G1369C LAN Card

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

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

Overview Interfaces

CAN

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

LAN

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

NOTE

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

USB

The USB interface replaces the RS-232 Serial interface in new FUSION generation modules. For details on USB refer to "USB (Universal Serial Bus)" on page 131.

Analog Signal Output

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

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 InfinityLab LC Series products using the FUSION core electronics use ERI. This interface is already used in the Agilent Universal Interface Box 2 (UIB2)

ERI Description

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

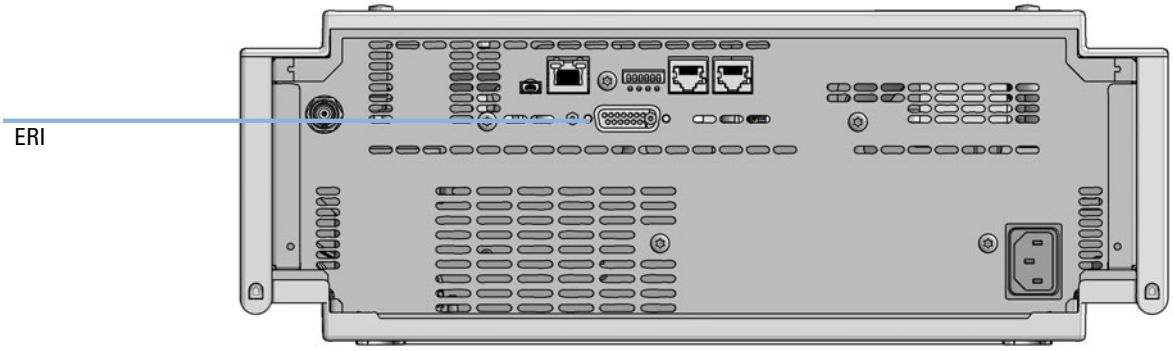
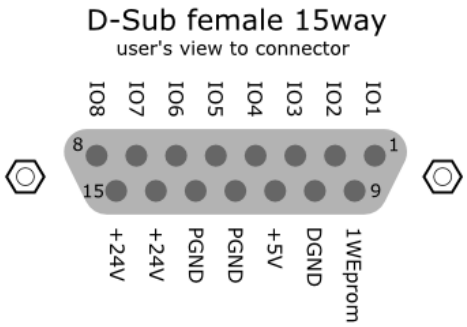


Figure 15 Location of the ERI interface (example shows a G7114A/B VWD)



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

IO (Input/Output) Lines

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

1-Wire Data (Future Use)

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

5V Distribution (Future Use)

- Available directly after turning on the hosting module (assures that the firmware can detect certain basic functionality of the device).
- For digital circuits or similar.
- Provides 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

Config Switch Settings of the Infinity II Valve Drive

Configuration Switch Settings

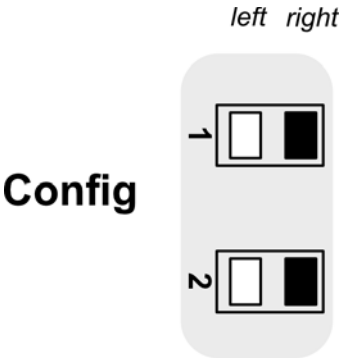


Figure 16 Config Switches

Table 10 Dip switches settings for G1170A

Mode select	1	2
Default	right	right
Coldstart	right	left
Boot resident	left	right
Not supported	left	left

Special Settings

Boot-Resident

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

Forced Cold Start

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

CAUTION

Loss of data

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

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

11 Appendix

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

General Safety Information

General Safety Information

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

WARNING

Ensure the proper usage of the equipment.

The protection provided by the equipment may be impaired.

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

Safety Standards

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

General

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

Before Applying Power

WARNING

Wrong voltage range, frequency or cabling

Personal injury or damage to the instrument

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

NOTE

Note the instrument's external markings described under "Symbols" on page 139.

Ground the Instrument

WARNING

Missing electrical ground

Electrical shock

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

Do Not Operate in an Explosive Atmosphere

WARNING

Presence of flammable gases or fumes

Explosion hazard

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

Do Not Remove the Instrument Cover

WARNING

Instrument covers removed

Electrical shock

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

Do Not Modify the Instrument

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

In Case of Damage

WARNING

Damage to the module

Personal injury (for example electrical shock, intoxication)

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

Solvents

WARNING

Toxic, flammable and hazardous solvents, samples and reagents

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

- ✓ **When working with these substances observe appropriate safety procedures (for example by wearing goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the vendor, and follow good laboratory practice.**
- ✓ **Do not use solvents with an auto-ignition temperature below 200 °C (392 °F). Do not use solvents with a boiling point below 56 °C (133 °F).**
- ✓ **Avoid high vapor concentrations. Keep the solvent temperature at least 40 °C (72 °F) below the boiling point of the solvent used. This includes the solvent temperature in the sample compartment. For the solvents methanol and ethanol keep the solvent temperature at least 25 °C (45 °F) below the boiling point.**
- ✓ **Do not operate the instrument in an explosive atmosphere.**
- ✓ **Do not use solvents of ignition Class IIC according IEC 60079-20-1 (for example, carbon disulfide).**
- ✓ **Reduce the volume of substances to the minimum required for the analysis.**
- ✓ **Never exceed the maximum permissible volume of solvents (8 L) in the solvent cabinet. Do not use bottles that exceed the maximum permissible volume as specified in the usage guideline for solvent cabinet.**
- ✓ **Ground the waste container.**
- ✓ **Regularly check the filling level of the waste container. The residual free volume in the waste container must be large enough to collect the waste liquid.**
- ✓ **To achieve maximal safety, regularly check the tubing for correct installation.**

NOTE

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

Symbols

Table 11 Symbols

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

Table 11 Symbols

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

WARNING

A WARNING

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

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

CAUTION

A CAUTION

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

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

Waste Electrical and Electronic Equipment (WEEE) Directive

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

NOTE

Do not dispose of in domestic household waste

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

Radio Interference

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

Test and Measurement

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

Sound Emission

Sound pressure

Sound pressure Lp <70 db(A) according to DIN EN ISO 7779

Schalldruckpegel

Schalldruckpegel Lp <70 db(A) nach DIN EN ISO 7779

Solvent Information

Observe the following recommendations on the use of solvents.

- Brown glass ware can avoid growth of algae.
- Avoid the use of the following steel-corrosive solvents:
  - solutions of alkali halides and their respective acids (for example, lithium iodide, potassium chloride, and so on),
  - high concentrations of inorganic acids like sulfuric acid and nitric acid, especially at higher temperatures (if your chromatography method allows, replace 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:

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

    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, diisopropyl ether) should be filtered through dry aluminium oxide which adsorbs the peroxides,
  - solvents containing strong complexing agents (e.g. EDTA),
  - mixtures of carbon tetrachloride with 2-propanol or THF.
- Avoid the use of dimethyl formamide (DMF). Polyvinylidene fluoride (PVDF), which is used in leak sensors, is not resistant to DMF.

Agilent Technologies on Internet

For the latest information on products and services visit our worldwide web site on the Internet at:

http://www.agilent.com

In This Book

This User's Guide describes common applications as well as installation, operation and maintenance of the
Agilent InfinityLab LC Series 1290 Infinity II Valve Drive (G1170A)
and Agilent InfinityLab Quick Change Valves.

www.agilent.com

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