Agilent

Agilent InfinityLab LC Series

Diode Array Detectors

User Manual

Notices

Document Information

The information in this document also applies to 1260 Infinity II and 1290 Infinity II modules.

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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.

Contents

In This Book

This manual covers the following Agilent InfinityLab LC Series modules:

- Agilent 1290 Infinity III Diode Array Detector FS (with fixed slit) (G7117A)
- Agilent 1290 Infinity III Diode Array Detector (with variable slit) (G7117B)
- Agilent 1260 Infinity III Diode Array Detector HS (with fixed slit) (G7117C)

Find information on other Agilent Diode Array Detectors in separate manuals.

1 Introduction

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

Overview of the Module

The detector described in this manual is designed for highest optical performance, GLP compliance and easy maintenance. It includes the following features:

- Maximum of 120 Hz (G7117A/G7117C) or 240 Hz (G7117B) data acquisition rate
- Higher sensitivity for conventional LC as well as ultra fast applications by using next generation optical design
- Increased sensitivity with 60 mm Max-Light cartridge flow cell
- Optimized cell geometry for less peak dispersion for narrow bore applications
- Max-Light cartridge flow cells for standard applications are available, see Max-Light Cartridge Flow Cell on page 17
- More reliable and robust peak integration process (automated) due to less baseline noise/drift/refractive index and thermal effects especially under ultra fast gradient conditions
- RFID tracking technology is used for the UV-lamp and the Max-Light cartridge flow cells
- Multiple wavelength and full spectral detection at 120 Hz (G7117A/G7117C)/ 240 Hz (G7117B) sampling rate, keeping up with the analysis speed of ultra-fast LC
- Programmable 1 – 8 nm slit (G7117B) or fixed 4 nm slit (G7117A/C) for rapid optimization of sensitivity, linearity and spectral resolution provides optimum incident light conditions
- Improved Electronic temperature control (ETC) provides maximum baseline stability and practical sensitivity under fluctuating ambient temperature and humidity conditions
- Additional diagnostic signals for temperature and lamp voltage monitoring
- Easy exchange of flow cell by cartridge design

Product Description of the 1290 Infinity III Diode Array Detector FS (G7117A)

The Agilent 1290 Infinity III Diode Array Detector FS (with fixed slit) is based on the Agilent Max-Light cartridge cell with optofluidic waveguides that improve light transmission to near 100% efficiency without sacrificing resolution caused by cell dispersions effects.

With typical detector noise levels of < ±0.6 µAU/cm the 60 mm flow cell gives up to 10 times higher sensitivity than detectors with conventional flow cells.

Any compromising refractive index and thermal effects are almost completely eliminated, resulting in significantly less baseline drift for more reliable and precise peak integration.

For fast separations, this detector has multiple wavelength and full spectral detection at sampling rates up to 120 Hz.

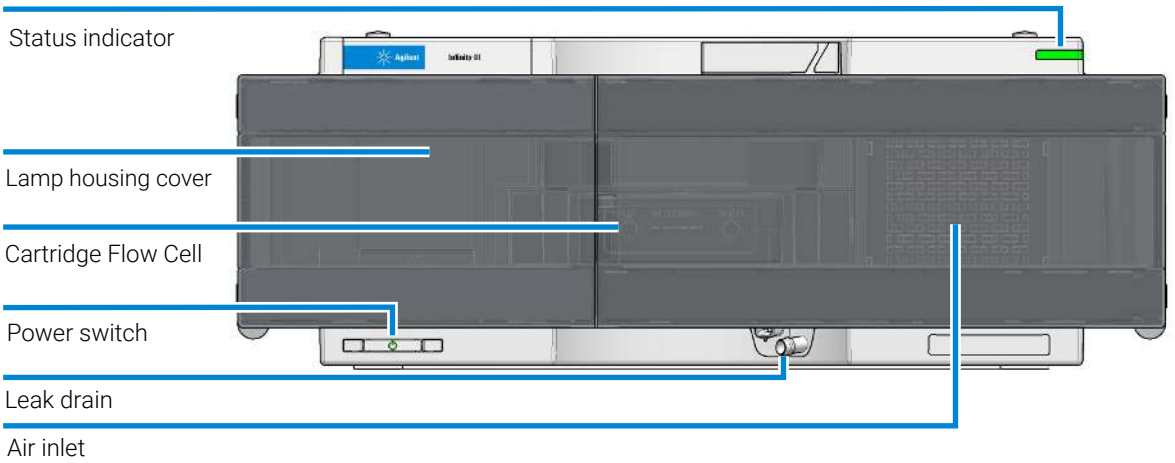


Figure 1: Overview of the G7117A Detector

Features of the 1290 Infinity III Diode Array Detector FS (G7117A)

- Universal Agilent Max-Light standard cartridge cell with 10 mm optical path length provides high sensitivity (noise: < ± 3 µAU) and low peak dispersion for 2.1 , 3 and 4.6 mm id columns.
- Multiple wavelength and full spectral detection at high sampling rate of 120 Hz.
- A reliable and robust peak integration process due through less baseline drift.
- Full spectral detection for compound identification by spectral libraries or verification of the separation quality with peak purity analysis for ultrafast LC. Simultaneous detection of up to 8 signals for increased sensitivity and selectivity.
- Upgrade option to HDR DAD solution provides 30x wider linear range for samples with widely different concentration levels.
- Radio frequency identification (RFID) technology for flow cells and lamp improve data security and traceability.
- Electronic temperature control (ETC) provides high baseline stability and practical sensitivity under fluctuating ambient temperature and humidity conditions.

Product Description of the 1290 Infinity III Diode Array Detector (G7117B)

The Agilent 1290 Infinity III Diode Array Detector (with variable slit) is based on the Agilent Max-Light cartridge cell with optofluidic waveguides that improve light transmission to near 100% efficiency without sacrificing resolution caused by cell dispersions effects.

With typical detector noise levels of < ±0.6 µAU/cm the 60 mm flow cell gives up to 10 times higher sensitivity than detectors with conventional flow cells.

Any compromising refractive index and thermal effects are almost completely eliminated, resulting in significantly less baseline drift for more reliable and precise peak integration.

For fast separations, this detector has multiple wavelength and full spectral detection at sampling rates up to 240 Hz.

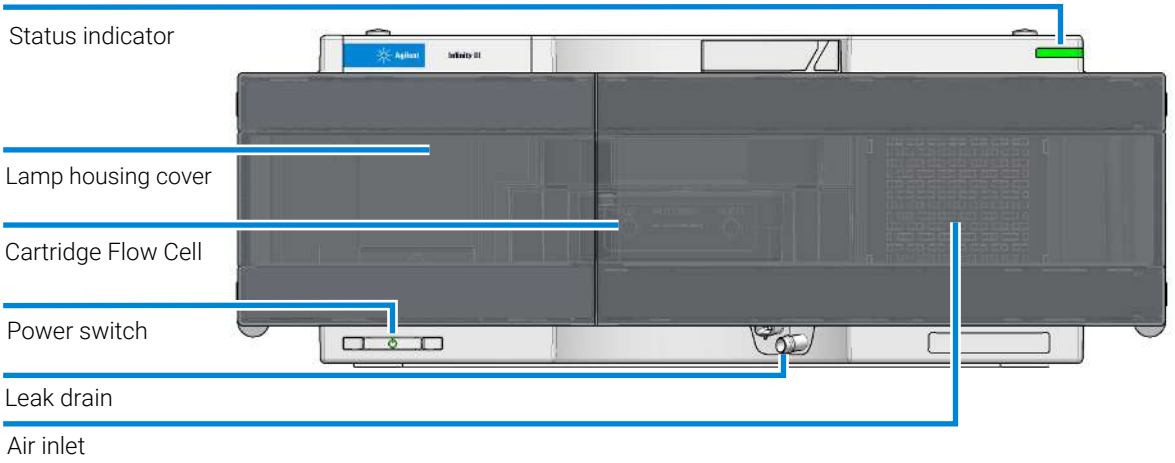


Figure 2: Overview of the G7117B Detector

Features of the 1290 Infinity III Diode Array Detector (G7117B)

- Universal Agilent Max-Light standard cartridge cell with 10 mm optical path length provides high sensitivity (noise: < ± 3 µAU) and low peak dispersion for 2.1 , 3 and 4.6 mm id columns.
- Programmable slit from 1 to 8 nm provides incident light conditions for rapid optimization of sensitivity, linearity and spectral resolution.
- Multiple wavelength and full spectral detection at high sampling rate of 240 Hz.
- A reliable and robust peak integration process due through less baseline drift.
- Full spectral detection for compound identification by spectral libraries or verification of the separation quality with peak purity analysis for fast LC. Simultaneous detection of up to 8 signals for increased sensitivity and selectivity.
- Wide linear range (typically up to 2.5 AU) enables simultaneous quantification of primary compounds, by-products and impurities.
- Upgrade option to HDR DAD solution provides 30x wider linear range for samples with widely different concentration levels.
- Radio frequency identification (RFID) technology for flow cells and lamp improve data security and traceability.
- Electronic temperature control (ETC) provides high baseline stability and practical sensitivity under fluctuating ambient temperature and humidity conditions.

Product Description of the 1260 Infinity III Diode Array Detector HS (G7117C)

The Agilent 1260 Infinity III Diode Array Detector HS (with fixed slit) is based on the Agilent Max-Light cartridge cell with optofluidic waveguides that improve light transmission to near 100 % efficiency without sacrificing resolution caused by cell dispersions effects.

With typical detector noise levels of < ±0.6 µAU/cm the 60 mm flow cell gives up to 10 times higher sensitivity than detectors with conventional flow cells.

Any compromising refractive index and thermal effects are almost completely eliminated, resulting in significantly less baseline drift for more reliable and precise peak integration.

For fast separations, this detector has multiple wavelength and full spectral detection at sampling rates up to 120 Hz.

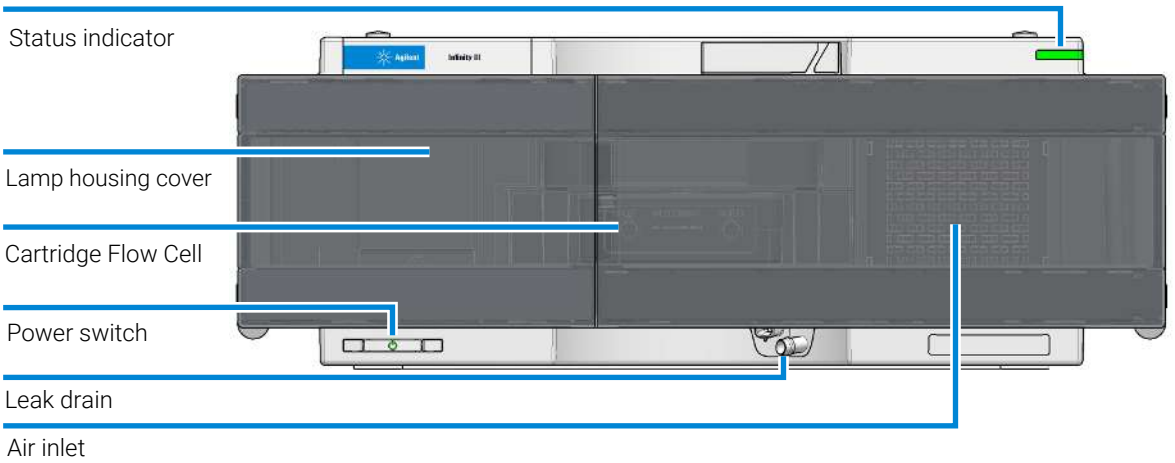


Figure 3: Overview of the detector

Features of the 1260 Infinity III Diode Array Detector HS (G7117C)

- Ultra sensitivity through revolutionary Agilent Max-Light cartridge cell with 60 mm optical path length (typically noise: <± 0.6 µAU)
- Universal Agilent Max-Light cartridge standard cell with 10 mm optical path length provides high sensitivity (noise: <± 3 µAU)
- Wide linear range (typically up to 2.5 AU) - for reliable, simultaneous quantification of primary compounds, by-products and impurities.
- More reliable and robust peak integration process due through less baseline drift.
- Full spectral detection up to 120 Hz for compound identification by spectral libraries or verification of the separation quality with peak purity analysis for conventional and ultrafast LC.
- Simultaneous detection of up to 8 signals for increased sensitivity and selectivity.
- Radio frequency identification (RFID) tags for all flow cells and UV lamp provide new levels of data traceability by recording parameters such as cell dimensions, lamp usage, serial number etc.
- Electronic temperature control (ETC) provides maximum baseline stability and practical sensitivity under fluctuating ambient temperature and humidity conditions.
- Reference wavelength for elimination of background interference.
- Early maintenance feedback (EMF) for continuous tracking of instrument usage in terms of lamp burn time with user-settable limits and feedback messages.
- Extensive diagnostics, error detection and display with Instant Pilot controller and Agilent Lab Advisor software.

Operating Principle

Optical System

The optical system of the detector is shown in Figure 4 on page 16.

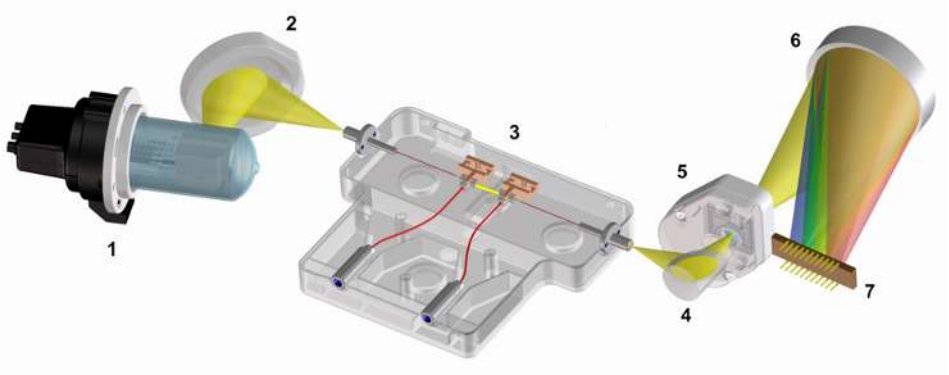


Figure 4: Optical System of the Detector

1	UV-lamp
2	Lamp mirror
3	Flow cell
4	Fold mirror
5	Programmable (G7117B) or Fixed (G7117A/G7117C) slit
6	Grating
7	Array

The illumination source is a deuterium-arc-discharge lamp [1] for the ultraviolet (UV) wavelength range. Its light is focused by a lamp mirror [2] onto the entrance of the Max-light cartridge flow cell [3] with optofluidic waveguides. The light leaves the Max-light cartridge flow cell at the other side and is focused by the fold mirror [4] through the slit assembly [5] onto a holographic grating [6] light being dispersed onto the diode array [7]. This allows simultaneous access to all wavelength information.

Lamp

The light source for the UV-wavelength range is a long-life UV-lamp with RFID tag. As a result of plasma discharge in low-pressure deuterium gas, the lamp emits light over the 190 nm to approximately 800 nm wavelength range.

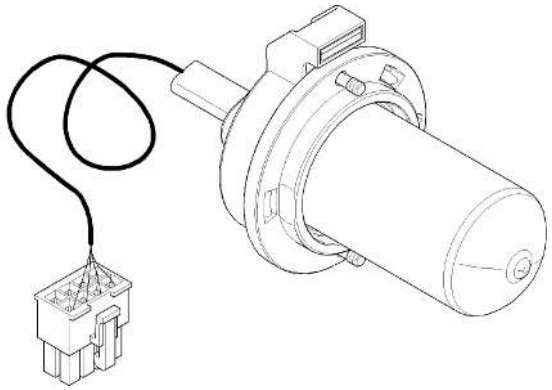


Figure 5: UV-Lamp

Max-Light Cartridge Flow Cell

The detector allows easy access to flow cells via a cartridge. A variety of optional flow cells can be inserted using the same quick, simple mounting system.

Max-Light Cartridge Flow Cells for standard and bio-inert applications are available. For testing of the detector, a Max-Light Cartridge Test Cell is available.

p/n	Description
G4212-60008	Max-Light Cartridge Cell (10 mm, V(σ) 1.0 µL)
G4212-60007	Max-Light Cartridge Cell (60 mm, V(σ) 4.0 µL)
G4212-60032	HDR Max-Light Cartridge Cell (3.7 mm, V(σ) 0.9 µL)
G4212-60038	ULD Max-Light Cartridge Cell (10 mm, V(σ) 0.6 µL)
G7117-60020	Max-Light Cartridge Cell LSS (10 mm, V(σ) 1.0 µL)
G4212-60011	Max-Light Cartridge Test Cell

The optical principle of the Max-Light Cartridge cell is based on opto-fluidic waveguides. Nearly 100 % light transmission is achieved by utilizing total internal reflection in a non-coated silica fiber. Compromising refractive index and thermal effects are almost completely eliminated, resulting in significantly less baseline drift.

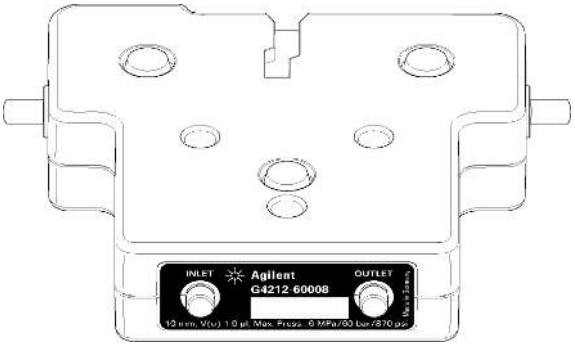


Figure 6: Max-Light Cartridge Flow Cell

NOTE

For additional information on the Max-Light Cartridge flow cell refer to Choosing a Flow Cell on page 81 and Inline Pressure Relief Valve Kit (G4212-68001) on page 84.

Slit Assembly

Programmable Slit (G7117B)

The micro-slit system makes use of the mechanical properties of silicon combined with the precise structuring capabilities of bulk micro-machining. It combines the required optical functions — slit and shutter — in a simple and compact component. The slit width is directly controlled by the micro-processor of the instrument and can be set as method parameter.

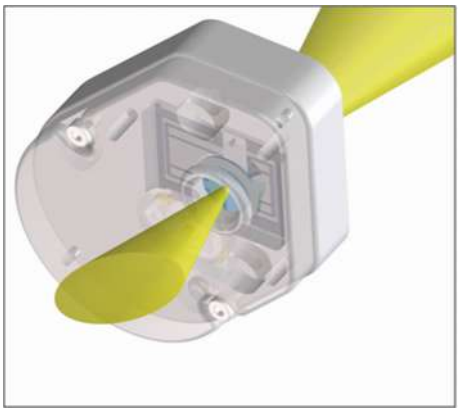


Figure 7: Slit Assembly

The slit width influences the spectral resolution and noise.

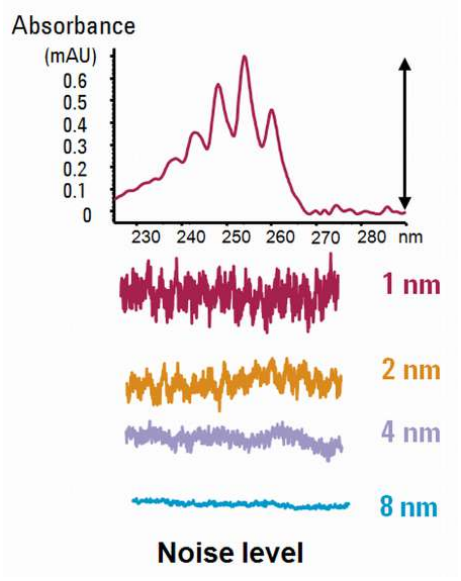


Figure 8: Influence of slitwidth on resolution and noise level

Fixed Slit (G7117A/G7117C)

The fixed slit combines the required optical functions - slit and shutter - in a simple and compact component. The slit width is fixed to 4 nm and both positions (fixed slit and shutter) are directly controlled by the micro- processor of the instrument.

Grating and Diode Array

The combination of dispersion and spectral imaging is accomplished by using a concave holographic grating. The grating separates the light beam into all its component wavelengths and reflects the light onto the photodiode array.

The diode array is a series of 1024 individual photodiodes and control circuits located on a ceramic carrier. It has a wavelength range from 190 – 640 nm and the sampling interval is ~0.5 nm.

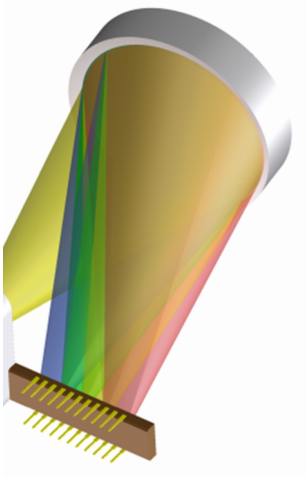


Figure 9: Grating and diode array

Hydraulic Path

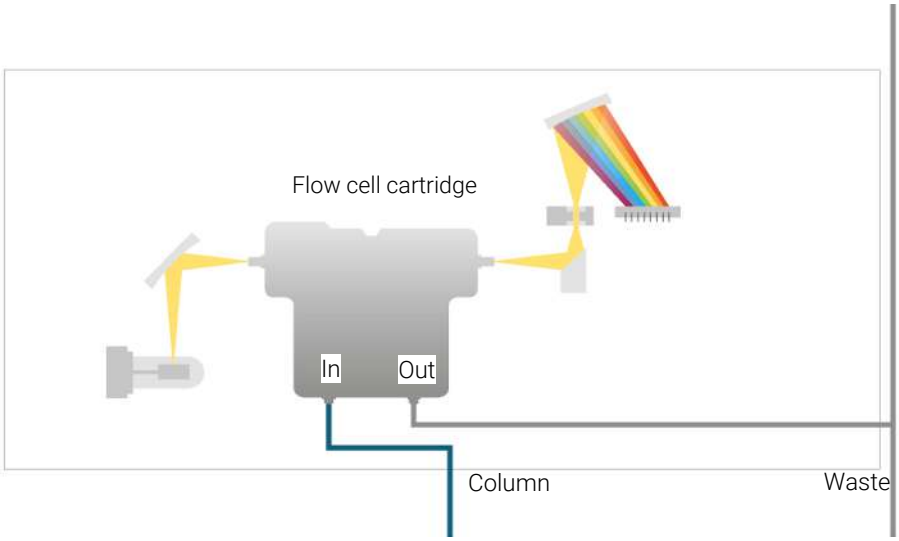


Figure 10: Hydraulic path

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 module.

Power Consideration

The module power supply has wide ranging capabilities and accepts any line voltage in the range mentioned in Specifications of the 1290 Infinity III Diode Array Detector FS (G7117A) on page 27, Specifications of the 1290 Infinity III Diode Array Detector (G7117B) on page 30, and Specifications of the 1260 Infinity III Diode Array Detector HS (G7117C) on page 33. 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 **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.**

WARNING **Incorrect line voltage at the module**

Shock hazard or damage of your instrument can result if the devices are connected to line voltage higher than specified.

- **Connect your module to the specified line voltage.**

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

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

- **Make sure that it is always possible to access the power plug.**
- **Remove the power cable from the instrument before opening the cover.**
- **Do not connect the power cable to the Instrument while the covers are removed.**

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 Physical Specifications) 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.

Environment

Your module will work within the specifications at ambient temperatures and relative humidity described in Physical Specifications.

ASTM drift tests require a temperature change below 2 °C/hour (3.6 F/hour) over one hour period. Our published drift specification (refer also to Specification Conditions on page 36) is based on these conditions. Larger ambient temperature changes will result in larger drift.

Better drift performance depends on better control of the temperature fluctuations. To realize the highest performance, minimize the frequency and the amplitude of the temperature changes to below 1 °C/hour (1.8 F/hour). Turbulences around one minute or less can be ignored.

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.

NOTE

This module is designed to operate in a typical electromagnetic environment, i.e. where RF transmitters such as mobile telephones may not be used in close proximity.

Specifications of the 1290 Infinity III Diode Array Detector FS (G7117A)

Table 1: Physical specifications of the 1290 Infinity III Diode Array Detector FS (G7117A)

Type	Specification	Comments
Weight	11.5 kg (25.4 lbs)	
Dimensions (height × width × depth)	140 x 396 x 436 mm (5.5 x 15.6 x 17.2 inches)	
Line voltage	100–240 V~, ±10%	Wide-ranging capability
Line frequency	50 or 60 Hz, ±5%	
Power consumption	110 VA, 100 W	
Ambient operating temperature	4–55 °C (39–131 °F)	
Ambient non-operating temperature	-40–70 °C (-40–158 °F)	
Humidity	< 95% r.h. at 40 °C (104 °F)	Non-condensing
Operating altitude	Up to 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

Table 2: Performance specifications of the 1290 Infinity III Diode Array Detector FS (G7117A)

Type	Specification
Detection type	1024-element photodiode array
Designed for use with Agilent InfinityLab Assist	Intuitive User Interface, Automated Workflows, Predictive Maintenance & Assisted Troubleshooting
Light source	Deuterium lamp
Number of signals	8
Maximum data rate	120 Hz (both spectra and signals)

Type	Specification
Short term signal noise (ASTM)	With 10 mm Max-Light cartridge cell: $<\pm 3 \cdot 10^{-6}$ AU/cm at 230 nm, slit width 4 nm, TC 2 s With 60 mm Max-Light cartridge cell: $<\pm 0.6 \cdot 10^{-6}$ AU/cm at 230 nm, slit width 4 nm, TC 2 s
Drift	$< 0.5 \cdot 10^{-3}$ AU/h at 230 nm
Linear absorbance range	> 2.0 AU (5 %) at 273 nm, typically 2.5 AU (5 %)
Wavelength range	190 – 640 nm
Wavelength accuracy	± 1 nm, self-calibration with deuterium lines
Wavelength precision	< ± 0.1 nm
Wavelength bunching	2 – 400 nm, programmable in 1 nm steps
Slit width	4 nm
Diode width	~0.5 nm
Time programmable	Wavelength, polarity, peak width, lamp bandwidth, auto balance, wavelength range, threshold, spectra storage mode
Flow cells	User-exchangeable, self-aligning cartridge cells with RFID tags. Max-Light Cartridge Cell (Standard): 10 mm, σ_V = 1.0 µL Max-Light Cartridge Cell (High Sensitivity): 60 mm, σ_V = 4 µL Max-Light Cartridge Ultra Low Dispersion (ULD) Cell: 10 mm, σ_V = 0.6 µL Max-Light Cartridge High Dynamic Range (HDR) Cell: 3.7 mm, σ_V = 0.9 µL Max-Light Cartridge Cell LSS: 10 mm, σ_V = 1.0 µL Maximum Operating Pressure (MOP) [1]: 70 bar Maximum Incidental Pressure (MIP) [2]: 150 bar
Spectral tools	Data analysis software for spectra evaluation, including spectral libraries and peak purity functions
Analog output	Recorder/integrator: 100 mV or 1 V, output range 0.001 – 2 AU, one output
Instrument control	LC and CE Drivers A.02.11 or above Instrument Control Framework (ICF) A.02.04 or above Lab Advisor B.02.06 or above InfinityLab Assist (G7180A) with firmware D.07.40 or above Agilent Instant Pilot (G4208A) with firmware B.02.19 or above For details about supported software versions refer to the compatibility matrix of your version of the LC and CE Drivers
Communication	LAN, Controller Area Network (CAN), USB ERI: ready, start, stop and shut-down signals

1 Maximum operating pressure (MOP): Maximum pressure at which a system can operate continuously under normal conditions.

2 Maximum incidental pressure (MIP): The maximum pressure which the system can experience during a short time.

Type	Specification
GLP	RFID for electronics records of flow cell and UV lamp conditions (path length, volume, product number, serial number, test passed, usage) Early maintenance feedback (EMF) for continuous tracking of instrument usage in terms of lamp burn time with user settable limits and feedback messages. Electronic records of maintenance and errors. Verification of wavelength accuracy with deuterium lines.
Safety and maintenance	Extensive diagnostics, error detection and display through Agilent Instant Pilot and Agilent Lab Advisor software. Leak detection, safe leak handling, leak output signal for shutdown of pumping system. Low voltages in major maintenance areas.
Housing	All materials recyclable.
Others	Second generation of Electronic temperature control (ETC) for the complete optical unit.

Specifications of the 1290 Infinity III Diode Array Detector (G7117B)

Table 3: Physical specifications of the 1290 Infinity III Diode Array Detector (G7117B)

Type	Specification	Comments
Weight	11.5 kg (25.4 lbs)	
Dimensions (height × width × depth)	140 x 396 x 436 mm (5.5 x 15.6 x 17.2 inches)	
Line voltage	100–240 V~, ±10%	Wide-ranging capability
Line frequency	50 or 60 Hz, ±5%	
Power consumption	110 VA, 100 W	
Ambient operating temperature	4–55 °C (39–131 °F)	
Ambient non-operating temperature	-40–70 °C (-40–158 °F)	
Humidity	< 95% r.h. at 40 °C (104 °F)	Non-condensing
Operating altitude	Up to 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

Table 4: Performance specifications of the 1290 Infinity III Diode Array Detector (G7117B)

Type	Specification
Detection type	1024-element photodiode array
Designed for use with Agilent InfinityLab Assist	Intuitive User Interface, Automated Workflows, Predictive Maintenance & Assisted Troubleshooting
Light source	Deuterium lamp
Number of signals	8
Maximum data rate	240 Hz (both spectra and signals)

Type	Specification
Short term signal noise (ASTM)	With 10 mm Max-Light cartridge cell: <±3·10^{-6} AU/cm at 230 nm, slit width 4 nm, TC 2 s With 60 mm Max-Light cartridge cell: <±0.6·10^{-6} AU/cm at 230 nm, slit width 4 nm, TC 2 s
Drift	< 0.5·10^{-3} AU/h at 230 nm
Linear absorbance range	> 2 AU (5 %) at 273 nm, typically 2.5 AU (5 %)
Wavelength range	190 – 640 nm
Wavelength accuracy	± 1 nm, self-calibration with deuterium lines
Wavelength precision	< ± 0.1 nm
Wavelength bunching	2 – 400 nm, programmable in 1 nm steps
Slit width	1, 2, 4, 8 nm
Diode width	~0.5 nm
Nominal spectral resolution	< 1 nm
Time programmable	Wavelength, polarity, peak width, lamp bandwidth, auto balance, wavelength range, threshold, spectra storage mode
Flow cells	User-exchangeable, self-aligning cartridge cells with RFID tags. Max-Light Cartridge Cell (Standard): 10 mm, σ_V = 1.0 µL Max-Light Cartridge Cell (High Sensitivity): 60 mm, σ_V = 4 µL Max-Light Cartridge Ultra Low Dispersion (ULD) Cell: 10 mm, σ_V = 0.6 µL Max-Light Cartridge High Dynamic Range (HDR) Cell: 3.7 mm, σ_V = 0.9 µL Max-Light Cartridge Cell LSS: 10 mm, σ_V = 1.0 µL Maximum Operating Pressure (MOP) [3]: 70 bar Maximum Incidental Pressure (MIP) [4]: 150 bar
Spectral tools	Data analysis software for spectra evaluation, including spectral libraries and peak purity functions
Analog output	Recorder/integrator: 100 mV or 1 V, output range 0.001 – 2 AU, one output
Instrument control	LC and CE Drivers A.02.11 or above Instrument Control Framework (ICF) A.02.04 or above Lab Advisor B.02.06 or above InfinityLab Assist (G7180A) with firmware D.07.40 or above Agilent Instant Pilot (G4208A) with firmware B.02.19 or above For details about supported software versions refer to the compatibility matrix of your version of the LC and CE Drivers

3 Maximum operating pressure (MOP): Maximum pressure at which a system can operate continuously under normal conditions.

4 Maximum incidental pressure (MIP): The maximum pressure which the system can experience during a short time.

Type	Specification
Communication	LAN, Controller Area Network (CAN), USB ERI: ready, start, stop and shut-down signals
GLP	RFID for electronics records of flow cell and UV lamp conditions (path length, volume, product number, serial number, test passed, usage). Early maintenance feedback (EMF) for continuous tracking of instrument usage in terms of lamp burn time with user settable limits and feedback messages. Electronic records of maintenance and errors. Verification of wavelength accuracy with deuterium lines.
Safety and maintenance	Extensive diagnostics, error detection and display through Agilent InfinityLab Assist, Agilent Instant Pilot and Agilent Lab Advisor software. Leak detection, safe leak handling, leak output signal for shutdown of pumping system. Low voltages in major maintenance areas.
Housing	All materials recyclable.
Others	Second generation of Electronic Temperature Control (ETC) for the complete optical unit.

Specifications of the 1260 Infinity III Diode Array Detector HS (G7117C)

Table 5: Physical specifications of the 1260 Infinity III Diode Array Detector HS (G7117C)

Type	Specification	Comments
Weight	11.5 kg (25.4 lbs)	
Dimensions (height × width × depth)	140 x 396 x 436 mm (5.5 x 15.6 x 17.2 inches)	
Line voltage	100–240 V~, ±10%	Wide-ranging capability
Line frequency	50 or 60 Hz, ±5%	
Power consumption	110 VA, 100 W	
Ambient operating temperature	4–55 °C (39–131 °F)	
Ambient non-operating temperature	-40–70 °C (-40–158 °F)	
Humidity	< 95% r.h. at 40 °C (104 °F)	Non-condensing
Operating altitude	Up to 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

Table 6: Performance specifications of the 1260 Infinity III Diode Array Detector HS (G7117C)

Type	Specification
Detection type	1024-element photodiode array
Designed for use with Agilent InfinityLab Assist	Intuitive User Interface, Automated Workflows, Predictive Maintenance & Assisted Troubleshooting
Light source	Deuterium lamp
Number of signals	8
Maximum data rate	120 Hz (both spectra and signals)

Type	Specification
Short term signal noise (ASTM)	With 10 mm Max-Light cartridge cell: $<\pm 3 \cdot 10^{-6}$ AU/cm at 230 nm, slit width 4 nm, TC 2 s With 60 mm Max-Light cartridge cell: $<\pm 0.6 \cdot 10^{-6}$ AU/cm at 230 nm, slit width 4 nm, TC 2 s
Drift	$< 0.5 \cdot 10^{-3}$ AU/h at 230 nm
Linear absorbance range	> 2 AU (5 %) at 273 nm, typically 2.5 AU (5 %)
Wavelength range	190 – 640 nm
Wavelength accuracy	± 1 nm, self-calibration with deuterium lines
Wavelength precision	< ± 0.1 nm
Wavelength bunching	2 – 400 nm, programmable in 1 nm steps
Slit width	4 nm
Diode width	~0.5 nm
Time programmable	Wavelength, polarity, peak width, lamp bandwidth, auto balance, wavelength range, threshold, spectra storage mode
Flow cells	User-exchangeable, self-aligning cartridge cells with RFID tags. Max-Light Cartridge Cell (Standard): 10 mm, σ_V = 1.0 µL Max-Light Cartridge Cell (High Sensitivity): 60 mm, σ_V = 4 µL Max-Light Cartridge Cell LSS: 10 mm, σ_V = 1.0 µL Maximum Operating Pressure (MOP) [5]: 70 bar Maximum Incidental Pressure (MIP) [6]: 150 bar
Spectral tools	Data analysis software for spectra evaluation, including spectral libraries and peak purity functions.
Analog output	Recorder/integrator: 100 mV or 1 V, output range 0.001 – 2 AU, one output
Instrument control	LC and CE Drivers A.02.14 or above Instrument Control Framework (ICF) A.02.04 or above Lab Advisor B.02.08 or above InfinityLab Assist (G7180A) with firmware D.07.40 or above Agilent Instant Pilot (G4208A) B.02.20 or above For details about supported software versions refer to the compatibility matrix of your version of the LC and CE Drivers.
Communication	LAN, Controller-Area Network (CAN), USB Extended Remote Interface: ready, start, stop and shut-down signals

5 Maximum operating pressure (MOP): Maximum pressure at which a system can operate continuously under normal conditions.

6 Maximum incidental pressure (MIP): The maximum pressure which the system can experience during a short time.

Type	Specification
GLP	RFID for electronics records of flow cell and UV lamp conditions (path length, volume, product number, serial number, test passed, usage). Early maintenance feedback (EMF) for continuous tracking of instrument usage in terms of lamp burn time with user settable limits and feedback messages. Electronic records of maintenance and errors. Verification of wavelength accuracy with deuterium lines.
Safety and maintenance	Extensive diagnostics, error detection and display through Agilent InfinityLab Assist, Agilent Instant Pilot and Agilent Lab Advisor software. Leak detection, safe leak handling, leak output signal for shutdown of pumping system. Low voltages in major maintenance areas.
Housing	All materials recyclable.
Others	Second generation of Electronic Temperature Control (ETC) for the complete optical unit.

Specification Conditions

Following many of the principles outlined in ASTM method E165798.

Reference conditions:

- Wavelength: 230 nm/4 nm with Reference Wavelength 360 nm/100 nm, Slitwidth 4 nm, TC 2 s, (or with RT = 2.2 * TC), ASTM
- G4212-60008 (Max-Light Cartridge Cell (10 mm, V(σ) 1.0 µL)) with flow of 0.5 mL/min LC grade water or G4212-60011 (Max-Light Cartridge Test Cell)

Linearity:

Linearity is measured with caffeine at 273 nm/4 nm with slit width 4 nm and TC 1 s (or with RT 2 s) with G4212-60008 (Max-Light Cartridge Cell (10 mm, V(σ) 1.0 µL)) > 2.0 AU (5 %) [typical 2.5 AU (5 %)] .

NOTE

The specifications are based on the standard RFID tag lamp (5190-0917) and may be not achieved when other lamp types or aged lamps are used.

ASTM drift tests require a temperature change below 2 °C/hour (3.6 F/hour) over one hour period. Our published drift specification is based on these conditions. Larger ambient temperature changes will result in larger drift.

Better drift performance depends on better control of the temperature fluctuations. To realize the highest performance, minimize the frequency and the amplitude of the temperature changes to below 1 °C/hour (1.8 F/hour). Turbulences around one minute or less can be ignored.

Performance tests should be done with a completely warmed up optical unit (> two hours). ASTM measurements require that the detector should be turned on at least 24 h before start of testing.

Time constant versus response time

According to ASTM E1657-98 „Standard Practice of Testing Variable-Wavelength Photometric Detectors Used in Liquid Chromatography" the time constant is converted to response time by multiplying by the factor 2.2.

3 Installation

The installation of the module will be done by an Agilent service representative. In this chapter, only installation of user-installable options and accessories are described.

Installing Capillaries

This section provides information on how to install capillaries and fittings.

Install Capillaries

Capillaries and connections depend on which system is installed.

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

NOTE Agilent capillaries are color-coded for quick identification, see At-a-Glance Details About Agilent Capillaries on page 267.

Table 7: Capillary connections for 1260 Infinity III systems

p/n	From	To
G7120-60007 (Bottle Head Assembly)	Solvent Bottle	Infinity III Pump
5500-1246 (Capillary ST 0.17 mm x 500 mm SI/SI)	Pump	Sampler
5500-1217 (Capillary, ST, 0.17 mm x 900 mm SI/SX)	Pump	Vialsampler with ICC
5500-1246 (Capillary ST 0.17 mm x 500 mm SI/SI)	Multisampler	MCT Valve/Heat Exchanger
5500-1252 (Capillary, ST, 0.17 mm x 400 mm SL/SL)	Vialsampler	MCT Valve/Heat Exchanger
5500-1240 (Capillary ST 0.17 mm x 105 mm SL/SL)	Vialsampler	ICC Heat Exchanger
5500-1250 (Capillary, ST, 0.17 mm x 120 mm SL/SL, long socket)	ICC Heat Exchanger	Column
5500-1193 (InfinityLab Quick Turn Capillary ST 0.17 mm x 105 mm, long socket)	MCT Heat Exchanger	Column
5500-1191 (InfinityLab Quick Turn Capillary ST 0.12 mm x 280 mm, long socket)	Column/MCT Valve	Detector
5062-8535 (Waste accessory kit (Flow Cell to waste))	VWD	Waste
5062-2462 (Tube PTFE 0.7 mm x 5 m, 1.6 mm od)	DAD/FLD	Waste
G5664-68712 (Analytical tubing kit 0.25 mm i.d. PTFE-ESD)	Detector	Fraction Collector

Table 8: Capillary connections for 1290 Infinity III systems

p/n	From	To
G7120-60007 (Bottle Head Assembly)	Solvent Bottle	Infinity III Pump
5500-1245 (Capillary ST 0.17 mm x 400 mm SI/SI)	Pump	Sampler

p/n	From	To
5500-1217 (Capillary, ST, 0.17 mm x 900 mm SI/SX)	Pump	Vialsampler with ICC
5500-1157 (Capillary ST 0.12 mm x 500 mm SL/S)	Multisampler	MCT Valve/Heat Exchanger
5500-1251 (Capillary ST 0.12 mm x 400 mm SL/SL)	Vialsampler	MCT Valve/Heat Exchanger
5500-1238 (Capillary ST 0.12 mm x 105 mm SL/SL)	Vialsampler	ICC Heat Exchanger
5500-1249 (Capillary ST 0.12 mm x 120 mm SL/SL, long socket)	ICC Heat Exchanger	Column
5500-1201 (Capillary ST 0.12 mm x 105 mm SL)	MCT Heat Exchanger	Column
5500-1191 (InfinityLab Quick Turn Capillary ST 0.12 mm x 280 mm, long socket)	Column/MCT Valve	Detector
5062-8535 (Waste accessory kit (Flow Cell to waste))	VWD	Waste
5062-2462 (Tube PTFE 0.7 mm x 5 m, 1.6 mm od)	DAD/FLD	Waste
G5664-68712 (Analytical tubing kit 0.25 mm i.d. PTFE-ESD)	Detector	Fraction Collector

Table 9: Capillary connections for 1260 Infinity III Bio-inert LC

p/n	From	To
G7120-60007 (Bottle Head Assembly)	Solvent Bottle	Infinity III Pump
5500-1264 (Capillary Ti 0.17 mm x 500 mm, SL/SLV)	Pump	Multisampler
G5667-81005 (Capillary PK/ST 0.17 mm x 500 mm, RLO/RLO (Bio-inert))	Multisampler	MCT
5067-4741 (ZDV union (Bio-inert))	Capillary	Bio-inert Heat Exchanger
G7116-60041 (Quick Connect Heat Exchanger Bio-inert)		
0890-1763 (Capillary PEEK 0.18 mm x 1.5 m) and 5063-6591 (PEEK Fittings 10/PK)	Column/MCT Valve	Detector
5062-8535 (Waste accessory kit (Flow Cell to waste))	VWD	Waste
5062-2462 (Tube PTFE 0.7 mm x 5 m, 1.6 mm od)	DAD/FLD	Waste
G5664-68712 (Analytical tubing kit 0.25 mm i.d. PTFE-ESD)	Detector	Fraction Collector

Table 10: Capillary connections for 1290 Infinity III Bio LC

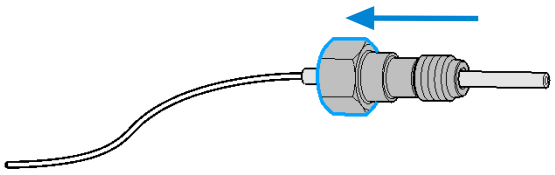
p/n	From	To
G7120-60007 (Bottle Head Assembly)	Solvent Bottle	Infinity III Pump

p/n	From	To
5500-1419 (Capillary MP35N 0.17 mm x 500 mm, SI/SI)	Pump	Multisampler
5500-1279 (Capillary MP35N 0.12 mm x 500 mm SI/SI)	Multisampler	MCT
5500-1578 (Quick Connect Capillary MP35N 0.12 mm x 105 mm)	MCT Heat Exchanger	Column
5500-1596 (Quick Turn Capillary MP35N 0.12 mm x 280 mm)	Column/MCT Valve	Detector (DAD)
5500-1598 (Quick Turn Capillary MP35N 0.12 mm x 500 mm)	Column/MCT Valve	Detector (VWD)
5062-8535 (Waste accessory kit (Flow Cell to waste))	VWD	Waste
5062-2462 (Tube PTFE 0.7 mm x 5 m, 1.6 mm od)	DAD/FLD	Waste
G5664-68712 (Analytical tubing kit 0.25 mm i.d. PTFE-ESD)	Detector	Fraction Collector

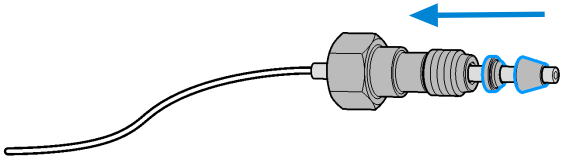
For correct installation of capillary connections it's important to choose the correct fittings, see Syntax for Capillary Description.

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

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



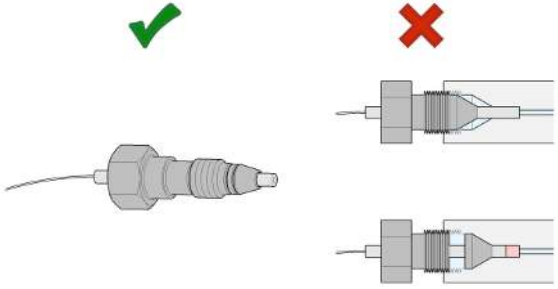
3 Carefully slide the ferrule components on after the nut and then finger-tighten the assembly while ensuring that the tubing is completely seated in the bottom of the end fitting.



4 Use a stable port installed to the module to gently tighten the fitting facing to the module. Or use the column to tighten the fitting facing to the column. This measure forces the ferrule to seat onto the tubing or capillary.

NOTE Do not overtighten. Over-tightening will shorten the lifetime of the fitting.

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



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

For Bio and Bio-Inert Systems, the Swagelok instructions do not apply.

Handling Leak and Waste

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 III 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/III 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 Thermostat (condensate)
- from the pump's Seal Wash Sensor (if applicable)
- from the pump's Purge Valve or Multipurpose Valve

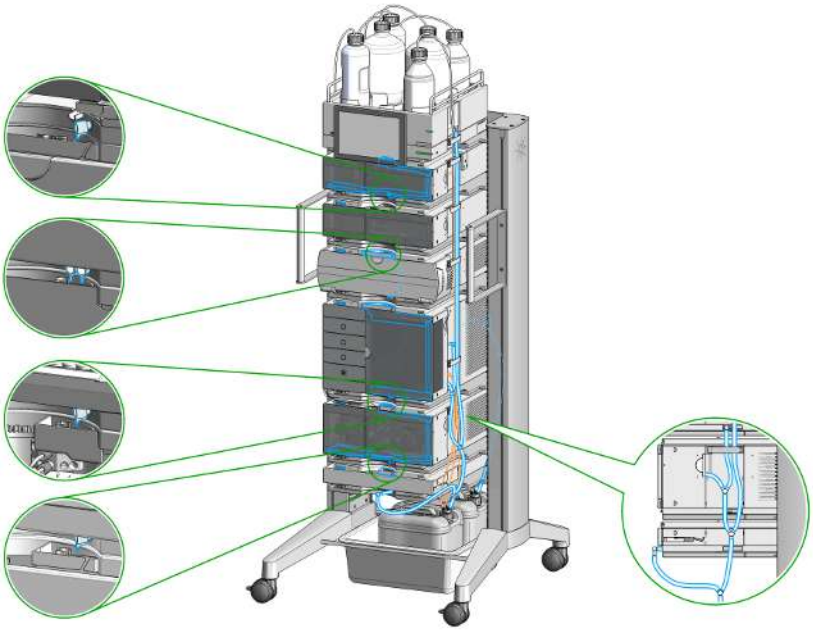


Figure 11: Infinity III Leak Waste Concept (Flex Bench installation)

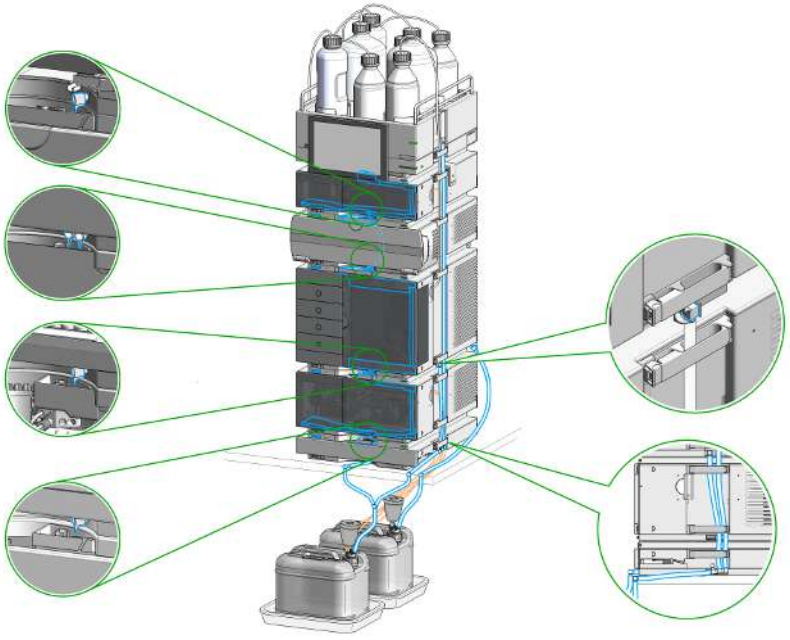


Figure 12: Infinity III Single Stack Leak Waste Concept (bench installation)

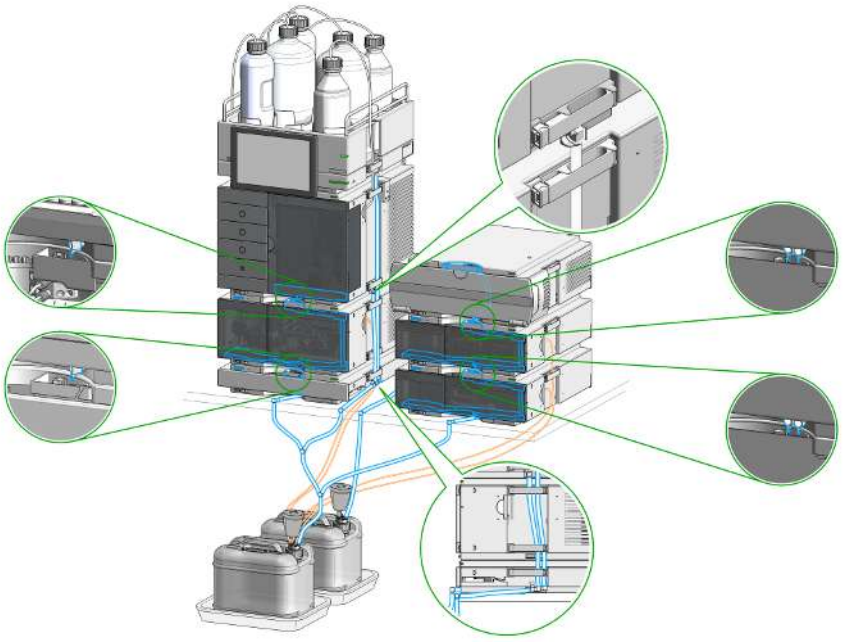


Figure 13: Infinity III Two Stack Leak Waste Concept (bench installation)

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

Drain Connectors Installation

Drain Connectors have been developed to improve leak drainage for low flow leaks of high viscosity solvents (for example, isopropanol) in Agilent InfinityLab LC Series Systems. Install these parts to modules where they are missing (usually preinstalled).

- Make sure that dripping adapters are correctly installed on each module in the LC stack, excluding lowest module.
- Remove the dripping adapter if it is appeared to be installed on the lowest module in the LC stack and connect waste tube instead.
- Consider 5004-0000 (Drain Connectors Kit) if drain adaptor is missing on some module(s).

For illustration, see Handling Leak and Waste on page 43.

Parts required

Qty.	p/n	Description
	5004-0000	Drain Connectors Kit

Content of Drain Connectors Kit (p/n 5004-0000)

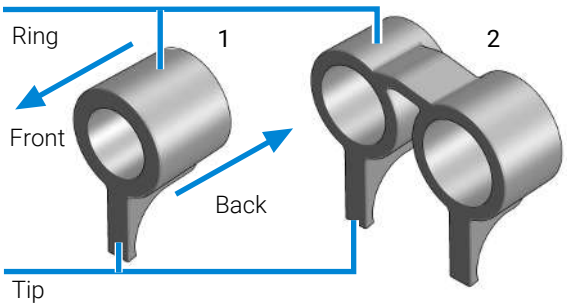


Figure 14: Overview of Drain Connectors: Single (left) and Double (right)

Qty.	p/n	Description
Parts can be ordered only as a complete kit.		
3	5043-1834	Single Drain Connector ID3.0-Long
1	5043-1836	Double Drain Connector-Long

Table 11: Compatibility of drain connectors and modules

Drain Connector Type	Compatible Module	Compatible Module Type
Double	G7116A/B	Column Compartment
Single	G7114A/B	Detector
	G7115A	
	G7117A/B/C	
	G7121A/B	
	G7162A/B	
	G7165A	
	G7129A/B/C	Sampler
	G7167A/B/C	
	G5668A	
	G7137A	
	G7157A	
	G4767A	
	G7122A	Degasser
	G7104A/C	Pump
	G7110B	
	G7111A/B	
	G7112B	
	G7120A	
	G7131A/C	
	G7132A	
	G5654A	
	G4782A	

Preparations

- Leak drains of LC modules are clean and free of salt or solvent residuals.

NOTE

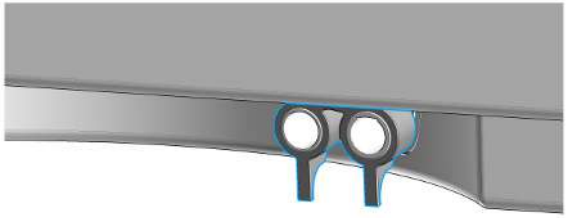
Do not install drain connectors on the bottom modules of the stack. Drain outlet of the bottom module has to be connected via waste tubing to a suitable waste container (see Leak and Waste Handling in the manual for a respective module).

NOTE In case of incorrect installation, drain connectors cannot fully perform the intended function.

NOTE It is not required to power off the HPLC stack to install Single and Double Drain Connectors. The installation of the connectors does not affect the analysis performed during the installation.

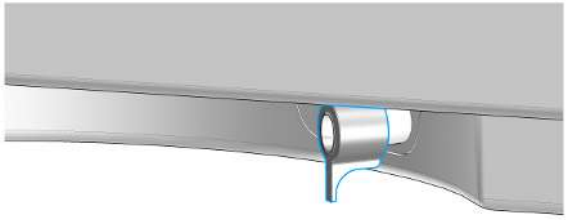
Install the Double Drain Connector on the leak drain of the 1260 Infinity III Multicolumn Thermostat (G7116A)/ 1290 Infinity III Multicolumn Thermostat (G7116B)

1 Align the rings with the leak drain outlets of the module, press slightly with the fingers, and slide the connector along the leak drain outlets until it is aligned with the front of the leak drain.



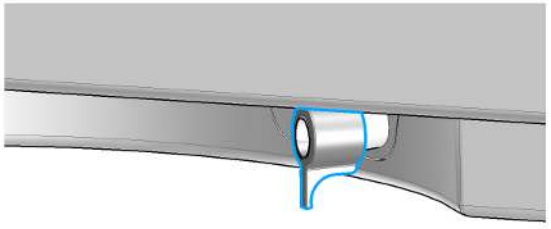
Install Single Drain Connectors on other modules in the LC stack

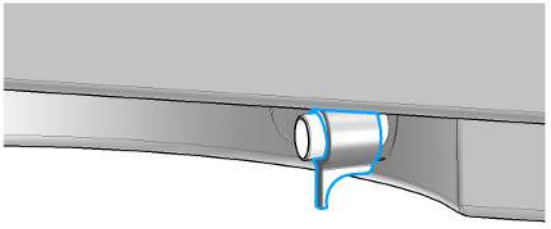
1 Align the ring with the leak drain outlet of the module, press slightly with the fingers, and slide the connector along the leak drain outlet until it is aligned with the front of the leak drain.



Make sure that the following requirements are covered:

- The tip of the drain connector points straight down.
- The leak drain outlets and the drain connectors are aligned properly.

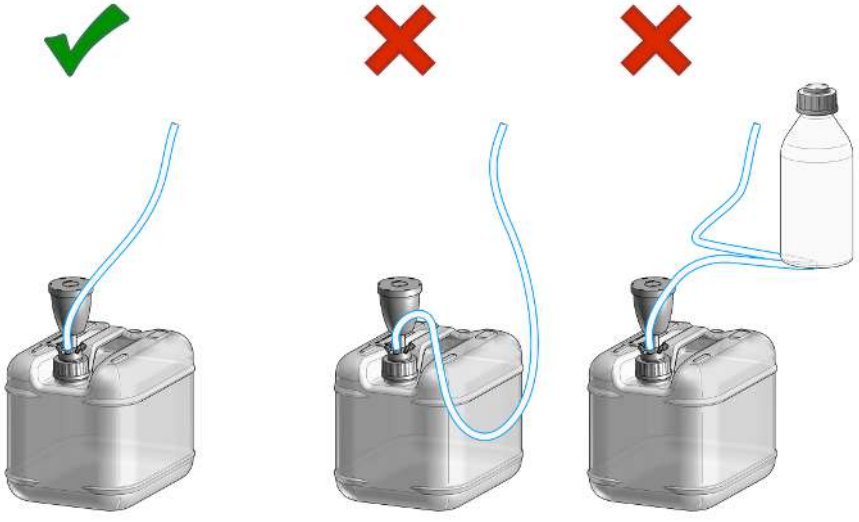




Waste Concept

Agilent recommends using the 5043-1221 (6 L waste can with 1 Stay Safe cap GL45 with 4 ports) 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.

Waste Guidance



NOTE The waste drainage must go straight into the waste containers. The waste flow must not be restricted at bends or joints.

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.

Connecting Modules and Control Software

WARNING Use of unsupplied cables

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

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

Instrument Configuration

Example shows an instrument configuration with a Diode Array Detector.

1 Set the switches of the Configuration switch at the rear of the module:

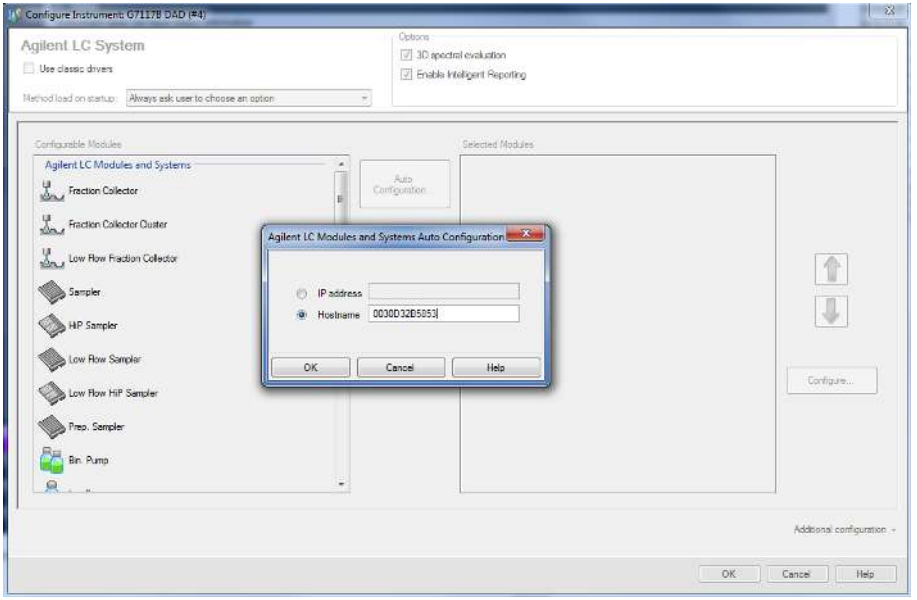
   a All switches DOWN: module uses the default IP address 192.168.254.11.

   b Switch 4 UP and others DOWN: module uses DHCP.

   c Switch 5 UP and others DOWN: modules uses STORED address.

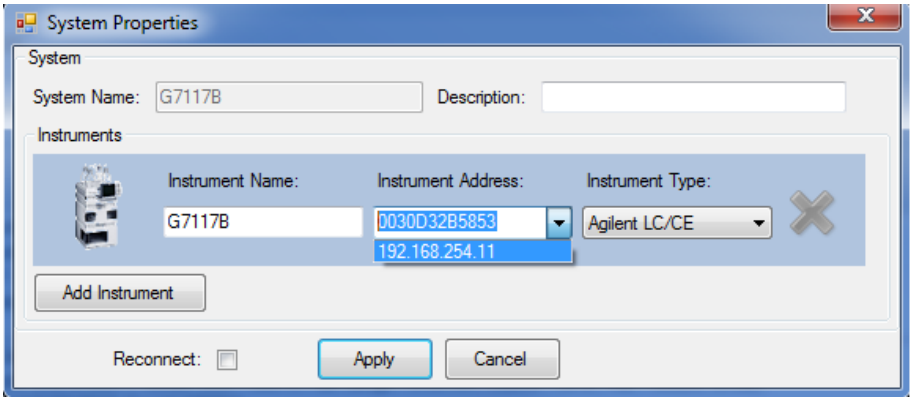
2 Enter the setup information (MAC [7] / IP address and/or Instrument Name).

   a Agilent OpenLab ChemStation (Configure Instrument):



7 MAC address can only be used in DHCP DIP-switch configuration.

b Lab Advisor (Instrument Overview - Add Instrument):



4 Using the Module

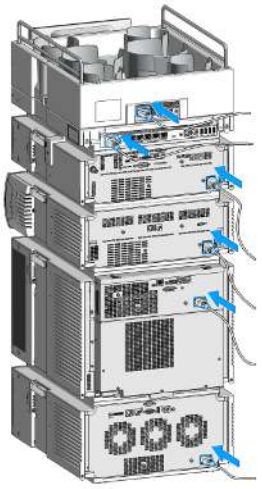
This chapter provides information on how to use the module.

General Information

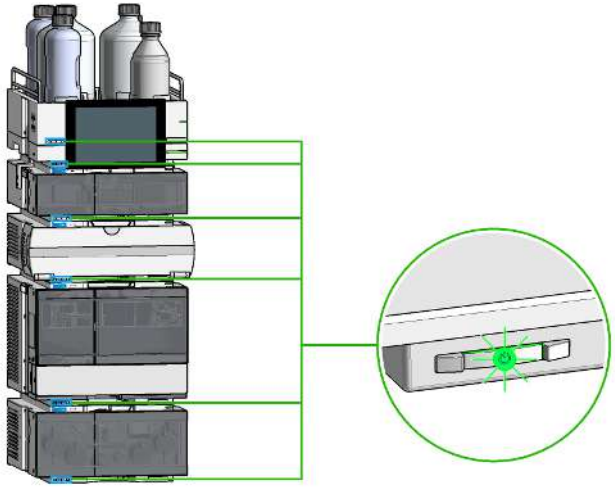
Turn On/Off

This procedure exemplarily shows an arbitrary LC stack configuration.

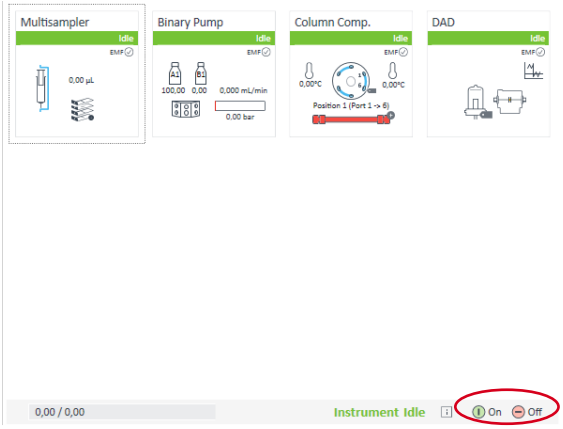
1



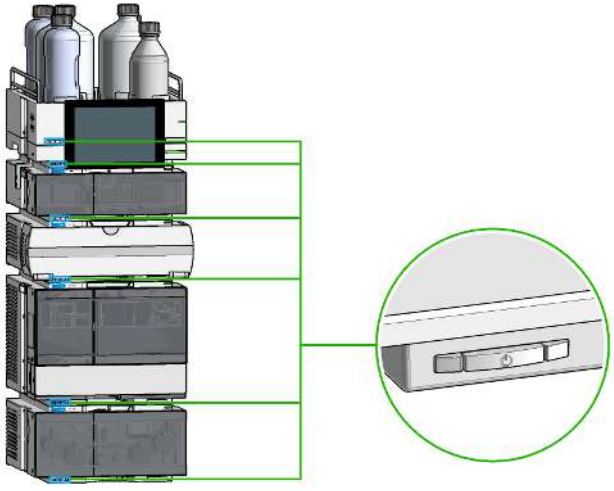
2 On/Off switch: On



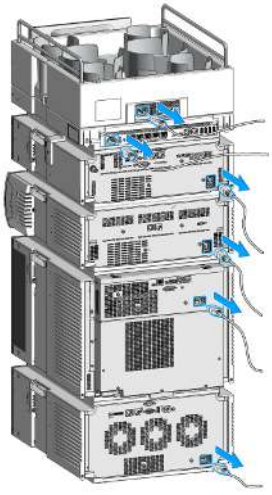
3 Turn instrument **On/Off** with the control software.



4 On/Off switch: Off



5



Status Indicators

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

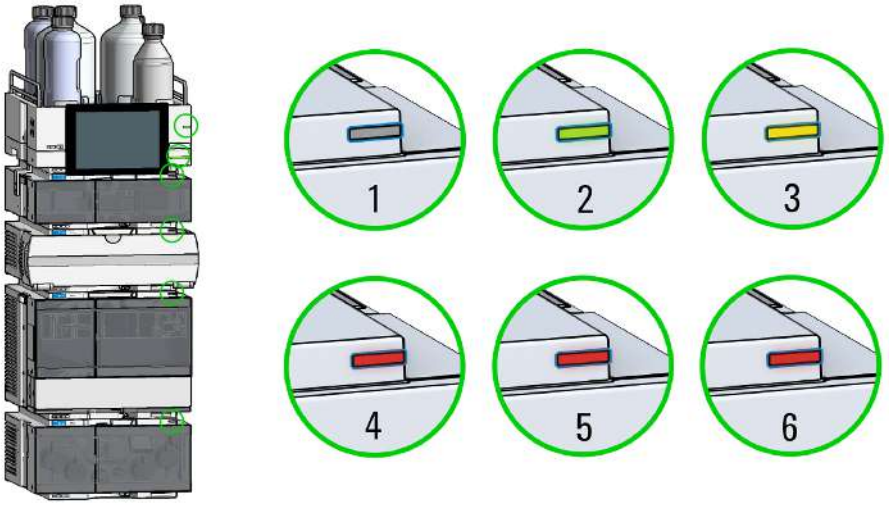


Figure 15: Arbitrary LC stack configuration (example)

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.

InfinityLab Assist Hub Status Indicator

The Assist Hub status indicator displays the status of the entire system. If a module in the system is not ready (yellow), the Assist Hub status indicator also shows not ready (yellow). The same applies for the module conditions **Idle**, **Run mode**, and **Error mode**.

Preparation of the System

Prepare a Run

This procedure exemplarily shows how to prepare a run. Parameters as shown in the screenshots may vary, depending on the system installed.

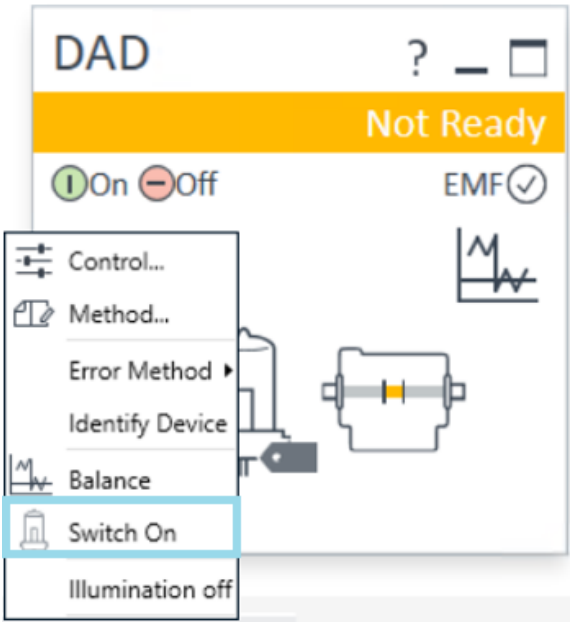
WARNING

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.**

1 Switch on the detector.

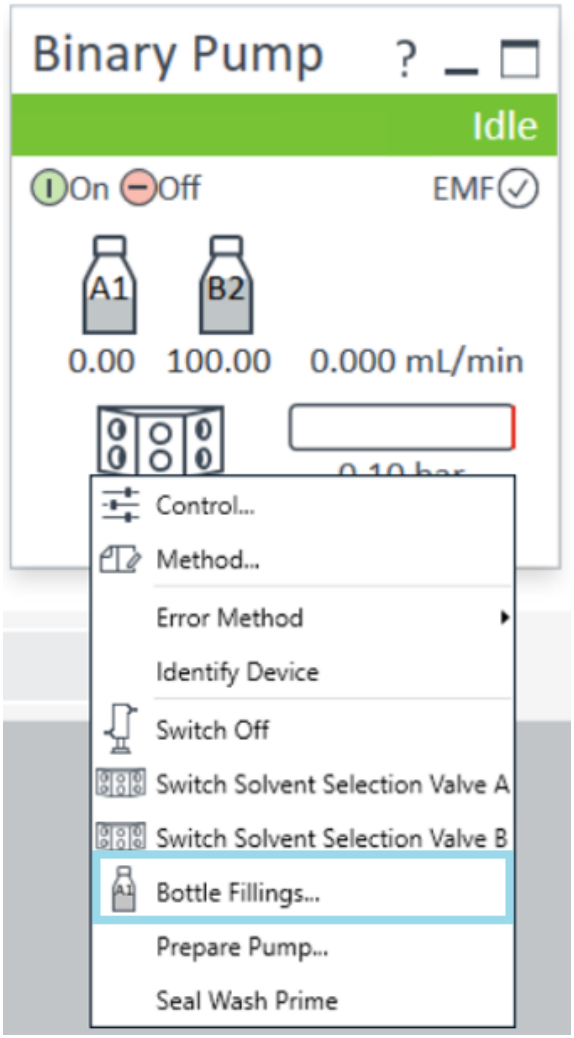


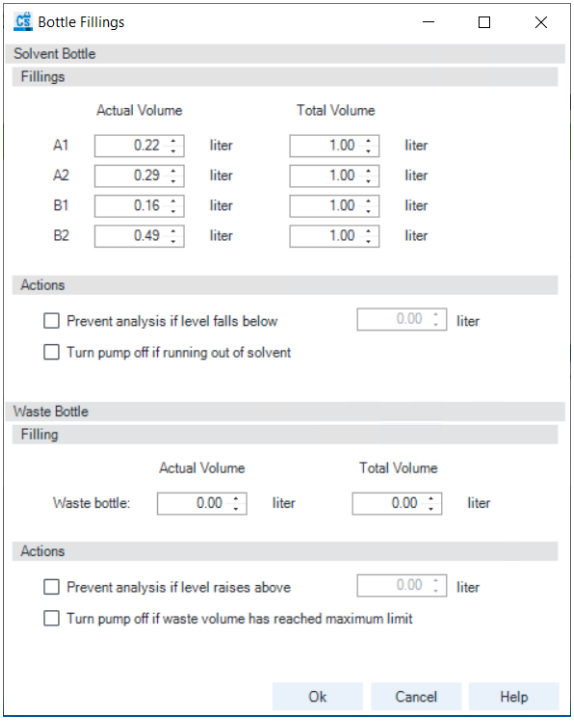
2 Fill the solvent bottles with adequate solvents for your application.

3 Place solvent tubings with bottle head assemblies into the solvent bottles.

4 Place solvent bottles into the solvent cabinet.

5 Solvent bottle filling dialog (in the software).





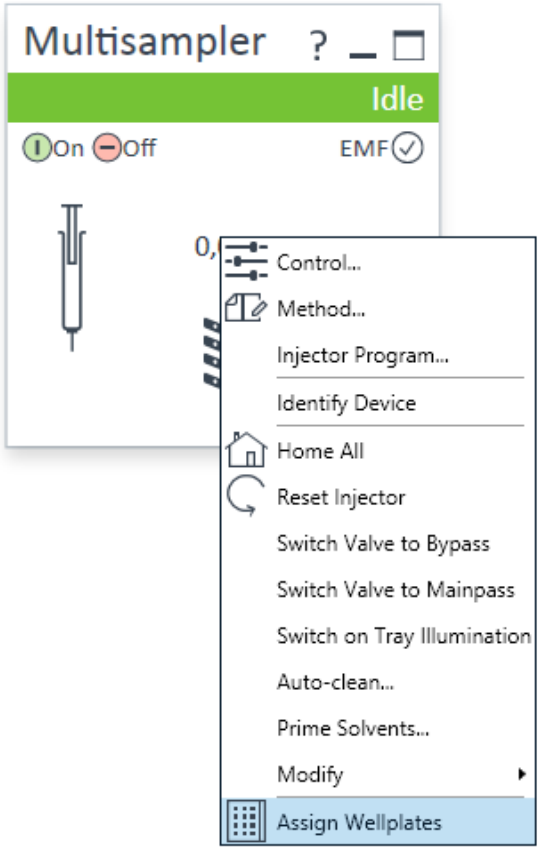
6 Purge the pump.

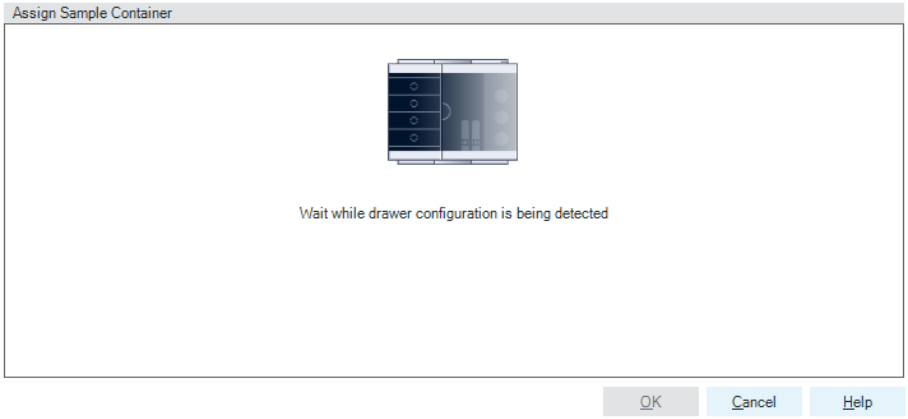
NOTE

For details on priming and purging, refer to the technical note *Best Practices for Using an Agilent LC System Technical Note (InfinityLab-BestPractice-en-SD-29000194.pdf, SD-29000194)*.

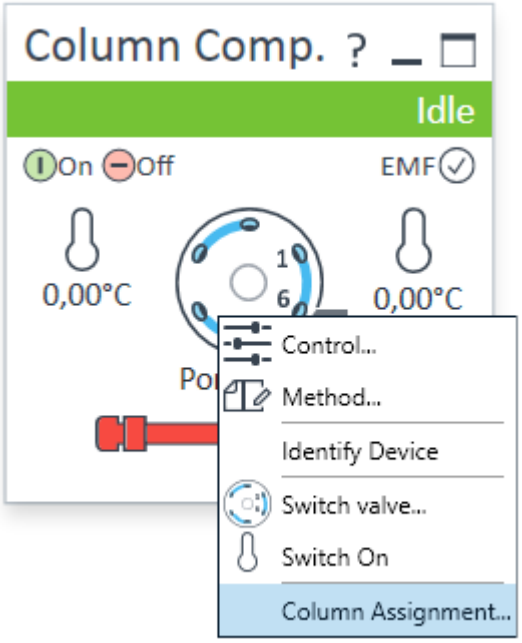
7 Change solvent type if necessary.

8 Choose the tray format of the sampler.

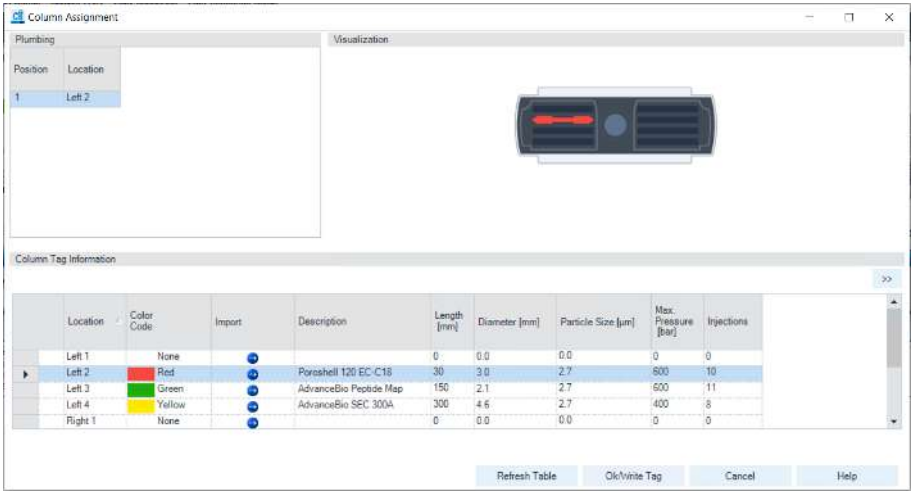




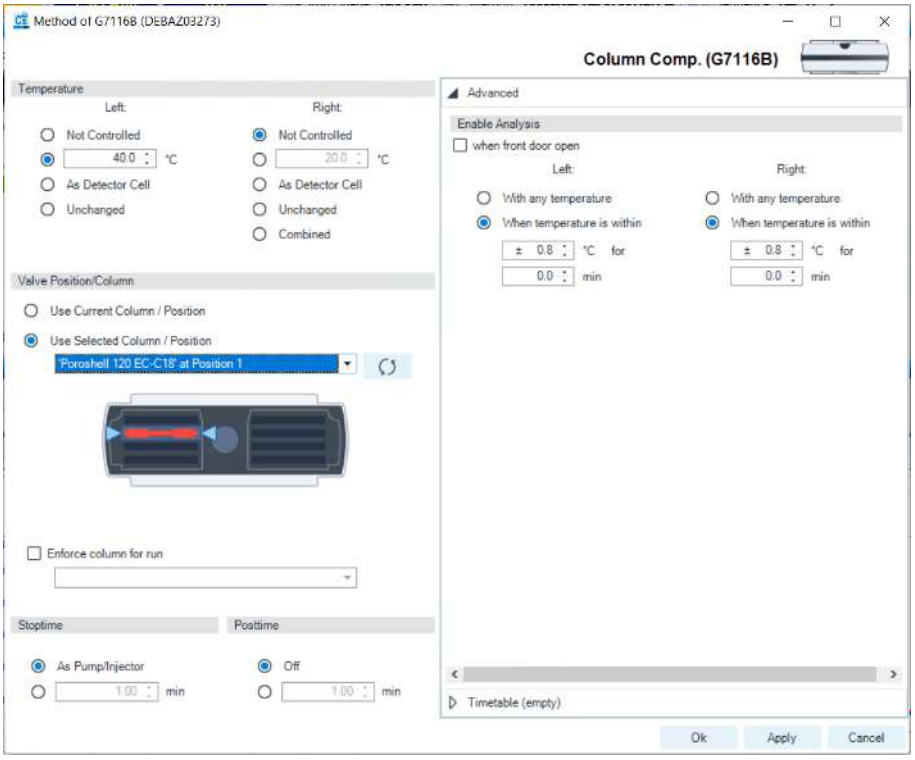
9 Add a new column.



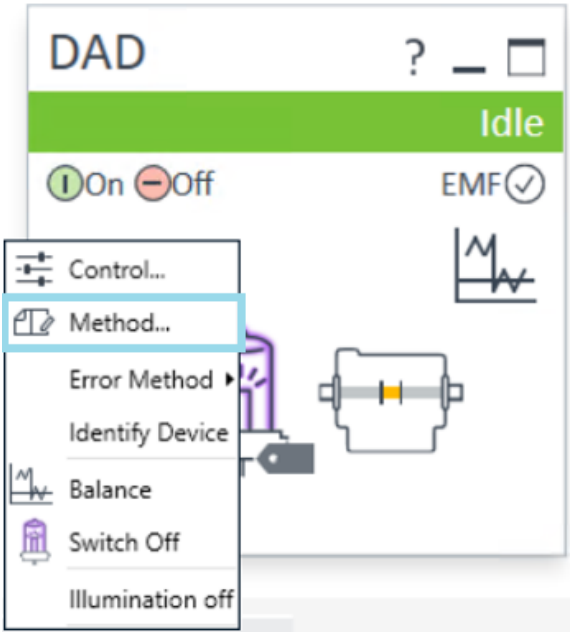
10 Enter the column information.



11 Select the column in the Method settings of the column compartment.



12 Set the detector parameters according to the needs of your method.


DAD
Idle
On
Off
EMF
Control...
Method...
Error Method
Identify Device
Balance
Switch Off
Illumination off

Prime and Purge the System

When the solvents have been exchanged or the pumping system has been turned off for a certain time (for example, overnight) oxygen will re-diffuse into the solvent channel between the solvent reservoir, vacuum degasser (when available in the system) and the pump. Solvents containing volatile ingredients will slightly lose these. Therefore priming of the pumping system is required before starting an application.

Table 12: Choice of priming solvents for different purposes

Activity	Solvent	Comments
After an installation	Isopropanol	Best solvent to flush air out of the system
When switching between reverse phase and normal phase (both times)	Isopropanol	Best solvent to flush air out of the system
After an installation	Ethanol or Methanol	Alternative to Isopropanol (second choice) if no Isopropanol is available
To clean the system when using buffers	Bidistilled water	Best solvent to re-dissolve buffer crystals
After a solvent change	Bidistilled water	Best solvent to re-dissolve buffer crystals
After the installation of normal phase seals (P/N 0905-1420)	Hexane + 5% Isopropanol	Good wetting properties

NOTE The pump should never be used for priming empty tubings (never let the pump run dry). Use a syringe to draw enough solvent for completely filling the tubings to the pump inlet before continuing to prime with the pump.

1 Open the purge valve of your pump (by turning it counterclockwise) and set flow rate to 3 – 5 mL/min.

2 Flush all tubes with at least 30 mL of solvent.

3 Set flow to required value of your application and close the purge valve.

NOTE Pump for approximately 10 minutes before starting your application.

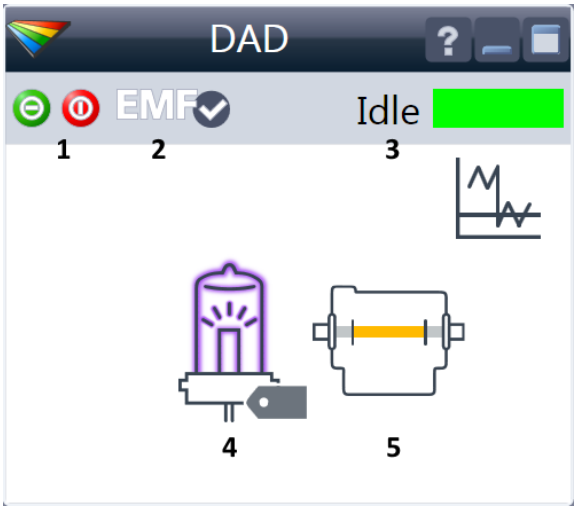
Preparing the Detector

For best performance of the detector

- Let the lamp warm-up and stabilize for at least one hour (initial turn on of the module requires a longer time depending on the environment and the application needs); refer to Specification Conditions on page 36.
- For high sensitivity measurements, a stable environment is required; refer to Environment. Prevent drafts from air condition systems.
- Setting an appropriate reference wavelength could improve the baseline behavior.
- Do not work with removed/open front panels/doors. When the system includes a G1316 TCC (typically located below the detector) and its front panel is removed while the TCC is set to high temperatures, the up-streaming air could influence the stability of the detector baseline.

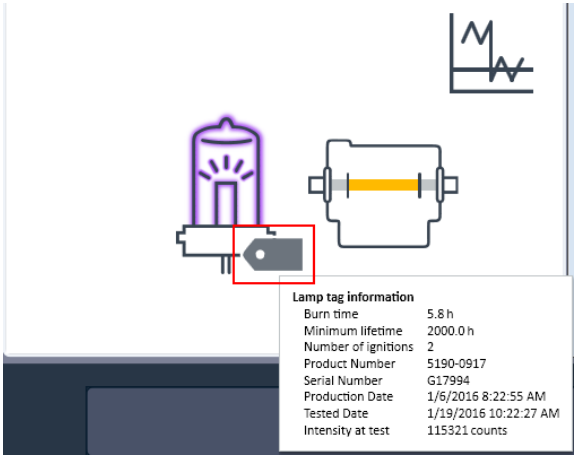
Preparing the Module

The Detector User Interface



Within the detector GUI, there are active areas. If you move the mouse cursor across the icons the cursor will change.

1. Lamp: turn on and off of UV-lamp
2. EMF status
3. Detector status
4. Lamp status (on/off) and information (RFID tag)
5. Flow Cell information (RFID tag)



RFID tag information is displayed when moving with the mouse cursor on to the tag attached to the flow cell or lamp. The information provides flow cell and lamp related information like

- Part number
- Production date
- Serial number

and other details.

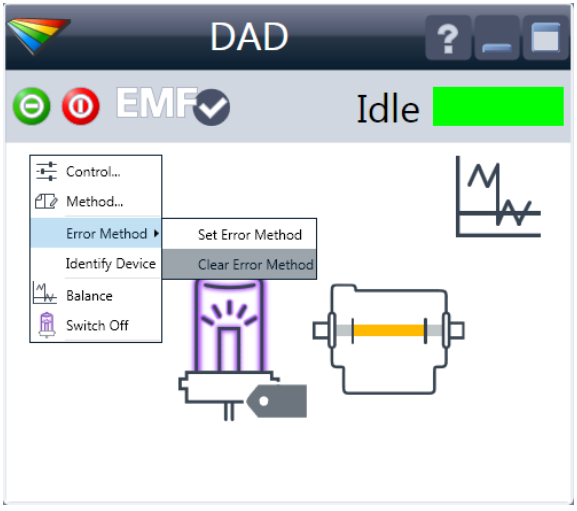
EMF Status shows Run / Ready / Error state and "Not Ready text" or "Error text"

- Offline (gray)
- Ok. No Maintenance required (green)
- EMF warning. Maintenance might be required (yellow)
- EMF warning. Maintenance required (red)

Important: The EMF settings can be accessed via Agilent Lab Advisor. The limit(s) can be changed. Based on the limit, the User Interface displays the above status.

Module Status shows Run / Ready / Error state and "Not Ready text" or "Error text"

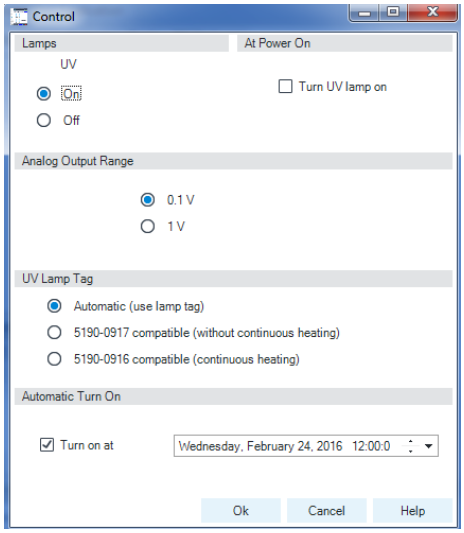
- Error (red)
- Not ready (yellow)
- Ready (green)
- Pre run, Post run (purple)
- Run (blue)
- Idle (green)
- Offline (dark gray)
- Standby (light gray)



A right-click into the Active Area will open a menu to

- Show the Control Interface (special module settings)
- Show the Method interface (similar as via menu **Instrument** > **Setup Instrument Method**)
- Set Error Method
- Identify Module (Status LED will blink)
- Perform a Balance
- Switch the UV-lamp on/off (same as click on button "Make Device Ready/Turn device off (standby)")

Detector Control Settings



The figure shows the default settings.

- Lamps: can be turned ON/OFF.
- Analog Output Range: can be set to either 100 mV or 1 Vfull scale, for additional settings see Analog Output (under Method Parameter Settings on page 74).
- UV Lamp Tag
  - Automatic detects a lamp with RFID tag. If no RFID tag lamp is used, "UV lamp not ready" is displayed and it cannot be ignited. A compatible mode has to be selected based on the used lamp; see Non-RFID-tag lamp information below.
  - Manual (by PN) uses the selected "heating" mode. This mode can also be used when the RFID tag of the standard lamp (5190-0917) is not recognized (defect RFID tag or reader).
  - Non-RFID-tag lamp: In case a non-RFID-tag lamp is used, the user interface will show this when selecting a compatible mode. You may operate the detector outside of the guaranteed specification. The correct selection is important for optimal performance and lifetime.
- At Power On: automatic lamp-on at power on.
- Automatic Turn On: automatic detector power on.

Method Parameter Settings

These settings are available via **Menu** > **Instrument** > **Set up Instrument Method** or via right click into the module's active area (does not show the **Instrument Curves** tab).

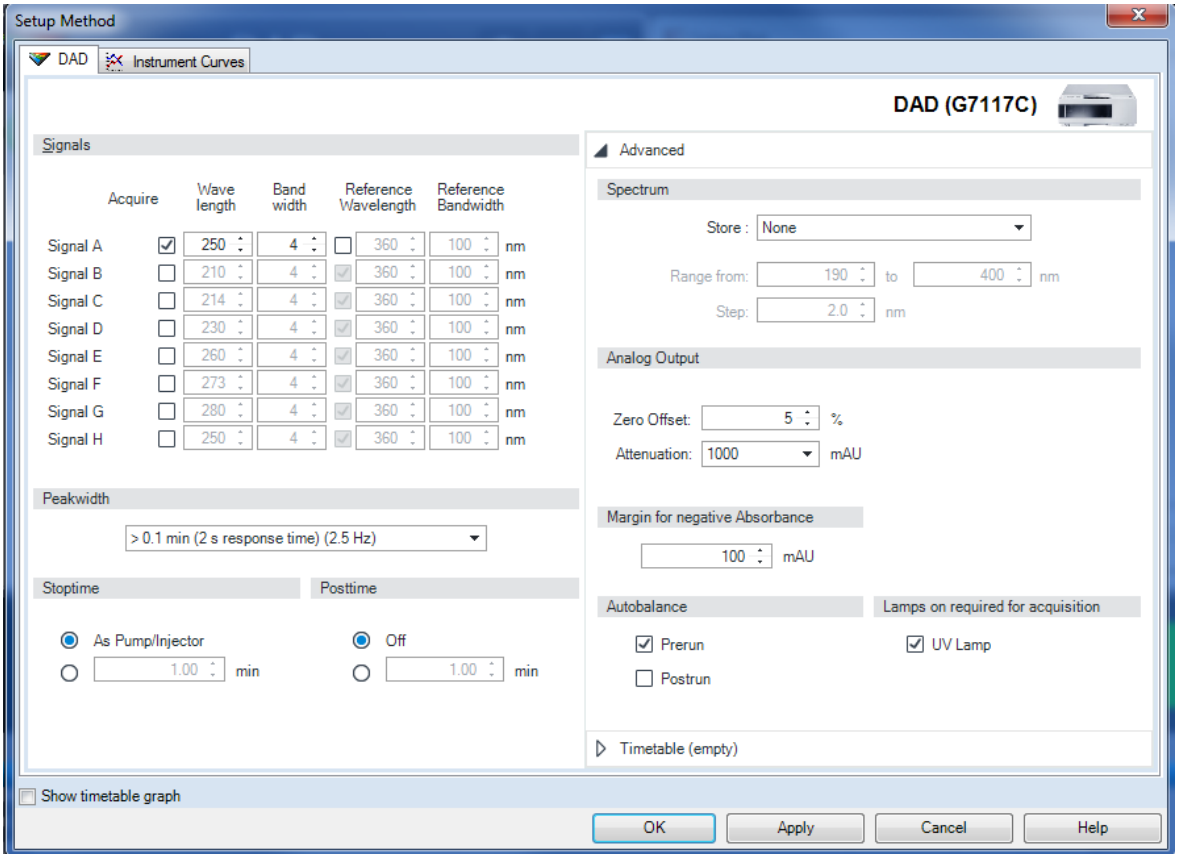
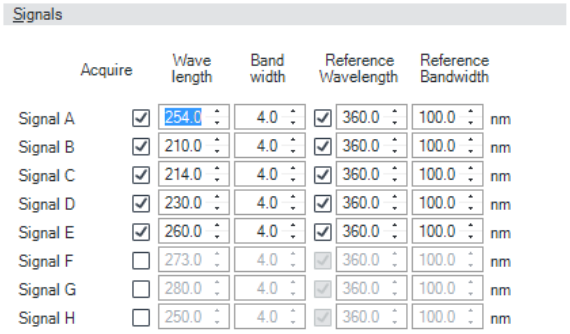


Figure 16: Method parameter settings

NOTE For additional help and support: Highlight the desired cell and press **F1**. A help screen will open with additional information and documentation about the topic.

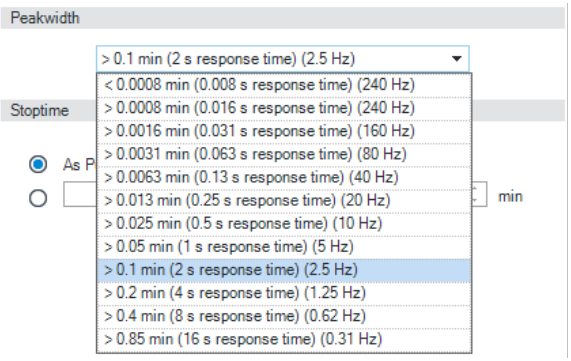
Table 13: Method Parameter Settings



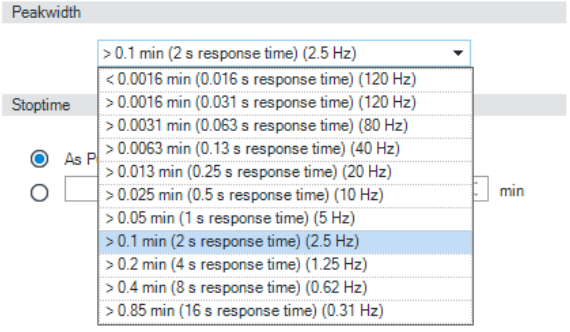
Signals
Up to 8 individual signals can be set. For each of the signals, the wavelength and bandwidth can be set for sample and reference.

Limits:
- Wavelength: 190.0 to 640.0 nm in steps of 0.1 nm
- Bandwidth: 1.0 to 400.0 nm in steps of 0.1 nm

Setting an appropriate reference wavelength could improve the baseline behavior.

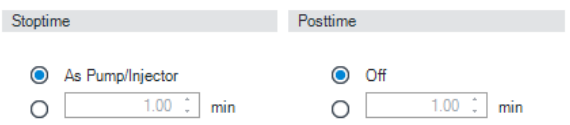


G7117B Peakwidth Settings

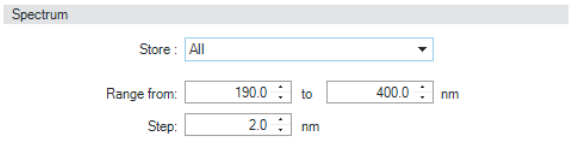


G7117A/C Peakwidth Settings

Peakwidth (Responsetime, Data Rate)
Peakwidth enables you to select the peak width (response time) for your analysis. The peak width is defined as the width of a peak, in minutes, at half the peak height. Set the peak width to the narrowest expected peak in your chromatogram. The peak width sets the optimum response time for your detector. The peak detector ignores any peaks that are considerably narrower, or wider, than the peak width setting. The response time is the time between 10 % and 90 % of the output signal in response to an input step function. When the All spectrum storage option is selected, then spectra are acquired continuously depending on the setting of the peak width. The time specified by the peak width is used as a factor in the acquisition of spectra. The acquisition time for one spectrum is slightly less than the peak width divided by 8 , which is the acquisition time.
Limits: When you set the peak width (in minutes), the corresponding response time is set automatically and the appropriate data rate for signal and spectra acquisition is selected.
Do not use peak width shorter than necessary.
G7117A: Do not use 0.025 s response time (no filtering/high noise and no need (actually ultra-fast LC doesn't deliver peaks <0.0025 min/<0.15 s).
NOTE: The G7117A and the G7117C have a data rate of up to 120 Hz. The G7117B has a data rate of up to 240 Hz.
For details see Peak Width (Response Time) on page 87.



Stoptime/Posttime
The stoptime is the time where either the complete system stops (**As Pump/Injector**) or the module (if different from system stop time). The data collection is stopped at this time. A posttime period can be used to allow module's items to equilibrate (e.g. after gradient change or temperature change).



Spectrum Settings

- None
- All
- Range (from - to)
- Step width

Analog Output

The range can be set to either 100 mV or 1 V full scale, see Detector Control Settings on page 73.

- **Zero Offset**: 1 – 99 % in steps of 1 % (5 % equal to 50 mV).
- **Attenuation**: 0.98 – 2000 mAU at discrete values for either 100 mV or 1 V full scale.

Margin for negative Absorbance

Use this field to modify the detector's signal handling to increase the margin for negative absorbance. Use this option if, for example, your solvent gradient produces a decreasing baseline absorbance, and for GPC analyses.

Limits: 100 to 4000 mAU.

The higher the value the greater the baseline noise. Set this value only if you expect negative absorbance greater than -100 mAU.

Slitwidth (G7117B): You can select the optical bandwidth (1, 2, 4 or 8 nm) of the detector; the narrower the slit, the smaller the optical bandwidth of the instrument, but the lower its sensitivity. The smaller the optical bandwidth the higher the spectral resolution.

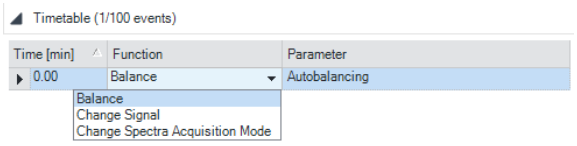
Slitwidth The G7117A and G7117C have a fixed slit width of 4 nm.

Autobalance

Defines, whether a balance is performed prior to a run and/or after a run has finished.

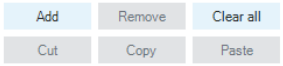
Lamp on required for acquisition:

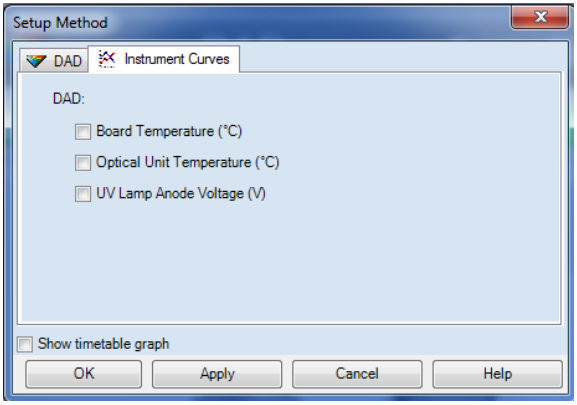
If unchecked, the lamp will be turned off after the analysis has finished. Note that the lamp on requires at least one hour warm-up time, see Warm up of the Detector on page 104.

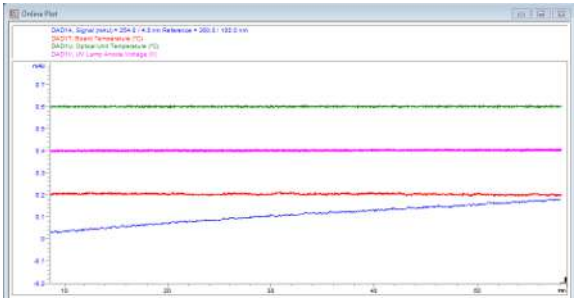


Timetable

You may set up time events to change functions with their parameters over the run time. Add lines as required.
Time Limits: 0.00 to 99999.00 min in steps of 0.01 min.
Via the buttons in the bottom area, time table lines can be added, removed, cut copied, pasted or completely cleared.
Based on the chosen function, a certain parameter can be selected.







Instrument Curves

The detector has several signals (internal temperatures, voltages of lamps) that can be used for diagnosing problems. These can be baseline problems deriving from deuterium lamps wander / drift problems due to temperature changes.
These signals can be used in addition to the normal baseline signal to determine whether correlation to temperature or voltage/current of the lamp.
These signals are available via the Agilent ChemStation Online Plot/Data Signal and/or Agilent Lab Advisor Software.

5 Optimizing the Performance of the Module

This chapter provides information on how to optimize the module.

Introduction

The detector has a variety of parameters that can be used to optimize performance. Depending on whether signal or spectral data need to be optimized, different settings are recommended. The following sections describe optimization for:

- signal sensitivity, selectivity and linearity,
- spectral sensitivity and resolution (DAD only), and
- disk space required for storing data.

NOTE

The information in this chapter should be seen as a basic introduction to diode array detector techniques. Some of these techniques may not be available in the instrument software controlling the detector.

How to Get the Best Detector Performance

The information below will guide you on how to get the best detector performance. Follow these rules as a start for new applications. It gives rules-of-thumb for optimizing detector parameters.

Optimization Overview

Table 14: Optimization overview

Parameter	Impact
1 Selection of flow cell	• peak resolution versus sensitivity
• Choose flow cell according to used column (Choosing a Flow Cell on page 81).	
2 Connection of flow cell	• chromatographic resolution
3 Setting the peak width (response time)	• peak resolution versus sensitivity versus disk space
• Use peak width according Choosing a Flow Cell on page 81 as starting point. • Set the peak-width close to the width of a narrow peak of interest in your chromatogram.	
4 Setting wavelength and bandwidth	
• Sample wavelength: ◦ Never miss a peak by the use of a browser wavelength like 250 nm with 100 nm bandwidth. ◦ Select specific wavelength with reduced optical bandwidth if you need selectivity, e.g. 254.0 nm / 4 nm and 360.0 nm / 100 nm as reference wavelength. ◦ Set the sample wavelength to a peak or valley to get best linearity in general; select a valley to get best linearity for high concentrations.	• sensitivity versus selectivity • sensitivity versus linearity
• Reference wavelength: ◦ Select the reference wavelength with broad bandwidth (30...100 nm) wavelength range where your analytes have little or no absorbance (e.g. sample at 254 nm, reference at 320 nm). ◦ Select the reference wavelength as near as possible to the UV range.	• baseline drift due to RI effects.
5 Setting the slit width (G7117B only)	

Parameter	Impact
• Use 4 nm slit for normal applications. • Use narrow slit (e.g 1 nm) if your analytes have narrow absorbance bands and for high concentrations. • Use a wide slit (e.g. 8 nm) to detect very low concentrations. • Optimizing spectral acquisition (DAD only) • Set the spectral wavelength range (for colorless samples 190...400 nm is sufficient). • Set step to 4 nm for normal use; set small step (and slit width) if high resolution of spectra with fine structure is wanted.	• spectral resolution, sensitivity and linearity.

Choosing a Flow Cell

Several flavors of the Max-Light Cartridge Flow Cell are available, see Table 15 on page 81.

Table 15: Specifications for Max-Light Cartridge Flow Cells

Cartridge Cells	• G4212-60008 (Max-Light Cartridge Cell (10 mm, V(σ) 1.0 µL)) • G4212-60007 (Max-Light Cartridge Cell (60 mm, V(σ) 4.0 µL)) • G4212-60032 (HDR Max-Light Cartridge Cell (3.7 mm, V(σ) 0.9 µL)) • G4212-60038 (ULD Max-Light Cartridge Cell (10 mm, V(σ) 0.6 µL)) • G4212-60011 (Max-Light Cartridge Test Cell) • G7117-60020 (Max-Light Cartridge Cell LSS (10 mm, V(σ) 1.0 µL))
Maximum pressure	70 bar (1015 psi) Maximum Operating Pressure (MOP) [8] 150 bar (2175 psi) Maximum Incidential Pressure (MIP) [9]
pH range	1.0-12.5 (solvent dependent)

8 Maximum operating pressure (MOP): Maximum pressure at which a system can operate continuously under normal conditions.

9 Maximum incidental pressure (MIP): The maximum pressure which the system can experience during a short time.

High Sensitivity

If higher sensitivity is necessary, the G4212-60007 (Max-Light Cartridge Cell (60 mm, V(σ) 4.0 µL)) can be used. This cell enhances the detector by lowering the limit of detection (LOD) by a factor of about 3 (depending on the application).

Normal Applications

The G4212-60008 (Max-Light Cartridge Cell (10 mm, V(σ) 1.0 µL)) covers a wide range of applications:

- all column diameter down to at least 2.1 mm ID or even less
- applications with peak dispersion (Peakwidth x flow) down to ~2 µL [example: pw = 0.04 min at flow = 0.1 mL/min gives peak dispersion of 0.04 min x 0.1 mL/min = 0.004 mL = 4 µL]

Ultra-Low Dispersion

The Max-Light Cartridge ULD cell can be used with the G7117A DAD FS and G7117B DAD. The cell is a requirement for the Ultra-Low Dispersion Kit solution which currently exists as 5067-5189 (InfinityLab Ultra-Low Dispersion Kit) . The cell should be part of the ultra-low dispersion solution.

High Dynamic Range

The Max-Light Cartridge HDR cell can be used with the G7117A DAD FS and G7117B DAD. The cell is required as a part of the High Dynamic Range (HDR) solution.

NOTE

To protect the flow cell against overpressure (e.g. in systems with LC/MS) install G4212-68001 (Inline Pressure Relief Valve Kit) , see Inline Pressure Relief Valve Kit (G4212-68001) on page 84.

Recommendations

For G4212-60007 and G4212-60008

The use of Peek-FS capillaries is not recommended. In combination with the SST zero dead volume fitting (e.g. at the inlet) the capillary could break and the glass particles could block/damage the flow cell.

Light-Sensitive Samples (LSS) Aperture (G7117-60101) for Max-Light Cartridge Cell LSS 10 mm

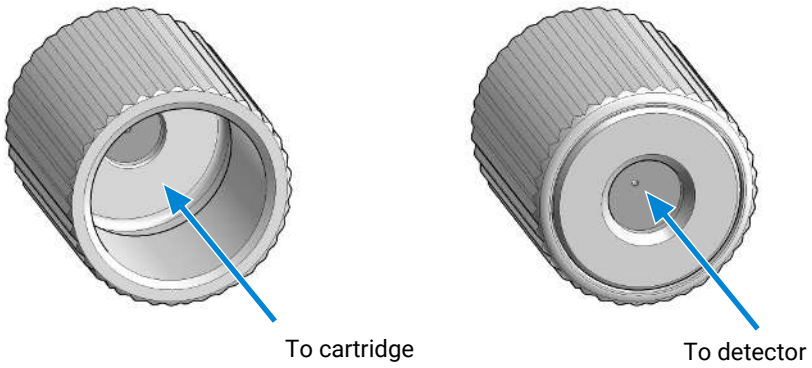


Figure 17: Aperture G7117-60101

- The Aperture should be installed for light-sensitive samples, which are likely to undergo photodegradation.
- The Aperture reduces the intensity of the light entering the cell and thus limits the photodegradation effects.
- The use of the Aperture increases the detector noise; for this reason, the use of the aperture is recommended for the light-sensitive samples only.
- The flow cell performance without the installed Aperture is the same as of the standard Max-Light Cartridge Cell 10 mm.

To install the Aperture, simply screw it on the light inlet of the G7117-60020 (Max-Light Cartridge Cell LSS (10 mm, V(σ) 1.0 µL)) . Do not apply any tools to affix the Aperture. Finger-tight fixation is enough. Make sure that the Aperture is aligned with the light path and does not obstruct the light path (not tilted in relation to the light axis). Check that after installation, the light intensity is approximately 10 % of the original.

Store the Aperture in a clean environment protected from dust. During installation and deinstallation wear powder-free gloves to protect the Aperture from possible contamination.

When performing detector tests in Lab Advisor, remove the Aperture.

Aperture is not compatible with other Max-Light Cartridges. It can only be installed on the G7117-60020 (Max-Light Cartridge Cell LSS (10 mm, V(σ) 1.0 µL)) .

Inline Pressure Relief Valve Kit (G4212-68001)

When several detectors are installed in a system the connecting capillary and fittings between the detectors must be carefully chosen to keep chromatographic influence on peak shape small. On the other hand narrow bore connection capillaries generate a significant pressure drop dependent on flow rate and solvent properties.

The pressure relief valve is designed to protect the Max-Light Cartridge Flow Cell. Agilent Technologies strongly recommend installing the pressure relief valve at the outlet of the detector as soon as a second detector is installed like in LC/MS applications.

The pressure relief valve is a low internal volume check valve. The dead volume is smaller than 100 nL delay volume (inlet to outlet). The ball of the check valve is spring loaded and adjusted to open at typically 80 bar. On overpressure (typically above 80 bar) it releases the pressure to waste.

Application Information

For the analysis and characterization of proteins and large biomolecules, and applications with mobile phases of a pH above 12.5 it is recommended to use an Agilent Diode Array Detector G1315C/D and G7115A (or Multiple Wavelength Detector G1365C/D and G7165A) and the respective bio-inert flow cell.

Special Information of 60 mm Cartridge Flow Cell

Application Information

The geometrical volume of the 60 mm cell is 6 times larger than the 10 mm cell. However, the chromatographic relevant dispersion volume, the square roots of variances, accounting for cell specific geometrical volume shape and fluidic flow pattern, have been determined as σV = 4 µL and σV = 1 µL in for the 10 mm cell.

Due to the larger dispersion volume, the 60 mm cell is primarily designed for 4.6 mm column applications to achieve highest sensitivity with no additional peak broadening. However, if sensitivity is important the 60 mm cell will also be advantageous in case of smaller columns (3 mm, 2.1 mm) but depending on the chromatographic system and method additional peak broadening might occur.

The upper limit of concentration

Care should be taken in methods where high background absorption of solvents or modifiers are present. When using the 60 mm cell the detector will measure 6 times the background absorption as in case of the 10 mm cell, which will reduce the remaining dynamic absorbance range for sample peaks. Furthermore those UV absorbing modifiers could compromise the sensitivity gain (signal/noise) of 60 mm cell.

The linearity limit of the detector is seen at about 2 AU for both, the 10 mm and the 60 mm Max-Light Cartridge Flow Cell. Using firmware revision B.06.25 and below, the 60 mm Max-Light Cartridge Cell linearity limit would be 333 mAU/cm.

Optimizing for Sensitivity, Selectivity, Linearity and Dispersion

Flow Cell Path Length

Lambert-Beer's law shows a linear relationship between the flow cell path length and absorbance.

$$\text{Absorbance} = -\log T = \log \frac{I_0}{I} = \varepsilon \times C \times d$$

where

T is the transmission, defined as the quotient of the intensity of the transmitted light I divided by the intensity of the incident light, I_0,

ε is the extinction coefficient, which is a characteristic of a given substance under a precisely-defined set of conditions of wavelength, solvent, temperature and other parameters,

C [mol/L] is the concentration of the absorbing species, and

d [m] is the path length of the cell used for the measurement.

The detector can now output the signal in two forms:

1. In Absorbance divide by the path length AU/cm, that is then similar to [ε x C]. Advantage: samples with same concentration have same peak height also at cells with different path lengths.

   The upper limit of concentration: the linearity limit of the detector is then seen at about 2 AU/path length, so for the 6 cm Max-Light Cartridge Cell the linearity limit is 333 mAU/cm].
2. In AU that is equal to ε x C x d like normal done in the past: now for recalculation to your concentration C the path length must be considered.

Therefore, flow cells with longer path lengths yield higher signals. Although noise usually increases little with increasing path length, there is a gain in signal-to-noise ratio.

When increasing the path length, the cell volume could increase. Depending on the peak volume, this could cause more peak dispersion.

As a rule-of-thumb the flow cell volume should be about 1/3 of the peak volume at half height. To determine the volume of your peaks, take the peak width as reported in the integration results multiply it by the flow rate and divide it by 3).

NOTE

This may result in problems when the used peak width is set to large and all peaks are filtered accordingly.

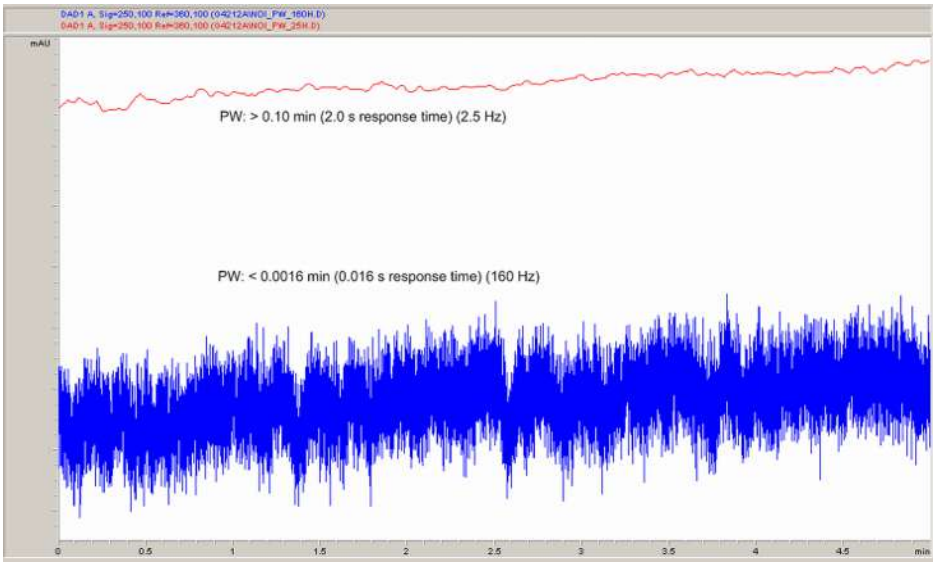
Traditionally LC analysis with UV detectors is based on comparing measurements with internal or external standards. To check photometric accuracy of the Agilent detector it is necessary to have more precise information on path lengths of the detector flow cells.

Part Number	Path Length	Cell Volume (σ)
G4212-60008/G5615-60018	1.0 cm	1.0 µL
G4212-60007/G5615-60017	6.0 cm	4.0 µL

Peak Width (Response Time)

Response time describes how fast the detector signal follows a sudden change of absorbance in the flow cell. The detector uses digital filters to adapt response time to the width of the peaks in your chromatogram. These filters do not affect peak area nor peak symmetry. When set correctly, such filters reduce baseline noise significantly (Influence of Response Time on Signal and Noise), but reduce peak height only slightly. In addition, these filters reduce the data rate to allow optimum integration and display of your peaks and to minimize disk space required to store chromatograms and spectra.

Response time = 2 s



Response time = 0.016 s

Slit width = 4 nm

Figure 18: Influence of response time on signal and noise

Table 16 on page 88 and Table 17 on page 89 list the filter choices of the detector. To get optimum results, set peak width as close as possible to a narrow peak of interest in your chromatogram. Response time will then be approximately 1/3 of the peak width, resulting in less than 5 % peak-height reduction and less than 5 % additional peak dispersion. Decreasing the peak width setting in the detector will result in less than 5 % gain in peak height but baseline noise will increase by a factor of 1.4 for a factor of 2 response-time reduction. Increasing the peak width (response time) by a factor of two from the recommended setting (over-filtering) will reduce peak height by about 20 % and reduce baseline noise by a factor of 1.4 . This gives you the best possible signal-to-noise ratio, but may affect peak resolution.

Table 16: Peak Width — Response Time — Data Rate (G7117B)

Peak width at half height [min] [10]	Response [s]	Signal data rate [Hz]	Scan data rate [HZ] ≤126 pts/scan	Scan data rate [HZ] ≤251 pts/scan	Scan data rate [HZ] ≤501 pts/scan	Scan data rate [HZ] >501 pts/scan
< 0.00078125	0.0078125	240	240	80	40	20
> 0.00078125	0.015625	240	240	80	40	20

10 Values in the User Interface may be rounded

Peak width at half height [min] [10]	Response [s]	Signal data rate [Hz]	Scan data rate [HZ] ≤126 pts/scan	Scan data rate [HZ] ≤251 pts/scan	Scan data rate [HZ] ≤501 pts/scan	Scan data rate [HZ] >501 pts/scan
> 0.0015625	0.03125	160	160	80	40	20
> 0.003125	0.0625	80	80	80	40	20
> 0.00625	0.125	40	40	40	40	20
> 0.0125	0.25	20	20	20	20	20
> 0.025	0.5	10	10	10	10	10
> 0.05	1	5	5	5	5	5
> 0.1	2	2.5	2.5	2.5	2.5	2.5
> 0.2	4	1.25	1.25	1.25	1.25	1.25
> 0.4	8	0.625	0.625	0.625	0.625	0.625
> 0.85	16	0.3125	0.3125	0.3125	0.3125	0.3125

Table 17: Peak Width — Response Time — Data Rate (G7117A/G7117C)

	Peak width at half height [min] [10]	Response [s]	Scan data rate[Hz] ≤ 251 pts/scan	Scan data rate[Hz] ≤ 501 pts/scan	Scan data rate[Hz] > 501 pts/scan
< 0.0015625	0.015625	120	120	40	20
> 0.0015625	0.03125	120	120	40	20
> 0.003125	0.0625	80	80	40	20
> 0.00625	0.125	40	40	40	20
> 0.0125	0.25	20	20	20	20
> 0.025	0.5	10	10	10	10
> 0.05	1	5	5	5	5
> 0.1	2	2.5	2.5	2.5	2.5
> 0.2	4	1.25	1.25	1.25	1.25
> 0.4	8	0.625	0.625	0.625	0.625
> 0.85	16	0.3125	0.3125	0.3125	0.3125

NOTE

The maximum spectra scan rate depends on the data points per scan, see Table 16 on page 88 and Table 17 on page 89. Running at 160 Hz, the spectra scan data rate is reduced automatically if the spectra scan data rate is more than 251 points/scan.

Sample and Reference Wavelength and Bandwidth

The detector measures absorbance simultaneously at wavelengths from 190 to 640 nm. A UV-lamp provides good sensitivity over the whole wavelength range.

If you know little about the analytes in your sample, store all spectra over the full wavelength range. This provides full information but fills up your disk space rather quickly. Spectra can be used to check a peak's purity and identity. Spectral information is also useful to optimize wavelength settings for your chromatographic signal.

The detector can compute and store at run time up to 8 signals with these properties:

- sample wavelength, the center of a wavelength band with the width of sample bandwidth (BW), and optionally
- reference wavelength, the center of a wavelength band with the width of reference bandwidth.

The signals comprises a series of data points over time, with the average absorbance in the sample wavelength band minus the average absorbance of the reference wavelength band.

Signal A in the detector default method is set to sample 254.0/4, reference 360.0/100, that is, the average absorbance from 252 – 256 nm minus the average absorbance from 310 – 410 nm. As all analytes show higher absorbance at 252 – 256 nm than at 310 – 410 nm, this signal will show you virtually every compound which can be detected by UV absorbance.

Many compounds show absorbance bands in the spectrum. Gradient Analysis of PTH-Amino Acids shows the spectrum of anisic acid as an example. To optimize for lowest possible detectable concentrations of anisic acid, set the sample wavelength to the peak of the absorbance band (that is, 252 nm) and the sample bandwidth to the width of the absorbance band (that is, 30 nm). A reference of 360,100 is adequate. Anisic acid does not absorb in this range.

If you work with high concentrations, you may get better linearity above 1.5 AU by setting the sample wavelength to a valley in the spectrum, like 225 nm for anisic acid.

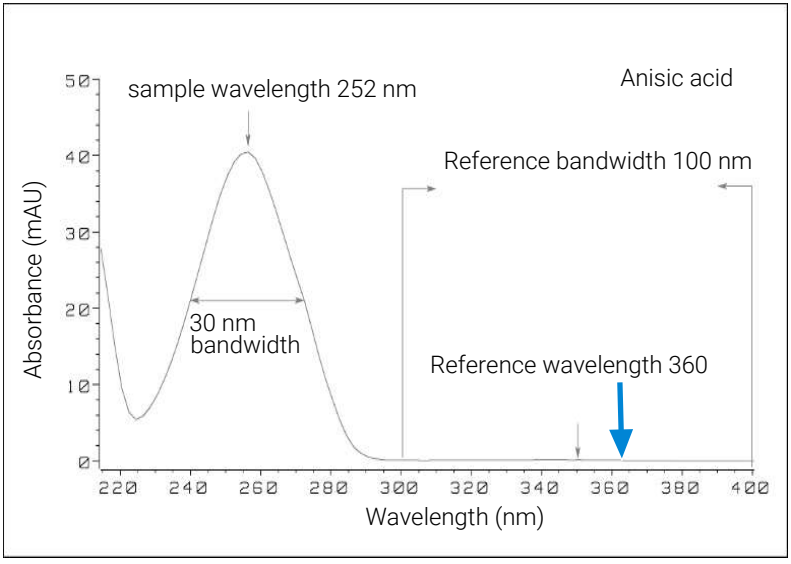


Figure 19: Optimization of wavelength setting

A wide bandwidth has the advantage of reducing noise by averaging over a wavelength range — compared to a 4 nm bandwidth, the baseline noise is reduced by a factor of approximately 2.5, whereas the signal is about 75 % of a 4 nm wide band. The signal-to-noise ratio for a 30 nm bandwidth is twice that for a 4 nm bandwidth in our example.

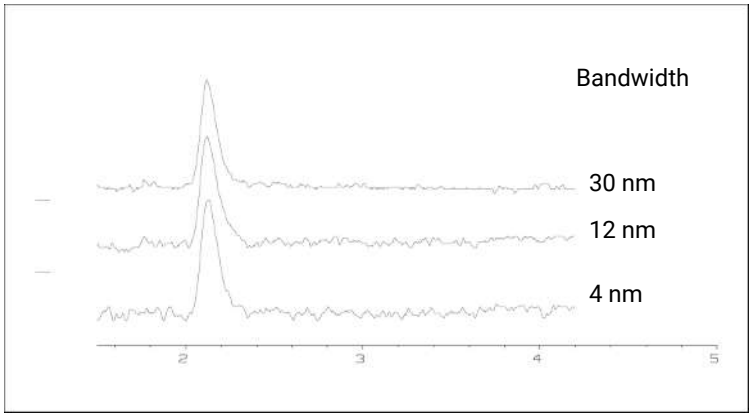


Figure 20: Influence of bandwidth on signal and noise

Because the detector averages absorbance values that are calculated for each wavelength, using a wide bandwidth does not negatively impact linearity.

The use of a reference wavelength is highly recommended to further reduce baseline drift and wander induced by room temperature fluctuations or refractive index changes during a gradient.

Slit Width (G7117B)

The 1290 Infinity DAD (G7117B) has a variable slit at the entrance of the spectrograph. This is an effective tool to adapt the detector to changing demand of different analytical problems.

A narrow slit provides spectral resolution for analytes with very fine structures in the absorbance spectrum. An example of such a spectrum is benzene. The five main absorbance bands (fingers) are only 2.5 nm wide and just 6 nm apart from each other.

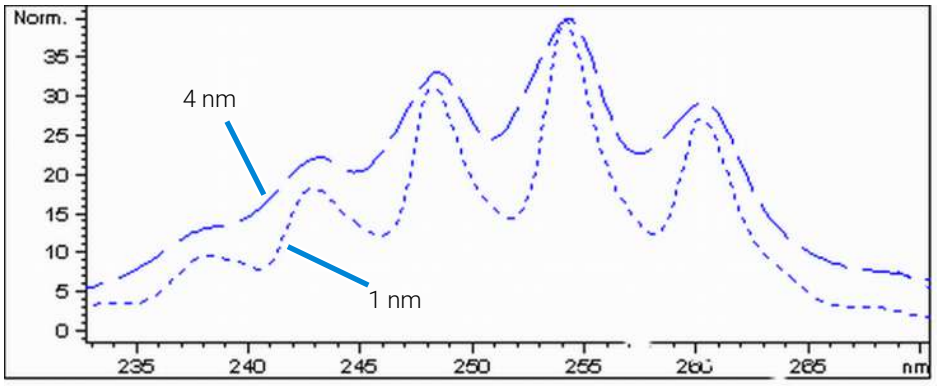


Figure 21: Benzene at 1 and 4 nm slit width (principle)

A wide slit uses more of the light shining through the flow cell. This gives lower baseline noise as shown in.Figure 22 on page 93

Slit width = 1 nm

Slit width = 8 nm

Data Rate = 160 Hz

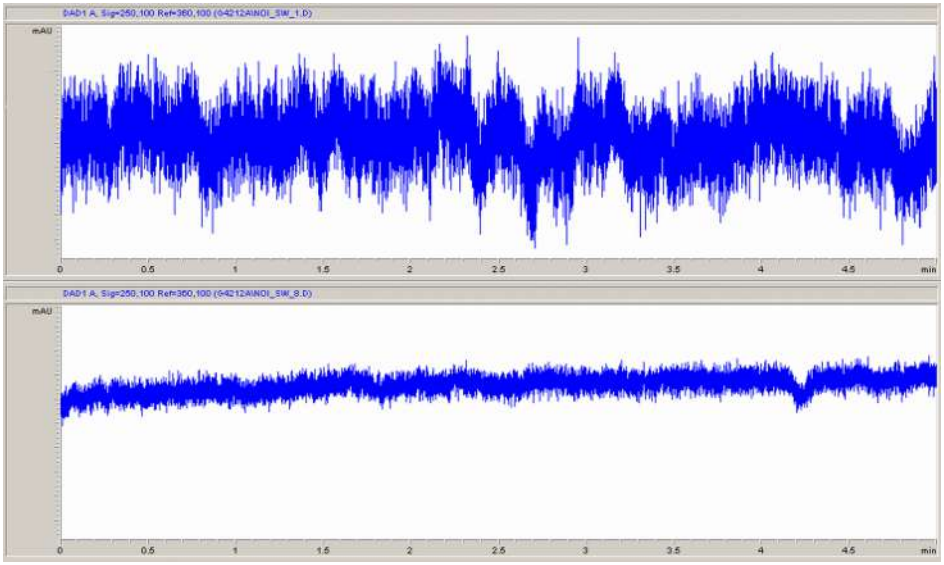


Figure 22: Influence of the slit width on baseline noise

However, with a wider slit, the spectrograph's optical resolution (its ability to distinguish between different wavelengths) diminishes. Any photodiode receives light within a range of wavelength determined by the slit width. This explains why the fine spectral structure of benzene disappears when using a 8 nm wide slit.

Furthermore, the absorbance is no longer strictly linear with concentration for wavelengths at a steep slope of a compound's spectrum.

Substances with fine structures and steep slopes like benzene are very rare.

In most cases the width of absorbance bands in the spectrum is more like 30 nm as with anisic acid (Figure 19 on page 91).

In most situations, a slit width of 4 nm will give the best results.

Use a narrow slit (1 or 2 nm) if you want to identify compounds with fine spectral structures or if you need to quantify at high concentrations (> 1000 mAU) with a wavelength at the slope of the spectrum. Signals with a wide bandwidth can be used to reduce baseline noise. Because (digital) bandwidth is computed as average of absorbance, there is no impact on linearity.

Use a wide (8 nm) slit when your sample contains very small concentrations. Always use signals with bandwidth at least as wide as the slit width.

Optimizing Spectral Acquisition

Storage of all spectra consumes a lot of disk space. It is very useful to have all spectra available during optimization of a method or when analyzing unique samples. However when running many samples of the same type, the large size of data files with all spectra may become a burden. The detector provides functions to reduce the amount of data, yet retaining the relevant spectral information.

Range

Only the wavelength range where the compounds in your sample absorb contains information that is useful for purity checks and library searches. Reducing the spectrum storage range saves disk space.

Step

Most substances have broad absorbance bands. Display of spectra, peak purity and library search works best if a spectrum contains 5 to 10 data points per width of the absorbance bands. For anisic acid (the example used before) a step of 4 nm would be sufficient. However a step of 2 nm gives a more optimal display of the spectrum.

Margin for Negative Absorbance

The detector adjusts its gain during *balance* such that the baseline may drift slightly negative (about -100 mAU). In some special case, for example, when gradient with absorbing solvents are used, the baseline may drift to more negative values.

Only for such cases, increase the margin for negative absorbance to avoid overflow of the analog-to-digital converter.

Optimizing Selectivity

Quantifying Coeluting Peaks by Peak Suppression

In chromatography, two compounds may often elute together. A conventional dual-signal detector can only detect and quantify both compounds independently from each other if their spectra do not overlap. However, in most cases this is highly unlikely.

With a dual-channel detector based on diode-array technology, quantifying two compounds is possible even when both compounds absorb over the whole wavelength range. The procedure is called peak suppression or signal subtraction. As an example, the analysis of hydrochlorothiazide in the presence of caffeine is described. If hydrochlorothiazide is analyzed in biological samples, there is always a risk that caffeine is present which might interfere chromatographically with hydrochlorothiazide. As the spectra in Figure 23 on page 96 shows, hydrochlorothiazide is best detected at 222 nm, where caffeine also shows significant absorbance. It would therefore be impossible, with a conventional variable wavelength detector, to detect hydrochlorothiazide quantitatively when caffeine is present.

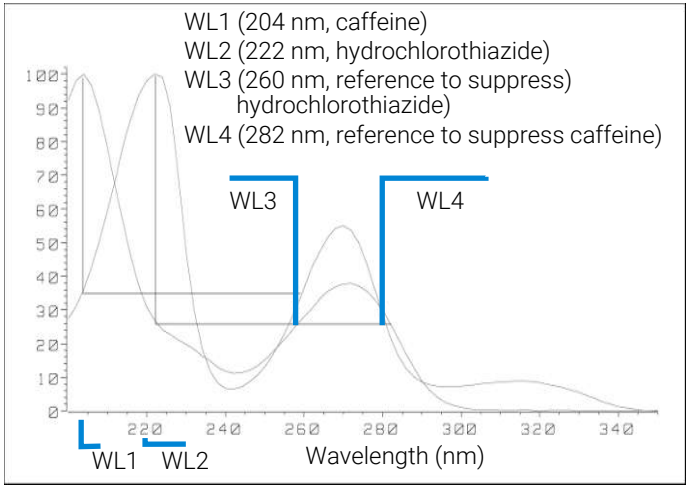


Figure 23: Wavelength selection for peak suppression

With a UV-visible detector based on a diode array and the correct choice of a reference wavelength setting, quantitative detection is possible. To suppress caffeine, the reference wavelength must be set to 282 nm. At this wavelength, caffeine shows exactly the same absorbance as at 222 nm. When the absorbance values are subtracted from each another, any indication of the presence of caffeine is eliminated. In the same way, hydrochlorothiazide can be suppressed if caffeine is to be quantified. In this case the wavelength is set to 204 nm and the reference wavelength to 260 nm. Figure 24 on page 97 shows the chromatographic results of the peak suppression technique.

The trade-off for this procedure is a loss in sensitivity. The sample signal decreases by the absorbance at the reference wavelength relative to the signal wavelength. Sensitivity may be decreased by as much as 10–30 %.

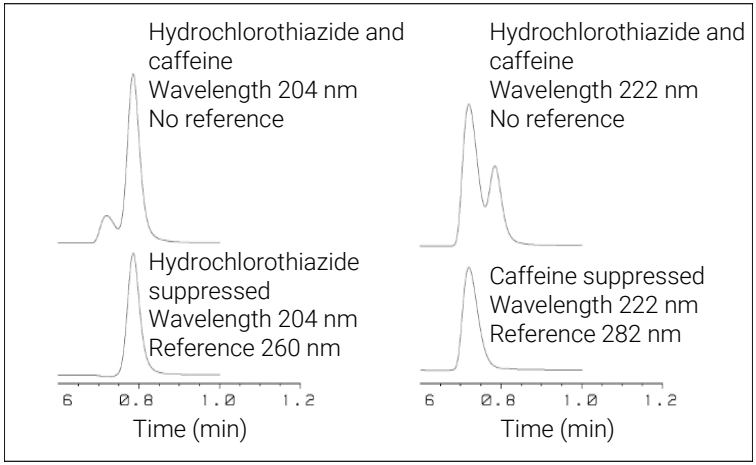


Figure 24: Peak suppression using reference wavelength

Optimizing the Detector Regarding to the System

Delay Volume and Extracolumn Volume

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

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

Extra-Column Volume

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

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

How to Configure the Optimum Delay Volume

To maintain resolution in the DAD / DAD FS the 10 mm Max-Light cartridge cell has a low dispersion volume (σ volume 1.0 µL) and no further volume optimization is required. In situations where the alternative 60 mm Max-Light high sensitivity cell is used to get higher sensitivity the cell volume is optimized for the use with 3 mm and 4.6 mm inner diameter columns.

How to Achieve Higher Sensitivity

The detector has a number of parameters that are used to optimize performance. The following sections describe how the detector parameters affect performance characteristics:

- Flow cell affects sensitivity,
- Wavelength and bandwidth affect sensitivity, selectivity and linearity,
- Slit width affects sensitivity, spectral resolution and linearity,
- Peak width affects sensitivity and resolution.

Flow Cell

The Max-Light cartridge flow cell has a standard 10 mm path length and is optimized for minimal volume and dispersion (σ volume 1.0 µL). It has high light transmission minimizing noise to reduce noise due to the optofluidic waveguide. It is suitable for use with a wide range of analytical columns from short narrow-bore columns to long standard diameter (4.6 mm) columns. Generally the peak dispersion volume (calculated from peak width x flow rate) should be greater than about 2 µL for this cell (for example 0.02 min x 200 µL/min = 4 µL).

The Max-Light high sensitivity cell has a path length of 60 mm and this will give between three and five times increase in signal-to-noise values depending on the application conditions. The dispersion volume is fractionally increased compared to the standard cell.

Wavelength and Bandwidth

The detector measures absorbance simultaneously at wavelengths from 190 nm to 640 nm using diode-array detection. A UV-lamp provides good sensitivity over the whole wavelength range. The diode-array detector (DAD) can simultaneously compute and send to the data system up to eight chromatographic signals and the full-range spectra at every time point.

A UV chromatogram or signal is a plot of absorbance data versus time and is defined by its wavelength and bandwidth.

- The wavelength indicates the center of the detection band.
- The bandwidth defines the wavelength range over which the absorbance values are averaged to give the result at each time point.

For example, a signal at wavelength 250 nm with a bandwidth of 16 nm will be an average of the absorbance data from 242 nm to 258 nm. Additionally, a reference wavelength and reference bandwidth can be defined for each signal. The average absorbance from the reference bandwidth centered on the reference wavelength will be subtracted from its equivalent value at the signal wavelength to produce the output chromatogram.

The signal wavelength and bandwidth can be chosen so that they are optimized for:

- Broad band universal detection
- Narrow band selective detection
- Sensitivity for a specific analyte.

Broad band or universal detection works by having a wide bandwidth to detect any species with absorbance in that range. For example, to detect all absorbing molecules between 200 nm and 300 nm set a signal at 250 nm with a bandwidth of 100 nm. The disadvantage is that sensitivity will not be optimal for any one of those molecules. Narrow band or selective detection is used most often. The UV spectrum for a particular molecule is examined and an appropriate absorbance maximum is selected. If possible, the range where solvents absorb strongly should be avoided (below 220 nm for methanol, below 210 nm for acetonitrile). For example, in Figure 25 on page 101, anisic acid has a suitable absorbance maximum at 252 nm. A narrow bandwidth of 4 nm to 12 nm generally gives good sensitivity and is specific for absorbance in a narrow range.

The narrow band can be optimized for sensitivity for a specific molecule. As the bandwidth is increased the signal is reduced but so is the noise and there will be an optimum for best S/N. As an approximate guide, this optimum is often close to the natural bandwidth at half-height of the absorption band in the UV spectrum. In the anisic acid example this is 30 nm.

The analytical wavelength is usually set at a wavelength maximum to increase sensitivity to that molecule. The detector is linear up to 2 AU and beyond for many applications. This offers a wide linear range for concentration. For high concentration analysis the concentration linear range can be extended by setting the wavelength to one with a lower absorbance such as a wavelength minimum or by taking a wider bandwidth which usually includes lower absorbance values. The use of wavelength maxima and minima for quantitation dates back to conventional UV detectors which because of mechanical tolerances in moving gratings needed to avoid steeply sloping parts of the spectrum. Diode-array based detectors do not have this limitation but for reasons of convention maxima and minima are chosen in preference to other parts of the spectrum.

The reference bandwidth is normally set on a region of the UV spectrum in which the analyte has no absorbance. This is shown in the spectrum for anisic acid in Figure 25 on page 101. This spectrum is typical of many small molecules containing a UV chromophore. For best results the reference has been set so that it is a wide band as close to the signal wavelength as possible but on a zero absorbance region. Reference bandwidths of 60 nm to 100 nm are commonly used. The default reference is 360 nm with a bandwidth of 100 nm. A wide bandwidth is used because this reduces the noise in the reference signal (from statistical theory, the error, i.e. noise in this case, is reduced by the square root of the number of determinations). It is important that the reference bandwidth does not extend to a part of the spectrum that has some absorbance as this would then reduce the resulting signal and sensitivity would be reduced. The use of a reference wavelength can help to reduce drift or wander in the chromatogram caused by refractive index changes due to room temperature fluctuation or gradient operation. The effect of a reference signal can be easily tested by setting two otherwise identical signals, one with and one without a reference signal. If there is no part of the spectrum with zero absorbance then it will be better to have the reference signal turned off.

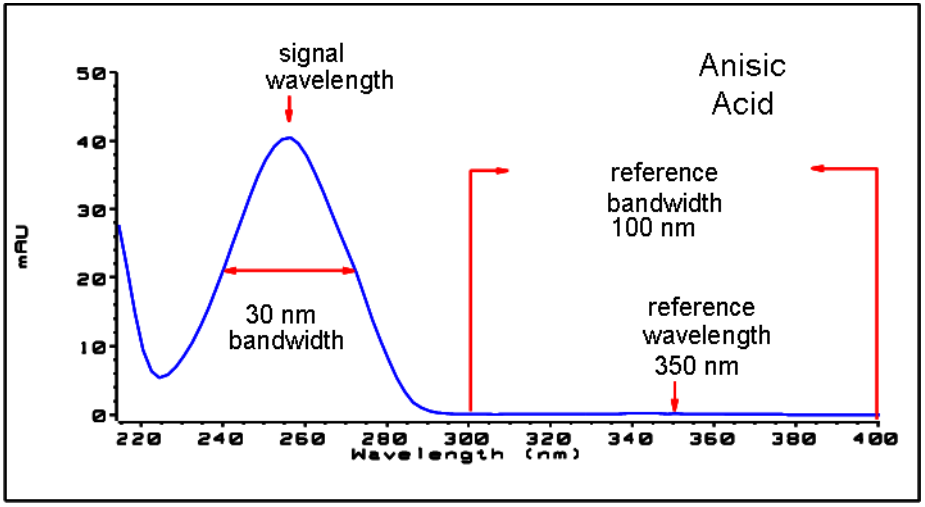


Figure 25: Spectrum of Anisic Acid

Peak Width, Response Time and Data Collection Rate

The peak width setting, response time and data rate in the detector are all linked. The available settings are shown in Table 18 on page 102 and in Table 19 on page 103. It is important to set this correctly for optimum sensitivity and to preserve the resolution achieved in the separation.

The detector internally acquires data points faster than is needed for a chromatogram and processes them to produce the signal seen by the data system. Part of the processing reduces the data to an appropriate data rate which allows the chromatographic peaks to be accurately drawn. As with most analytical determinations groups of readings are effectively averaged to reduce error in the result. The detector bunches raw data points and produces the output signal data at the required data collection rate by an electronic filtering process. If the resulting data rate is too slow (over filtering) the peak heights will be reduced and the resolution between them reduced; too fast and the data is noisier than it need be to accurately profile narrow peaks.

The *peak width* setting in the detector allows the user to correctly set these parameters without needing any knowledge other than sight of the chromatogram integration results to see how wide the peaks are. The peak width setting should be set for the narrowest peak width observed in the chromatogram. If it is set too wide it will make the peaks appear lower in height and wider (and potentially less resolved) and if it is set too narrow it will increase the baseline noise unnecessarily. Essentially the software uses this value to set the *data collection rate* such that it collects enough data points over the narrowest peaks and it is aiming for 15 to 25 points across a peak. The 1290 Infinity DAD can collect at a maximum up to 240 Hz if required which would allow enough data points to be collected over a peak that is only 0.1 s wide. The *response time* setting is another way of indicating how this filtering is set. It is measured in seconds and is about one-third of the peak width value (which is measured in minutes). It effectively shows how quickly the plotted signal responds to a step change in the input signal.

NOTE

The full spectra is not available under all conditions.
Based on the data points, the scan data rate is reduced, see Table 18 on page 102 and Table 19 on page 103.

Table 18: Peak Width — Response Time — Data Rate (G7117B)

Peak width at half height [min] [11]	Response [s]	Signal data rate [Hz]	Scan data rate [HZ] ≤126 pts/scan	Scan data rate [HZ] ≤251 pts/scan	Scan data rate [HZ] ≤501 pts/scan	Scan data rate [HZ] >501 pts/scan
< 0.00078125	0.0078125	240	240	80	40	20
> 0.00078125	0.015625	240	240	80	40	20
> 0.0015625	0.03125	160	160	80	40	20

11 Values in the User Interface may be rounded

Peak width at half height [min] [11]	Response [s]	Signal data rate [Hz]	Scan data rate [HZ] ≤126 pts/scan	Scan data rate [HZ] ≤251 pts/scan	Scan data rate [HZ] ≤501 pts/scan	Scan data rate [HZ] >501 pts/scan
> 0.003125	0.0625	80	80	80	40	20
> 0.00625	0.125	40	40	40	40	20
> 0.0125	0.25	20	20	20	20	20
> 0.025	0.5	10	10	10	10	10
> 0.05	1	5	5	5	5	5
> 0.1	2	2.5	2.5	2.5	2.5	2.5
> 0.2	4	1.25	1.25	1.25	1.25	1.25
> 0.4	8	0.625	0.625	0.625	0.625	0.625
> 0.85	16	0.3125	0.3125	0.3125	0.3125	0.3125

Table 19: Peak Width — Response Time — Data Rate (G7117A/G7117C)

	Peak width at half height [min] [11]	Response [s]	Scan data rate[Hz] ≤ 251 pts/scan	Scan data rate[Hz] ≤ 501 pts/scan	Scan data rate[Hz] > 501 pts/scan
< 0.0015625	0.015625	120	120	40	20
> 0.0015625	0.03125	120	120	40	20
> 0.003125	0.0625	80	80	40	20
> 0.00625	0.125	40	40	40	20
> 0.0125	0.25	20	20	20	20
> 0.025	0.5	10	10	10	10
> 0.05	1	5	5	5	5
> 0.1	2	2.5	2.5	2.5	2.5
> 0.2	4	1.25	1.25	1.25	1.25
> 0.4	8	0.625	0.625	0.625	0.625
> 0.85	16	0.3125	0.3125	0.3125	0.3125

NOTE

The maximum spectra scan rate depends on the data points per scan, see Table 18 on page 102 and Table 19 on page 103. Running at 240 , the spectra scan data rate is reduced automatically if the spectra scan data rate is more than 251 points/scan.

Warm up of the Detector

Give the optical unit enough time to warm-up and stabilize (> 60 minutes). The detector is temperature controlled. After turn-on of the detector, it goes through a cycle of different states:

- 0 to 0.5 minutes the heater control is OFF and the heater element runs at 0 % duty cycle.
- 0.5 to 1 minutes the heater control is OFF and the heater element runs at 66% duty cycle. This first minute is used as self-test of the heater functionality.
- 1 to 30 minutes the heater control is OFF and the heater element runs at 40% duty cycle.
- After 30 minutes the heater control is ON and is working with optimized parameters to get the optical unit into the optimal temperature window stabilized.

This cycle starts

- when the detector is turned off/on
- when the lamp is turned off/on

to ensure that the temperature control operates in a defined control range.

NOTE

The times to stabilize the baseline may vary from instrument to instrument and depends on the environment. The example below was done under stable environmental conditions.

The figures below show the first two hours of a detector warm-up phase. The lamp was turned on immediately after turn on of the detector.

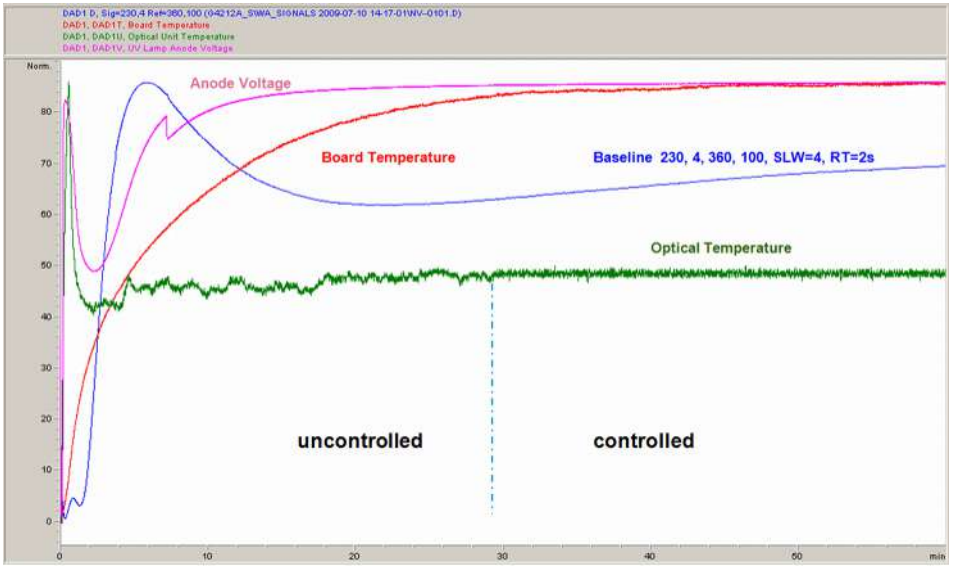


Figure 26: Detector Warm-up – 1st hour

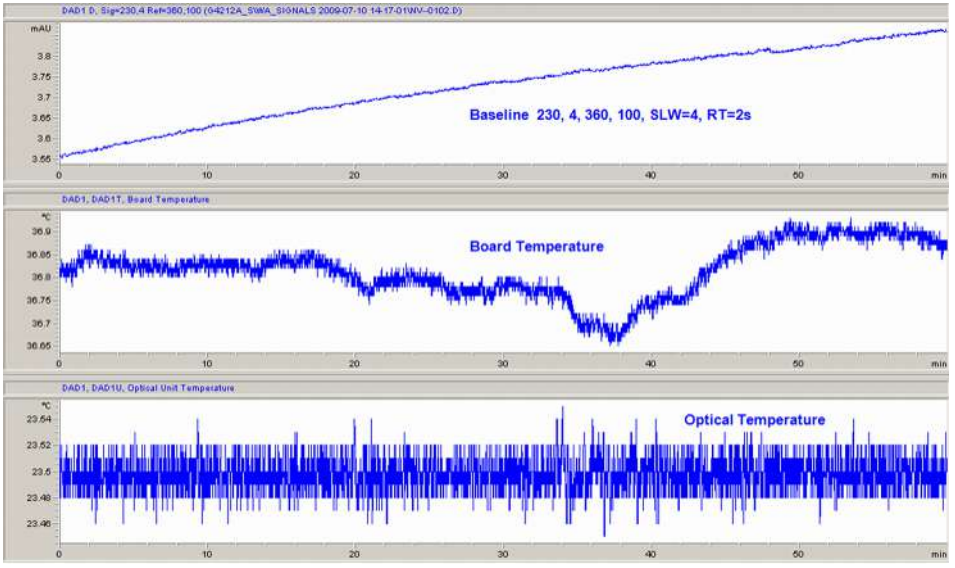


Figure 27: Detector Warm-up – 2nd hour

6 Diagnostics and Troubleshooting

This chapter gives an overview of the maintenance, troubleshooting, and diagnostic features available.

Diagnostic Features

This section gives an overview of the diagnostic features available.

User Interfaces

InfinityLab Assist

InfinityLab Assist provides you with assisted troubleshooting and maintenance at your instrument.

If the system in use supports the InfinityLab Assist, follow the instructions provided. Else, the preferred solution is to use Agilent Lab Advisor Software.

- Depending on the user interface, the available tests and the screens/reports may vary.
- The preferred tool for troubleshooting and diagnostics should be Agilent Lab Advisor Software, see Agilent Lab Advisor Software on page 143.
- Screenshots used within these procedures are based on the Agilent Lab Advisor Software.

Troubleshooting With HPLC Advisor

Baseline, Peak Shape, Pressure, Retention related issues, can be solved using the HPLC Advisor App. For more information, see Troubleshooting Reversed-Phase Chromatographic Techniques With HPLC Advisor.

If using an InfinityLab Assist, navigate to **Health** > **Troubleshooting** to help solve baseline, peak shape, pressure, and retention related issues.

Overview of Available Tests and Tools

Tests and Calibrations in Agilent Lab Advisor

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

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

Maintenance and Troubleshooting Tools of the Module

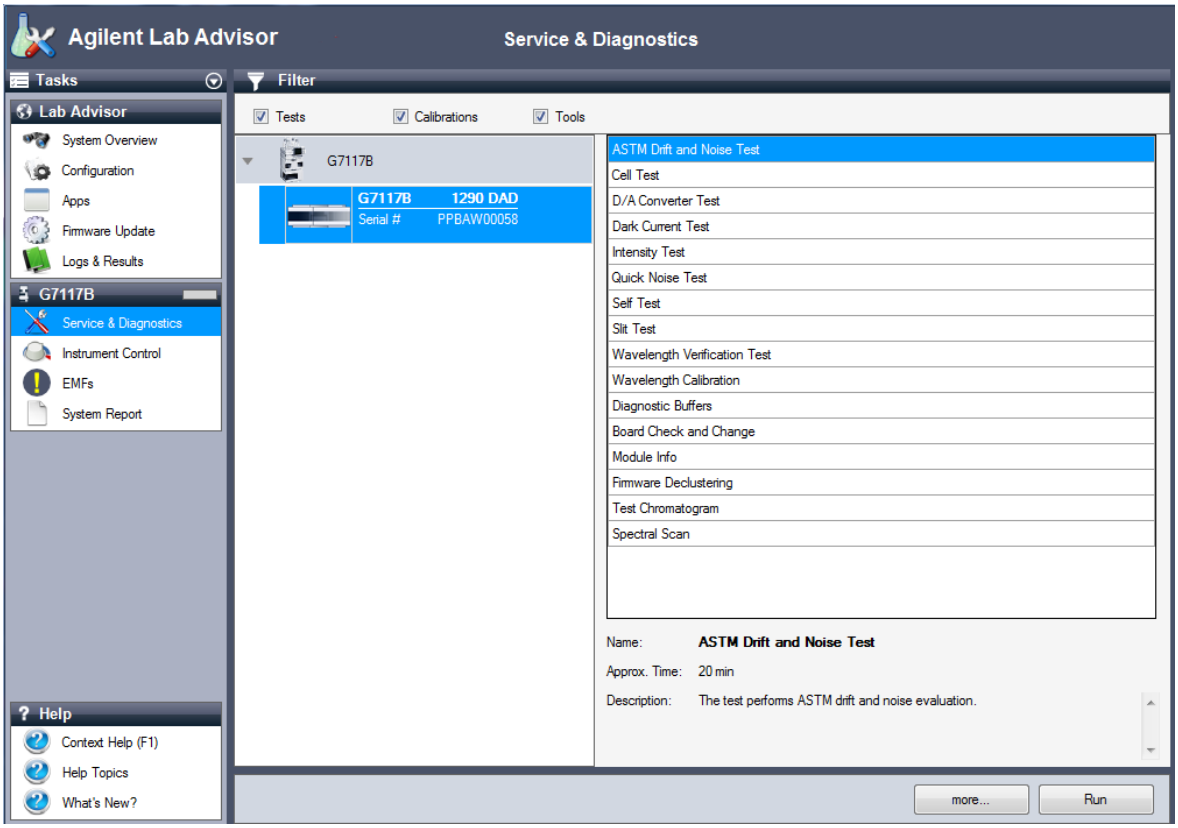
This chapter describes the tests for the module.

Available Tests vs User Interfaces

NOTE

Depending on the used interface, the available tests and the screens/reports may vary.
Preferred tool should be the Agilent Lab Advisor, see Agilent Lab Advisor Software on page 143.
Agilent Lab Advisor B.02.08 or later is required.
The Instant Pilot (G4208A) supports the G7117A/B with B.02.19 and the G7117C with B.02.20 or later.

- Preferred tool should be the Agilent Lab Advisor software, see Agilent Lab Advisor Software on page 143.
- Screenshots used within these procedures are based on the Agilent Lab Advisor software.



Introduction

All tests are described based on the Agilent Lab Advisor Software B.02.08. Other user interfaces may not provide any test or just a few.

For details on the use of the interface refer to the interface documentation.

The Lab Advisor shows the available test under Service & Diagnostics.

Table 20: Interfaces and available test functions

Interface	Comment	Available Function
Agilent Lab Advisor	For functions, refer to Function Overview Lab Advisor • See Table 21 on page 111	Available functions depend on Product Level (Basic – Advanced – FSE)
Agilent ChemStation	No tests available Adding of temperature/lamp signals to chromatographic signals possible	• Temperature main board • Temperature optical unit • Lamp anode voltage

Function Overview Lab Advisor

Table 21: Function Overview Lab Advisor Basic/Advanced (G7117A/G7117B/G7117C)

Functions	Product Level	
Tests		
- ASTM Drift and Noise Test	Basic	Advanced
- Cell Test	Basic	Advanced
- D/A Converter Test	Basic	Advanced
- Dark Current Test	Basic	Advanced
- Intensity Test	Basic	Advanced
- Quick Noise Test	Basic	Advanced
- Self Test	Basic	Advanced
- Slit Test (G7117B only)	Basic	Advanced
- Wavelength Verification Test	Basic	Advanced
Calibrations		
- Wavelength Calibration	Basic	Advanced
Tools		
- Diagnostic Buffers	Basic	Advanced
- Module Info	Basic	Advanced
- Test Chromatogram	Basic	Advanced
- Spectral Scan	Basic	Advanced

Functions	Product Level	
Controls		
- Advanced Method Parameters		
2 lamp required		Advanced
- Analog Output 1 Attenuation		Advanced
- Analog Output 1 Offset [% Full Scale]		Advanced
- Configuration		
- Remote Pulse Duration [s] *	Basic	Advanced
- Analog Output 1 Range		Advanced
- Control		
- UV Lamp	Basic	Advanced
- Balance Detector		Advanced
- Conversions		
- G7117B allows G7117A, G4212A, G4212B	Basic	Advanced
- 7117A allows G4212B	Basic	Advanced
- G7117C allows G4212B	Basic	Advanced
- Method Parameters		
- Set Signal C		Advanced
- Set Signal B		Advanced
- Set Signal A		Advanced
- Set Data Rate [Hz]		Advanced
- Module Information		
- Identify Module	Basic	Advanced
- Special Commands		
- Lamp tag required	Basic	Advanced
- Clear Error	Basic	Advanced
- Cell tag required	Basic	Advanced
- Detector Reset	Basic	Advanced
Actuals		

Functions	Product Level	
- Signal A [mAU]		Advanced
Statemachines		
- UV Lamp	Basic	Advanced
Signals		
- Signal A [mAU]		Advanced
- Lamp Voltage [V]		Advanced
- Board Temperature [°C]		Advanced
- Optical Temperature [°C]		Advanced
EMF Counters		
- Accumulated UV Lamp On-Time	Basic	Advanced
- Number of UV Lamp Ignitions	Basic	Advanced
- Current UV Lamp On-Time	Basic	Advanced

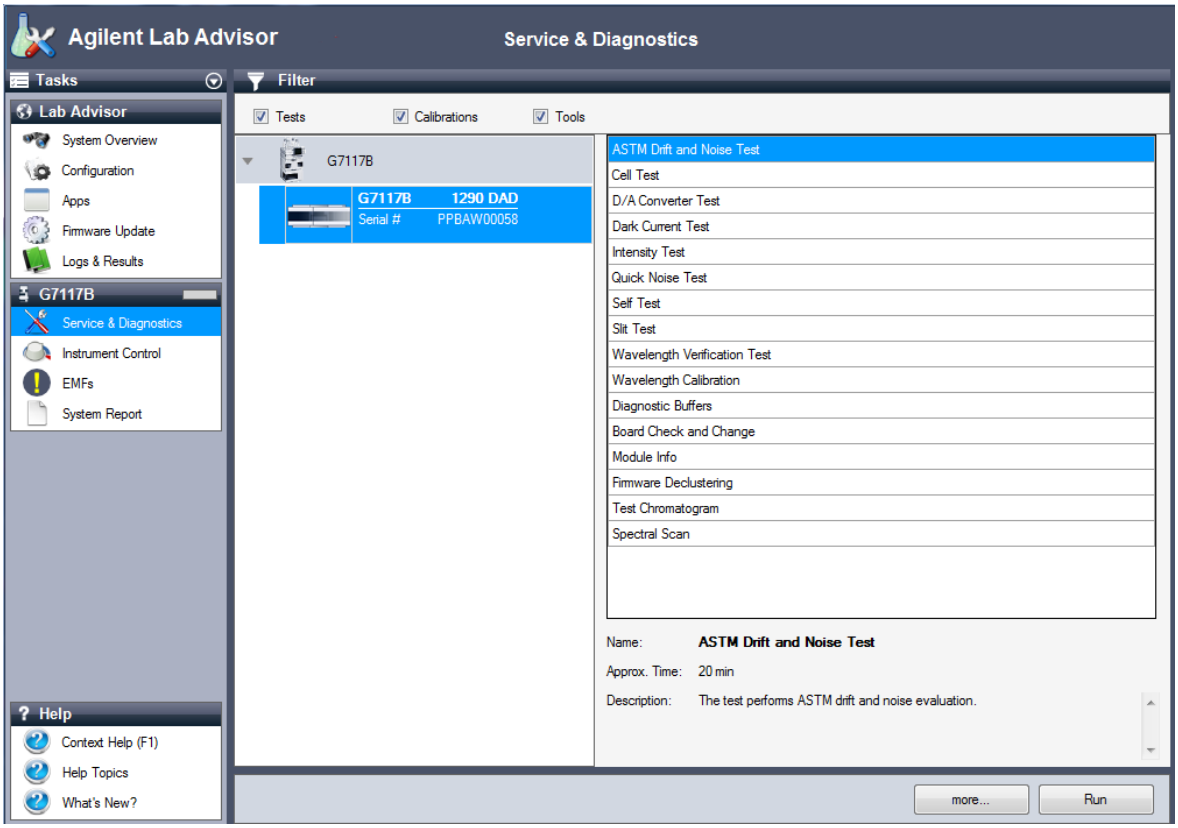


Figure 28: The Lab Advisor shows the available test

Use of Max-Light Cartridge Test Cell

The Max-Light Cartridge Test Cell is recommended to be used for several tests instead of the Max-Light Cartridge Cell (10 mm, V(σ) = 1 µL) or the Max-Light Cartridge Cell (60 mm, V(σ) = 4 µL) because it allows running the test(s) without any influence of the rest of the system (degasser, pump, sampler and others).

The results of the test cell are comparable with the Max-Light Cartridge Cell (10 mm, V(σ) = 1 µL) filled with water, e.g. Intensity Profile. Only the Absorbance value is higher on the Max-Light Cartridge Cell.

If the profile of the Max-Light Cartridge Cell differs in the low UV range, then absorbing solvents are in the cell and should be flushed out. See also Clean the Max-Light Cartridge Cell on page 189.

NOTE

When using the Max-Light Cartridge Cell for tests/calibrations, it should be run at 0.5 mL/min constant flow with water. This assures that the light path is always flushed.

Below table gives an idea on the signal height variation of the Max-Light Cartridge Cells compared to Max-Light Cartridge Test Cell.

Table 22: Max-Light Cartridge Cells compared to Max-Light Cartridge Test Cell

Part Number	Description	Signal Height (typical)
G4212-60011	Max-Light Cartridge Test Cell	100 %
G4212-60008	Max-Light Cartridge Cell 10 mmV(σ) = 1 µL	~ 100 %
G4212-60007	Max-Light Cartridge Cell 60 mmV(σ) = 4 µL	~ 100 %
G4212-60032	Max-Light Cartridge Cell HDR (3.7 mm, V(σ) 0.9 µL)	100 %
G4212-60017	Max-Light Cartridge Cell ULD (10 mm, V(σ) 0.6 µL)	100 %
G7117-60020	Max-Light Cartridge Cell LSS (10 mm, V(σ) 1.0 µL)	~ 100 %

Conditions of Detector

The test usually should be performed with a detector turned on for at least one hour, so that the temperature regulation of the optical unit is working (not active during the first 30 minutes after turn on). If the detector is on, tests can be performed usually 10 minutes after the UV-lamp has been turned on.

Failing a Test

If a test fails with the Max-Light Cartridge Cell repeat the test with the Max-Light Cartridge Test Cell and compare. If the test fails also, then start with proposed actions mentioned in the details of the tests.

Self-Test

The self-test runs a series of individual tests (described on the next pages), and evaluates the results automatically. The following tests are run:

- Slit Test (G7117B only)
- Dark Current Test
- Intensity Test
- Wavelength Verification Test
- ASTM Noise Test, a simplified version of the ASTM Drift and Noise Test (without testing the Drift)

When

- For complete detector check.

Parts required

Qty.	p/n	Description
1		Max-Light Cartridge Cell (filled with water) , or
1		Max-Light Cartridge Test Cell

Preparations

- Lamp must be on for at least 10 minutes.
- For noise test a longer warm-up time may be required (> 2 hours).
- When using a Max-Light Cartridge Cell a flow rate of 0.5 mL/min with water is required.

1 Run the **Self-Test** with Agilent Lab Advisor (for further information see Online-Help of user interface).

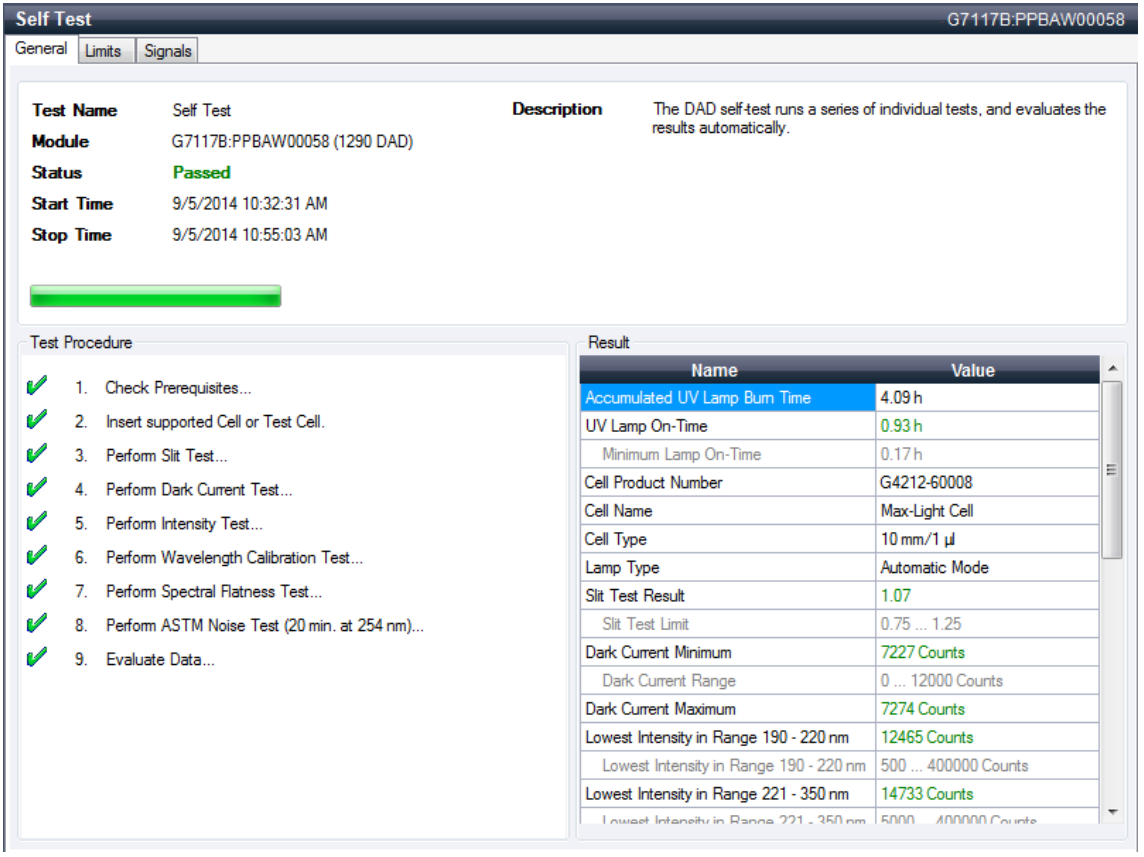


Figure 29: Self-Test – Results

Under the tab **Signals** you can find the detailed signals from the tests.

Intensity Test

The intensity test measures the intensity of the UV-lamp over the full wavelength range (190 - 640 nm). Four spectral ranges are used to evaluate the intensity spectrum. The test is used to determine the performance of the lamp and optics (see also Cell Test on page 120). When the test is started, the 1-nm slit is moved into the light path automatically (G7117B only). On the G7117A/G7117C, the 4 nm fixed slit is used. To eliminate effects due to absorbing solvents, the test should be done with water in the Max-Light Cartridge Cell or with the Max-Light Cartridge Test Cell. The shape of the intensity spectrum is primarily dependent on the lamp, grating, and diode array characteristics. Therefore, intensity spectra will differ slightly between instruments.

When

- In case of UV-lamp problem (drift, noise).

Parts required

Qty.	p/n	Description
1		Max-Light Cartridge Cell (filled with water) , or
1		Max-Light Cartridge Test Cell

Preparations

- Lamp must be on for at least 10 minutes.

1 Run the **Intensity-Test** with Agilent Lab Advisor (for further information see Online-Help of user interface).

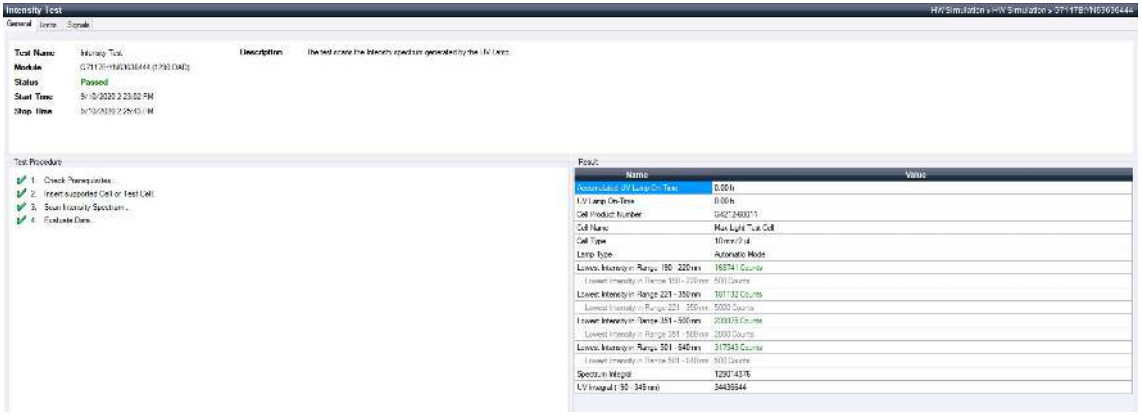


Figure 30: Intensity Test – Results

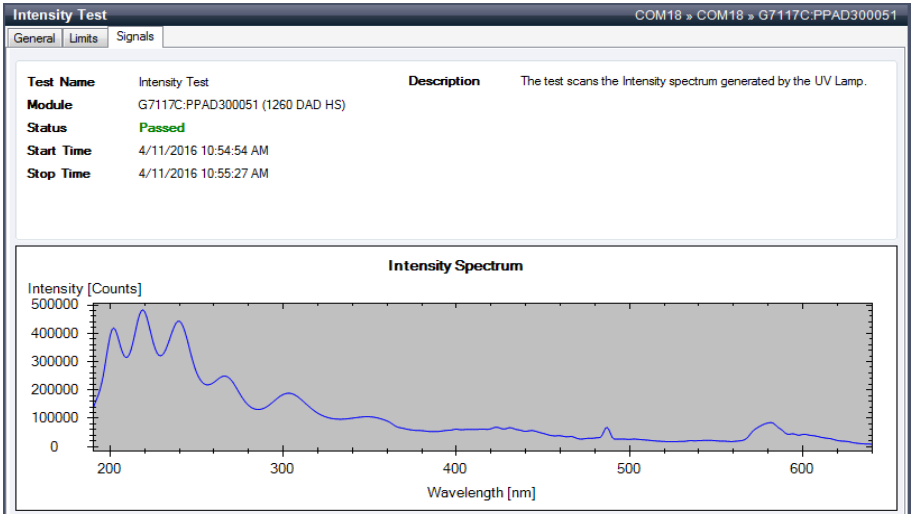


Figure 31: Intensity Test – Signals

Test Failed

Intensity Test Evaluation

NOTE

If only one range fails and the application does not require this range, the lamp may not be changed.

Probable cause		Suggested actions
1	Absorbing solvent or air bubble in flow cell.	• Ensure the flow cell is filled with water, and free from air bubbles. • Repeat test without flow cell and compare results.
2	Incorrect calibration	• Recalibrate and repeat the test.
3	Dirty or contaminated flow cell.	• Run the cell test. If the test fails, flush the flow cell. See also Clean the Max-Light Cartridge Cell on page 189.
4	Dirty or contaminated optical components.	• Please contact your Agilent service representative.
5	Old UV-lamp.	• Exchange the UV lamp.
6	Defect optical unit.	• If the test fails with flow cell and new UV-lamp, please contact your Agilent service representative.

Cell Test

The cell test measures the intensity of the UV-lamp over the full wavelength range (190 - 690 nm), once with the Max-Light Cartridge Cell installed, and once with the Max-Light Cartridge Test Cell. The resulting intensity ratio is a measure of the amount of light absorbed by the Max-Light Cartridge flow cell. The test can be used to check for dirty or contaminated flow cell windows. When the test is started, the 1-nm slit is moved into the light path automatically (G7117B only). On the G7117A/G7117C, the 4 nm fixed slit is used.

This test should be performed initially with a new detector/flow cell. The values should be kept for later reference/comparison.

When

- In case of low intensity or noise and drift problem.

Parts required

Qty.	p/n	Description
1		Max-Light Cartridge Cell (filled with water)
1		Max-Light Cartridge Test Cell

Preparations

- Lamp must be on for at least 10 minutes.
- When using a Max-Light Cartridge Cell a flow rate of 0.5 mL/min with water is required.

1 Run the **Cell-Test** with Agilent Lab Advisor (for further information see Online-Help of user interface).

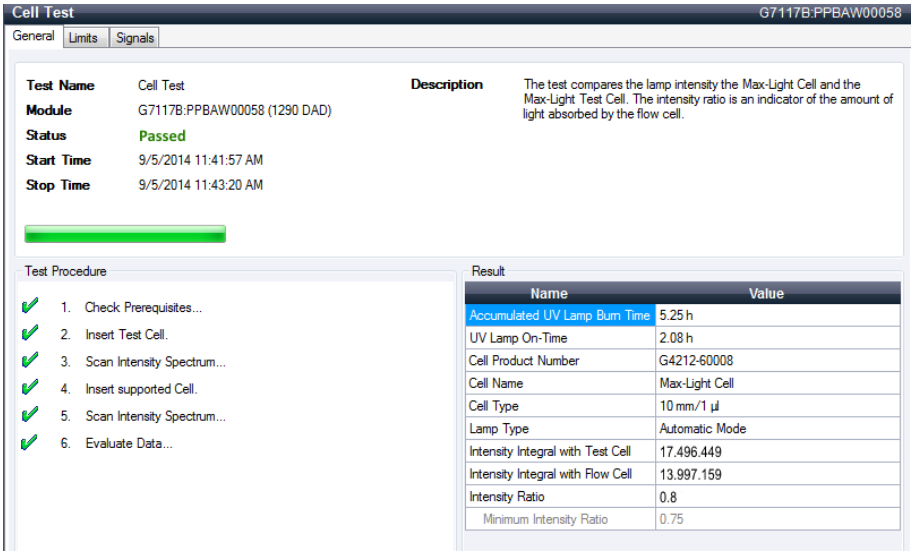


Figure 32: Cell Test – Results

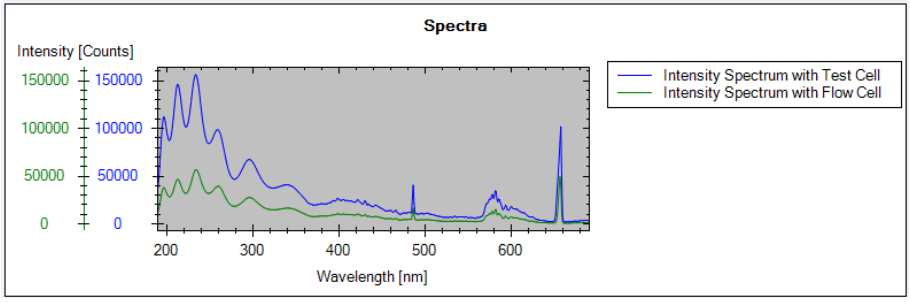


Figure 33: Cell Test – Signals (example shows low intensity for flow cell)

Test Failed (low ratio value)

Cell Test Evaluation

Probable cause		Suggested actions
1	Absorbing solvent or air bubble in flow cell.	• Ensure the flow cell is filled with water, and free from air bubbles.
2	Dirty or contaminated flow cell.	• Clean the flow cell as described in Clean the Max-Light Cartridge Cell on page 189.

Quick Noise Test

The quick noise test measures the noise of the detector, with Max-Light Cartridge Cell or with Max-Light Cartridge Test Cell installed, in one minute intervals over a total of 5 minutes.

The noise of the detector is calculated by using the maximum amplitude for all random variations of the detector signal of frequencies greater than one cycle per hour. The noise is determined for 5 one minute intervals and is based on the accumulated peak-to-peak noise for the intervals. At least seven data points per cycles are used in the calculation. The cycles in the noise determination are not overlapping.

If the test is performed with the Max-Light Cartridge Test Cell, the test results are not influenced by solvent or pump effects.

When

- In case of noise and drift problem.

Parts required

Qty.	p/n	Description
1		Max-Light Cartridge Cell (filled with water)
1		Max-Light Cartridge Test Cell

Preparations

- Detector and UV-lamp must be on for at least 2 hours.
- ASTM measurements based on specifications may require longer stabilization times.
- When using a Max-Light Cartridge Cell a flow rate of 0.5 mL/min with water is required.

1 Run the **Quick Noise Test** with Agilent Lab Advisor (for further information see Online-Help of user interface).

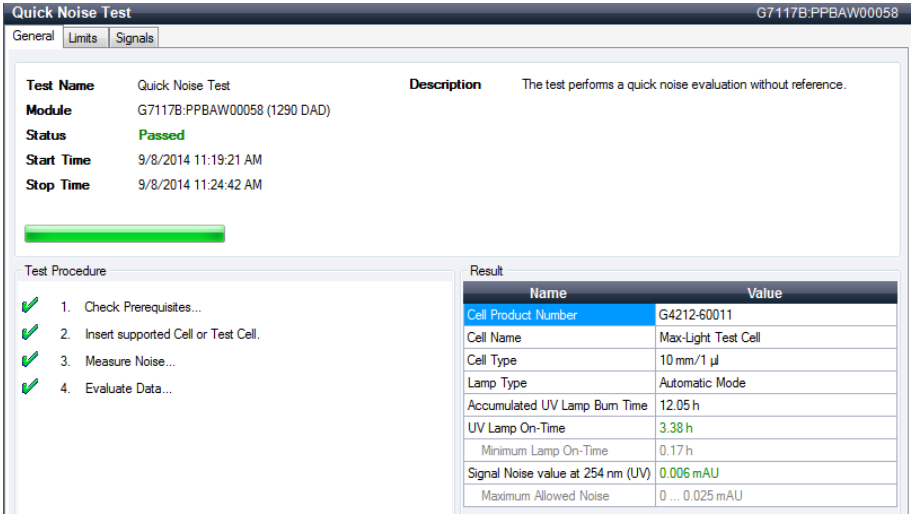


Figure 34: Quick Noise Test – Results

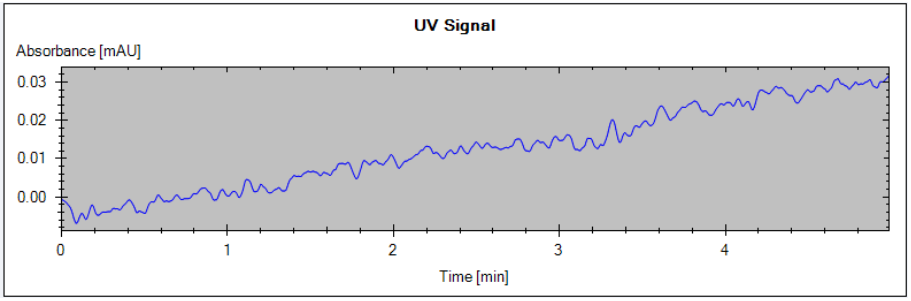


Figure 35: Quick Noise Test – Signal

Test Failed

Quick Noise Test Evaluation

Probable cause		Suggested actions
1	Insufficient lamp warm-up time.	• Allow detector and UV-lamp turned on for at least 2 hours.
2	Absorbing solvent or air bubble in flow cell.	• Ensure the flow cell is filled with water, and free from air bubbles.
3	Dirty or contaminated flow cell.	• Flush flow cell • Clean the flow cell as described in Clean the Max-Light Cartridge Cell on page 189.
4	Old UV-lamp.	• Exchange the UV-lamp.

ASTM Drift Noise Test

The ASTM noise test determines the detector noise over a period of 20 minutes. The test is done with installed Max-Light Cartridge Cell or Max-Light Cartridge Test Cell.

This test does also check for the drift. It is also part of the “Self Test” (without checking for the drift).

If the test is performed with the Max-Light Cartridge Test Cell, the test results are not influenced by solvent or pump effects.

When

- In case of noise and drift problem.

Parts required

Qty.	p/n	Description
1		Max-Light Cartridge Cell (filled with water)
1		Max-Light Cartridge Test Cell

Preparations

- Detector and UV-lamp must be on for at least 2 hours.
- ASTM measurements based on specifications may require longer stabilization times.
- When using a Max-Light Cartridge Cell a flow rate of 0.5 mL/min with water is required.

1 Run the **ASTM Drift and Noise Test** with Agilent Lab Advisor (for further information see Online-Help of user interface).

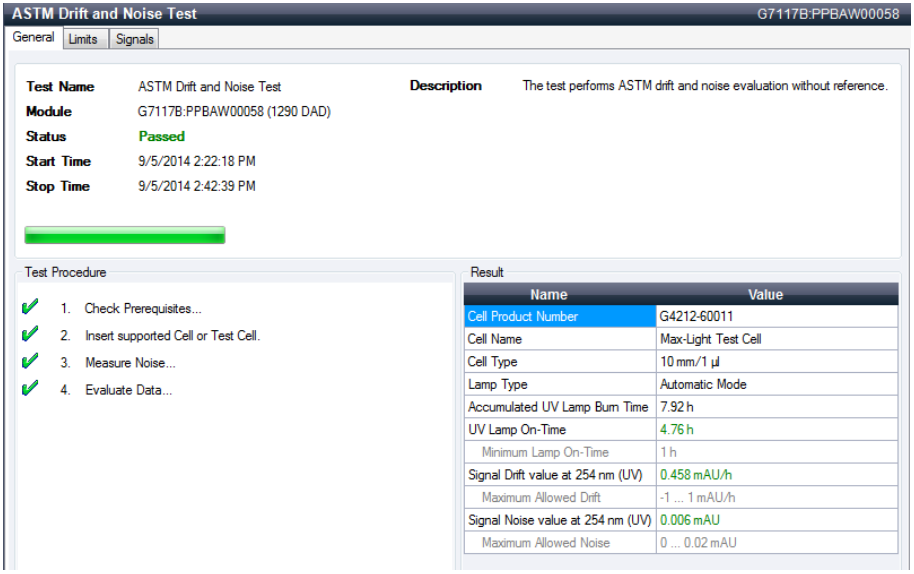


Figure 36: ASTM Drift and Noise Test – Results

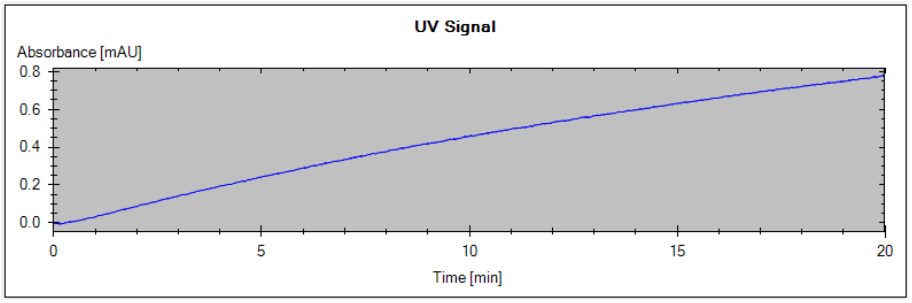


Figure 37: ASTM Drift and Noise Test – Signal

Test Failed

ASTM Noise Test Evaluation

Probable cause		Suggested actions
1	Insufficient lamp warm-up time.	• Allow detector and UV-lamp turned on for at least 2 hours.
2	Absorbing solvent or air bubble in flow cell.	• Ensure the flow cell is filled with water, and free from air bubbles.
3	Dirty or contaminated flow cell.	• Flush flow cell • Clean the flow cell as described in Clean the Max-Light Cartridge Cell on page 189.
4	Old UV-lamp.	• Exchange the UV lamp.
5	Environment not according to specifications.	• Improve environment.

Slit Test

Slit Test (G7117B)

The slit test verifies correct operation of the micromechanical slit.

During the test, the slit is moved through all slit positions while the detector monitors the lamp intensity change. When the slit position is changed, the intensity drop (move to smaller slit) or intensity increase (move to larger slit) must be within a defined range.

If the intensity changes are outside the expected range, the test fails.

When

- In case of problems.

Parts required

Qty.	p/n	Description
1		Max-Light Cartridge Cell (filled with water)
1		Max-Light Cartridge Test Cell

Preparations

- Lamp must be on for at least 10 minutes.
- When using a Max-Light Cartridge Cell a flow rate of 0.5 mL/min with water is required.

1 Run the **Slit Test** with the Agilent Lab Advisor (for further information see Online-Help of user interface).

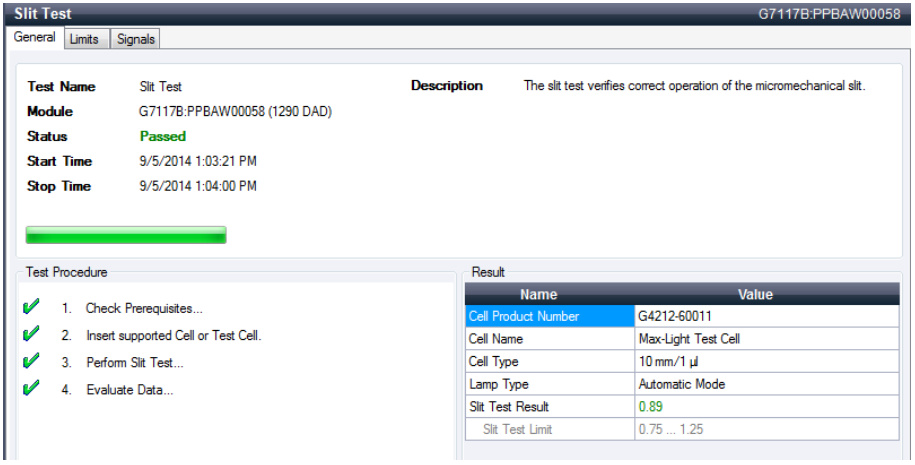


Figure 38: Slit Test – Results

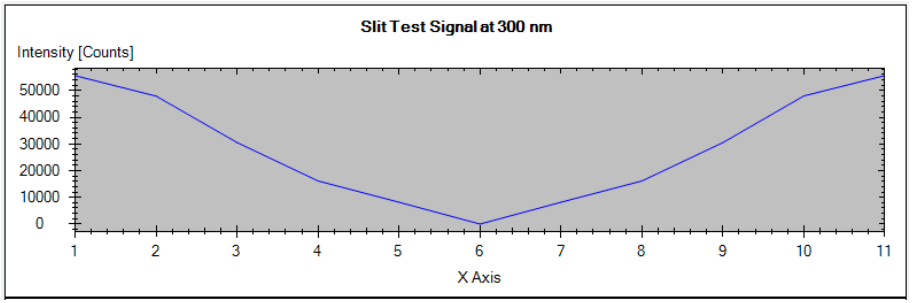


Figure 39: Slit Test – Signal

Test Failed

Slit Test Evaluation

Probable cause		Suggested actions
1	Air bubble in Max-Light Cartridge Cell.	• Flush the flow cell or use the Max-Light Cartridge Test Cell.
2	Old lamp.	• Run the “Intensity Test”. Exchange the lamp if old or defective.

Probable cause		Suggested actions
3	Defective slit assembly.	• Please contact your Agilent service representative.
4	Defective detector main board.	• Please contact your Agilent service representative.
5	Defective optical unit.	• Please contact your Agilent service representative.

Slit Test (G7117A/G7117C)

There is no dedicated slit test for the G7117A/G7117C. To verify the proper function perform the following tests:

- Intensity Test (tests the normal position)
- Dark Current Test (tests the dark position)

Wavelength Verification Test

The detector uses the alpha (656.1 nm) and beta (486 nm) emission lines of the UV-lamp for wavelength calibration. The sharp emission lines enable accurate calibration. When verification is started, the 1-nm slit is moved into the light path automatically. The test is run with the Max-Light Cartridge Cell or with Max-Light Cartridge Test Cell installed.

If the test is performed with the Max-Light Cartridge Test Cell, the test results are not influenced by solvent or pump effects.

When

- The detector is calibrated at the factory, and under normal operating conditions should not require recalibration. However, it is advisable to recalibrate:
- after repair of components in the optical unit,
- after exchange of the optical unit or main board,
- after replacing the Max-Light Cartridge Cell or UV-lamp,
- after significant environmental condition changes (temperature, humidity),
- at a regular interval, at least once per year (for example, prior to an Operational Qualification/Performance Verification procedure), and
- when chromatographic results indicate the detector may require recalibration.

Parts required

Qty.	p/n	Description
1		Max-Light Cartridge Test Cell or
1		Max-Light Cartridge Cell

Preparations

- Lamp must be on for at least 10 minutes.
- When using a Max-Light Cartridge Cell a flow rate of 0.5 mL/min with water is required.

1 Run the **Wavelength Verification Test** with the Agilent Lab Advisor (for further information see Online-Help of user interface).

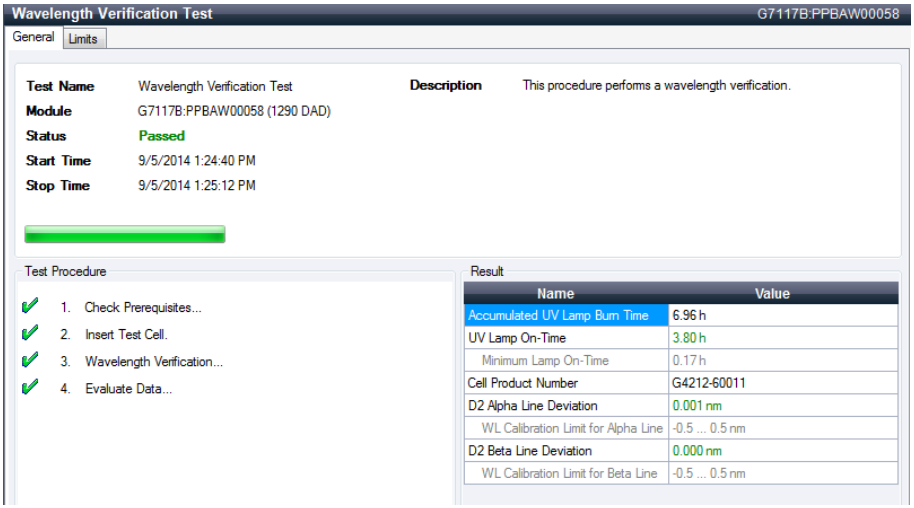


Figure 40: Wavelength Verification – Results

Wavelength Calibration

The detector uses the alpha (656.1 nm) and beta (486 nm) emission lines of the deuterium lamp for wavelength calibration. The sharp emission lines enable more accurate calibration than is possible with holmium oxide. When recalibration is started, the 1 nm slit is moved into the light path automatically (G7117B). The gain is set to zero.

On completion of the scan, the alpha- and beta-line deviations (in nm) are displayed. These values indicate how far the detector calibration deviates from the actual positions of the alpha and beta emission lines. After calibration, the deviation is zero.

To eliminate effects due to absorbing solvents, install the Max-Light Cartridge Test Cell before starting the test.

When

- The detector is calibrated at the factory, and under normal operating conditions should not require recalibration. However, it is advisable to recalibrate:
- after maintenance (flow cell or UV-lamp),
- after repair of components in the optical unit,
- after exchange of the optical unit or main board,
- after significant environmental condition changes (temperature, humidity),
- at a regular interval, at least once per year (for example, prior to an Operational Qualification/Performance Verification procedure), and
- when chromatographic results indicate the detector may require recalibration.

Parts required

Qty.	p/n	Description
1		Max-Light Cartridge Test Cell or
1		Max-Light Cartridge Cell

Preparations

- Detector/lamp must be on for more than 1 hour.
- When using a Max-Light Cartridge Cell a flow rate of 0.5 mL/min with water is required.

NOTE

If the detector is operated in a lab environment that differs at average from the final test environment (25 °C) then the detector should be recalibrated for this temperature.

NOTE If the detector was repaired (opened covers), the wavelength calibration can be done 10 minutes after lamp on. A final wavelength calibration should be repeated after complete warm-up of the detector.

1 Run the **Wavelength Calibration** with the Agilent Lab Advisor (for further information see Online-Help of user interface).

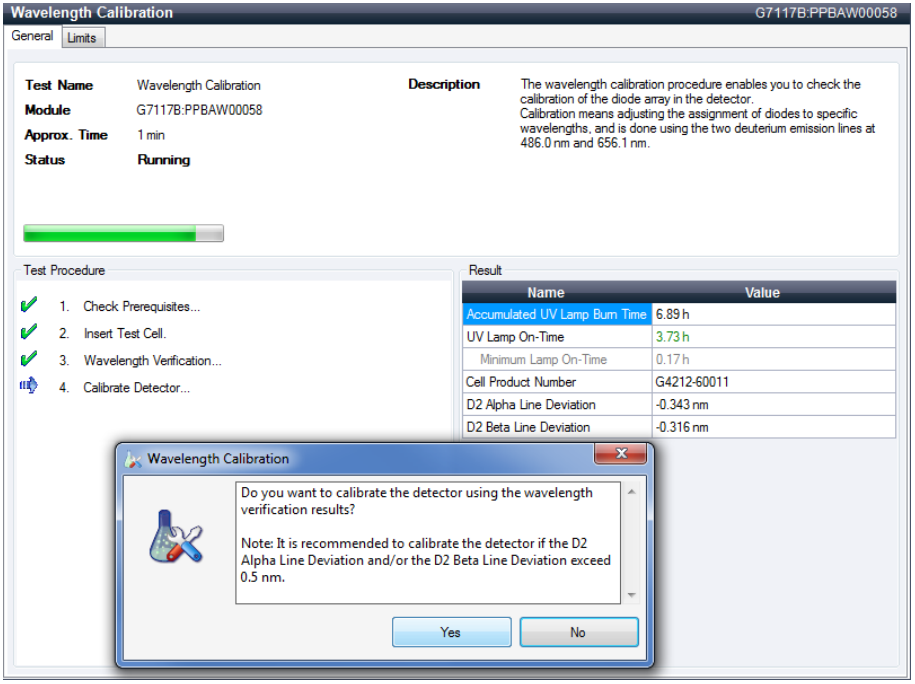


Figure 41: Wavelength Calibration - Results

If you select **No**, the test is aborted.

If you select **Yes**, the re-calibration is performed (the offset is corrected).

Wavelength Recalibration Fails

NOTE If the test fails with Max-Light Cartridge Test Cell and new UV-lamp, the optical unit must be replaced.

Probable cause		Suggested actions
1	Absorbing solvent or air bubble in Max-Light Cartridge Cell.	• Repeat calibration with Max-Light Cartridge Test Cell and compare results.
2	Dirty or contaminated Max-Light Cartridge Cell.	• Ensure the Max-Light Cartridge Cell is filled with water. • Recalibrate.
3	Old UV-lamp.	• Exchange the UV lamp.
4	Dirty or contaminated optical components.	• Run the Cell Test. If the test fails, flush the flow cell. See also Clean the Max-Light Cartridge Cell on page 189.

D/A Converter (DAC) Test

The detector provides analog output of chromatographic signals for use with integrators, chart recorders or data systems. The analog signal is converted from the digital format by the digital-analog-converter (DAC).

The DAC test is used to verify correct operation of the digital-analog-converter by applying a digital test signal to the DAC.

The DAC outputs an analog signal of approximately 50 mV (if the zero offset of the analog output is set to the default value of 5 %) which can be plotted on an integrator. A continuous square wave with an amplitude of 10 µV and a frequency of approximately 1 cycle/24 seconds is applied to the signal.

The amplitude of the square wave and the peak-to-peak noise are used to evaluate the DAC test.

When

- If the analog detector signal is noisy or missing.

Preparations

- Lamp must be on for at least 10 minutes. Connect integrator, chart recorder or data system to the detector analog output.

1 Run the **D/A Converter (DAC) Test** with the Agilent Lab Advisor (for further information see Online-Help of user interface).

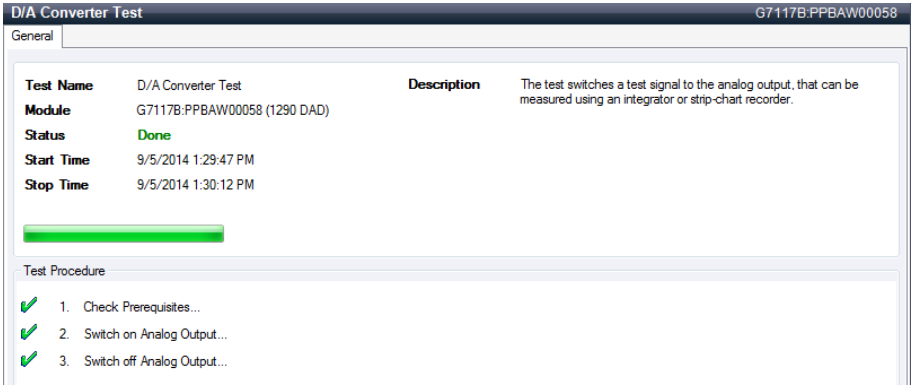


Figure 42: D/A Converter (DAC) Test – Results

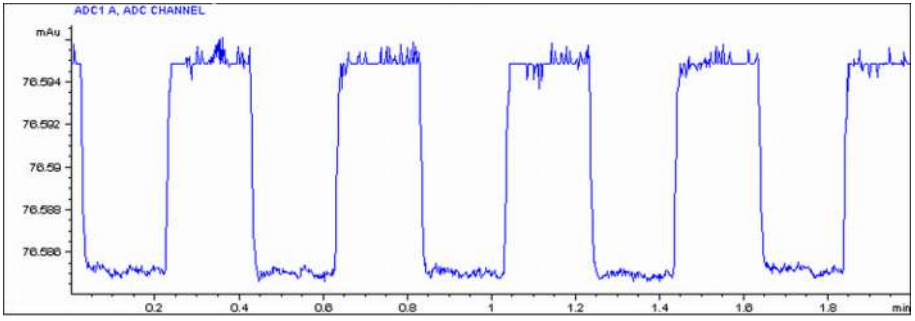


Figure 43: D/A Converter (DAC) Test – Example of Integrator Plot

D/A Converter Test failed

D/A Converter Test evaluation

The noise on the step should be less than 3 µV.

Probable cause		Suggested actions
1	Bad cable or grounding problem between detector and external device.	• Check or replace the cable.
2	Defective detector main board.	• Please contact your Agilent service representative.

Dark Current Test

The dark-current test measures the leakage current from each diode. The test is used to check for leaking diodes which may cause non-linearity at specific wavelengths. During the test, the slit assembly moves to the dark position, cutting off all light falling onto the diode array. Next, the leakage current from each diode is measured, and displayed graphically. The leakage current (represented in counts) for each diode should fall within the limits.

When

- In case of problem.

1 Run the **Dark Current Test** with the recommended user interface (for further information see Online-Help of user interface).

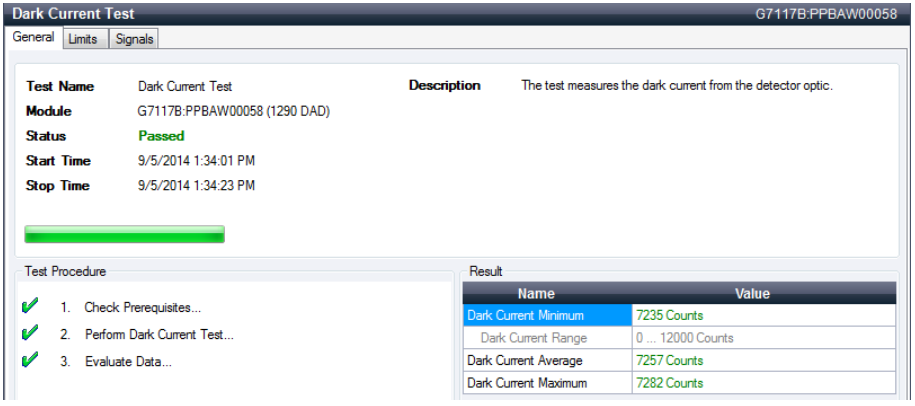


Figure 44: Dark Current Test – Results

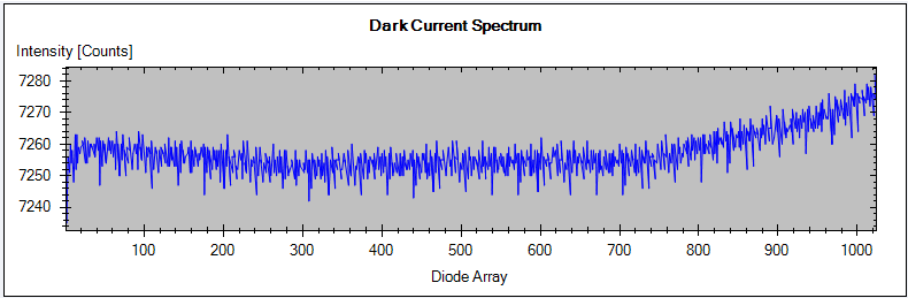


Figure 45: Dark Current Test – Signals

Dark-Current Test Failed

Dark-Current Test evaluation

Probable cause		Suggested actions
1	Defective slit assembly (stray light).	• Run the Self-Test on page 115. • Run the Slit Test (G7117B) on page 129 (part of the Self-Test on page 115). • Run the Slit Test (part of the Self-Test).
2	Defective detector main board.	• Please contact your Agilent service representative.
3	Defective PDA/optical unit.	• Please contact your Agilent service representative.

Using the Built-In Test Chromatogram

This function is available from the Agilent ChemStation, Lab Advisor and Instant Pilot.

The built-in Test Chromatogram can be used to check the signal path from the detector to the data system and the data analysis or via the analog output to the integrator or data system. The chromatogram is continuously repeated until a stop is executed either by means of a stop time or manually.

NOTE

The peak height is always the same but the area and the retention time depend on the set peakwidth, see example below.

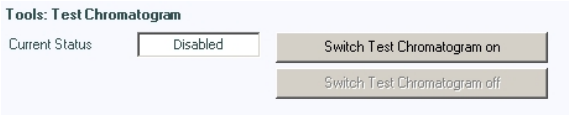
This procedure works for all Agilent 1200 Infinity detectors (DAD, MWD, VWD, FLD and RID). The example figure is from the RID detector.

Procedure using the Agilent Lab Advisor

1 Assure that the default LC method is loaded via the control software.

2 Start the Agilent Lab Advisor software (B.01.03 SP4 or later) and open the detector's **Tools** selection.

3 Open the test chromatogram screen



4 Turn the **Test Chromatogram** on.

5 Change to the detector's **Module Service Center** and add the detector signal to the Signal Plot window.

6 To start a test chromatogram enter in the command line: STRT

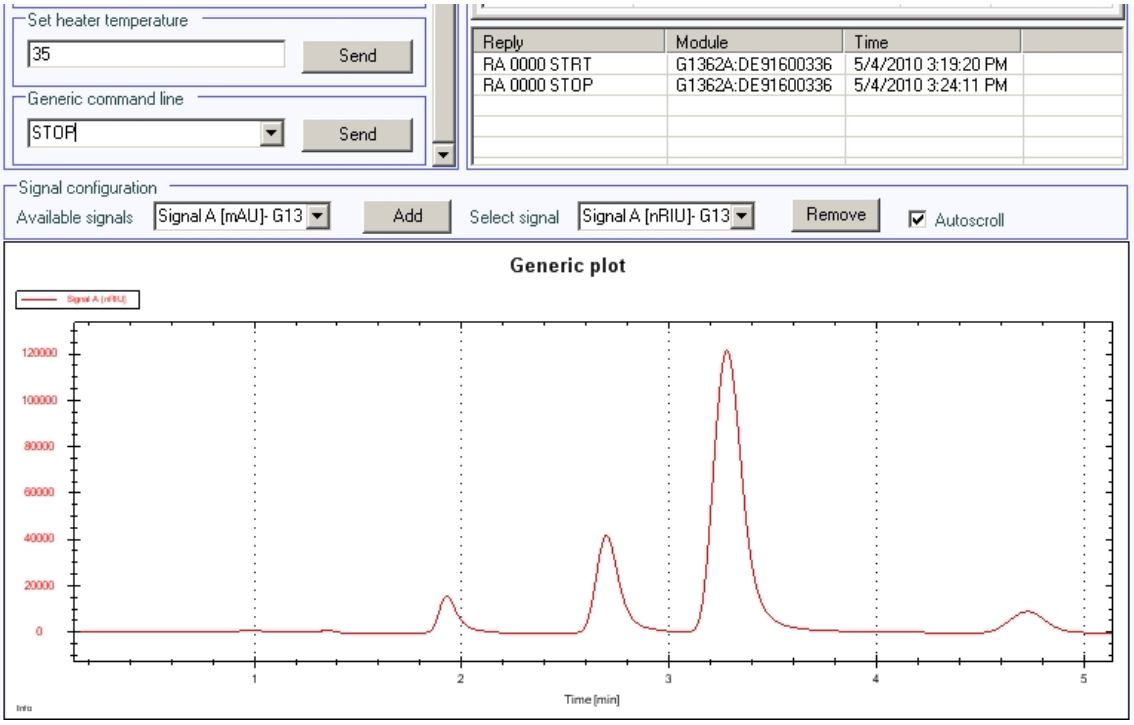


Figure 46: Test Chromatogram with Agilent Lab Advisor

7 To stop the test chromatogram enter in the command line: STOP

NOTE The test chromatogram is switched off automatically at the end of a run.

Agilent Lab Advisor Software

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

The Agilent Lab Advisor software is available in two versions:

- Lab Advisor Basic
- Lab Advisor Advanced

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

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

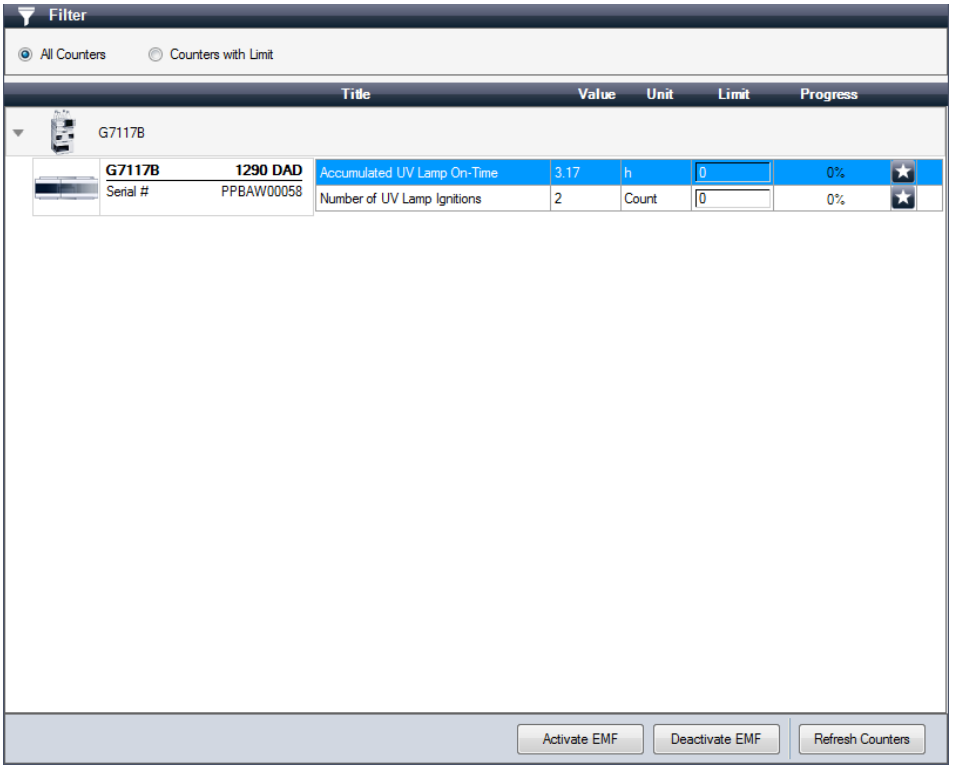
The optional Agilent Maintenance Wizard Add-on provides an easy-to-use, step-by-step multimedia guide for performing preventive maintenance on Agilent 1200 Infinity LC Series instrument.

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

Other Lab Advisor Functions

EMFs - Early Maintenance Feature

The EMFs screen allows you to view and manage the EMF counters for all modules in all systems.



7 Error Information

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

What Are Error Messages

Error messages are displayed in the user interface when an electronic, mechanical, or hydraulic (flow path) failure occurs that 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).

If using the InfinityLab Assist, instrument errors will generate a notification. To view the probable causes and recommended actions for this error, click on Help button displayed on the notification.

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: 62

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: 63

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. • Check the external vacuum degasser module (if installed) 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: 70

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: 71

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: 64

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 mainboard.

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

Leak Sensor Open

Error ID: 83

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 on/off switch board.	• Please contact your Agilent service representative.
2	Defective leak sensor.	• Please contact your Agilent service representative.
3	Leak sensor incorrectly routed, being pinched by a metal component.	• Please contact your Agilent service representative.
4	On/Off switch assembly defective.	• Please contact your Agilent service representative.

Leak Sensor Short

Error ID: 82

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.
3	On/Off switch assembly defective.	• Please contact your Agilent service representative.
4	Cable or contact problem.	• Please contact your Agilent service representative.

Compensation Sensor Open

Error ID: 81

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

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

Probable cause		Suggested actions
1	Loose connection between the on/off switch board and the mainboard.	• Please contact your Agilent service representative.
2	Defective on/off switch assembly.	• Please contact your Agilent service representative.

Compensation Sensor Short

Error ID: 80

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

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

Probable cause		Suggested actions
1	Defective on/off switch assembly.	• Please contact your Agilent service representative.
2	Loose connection between the on/off switch board and the mainboard.	• Please contact your Agilent service representative.

Fan Failed

Error ID: 68

The cooling fan in the module has failed.

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

Probable cause		Suggested actions
1	Fan cable disconnected.	• Please contact your Agilent service representative.
2	Defective fan.	• Please contact your Agilent service representative.
3	Defective mainboard.	• Please contact your Agilent service representative.

Open Cover

Error ID: 205

The top foam has been removed.

The sensor on the main board detects when the top foam is in place. If the foam is removed, the fan is switched off, and the error message is generated.

Probable cause		Suggested actions
1	The top foam was removed during operation.	• Please contact your Agilent service representative.
2	Foam not activating the sensor.	• Please contact your Agilent service representative.
3	Defective sensor or main board.	• Please contact your Agilent service representative.

Cover Violation

Error ID: 7461

The top foam has been removed.

The sensor on the main board detects when the top foam is in place. If the foam is removed while the lamps are on (or if an attempt is made to switch on for example the lamps with the foam removed), the lamps are switched off, and the error message is generated.

Probable cause		Suggested actions
1	The top foam was removed during operation.	• Please contact your Agilent service representative.
2	Foam not activating the sensor.	• Please contact your Agilent service representative.

ERI Messages

Error ID: 11120, 11121

The ERI (Enhanced Remote Interface) provides two error events related to over current situations on the +5 V and +24 V lines.

Probable cause		Suggested actions
1	The load on the ERI is too high.	• Reduce the load.

Detector Error Messages

These errors are detector specific.

Diode Current Leakage

Error ID: 1041

When the detector is switched on, the processor checks the leakage current of each of the optical diodes. If the leakage current exceeds the upper limit, the error message is generated.

Probable cause		Suggested actions
1	Defective PDA/optical unit.	• Please contact your Agilent service representative.
2	Defective connector or cable.	• Please contact your Agilent service representative.

UV Lamp: No Current

Error ID: 7450

The lamp anode current is missing. The processor continually monitors the anode current drawn by the lamp during operation. If the anode current falls below the lower current limit, the error message is generated.

Probable cause		Suggested actions
1	Lamp disconnected.	• Ensure the lamp connector is seated firmly. • Ensure the lamp is connected.
2	Defective UV lamp or non-Agilent lamp.	• Exchange the UV lamp.
3	Defective mainboard.	• Please contact your Agilent service representative.
4	Defective power supply.	• Please contact your Agilent service representative.

UV Lamp: No Voltage

Error ID: 7451

The lamp anode voltage is missing. The processor continually monitors the anode voltage across the lamp during operation. If the anode voltage falls below the lower limit, the error message is generated.

Probable cause		Suggested actions
1	Defective UV lamp or non-Agilent lamp.	• Exchange the UV lamp.
2	Defective power supply.	• Please contact your Agilent service representative.
3	Defective mainboard.	• Please contact your Agilent service representative.

Lamp Ignition Failed

Error ID: 7452

The lamp failed to ignite. The processor monitors the lamp current during the ignition cycle. If the lamp current does not rise above the lower limit within 2 – 5 s, the error message is generated.

Probable cause		Suggested actions
1	Lamp too hot. Hot gas discharge lamps may not ignite as easily as cold lamps.	• Switch off the lamp and allow it to cool down for at least 15 minutes.
2	Lamp disconnected.	• Ensure the lamp connector is seated firmly. • Ensure the lamp is connected.
3	Defective UV lamp or non-Agilent lamp.	• Exchange the UV lamp.
4	Defective power supply.	• Please contact your Agilent service representative.
5	Defective mainboard.	• Please contact your Agilent service representative.

No Heater Current

Error ID: 7453

The lamp heater current in the detector is missing. During lamp ignition, the processor monitors the heater current. If the current does not rise above the lower limit within 1 , the error message is generated.

Probable cause		Suggested actions
1	Lamp disconnected.	• Ensure the lamp connector is seated firmly. • Ensure the lamp is connected.
2	Ignition started without the top foam in place.	• Please contact your Agilent service representative.
3	Defective mainboard.	• Please contact your Agilent service representative.
4	Defective UV lamp or non-Agilent lamp.	• Exchange the UV lamp.
5	Defective power supply.	• Please contact your Agilent service representative.

Calibration Values Invalid

Error ID: 1036

The calibration values read from the spectrometer ROM are invalid.

After recalibration, the calibration values are stored in ROM. The processor periodically checks if the calibration data are valid. If the data are invalid or cannot be read from the spectrometer ROM, the error message is generated.

Probable cause		Suggested actions
1	Defective connector or cable.	• Please contact your Agilent service representative.
2	Defective PDA/optical unit.	• Please contact your Agilent service representative.

Wavelength Recalibration Lost

Error ID: 1037

The calibration information needed for your detector to operate correctly has been lost.

During calibration of the detector the calibration values are stored in ROM. If no data is available in the spectrometer ROM, the error message is generated.

Probable cause		Suggested actions
1	The detector is new.	• Recalibrate the detector.
2	The detector has been repaired.	• Please contact your Agilent service representative.

Illegal Temperature Value from Sensor on Main Board

Error ID: 1071

This temperature sensor (located on the detector main board) delivered a value outside the allowed range. The parameter of this event equals the measured temperature in 1/100 centigrade. As a result the temperature control is switched off.

Probable cause		Suggested actions
1	Defective sensor or main board.	• Please contact your Agilent service representative.
2	Detector is exposed to illegal ambient conditions.	• Verify that the ambient conditions are within the allowed range.

Illegal Temperature Value from Sensor at Air Inlet

Error ID: 1072

This temperature sensor delivered a value outside the allowed range. The parameter of this event equals the measured temperature in 1/100 centigrade. As a result the temperature control is switched off.

Probable cause		Suggested actions
1	The temperature sensor is defect.	• Please contact your Agilent service representative.
2	Detector is exposed to illegal ambient conditions.	• Verify that the ambient conditions are within the allowed range.

Heater at Fan Assembly Failed

Error ID: 1073

Every time the deuterium lamp or the tungsten lamp (DAD only) is switched on or off a heater self-test is performed. If the test fails an error event is created. As a result the temperature control is switched off.

Probable cause		Suggested actions
1	Defective connector or cable.	• Please contact your Agilent service representative.
2	Defective heater.	• Please contact your Agilent service representative.

Heater Power at Limit

Error ID: 1074

The available power of the heater reached either the upper or lower limit. This event is sent only once per run. The parameter determines which limit has been hit:

0 means upper power limit hit (excessive ambient temperature drop).

1 means lower power limit hit (excessive ambient temperature increase).

Probable cause		Suggested actions
1	Excessive ambient temperature change.	• Wait until temperature control equilibrates.

8 Maintenance

This chapter provides general information on maintenance of the module.

Introduction to Maintenance

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

NOTE There are no serviceable parts inside.
Do not open the module.

Safety Information Related to Maintenance

WARNING Eye damage by detector light

Eye damage may result from directly viewing the UV-light produced by the lamp of the optical system used in this product.

— Always turn the lamp of the optical system off before removing it.

WARNING Fire and damage to the module

Wrong fuses

— Make sure that only fuses with the required rated current and of the specified type (super-fast, fast, time delay etc) are used for replacement.

— The use of repaired fuses and the short-circuiting of fuse-holders must be avoided.

WARNING 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.

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 Sharp metal edges

Sharp-edged parts of the equipment may cause injuries.

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

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

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

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

CAUTION 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.

Overview of Maintenance

The following pages describe maintenance (simple repairs) of the detector that can be carried out without opening the main cover.

Table 23: Overview of Maintenance

Procedure	Typical Frequency	Notes
Cleaning of module	If required	
Deuterium lamp exchange	If noise and/or drift exceeds your application limits or lamp does not ignite.	A wavelength calibration test and an intensity test should be performed after replacement.
Flow cell exchange	If leaking or if intensity drops due to contaminated flow cell.	A wavelength calibration test should be performed after replacement.
Leak sensor drying	If leak has occurred.	Check for leaks.
Leak handling System replacement	If broken or corroded.	Check for leaks.

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.

Remove and Install Doors

When

- The instrument doors or the hinges are broken.

Tools required

Qty.	p/n	Description
1	5023-3138	Reversible Screwdriver + Blade 1,0 x 5,5

Parts required (Infinity III)

Qty.	p/n	Description
	5004-3140	Door Kit Infinity III 140mm

Parts required (Infinity II)

Qty.	p/n	Description
	5004-0140	Door Kit Infinity II 140mm

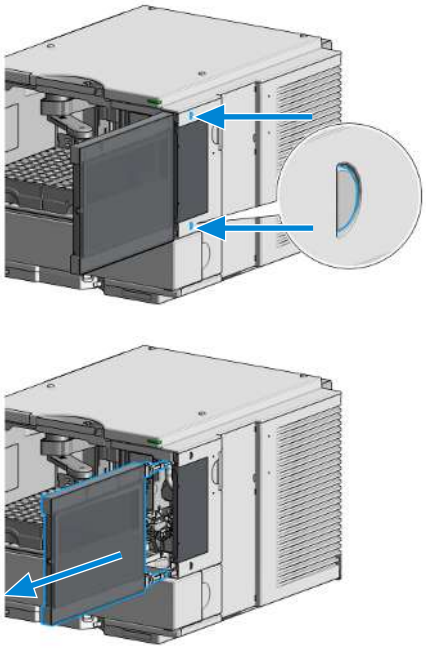
Preparations

- Finish any pending acquisition job.

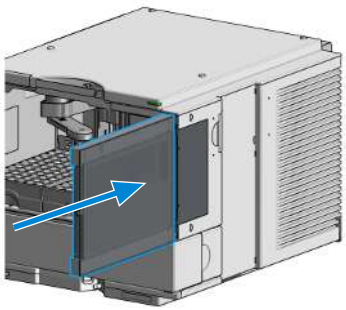
NOTE

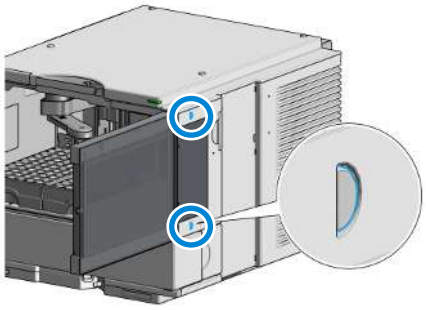
The figures shown in this procedure exemplarily show the Infinity III Vialsampler module. The principle of how to remove and/or install doors works in the same way for all Infinity III modules.

1 Press the release buttons and pull the front door out.



2 For the Installation of the front door, insert the hinges into their guides and push the door in until the release buttons click into their final position.





Replace the Deuterium Lamp

When

- If noise or drift exceeds application limits or lamp does not ignite.

Tools required

Qty.	p/n	Description
1		Screwdriver POZI 1 PT3

Parts required

Qty.	p/n	Description
1	5190-0917	Long-life Deuterium lamp (8-pin) with RFID tag

Preparations

- Turn the lamp off.

WARNING

Injury by touching hot lamp

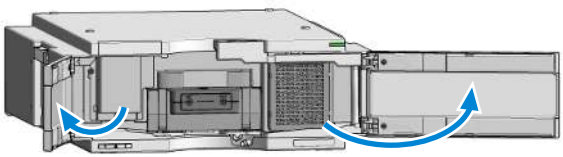
If the detector has been in use, the lamp may be hot.

— If so, wait for lamp to cool down.

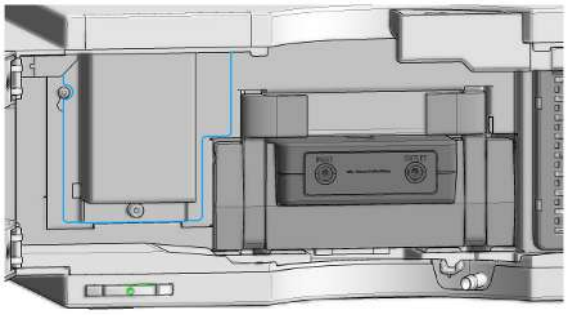
NOTE

The lamp house cover includes a magnet.

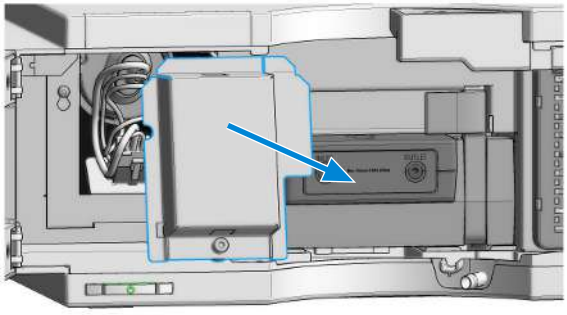
1 Open the doors.



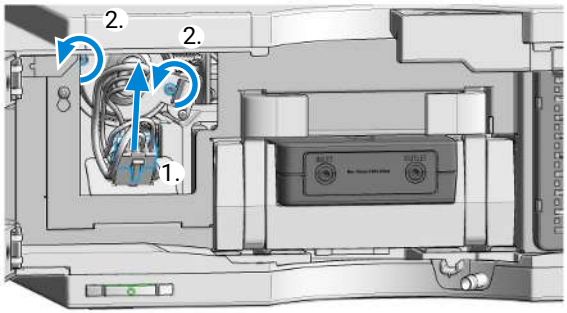
2 Locate the lamp cover.



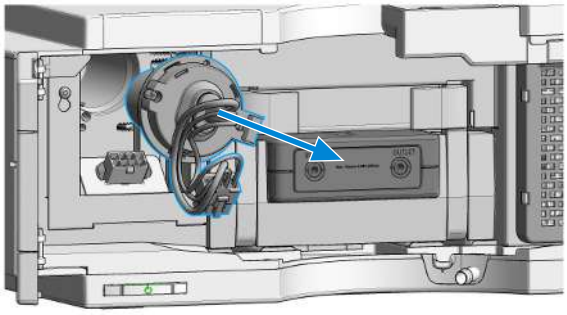
3 Grab the lamp cover and pull it off (it is fixed by a magnet in the bottom of the cover).



4 Unplug the lamp connector (1.) and unscrew the two lamp screws (2.) (Pozidriv).

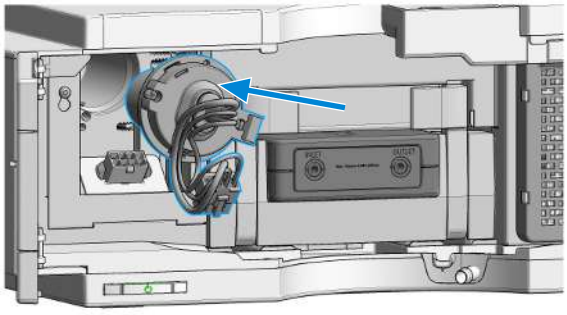


5 Remove the lamp and place it on a clean place.

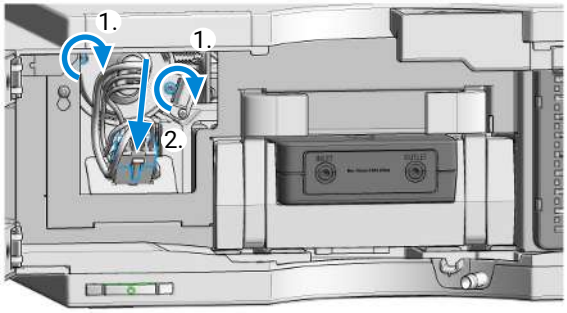


NOTE Do not touch the glass bulb with your fingers. It may reduce the light output.

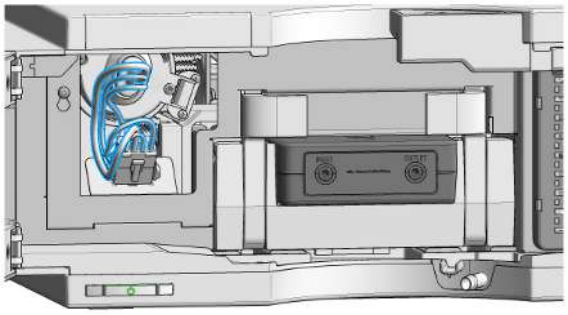
6 Insert the lamp (RFID tag on the right side).



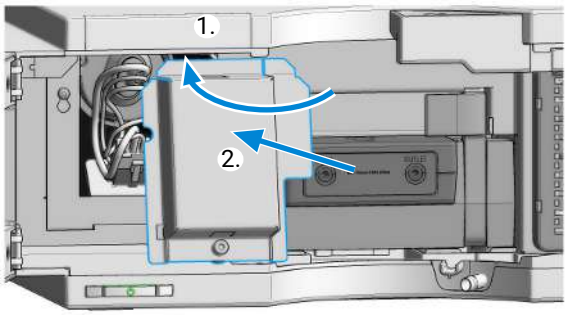
7 Fix the lamp screws (1.) and reconnect the lamp connector (2.).



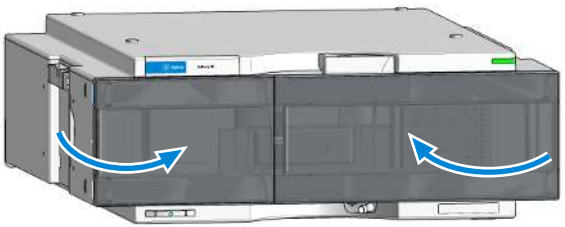
8 Place the lamp cable in the lamp cover.



9 Slide the lamp cover into the top position of the metal front (1.) and press the lamp cover completely in until it clicks (2.).



10 Close the doors.



11 Perform a Wavelength Re-calibration after lamp warm-up.

Replace the Max-Light Cartridge Cell

When

- If leaking or if intensity drops due to contaminated flow cell.

Tools required

Qty.	p/n	Description
1		Wrench, 1/4 inch for capillary connections

Parts required

Qty.	p/n	Description
1	G4212-60008	Max-Light Cartridge Cell (10 mm, V(σ) 1.0 µL)
1	G4212-60007	Max-Light Cartridge Cell (60 mm, V(σ) 4.0 µL)
1	G4212-60011	Max-Light Cartridge Test Cell
1	G4212-60032	HDR Max-Light Cartridge Cell (3.7 mm, V(σ) 0.9 µL)
1	G4212-60038	ULD Max-Light Cartridge Cell (10 mm, V(σ) 0.6 µL)
1	G7117-60020	Max-Light Cartridge Cell LSS (10 mm, V(σ) 1.0 µL)

Preparations

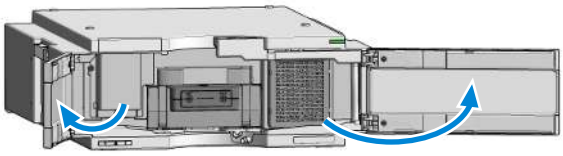
- Turn the pump off.

NOTE

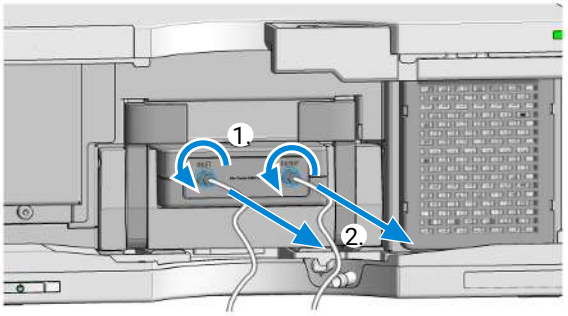
The flow cell is shipped with a filling of isopropanol. This is to avoid breakage due to subambient conditions. In case the flow cell is not used for some time (stored), then flush the flow cell with iso-propanol.

Remove the Max-Light Cartridge Cell

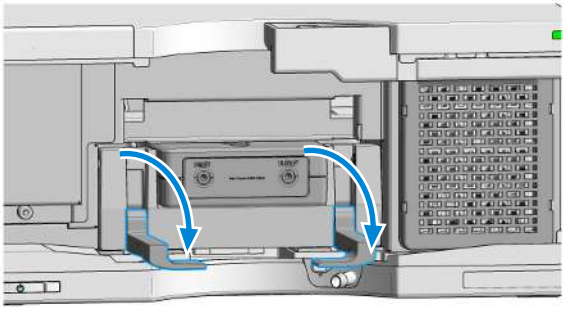
1 Open the doors.



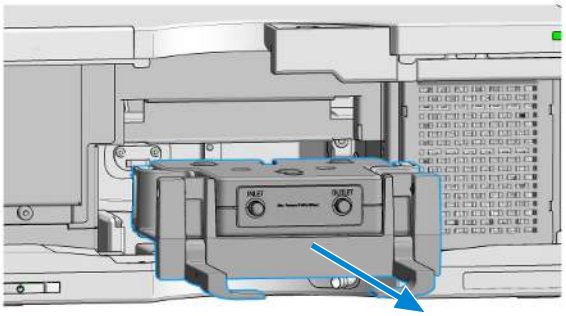
2 Disconnect the capillaries from the flow cell cartridge.



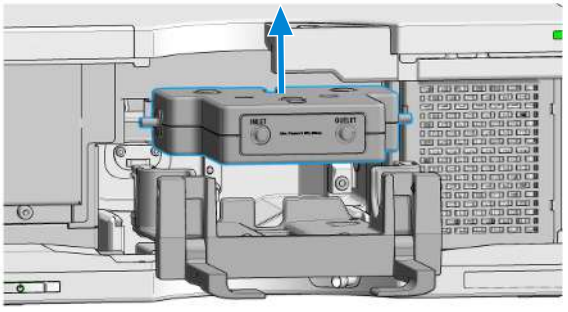
3 Flip the cartridge lever towards the front (down).



4 Pull the cartridge holder completely out.

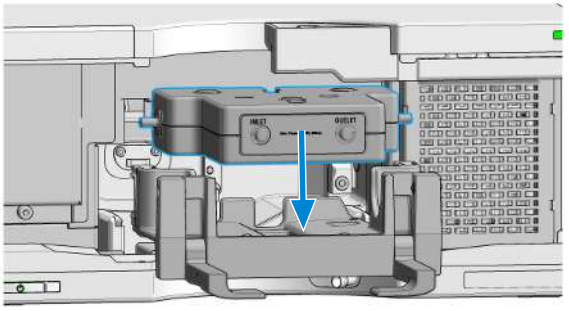


5 Remove the flow cell cartridge.

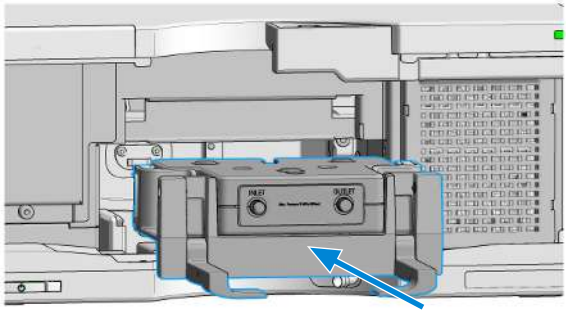


Install the Max-Light Cartridge Cell

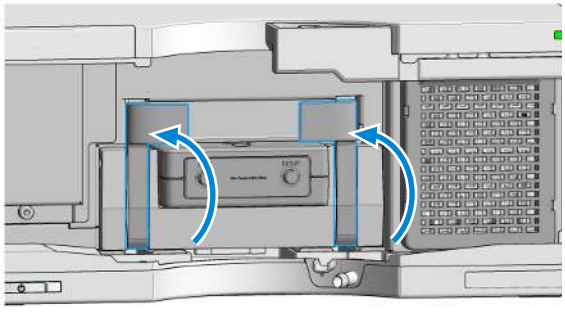
1 Insert the flow cell cartridge.



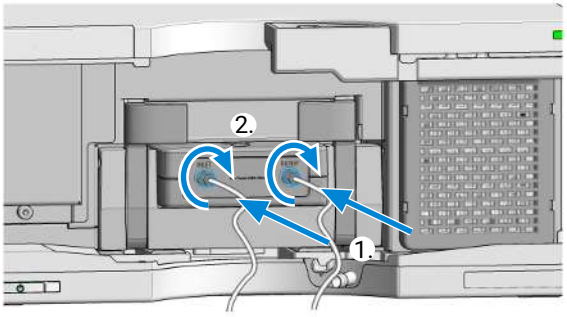
2 Slide the cartridge holder completely into the detector.



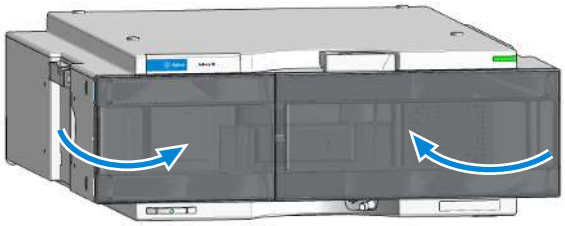
3 Lift the cartridge lever up into the final position.



4 Reconnect the capillaries.



5 Close the doors.



6 Perform a **Cell Test** and a **Wavelength Verification Test**.

Clean the Max-Light Cartridge Cell

When

- Low counts on Intensity Test or Cell Test (failed tests)

Tools required

Qty.	p/n	Description
1		Alcohol (Iso-propanol or Ethanol)
1		Lens tissue or Q-tips ®
1	5190-0530	Cell cleaning solvent

1 Flush the flow cell with the alcohol for some time.

2 Remove the cell from the cartridge holder (see Replace the Max-Light Cartridge Cell on page 184).

3 Carefully clean the light inlet and outlet of the cell using lens tissue or Q-tips® with alcohol.

NOTE If Q-tips® are used, ensure that no cotton fluff remains at the inlet or outlet.

NOTE Do not touch the light inlet and outlet of the cell with your fingers. This will add a layer of contamination on the window and reduce the light throughput.

4 Flush the flow cell with water and repeat the Intensity Test and or Cell Test.

5 If the cleaning with the alcohol did not improve the results, the flow cell might be cleaned with cleaning fluid (PN 5190-0530). Use a concentration of 0.5 – 2 v/v % (cleaning fluid/water). Use a syringe to fill the flow cell with cleaning fluid.

The following cleaning protocols are recommended:

- Maximum 3 hours at 25 – 30 °C or
- 30 – 40 min at 30 – 35 °C.

NOTE The optimal concentration depends on the water quality, the contamination, the temperature, and other factors. The use of demineralized water may improve the cleaning characteristics.

6 Flush the flow cell with water and repeat the Intensity Test and or Cell Test.

7 If tests fail again, the flow cell might be replaced if the chromatographic performance cannot be accepted.

Storage of Max-Light Cartridge Cell

1 Flush the Max- Light Cartridge Flow Cell with iso- propanol or methanol and insert the plugs into the cell inlet and outlet (see Replace the Max-Light Cartridge Cell on page 184).

2 Remove the Max-Light Cartridge Cell from the cartridge holder of the detector.

3 Replace the black hoods, that secure the cell light inlet and outlet.

4 Store the Max-Light Cartridge Cell in plastic case provided with the Max-Light Cartridge Flow Cell.

Correcting Leaks

When

- If leak has occurred.

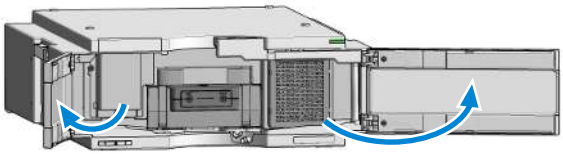
Tools required

Qty.	p/n	Description
1		Tissue

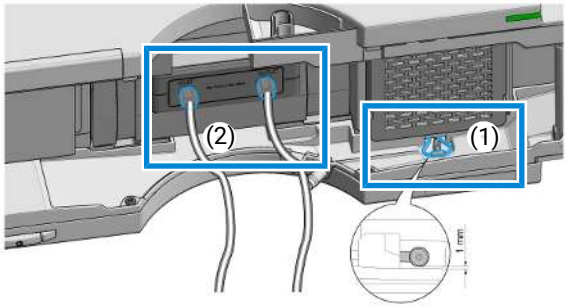
Preparations

- Turn the pump off.

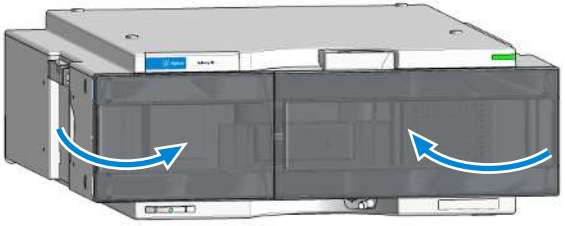
1 Open the doors.



2 Use tissue to dry the leak sensor area (1). Observe the capillary connections and the flow cell area (2) for leaks and correct, if required.



3 Close the doors.

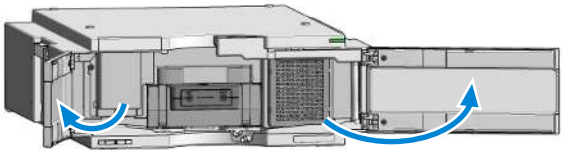


Replace Leak Handling System Parts

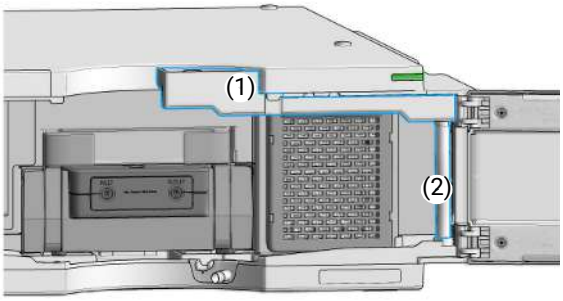
Parts required

Qty.	p/n	Description
1	5043-0856	Leak Adapter
1	5063-6527	Tubing, Silicon Rubber, 1.2 m, ID/OD 6 mm/ 9 mm approximately 85 mm required

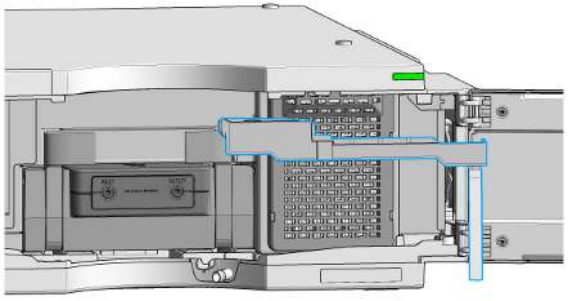
1 Open the doors.



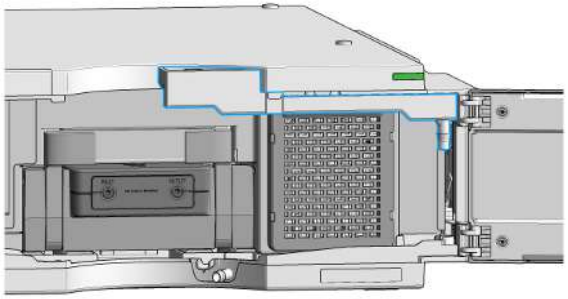
2 Locate the Leak Adapter (1) and Tubing (2).



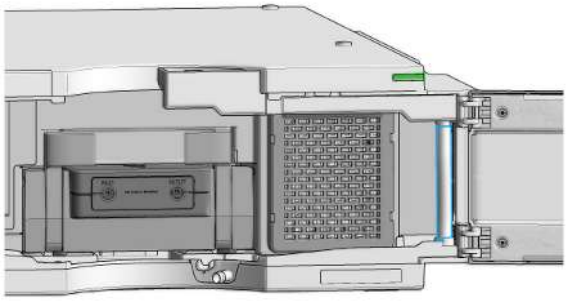
3 Press the Leak Adapter down and remove it together with the tubing.



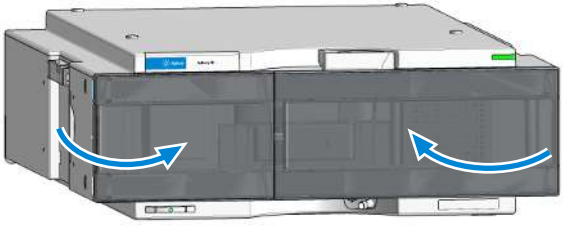
4 Install the Leak Adapter by pressing it into the Main Cover.



5 Insert the Tubing (approximately 85 mm required for replacement) between Leak Adapter outlet and Leak Panel.



6 Close the doors.



Replace the Module Firmware

When

Install a newer firmware

- It fixes known problems of older versions, or
- It introduces new features, or
- It ensures keeping all systems at the same (validated) revision

When

Install an older firmware

- It ensures keeping all systems at the same (validated) revision, or
- It ensures compatibility after adding a new module to the system, or
- A third-party control software requires a special version

Software required

- Agilent Lab Advisor software

Tools required

Qty.	p/n	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.
https://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

Table 24: Module specific information (G7117 A/G7117B/G7117C)

	G7117B 1290 DAD	G7117A 1290 DAD FS	G7117C 1260 DAD HS
Initial firmware (main and resident)		D.06.07	D.07.01
Compatibility with 1100/1200/1260/ 1290 series modules	When using the detector in a system, all other modules must have firmware from set 6.50 (latest version) or later (main and resident). Otherwise the communication will not work.		
Conversion to / emulation	G4212A, G4212B, G7117A	G4212B	-

Information from Module's Assemblies

Lamp and Flow Cell RFID Tag

The detector is equipped with a UV lamp and flow cell identification system using RFID (radio frequency identification) tags attached to the assemblies and RFID tag readers at the optical unit. The table below lists all parameters stored in the RFID tag.

Table 25: RFID Tag Data

Lamp information	Flow cell information
• product number	• product number
• serial number	• serial number
• production date	• production date
• accumulated UV on time (in hours)	• nominal path length of the cell (in mm)
• actual UV lamp on time (in hours)	• cell volume (σ) in µL
• number of ignitions	• maximum pressure (in bar)
• date of last intensity test	• date of last cell test

NOTE

The pressure value is always displayed in bar, even if the user interface uses other units, e.g. PSI.

Serial number and firmware revision

The user interface provides module specific information that is stored in the main board. These are for example the serial number, firmware revision.

9 Parts and Materials for Maintenance

This chapter provides information on parts for maintenance.

Overview of Maintenance Parts

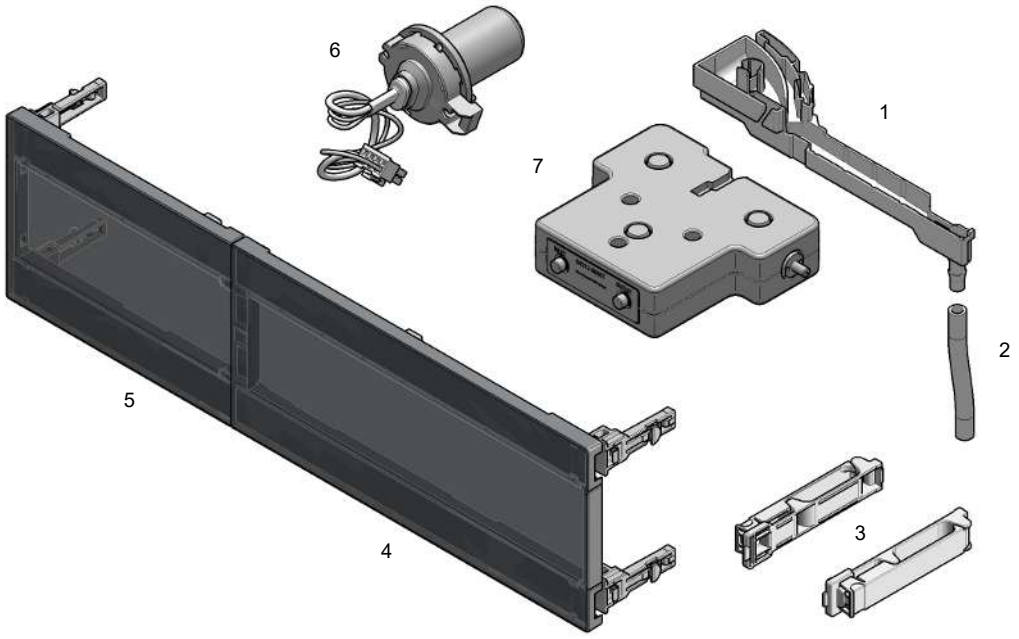


Figure 47: Maintenance Parts

#	Qty.	p/n	Description
1	1	5043-0856	Leak Adapter
2	1	5063-6527	Tubing, Silicon Rubber, 1.2 m, ID/OD 6 mm/9 mm for Waste and Leak Adapter (ca. 85 mm required)
	1	5062-8535	Waste accessory kit (Flow Cell to waste) (Flow Cell to waste)
3	1	5043-1013	Tubing Clip
4	1	5360-0015	Door 140mm right Infinity III (only orderable as part of 5004-3140 Door Kit Infinity III 140mm)
5	1	5360-0016	Door 140mm left Infinity III (only orderable as part of 5004-3140 Door Kit Infinity III 140mm)

#	Qty.	p/n	Description
4	1	5360-0003	Door 140mm right Infinity II (only orderable as part of 5004-0140 Door Kit Infinity II 140mm)
5	1	5360-0002	Door 140mm left Infinity II (only orderable as part of 5004-0140 Door Kit Infinity II 140mm)
6	1	5190-0917	Long-life Deuterium lamp (8-pin) with RFID tag
7	1	G4212-60008	Max-Light Cartridge Cell (10 mm, V(σ) 1.0 µL), or
7	1	G4212-60007	Max-Light Cartridge Cell (60 mm, V(σ) 4.0 µL), or
7	1	G7117-60020	Max-Light Cartridge Cell LSS (10 mm, V(σ) 1.0 µL), or
7	1	G4212-60011	Max-Light Cartridge Test Cell, or
7	1	G4212-60032	HDR Max-Light Cartridge Cell (3.7 mm, V(σ) 0.9 µL), or
7	1	G4212-60038	ULD Max-Light Cartridge Cell (10 mm, V(σ) 0.6 µL)

For cables, see Cable Overview on page 204.

Accessory Kit (G7117-68755)

p/n	Description
5062-8535	Waste accessory kit (Flow Cell to waste)
5063-6527	Tubing, Silicon Rubber, 1.2 m, ID/OD 6 mm/9 mm see item 4 in Figure 47 on page 200
5181-1516	CAN cable, Agilent module to module, 0.5 m
5500-1155	Tube Connector, 90 degree, ID 6.4
5043-1013	Tubing Clip see item 7 in Figure 47 on page 200

10 Identifying Cables

This chapter provides information on cables used with the 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)

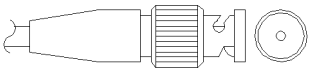
RS-232 cables

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

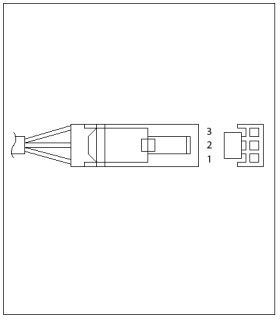
p/n	Description
5188-8050	USB A M-USB Mini B 3 m (PC-Module)
5188-8049	USB A F-USB Mini B M OTG (Module to Flash Drive)

Analog Cables

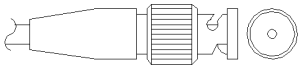


One end of these cables provides a BNC connector to be connected to Agilent modules. The other end depends on the instrument to which connection is being made.

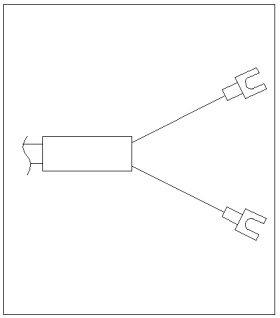
Agilent Module to 35900 A/D converters

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 +

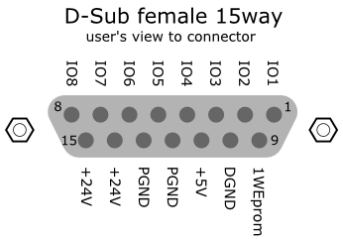
Agilent Module to General Purpose

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	PEAK DETECT	Low
	5	grey	IO5	POWER ON	High
	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			

NOTE Configuration is different with old firmware revisions.
The configuration for IO4 and IO5 is swapped for modules with firmware lower than D.07.10.

NOTE Peak Detection is used for LCMS systems connected with the Fraction Collection Remote Y-Cable (5188-8057).

- 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	

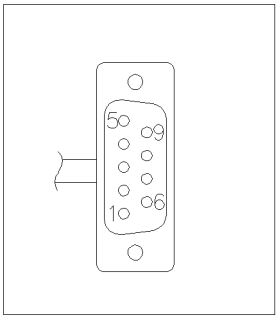
- 5188-8057 ERI to APG and RJ45 (Connector D_Subminiature 15 pin (ERI), Connector D_Subminiature 9 pin (APG), Connector plug Cat5e (RJ45))

Table 26: 5188-8057 ERI to APG and RJ45

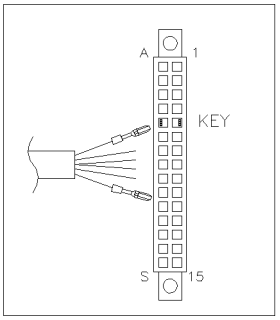
p/n 5188-8057	Pin (ERI)	Signal	Pin (APG)	Active (TTL)	Pin (RJ45)
					
	10	GND	1		5
	1	Start Request	9	High	
	2	Stop	8	High	
	3	Ready	7	High	
	4	Fraction Trigger	5	High	4
	5	Power on	6	High	
	6	Shut Down	4	High	
	7	Start	3	High	
	8	Prepare	2	High	
	Ground	Cable Shielding	NC		

One end of these cables provides an 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.

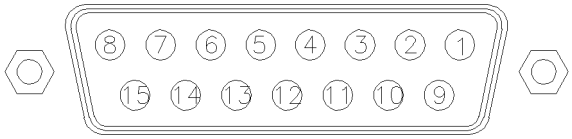
Agilent Module to Agilent 35900 A/D Converters

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

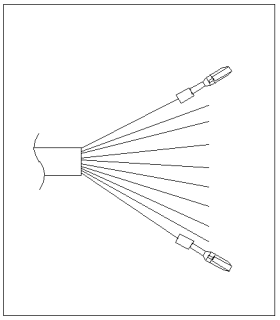
p/n 01046-60201	Wire Color	Pin Agilent module	Signal Name	Active (TTL)
	White	1	Digital ground	
	Brown	2	Prepare run	Low
	Gray	3	Start	Low
	Blue	4	Shut down	Low
	Pink	5	Not connected	
	Yellow	6	Power on	High
	Red	7	Ready	High
	Green	8	Stop	Low
	Black	9	Start request	Low

BCD Cables

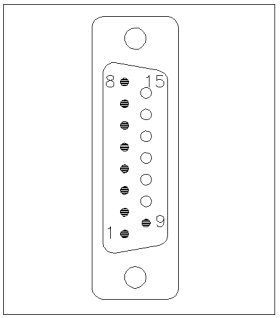


One end of these cables provides a 15-pin BCD connector to be connected to the Agilent modules. The other end depends on the instrument to be connected to

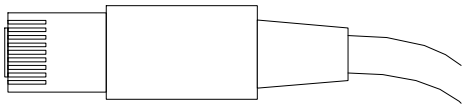
Agilent Module to General Purpose

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

Agilent Module to 3396 Integrators

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

CAN/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)

11 Hardware Information

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

General Hardware Information

This section provides detailed hardware information on firmware that is valid for this module.

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: https://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.

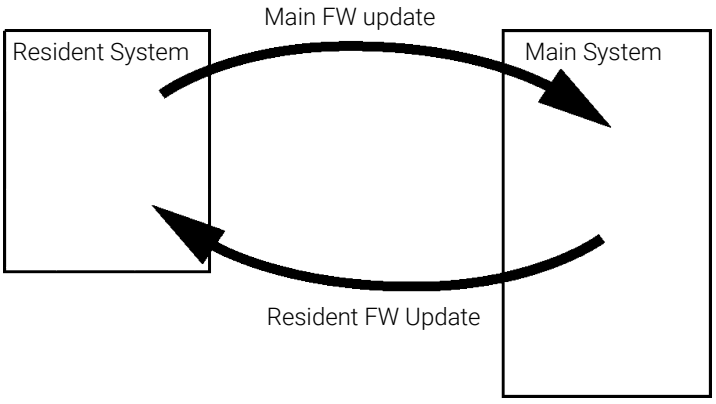


Figure 48: Firmware update mechanism

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.

- https://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.
- One analog output provides signals for integrators or data handling systems.
- The ERI connector may be used in combination with other analytical instruments from Agilent Technologies if you want to use features such as start, stop, common shut down, prepare, and so on.

- With the appropriate software, the 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.

WARNING **Electric shock due to insufficient insulation of connected instruments**

Personal injury or damage to the instrument

— **Any other instruments connected to this instrument shall be approved to a suitable safety standard and must include reinforced insulation from the mains.**

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

Rear View of the Module

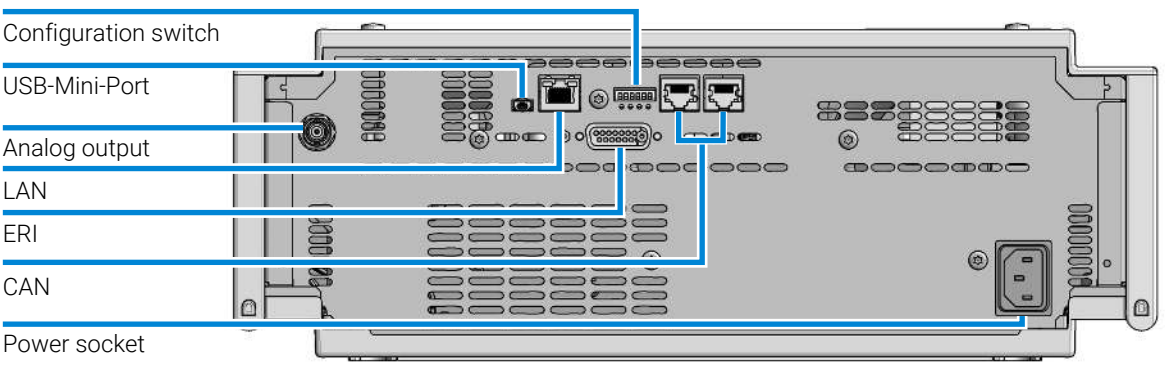


Figure 49: Rear view of detector (example shows a G7114A/B VWD) – electrical connections and label

Serial Number Information

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

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

Interfaces

The Agilent InfinityLab LC Series modules provide the following interfaces:

Table 27: 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/C, G7137A, G5668A, G3167A	2	Yes	Yes	No	No	E	

Module	CAN	USB	LAN (on-board)	RS-232	Analog	APG (A) / ERI (E)	Special
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	
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	Requires a host module with on-board LAN or with additional G1369C LAN Card.
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

LAN connection is made between at least one of the Agilent modules and the Control PC.

- If an Assist Hub is installed, connect the LAN to the Lab LAN port of this module.
- If an Assist Hub is NOT installed and a detector (DAD/MWD/FLD/VWD/RID) is installed, connect the LAN to this module.
- If an Assist Hub is NOT installed and there are multiple detectors with spectral capabilities, consider using additional LAN connections for each detector.
- If an Assist Hub is installed, connect additional LAN connections from the detectors and pumps to the Assist Hub.

- 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 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

LAN connection is made between at least one of the Agilent modules and the Control PC.

- If an Assist Hub is installed, connect the LAN to the Lab LAN port of this module.
- If an Assist Hub is NOT installed and a detector (DAD/MWD/FLD/VWD/RID) is installed, connect the LAN to this module.
- If an Assist Hub is NOT installed and there are multiple detectors with spectral capabilities, consider using additional LAN connections for each detector.
- If an Assist Hub is installed, connect additional LAN connections from the detectors and pumps to the Assist Hub.

USB

The USB interface replaces the RS-232 Serial interface in new generation modules. For details on USB refer to USB (Universal Serial Bus) on page 229.

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 28: 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 communication board 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.

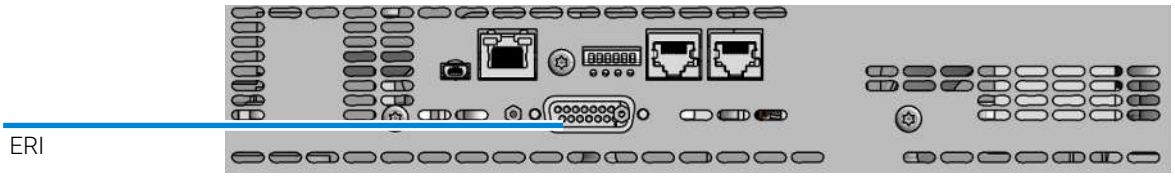
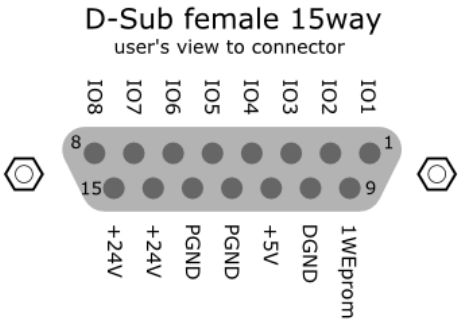


Figure 50: Location of the ERI interface



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

	Pin	Enhanced Remote
	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

Instrument Layout

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

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

Early Maintenance Feedback (EMF)

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

EMF Counters

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

Lamp Type	Counter Reset	Comment
Lamp with RFID tag	NO	
Lamp without RFID tag	YES	Via LabAdvisor or Instant Pilot

The detector provides the following EMF counters:

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

Using the EMF Counters

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

Setting the EMF Limits

The setting of the EMF limits must be optimized over one or two maintenance cycles. Initially the default EMF limits should be set. When instrument performance indicates maintenance is necessary, take note of the values displayed by the EMF counters. Enter these values (or values slightly less than the

displayed values) as EMF limits, and then reset the EMF counters to zero. The next time the EMF counters exceed the new EMF limits, the EMF flag will be displayed, providing a reminder that maintenance needs to be scheduled.

Module-Specific Hardware Information

Setting the 6-bit Configuration Switch

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

All modules with communication board electronics:

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

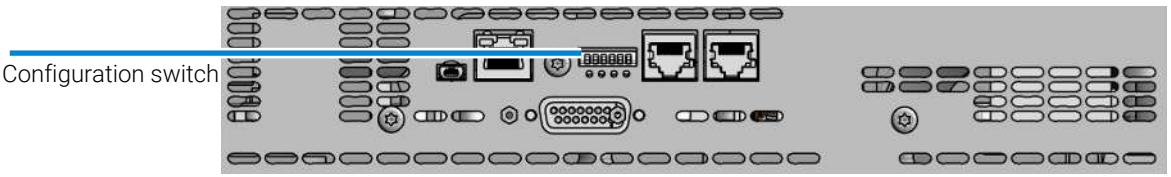


Figure 51: Location of configuration switch

Table 29: 6-bit configuration switch

SW1	SW2	SW3	SW4	SW5	SW6	Mode	Init Mode
0	0	0	0	0	0	COM	Use Default IP Address (192.168.254.11, Subnet mask: 255.255.255.0)
0	0	0	0	1	0	COM	Use Stored IP Address
0	0	0	1	0	0	COM	USE DHCP to request IP Address (Host name will be the MAC address)
1	0	0	0	0	0	Test	Boot Main System/Keep Data
1	1	0	0	0	0	Test	Boot Resident System/Keep Data

SW1	SW2	SW3	SW4	SW5	SW6	Mode	Init Mode
1	0	0	0	0	1	Test	Boot Main System/Revert to Default Data
1	1	0	0	0	1	Test	Boot Resident System/Revert to Default Data

Legend:

0 (switch down), 1 (switch up), SW (switch)

Special Settings

Boot-Resident/Main

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

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

Forced Cold Start

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

- Boot Main System / Revert to Default Data

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

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

CAUTION Loss of data

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

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

12 LAN Configuration

This chapter provides information on connecting the module to the control software.

What You Have to Do First

The module has an on-board LAN communication interface.

NOTE This chapter is generic and may show figures that differ from your module. The functionality is the same.

1 Note the MAC (Media Access Control) address for further reference. The MAC or hardware address of the LAN interfaces is a world wide unique identifier. No other network device will have the same hardware address. The MAC address can be found on a label at the rear of the module underneath the configuration switch (see Figure 53 on page 236).

Part number of the detector mainboard
Revision Code, Vendor, Year and Week of assembly
MAC address
Country of Origin

Figure 52: MAC label

2 Connect the instrument's LAN interface to

- the PC network card using a crossover network cable (point-to-point) or
- a hub or switch using a standard LAN cable.

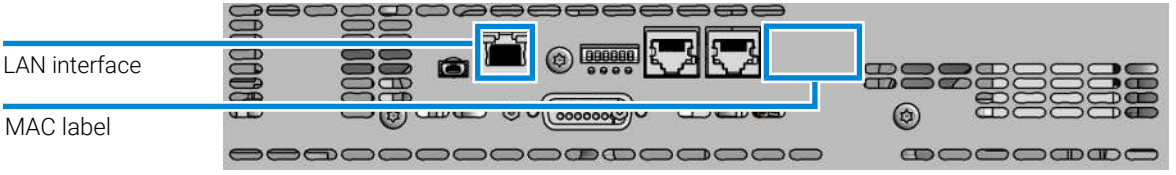


Figure 53: Location of LAN interfaces and MAC label

TCP/IP Parameter Configuration

To operate properly in a network environment, the LAN interface must be configured with valid TCP/IP network parameters. These parameters are:

- IP address
- Subnet Mask
- Default Gateway

The TCP/IP parameters can be configured by the following methods:

- by automatically requesting the parameters from a network-based DHCP Server (using the so-called Dynamic Host Configuration Protocol). This mode requires a LAN-onboard Module or a G1369C LAN Interface card, see Setup (DHCP) on page 241
- by manually setting the parameters using Telnet
- by manually setting the parameters using the Local Controller

The LAN interface differentiates between several initialization modes. The initialization mode (short form 'init mode') defines how to determine the active TCP/IP parameters after power-on. The parameters may be derived non-volatile memory or initialized with known default values. The initialization mode is selected by the configuration switch, see Table 30 on page 239.

Configuration Switch

The configuration switch can be accessed at the rear of the module.

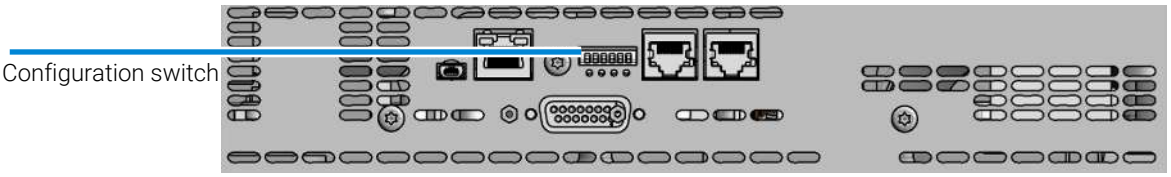


Figure 54: Location of configuration switch

The module is shipped with all switches set to OFF, as shown above.

NOTE To perform any LAN configuration, SW1 and SW2 must be set to OFF.

Initialization Mode Selection

The following initialization (init) modes are selectable:

Table 30: Initialization mode switches

	SW1	SW2	SW3	SW4	SW5	SW6	Init Mode
	0	0	0	0	0	0	Use Default IP Address
	0	0	0	0	1	0	Use Stored IP Address
	0	0	0	1	0	0	Use DHCP
	Note: The setting '0' (down) is essential.						

Legend:

0 (switch down), 1 (switch up), SW (switch)

Default IP address for LAN is 192.168.254.11.

DHCP address is the module's LAN MAC address.

Using Stored

When initialization mode **Using Stored** is selected, the parameters are taken from the non-volatile memory of the module. The TCP/IP connection will be established using these parameters. The parameters were configured previously by one of the described methods.

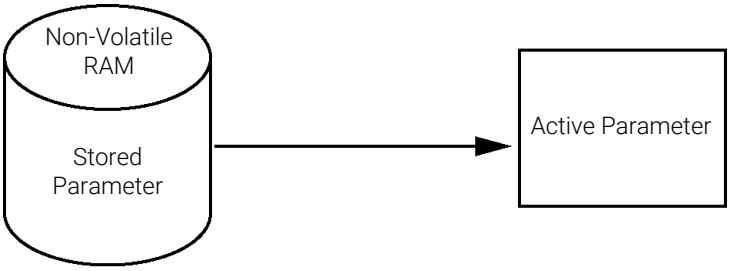


Figure 55: Using Stored (principle)

Using Default

When **Using Default** is selected, the factory default parameters are taken instead. These parameters enable a TCP/IP connection to the LAN interface without further configuration, see Table 31 on page 240.

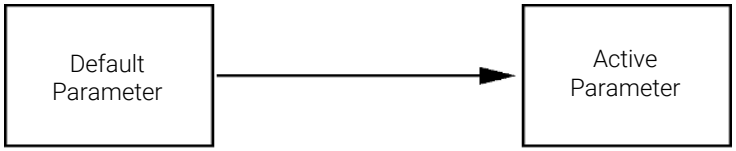


Figure 56: Using Default (principle)

NOTE Using the default address in your local area network may result in network problems. Take care and change it to a valid address immediately.

Table 31: Using default parameters

IP address:	192.168.254.11
Subnet Mask:	255.255.255.0
Default Gateway	not specified

Since the default IP address is a so-called local address, it will not be routed by any network device. Thus, the PC and the module must reside in the same subnet.

The user may open a Telnet session using the default IP address and change the parameters stored in the non-volatile memory of the module. He may then close the session, select the initialization mode Using Stored, power-on again and establish the TCP/IP connection using the new parameters.

When the module is wired to the PC directly (e.g. using a cross-over cable or a local hub), separated from the local area network, the user may simply keep the default parameters to establish the TCP/IP connection.

NOTE In the **Using Default** mode, the parameters stored in the memory of the module are not cleared automatically. If not changed by the user, they are still available, when switching back to the mode Using Stored.

Dynamic Host Configuration Protocol (DHCP)

General Information (DHCP)

The Dynamic Host Configuration Protocol (DHCP) is an auto configuration protocol used on IP networks. The DHCP functionality is available on all Agilent HPLC modules with on-board LAN Interface or LAN Interface Card G1369C, and “B”-firmware (B.06.40 or above) or modules with "D"-firmware. All modules should use latest firmware from the same set.

When the initialization mode “DHCP” is selected, the card tries to download the parameters from a DHCP Server. The parameters obtained become the active parameters immediately. They are not stored to the non-volatile memory of the card.

Besides requesting the network parameters, the card also submits its hostname to the DHCP Server. The hostname equals the MAC address of the card, e.g. *0030d3177321*. It is the DHCP server's responsibility to forward the hostname/address information to the Domain Name Server. The card does not offer any services for hostname resolution (e.g. NetBIOS).

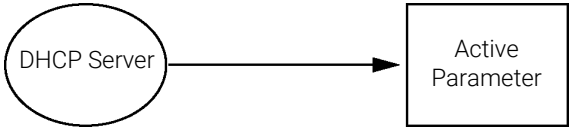


Figure 57: DHCP (principle)

NOTE

- It may take some time until the DHCP server has updated the DNS server with the hostname information.
- It may be necessary to fully qualify the hostname with the DNS suffix, e.g. *0030d3177321.country.company.com*.
- The DHCP server may reject the hostname proposed by the card and assign a name following local naming conventions.

Setup (DHCP)

The DHCP functionality is available on all Agilent HPLC modules with on-board LAN Interface or LAN Interface Card G1369C, and “B”-firmware (B.06.40 or above) or modules with "D"-firmware. All modules should use latest firmware from the same set.

1 Note the MAC address of the LAN interface (provided with G1369C LAN Interface Card or mainboard). This MAC address is on a label on the card or at the rear of the mainboard, for example, *0030d3177321*.

On the Local Controller the MAC address can be found under **Details** in the LAN section.

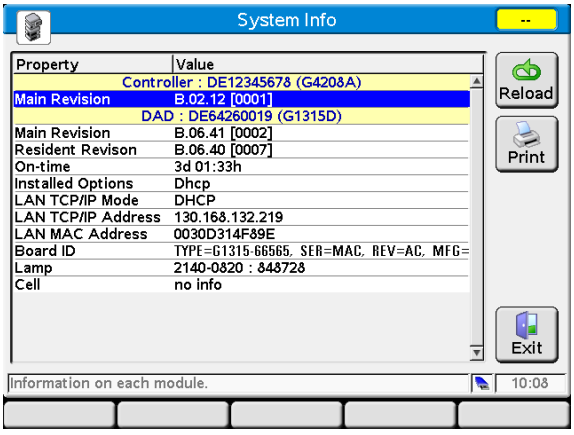


Figure 58: LAN setting on Instant Pilot

2 Set the configuration switch to DHCP either on the G1369C LAN Interface Card or the mainboard of above mentioned modules.

Table 32: G1369C LAN Interface Card (configuration switch on the card)

SW 4	SW 5	SW 6	SW 7	SW 8	Initialization Mode
ON	OFF	OFF	OFF	OFF	DHCP

Table 33: LC Modules with 8-bit configuration switch (B-firmware) (configuration switch at rear of the instrument)

SW 6	SW 7	SW 8	Initialization Mode
ON	OFF	OFF	DHCP

3 Turn on the module that hosts the LAN interface.

4 Configure your Control Software (e.g. OpenLAB CDS ChemStation Edition, Lab Advisor, Firmware Update Tool) and use MAC address as host name, e.g. *0030d3177321*.

The LC system should become visible in the control software (see Note in section General Information (DHCP) on page 241).

Manual Configuration

Manual configuration only alters the set of parameters stored in the non-volatile memory of the module. It never affects the currently active parameters. Therefore, manual configuration can be done at any time. A power cycle is mandatory to make the stored parameters become the active parameters, given that the initialization mode selection switches are allowing it.

With Telnet

Whenever a TCP/IP connection to the module is possible (TCP/IP parameters set by any method), the parameters may be altered by opening a Telnet session.

1 Open the system (DOS) prompt window by clicking on Windows START button and select "Run...". Type "cmd" and press OK.

2 Type the following at the system (DOS) prompt:

- `c:\>telnet <IP address>` or
- `c:\>telnet <host name>`

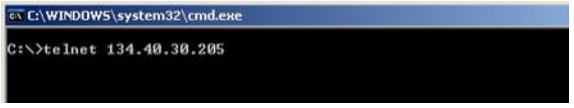


Figure 59: Telnet - Starting a session

where <IP address> may be the assigned address from a Bootp cycle, a configuration session with the Handheld Controller, or the default IP address (see Configuration Switch on page 238).

When the connection was established successfully, the module responds with the following:

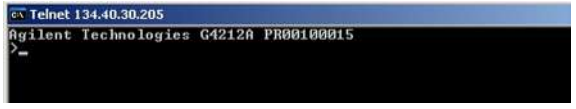


Figure 60: A connection to the module is made

3 Type `?` and press enter to see the available commands.

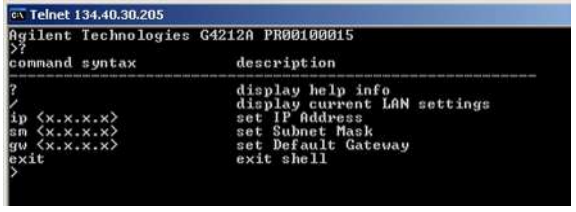


Figure 61: Telnet commands

Table 34: Telnet commands

Value	Description
?	displays syntax and descriptions of commands
/	displays current LAN settings
ip <x.x.x.x>	sets new ip address
sm <x.x.x.x>	sets new subnet mask
gw <x.x.x.x>	sets new default gateway
exit	exits shell and saves all changes

4 To change a parameter follows the style:

- parameter value, for example: `ip 134.40.28.56`

Then press [Enter], where parameter refers to the configuration parameter you are defining, and value refers to the definitions you are assigning to that parameter. Each parameter entry is followed by a carriage return.

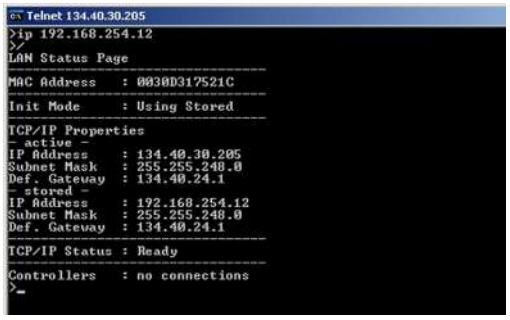
5 Use the "/" and press Enter to list the current settings.

Telnet - Current settings in "Using Stored" mode

information about the LAN interface
MAC address, initialization mode
Initialization mode is Using Stored
active TCP/IP settings

TCP/IP status - here ready
connected to PC with controller software (e.g. Agilent ChemStation), here not connected

6 Change the IP address (in this example 192.168.254.12) and type "/" to list current settings.



Telnet - Change IP settings

change of IP setting to Initialization mode is Using Stored

active TCP/IP settings

stored TCP/IP settings in non-volatile memory

connected to PC with controller software (e.g. Agilent ChemStation), here not connected

7 When you have finished typing the configuration parameters, type `exit` and press Enter to exit with storing parameters.

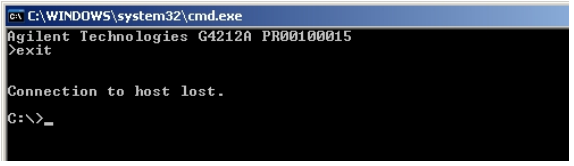


Figure 62: Closing the Telnet session

NOTE If the Initialization Mode Switch is changed now to “Using Stored” mode, the instrument will take the stored settings when the module is re-booted. In the example above it would be 192.168.254.12.

With the Instant Pilot (G4208A)

To configure the TCP/IP parameters before connecting the module to the network, the Instant Pilot (G4208A) can be used.

1 From the Welcome screen press the **More** button.

2 Select **Configure.**

3 Press the module button of the module that hosts the LAN interface (usually the detector).

4 Scroll down to the LAN settings.

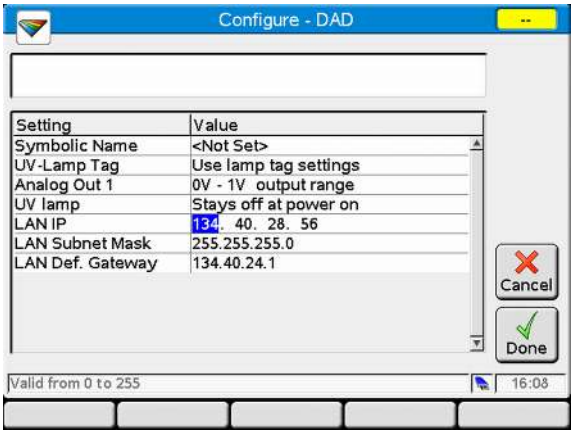


Figure 63: Instant Pilot - LAN configuration (edit mode)

5 Press the **Edit** button (only visible if not in Edit mode), perform the required changes and press the **Done** button.

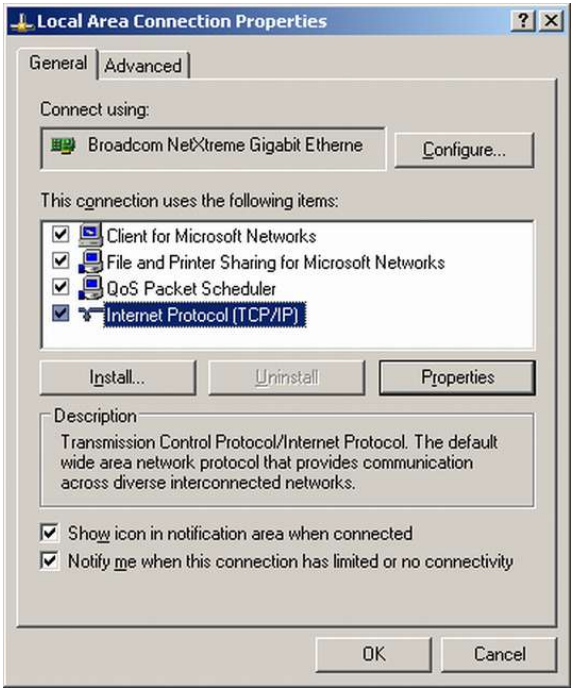
6 Leave the screen by clicking **Exit**.

PC and User Interface Software Setup

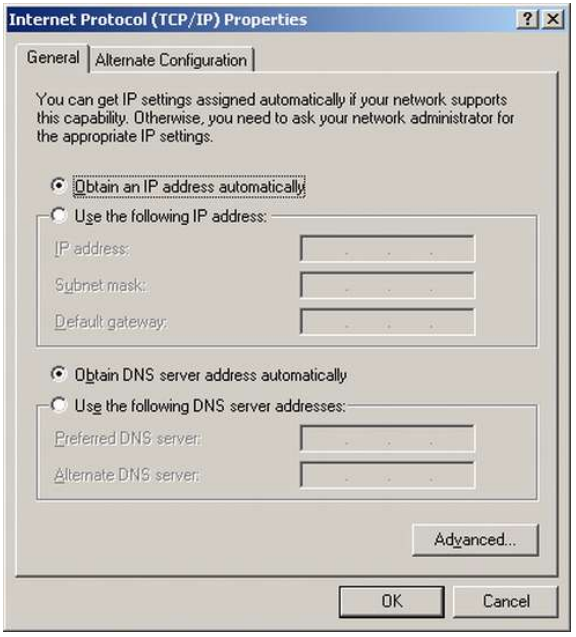
PC Setup for Local Configuration

This procedure describes the change of the TCP/IP settings on your PC to match the module's default parameters in a local configuration (see Table 31 on page 240).

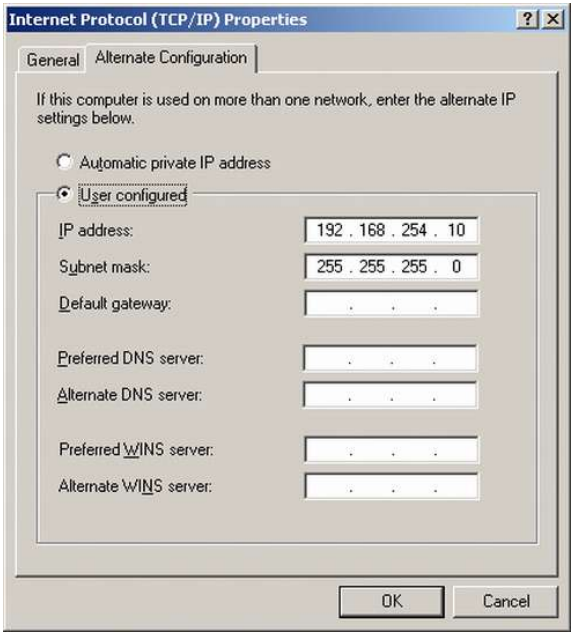
1 Open the Local Area Connection Properties and select Internet Protocol (TCP/IP). Then click on Properties.



2 You may enter here the fixed IP address of the module or use the Alternative Configuration.



3 We will use the direct LAN access via Cross-over LAN cable with the module's IP address.



4 Click on **OK** to save the configuration.

13 Appendix

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

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.

WARNING Use of unsupplied cables

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

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

NOTE Note the instrument's external markings described under Safety Symbols on page 258.

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.**

Solvent Information

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

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

- **When working with these substances observe appropriate safety procedures (for example by wearing goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the vendor, and follow good laboratory practice.**
- **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.

Recommendations on the Use of Solvents

Observe the following recommendations on the use of solvents.

- Brown glass ware can avoid growth of algae.
- 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.
- 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.

Flow cell

To protect optimal functionality of your flow-cell:

- The recommended pH range of the cell is 1.0 - 12.5 (solvent dependent).

- If the flow cell is transported while temperatures are below 5 degree C, it must be assured that the cell is filled with alcohol.
- Aqueous solvents in the flow cell can built up algae. Therefore do not leave aqueous solvents sitting in the flow cell. Add a small % of organic solvents (e.g. acetonitrile or methanol ~5%).

Magnets

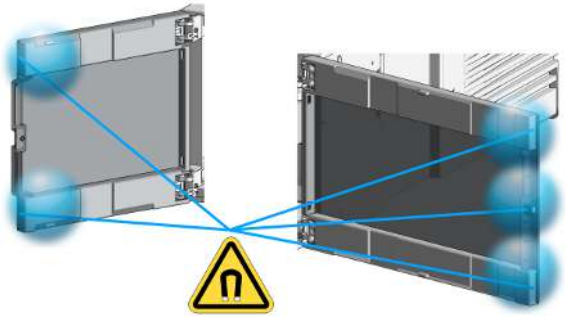
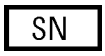


Figure 64: Magnets in doors of pumps, autosamplers, detectors, and fraction collectors

Safety Symbols

Table 35: 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.
	Indicates flammable material used. Consult the Agilent Information Center / User Manual before attempting to install or service this equipment. Follow all safety precautions.
	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.
	Product Number
	Serial Number
	Power symbol indicates On/Off. The apparatus is not completely disconnected from the mains supply when the on/off 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.
	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.

Material Information

This section provides detailed information about materials used in the HPLC system and general information about solvent/material compatibility.

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 also cannot 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 nonconductive 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 are still some 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 clad PEEK capillaries in bio-inert systems. The use of stainless steel clad 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/III 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 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, diisopropyl ether). Such ethers should be filtered through dry aluminum 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, ethylenediaminetetraacetic 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 (dimethylformamide).

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.

Flow Cell

To protect optimal functionality of your flow cell:

- If the flow cell is transported while temperatures are below 5 °C, it must be ensured that the cell is filled with alcohol to avoid damage by freezing water.
- Aqueous solvents in the flow cell can build up algae. Therefore, do not leave aqueous solvents sitting in the flow cell. Add a small percentage of organic solvents (for example, about 5 % of acetonitrile or methanol).

At-a-Glance Details About Agilent Capillaries

The following section provides useful information about Agilent capillaries and its characteristics.

Syntax for capillary description

Type - Material - Capillary dimensions - Fitting Left/Fitting right

Table 36: Example for a capillary description

Code provided with the part	Meaing of the code
Color code: 	Material of the product is MP35N, the inner diameter is 0.20 or 0.25 mm
Capillary	The part is a connection capillary
MP35N	Material of the part is MP35N
0.25 x 80 mm	The part has an inner diameter of 0.25 mm and a length of 80 mm
SI/SI	Left fitting: Swagelok + 1.6 mm Port id, Intermediate Right fitting: Swagelok + 1.6 mm Port id, Intermediate

To get an overview of the code in use, see

- Color: Table 37 on page 268
- Type: Table 38 on page 268
- Material: Table 39 on page 269
- Dimension: Table 40 on page 269
- Fittings: Table 41 on page 270

Color Coding Guide

Table 37: Color-coding key for Agilent capillary tubing

Internal diameter in mm		Color code
0.015		Orange
0.025		Yellow
0.05		Beige
0.075		Black
0.075	MP35N	Black with orange stripe
0.1		Purple
0.12		Red
0.12	MP35N	Red with orange stripe
0.17		Green
0.17	MP35N	Green with orange stripe
0.20 /0.25		Blue
0.20 /0.25	MP35N	Blue with orange stripe
0.3		Grey
0.50		Bone White

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

Abbreviation Guide for Type

Table 38: Type (gives some indication on the primary function, like a loop or a connection capillary)

Key	Description
Capillary	Connection capillaries
Loop	Loop capillaries
Seat	Autosampler needle seats

Key	Description
Tube	Tubing
Heat exchanger	Heat exchanger

Abbreviation Guide for Material

Table 39: Material (indicates which raw material is used for the capillary)

Key	Description
ST	Stainless steel
Ti	Titanium
PK	PEEK
FS/PK	PEEK-coated fused silica [12]
PK/ST	Stainless steel-coated PEEK [13]
PFFE	PTFE
FS	Fused silica
MP35N	Nickel-cobalt-chromium-molybdenium alloy

Abbreviation Guide for Capillary Dimensions

Table 40: Capillary dimensions (indicates inner diameter (id), length, and volume of the capillary)

Description
id (mm) x Length (mm)
Volume (µL)

12 Fused silica in contact with solvent

13 Stainless steel-coated PEEK

Abbreviation Guide for Fitting Left/Fitting Right

Table 41: Fitting left/fitting right (indicates which fitting is used on both ends of the capillary)

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

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 https://www.agilent.com for more information.

Radio Interference

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

Test and Measurement

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

RFID Statement

Brasil

Este equipamento não tem direito à proteção contra interferência prejudicial e não pode causar interferência em sistemas devidamente autorizados. Para mais informações, consulte o site da Anatel: https://www.gov.br/anatel/pt-br.

Este produto não é apropriado para uso em ambientes domésticos, pois poderá causar interferências eletromagnéticas que obrigam o usuário a tomar medidas necessárias para minimizar estas interferências.

Canada

Statement according to RSS GEN Issue 5:

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil contient des émetteurs / récepteurs exemptés de licence conformes aux RSS (RSS) d'Innovation, Sciences et Développement économique Canada. Le fonctionnement est soumis aux deux conditions suivantes:

1. Cet appareil ne doit pas causer d'interférences
2. Cet appareil doit accepter toutes les interférences, y compris celles susceptibles de provoquer un fonctionnement indésirable de l'appareil.

Mexico

La operación de este equipo está sujeta a las siguientes dos condiciones:

1. es posible que este equipo o dispositivo no cause interferencia perjudicial y
2. este equipo o dispositivo debe aceptar cualquier interferencia, incluyendo la que pueda causar su operación no deseada.

Thailand

This telecommuinication equipment conforms to NTC/NBTC technical requirement.

USA

1. User Information according to FCC 15.21:Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
2. Part 15 Statement according to FCC 15.19:

   This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

   - This device may not cause interference.
   - This device must accept any interference, including interference that may cause undesired operation.

CAUTION Do not change or modify the equipment.

Changes or modifications not expressly approved by Agilent could void your authority to operate the equipment.

NOTE This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Table 42: Operating frequencies and maximum power levels

Technology	Operating Frequencies/ Bands	Maximum Transmit Power Level
RFID	125 kHz	26.8 dBm

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

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

https://www.agilent.com

In This Book

This manual contains technical reference information about the Agilent 1290 Infinity III Diode Array Detector FS (with fixed slit) (G7117A), Agilent 1290 Infinity III Diode Array Detector (with variable slit) (G7117B), and Agilent 1260 Infinity III Diode Array Detector HS (with fixed slit) (G7117C).

The manual describes the following:

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

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