

ACQUITY™ UPLC PDA



Discussion:

- In this session we will discuss:
 - Equipment Specifications
 - New Components
 - Component Details
 - Product Installation
 - Performing Test Methods
 - Additional comments

ACQUITY UPLC PDA

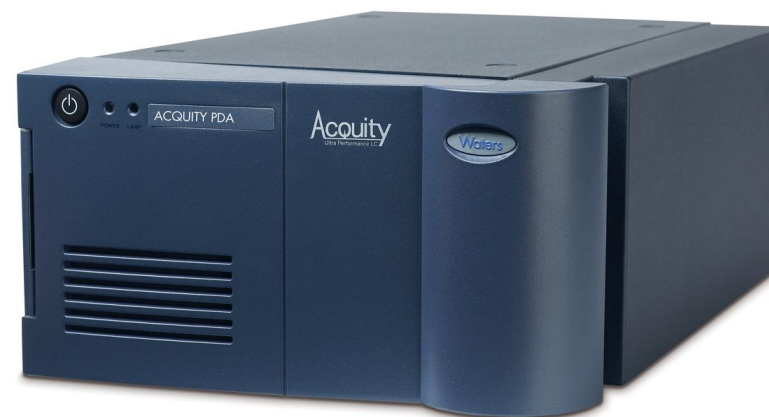


- Wavelength Range 190-500nm
- Light Source D2 High Brightness
- Light Guided Flowcell
- Data rates up to 80 Hz.
- Noise specifications as low as 10 μ AU with a medium shunt cell installed.
- Refer to the Service Note.

***"Waters ACQUITY UPLC PDA
Detector Specifications Sheet"***

PDA Specifications

- Wavelength Range 190- 500 nm
- Optical Resolution 1.2 nm
- Light Source D2 High Brightness
- Wavelength Accuracy ± 1.0 nm
- Noise 10 μ AU (dry) 14 μ AU (wet)
- Drift 1000 μ AU/hr (dry and wet)
- Software Compatibility
 - Empower 2
 - Empower 1154, Service Pack "I"
 - MassLynx 4.1
- Simultaneous 3D and 2D collection



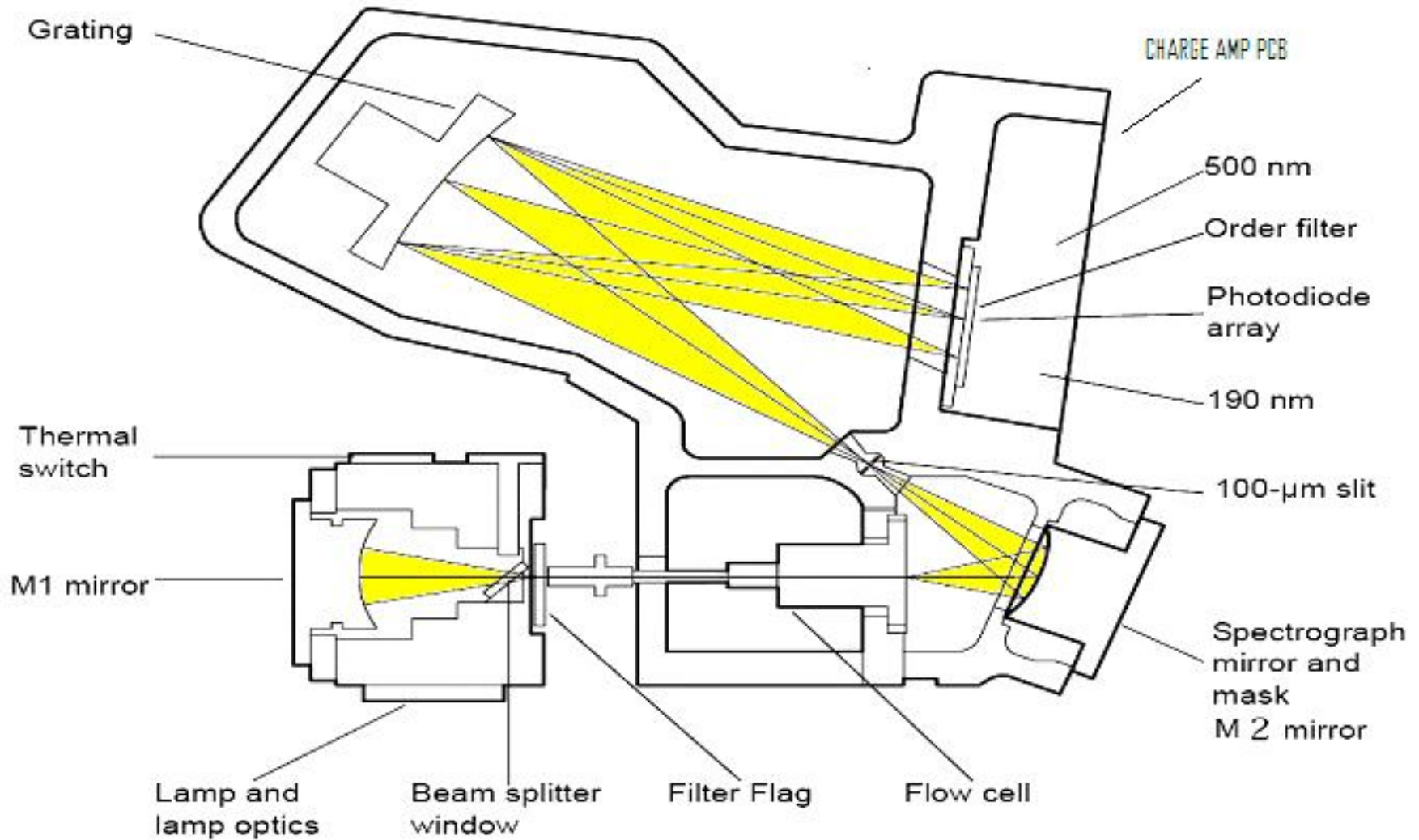
ACQUITY PDA e λ Detector Features

- Extended wavelength range from 190 – 800 nm
- Excellent Sensitivity
 - 15 μ AU
- Superior Linearity
- Light Guided Flow cell
- Lamp Optimization
- Spectral Exposure Optimization
- Simultaneous 2D & 3D
- Reference Wavelength Compensation
- 2D functions
 - Wavelength subtraction
 - Wavelength addition
 - Ratio
 - Reference Compensation
- Ethernet Connectivity
- Higher Data Rates
- Independent optimization of time constant and data rate
- Console control
- Leak Sensors

ACQUITY PDA e λ Detector Specifications

- Wavelength Range: 190 - 800 nm
- Optical Resolution: 1.2 nm
- Photodiodes: 512
- Digital Resolution: 1.2nm/pixel
- Wavelength Accuracy: ± 1.0 nm
- Wavelength repeatability: ± 0.1 nm
- Noise:
 - 15 μ AU, analytical flow cell(shunt cell)
- Drift ≤ 1000 μ AU/hr / $^{\circ}$ C
- Linearity Range: $\leq 5\%$ at 2.0 AU, Propylparaben, at 257 nm
- Data Acquisition: Up to 80 Hz
- Simultaneous 3D and 2D collection
- Leak Sensors Standard

Optics Assembly Light Path

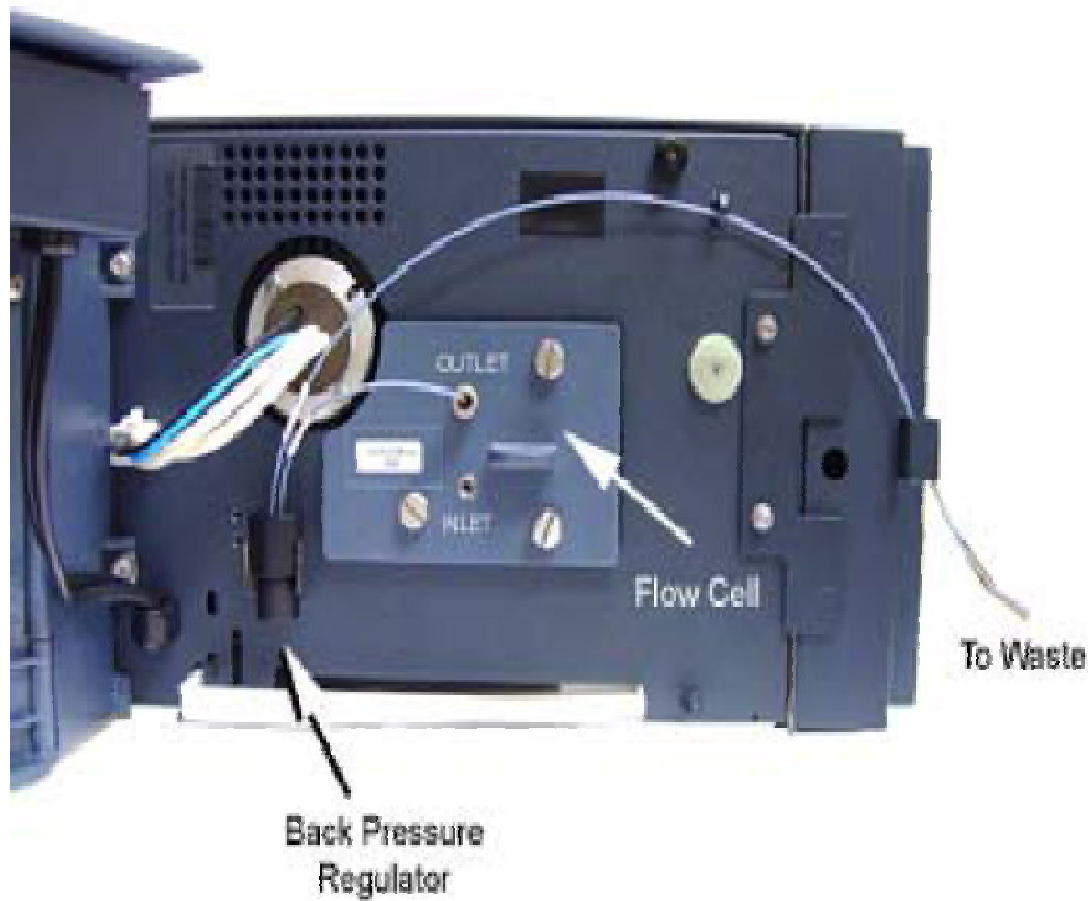


Flow Cells

- The flow cell is ordered as a separate line item.
- Light Guided Flow Cells
 - Analytical, 500nl, 10mm path length
 - Part number 205015004
 - High Sensitivity, 2400nl, 25mm path length
 - Part Number 205015005
- Critical to the performance of UPLC
- Specially designed flow cells
 - Very expensive and no serviceable components
 - Replace complete flow cell only.
 - Looking towards a refurbish cell program for the future.
- **CAUTION:** To ensure optimum performance of your Light-Guiding Flow Cell, make certain that eluent is flowing before powering-on the detector. If power is on for communications purposes before the eluent is flowing, we recommend turning off the lamp



Flow Cell Shunt



- Medium SHUNT cell
 - used as a diagnostic tool
- A substitute for the flow cell which allows transmission of light without liquid.
- The shunt transmits approximately the same amount of light as a flow cell.
- Part Number 700002874

Flow Cell Considerations

Flow cell considerations and topics to train the user on.

- Proper Maintenance of the Flow cell
 - Flushing the detector
 - Maintaining the flow cell
 - Flushing the flow cell
 - Reverse flushing the flow cell
 - Replacing the flow cell
- Refer to the ACQUITY UPLC PDA Getting Started Guide.
 - 71500108703 rev. A
 - Read in chapter 1, Light Guiding flow cell principles
 - Or at the Connections Elite site for all these topics and procedures.

Light Guided Flow Cell- Usage Guidelines

- LG Flow cells are quite expensive (~\$2500 STD cost)
- A lot of flow cells are being returned due to damage and misuse
- It is very important that we educate the customer on the proper care and use of the flow cells
- See document 71500172306- Usage Guidelines

General Guidelines

- For extended storage, flush the flow cell with pure organic solvent and cap the inlet and outlet ports.
- Do not power-on, operate, or ignite the lamp of the detector when there is no flow through the cell, or when the flow cell is dry.
- Flush new columns for 15 minutes before connecting the flow cell
 - minimizes contaminants that can leave deposits on the flow cell's walls.
- If the lamp intensity is so low that the noise is unacceptable for your method, consult the maintenance section of the latest revision of the ACQUITY UPLC System Operator's Guide.

Shutdown Considerations for LG flow cells

- **Downtime less than 24 hours-**

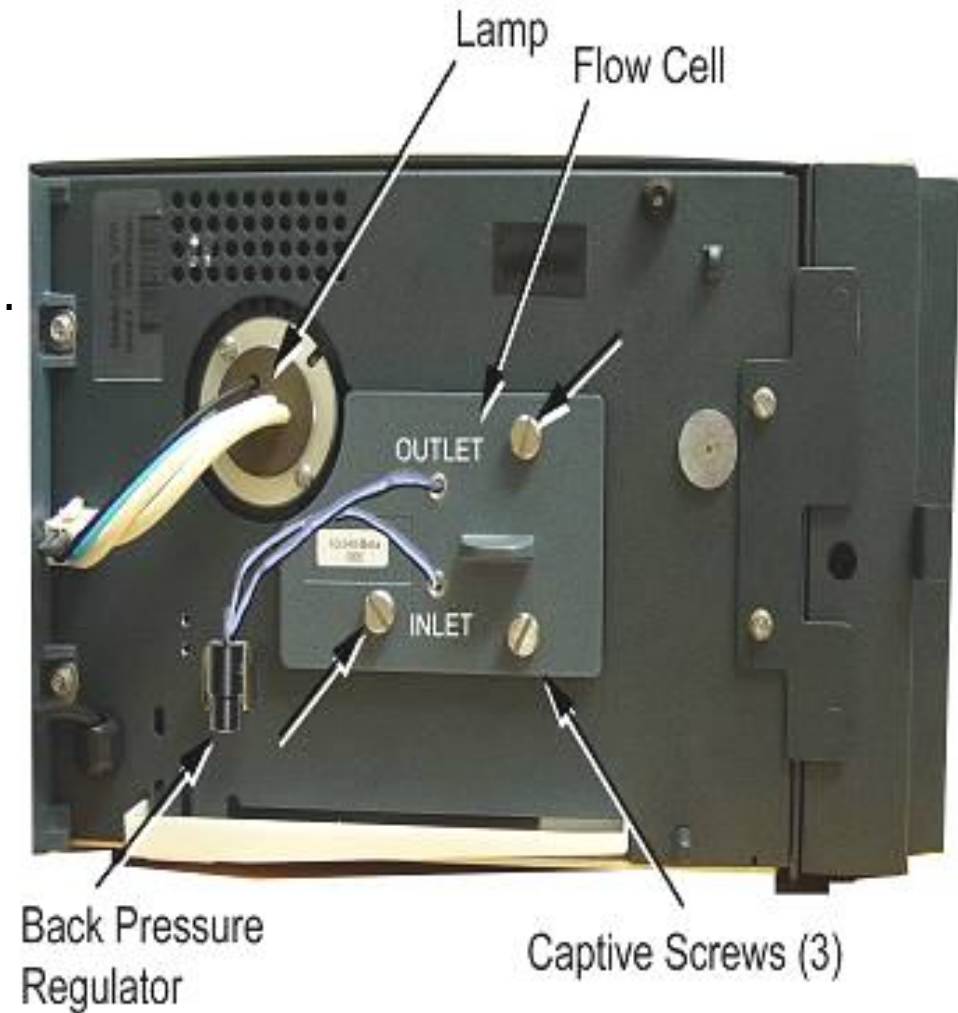
1. Continue to pump mobile phase through the flow cell. You can reduce the flow rate to conserve solvent.
2. Extinguish the detector lamp.

- **Downtime more than 24 hours-**

1. Extinguish the detector lamp.
2. Flush the flow cell with water.
3. Flush the flow cell with pure organic solvent (such as methanol or acetonitrile).
4. Power off the system.
5. Cap the inlet and outlet ports of the flow cell to preserve the cleanliness of the Teflon AF.

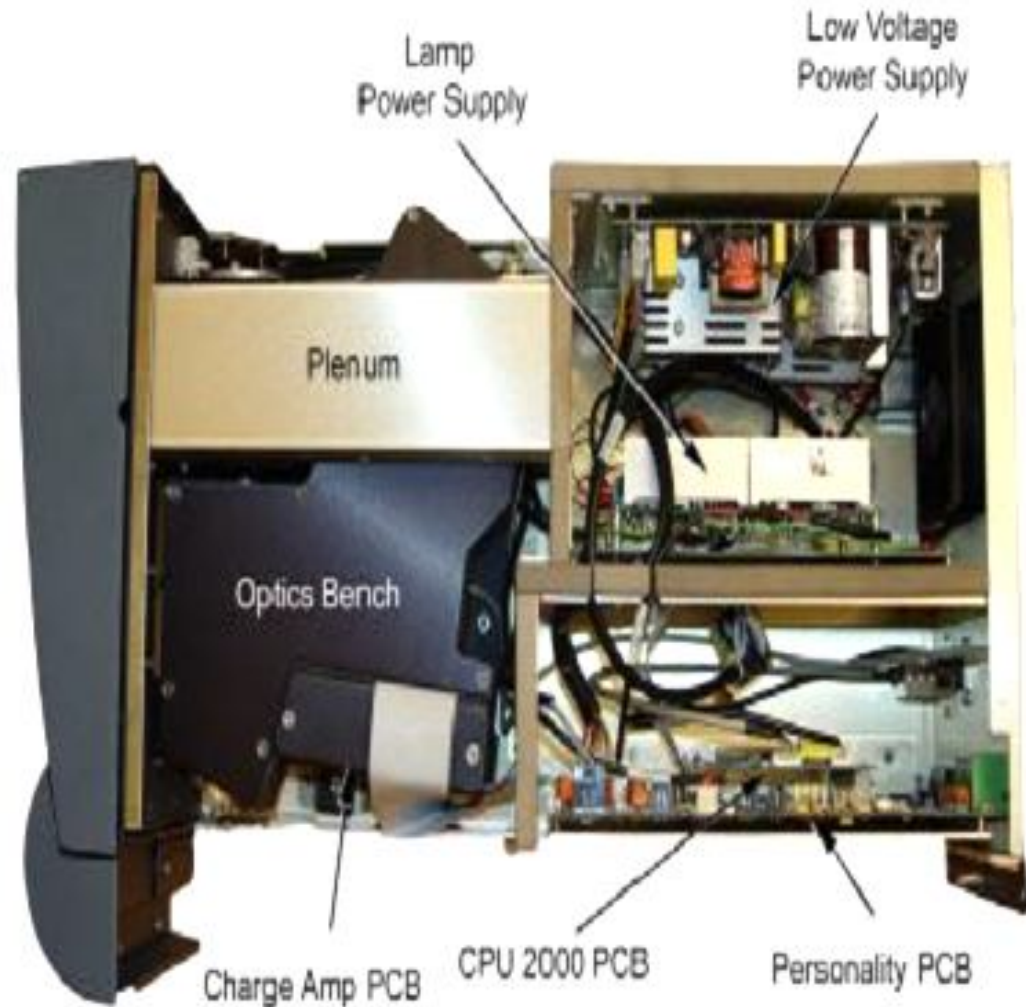
PM Kit

- D2 is a special High Brightness Lamp.
 - More light throughput enabling the electronics to run at low noise levels producing maximum signal to noise ratio.
 - Lamp Warranty is 2000 hours or 1 year, which ever comes first
- Pre-aligned and customer installable.
- PM Kit
 - contains the D2
 - 201000186



Component Layout

- Emissions considerations
- Isolated compartments
- New Power Supplies and PCBs
 - DC Low Voltage Power Supply +5vdc, +24vdc, and +/-15vdc
 - Part Number 700002553
- Lamp Power Supply for High Brightness D2
 - Part Number 700002785
- Instrument Fan
 - Part Number 441000617



LV Power Supply



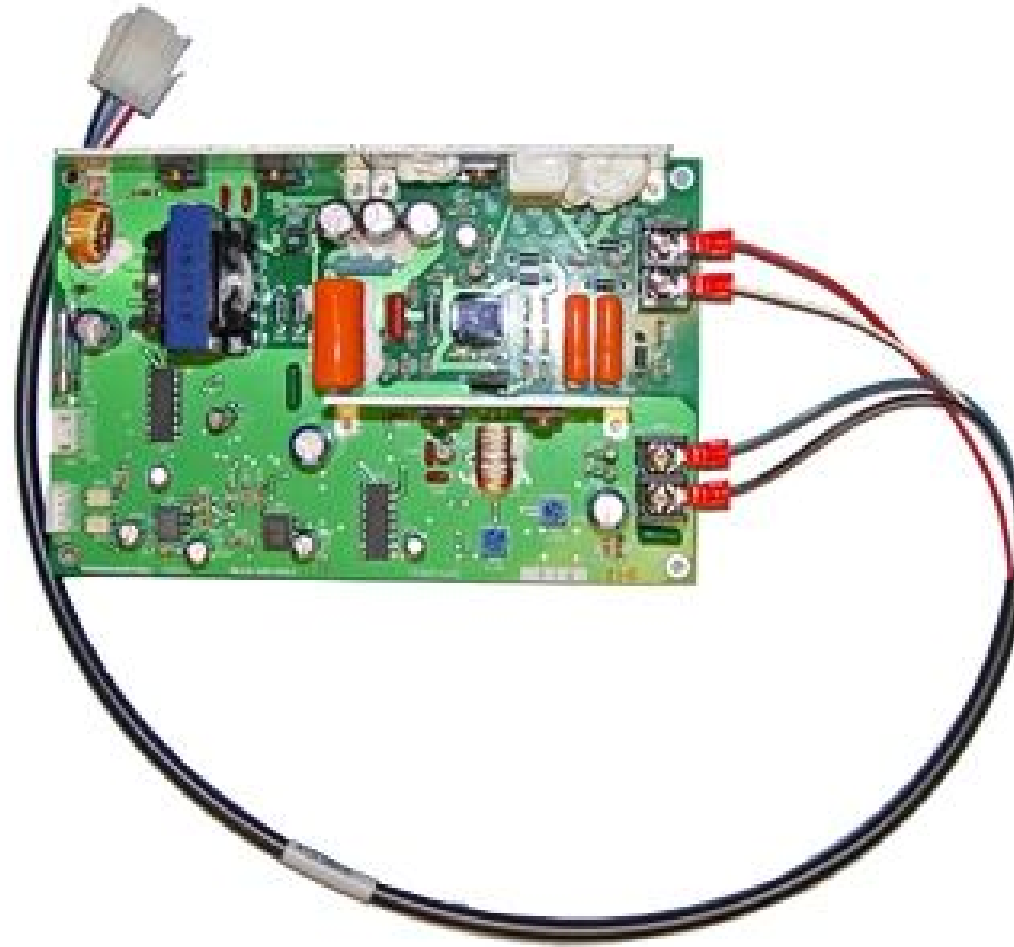
LV Power Supply Pinouts

**LVPS
Capacitor
Label**



LVPS Pinouts		
Location	Description	Wire Color
J1 Connector		
Pin 5	AC Line	Brown
Pin 4		
Pin 3	AC Neutral	Blue
Pin 2		
Pin 1	AC Ground	Green/Yellow
J3 Connector		
Pin 13	+15Vdc	Yellow
Pin 12	Key empty	
Pin 11	-15Vdc	Violet
Pin 10	empty	
Pin 9	+24Vdc	Orange
Pin 8	+24Vdc	Orange
Pin 7	Common	Black
Pin 6	Common	Black
Pin 5	Common	Black
Pin 4	Common	Black
Pin 3	+5Vdc	Red
Pin 2	+5Vdc	Red
Pin 1	+5Vdc	Red

Lamp Power Supply

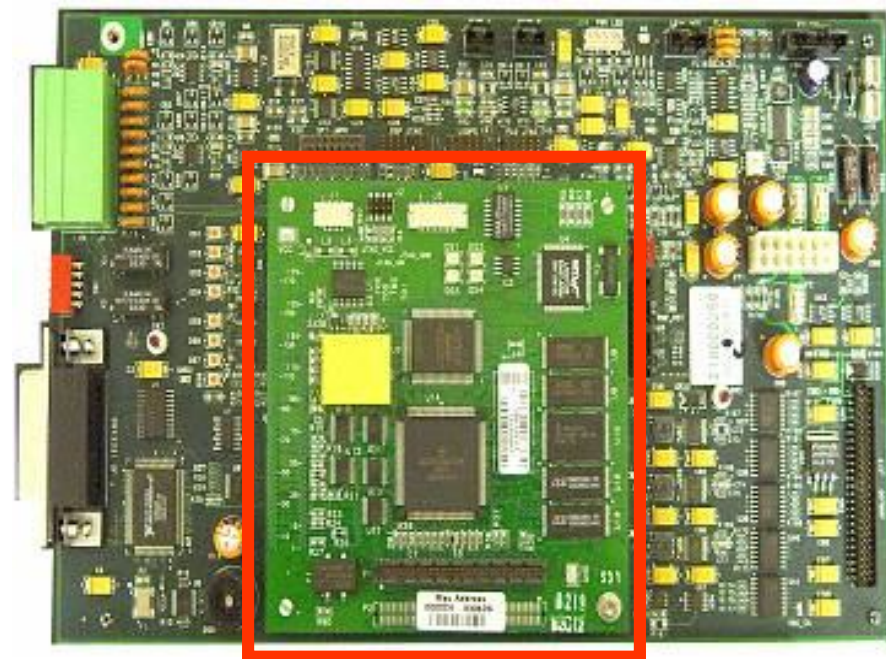
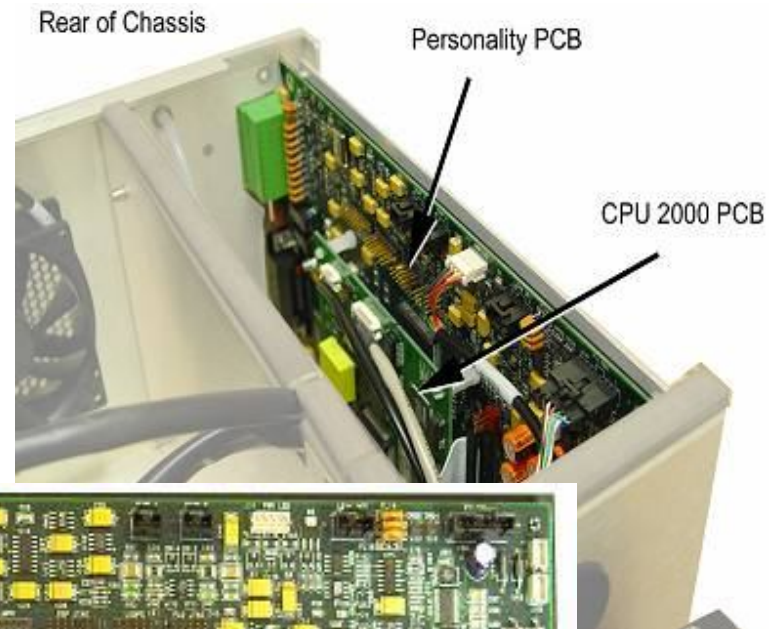


Lamp Power Supply Connections

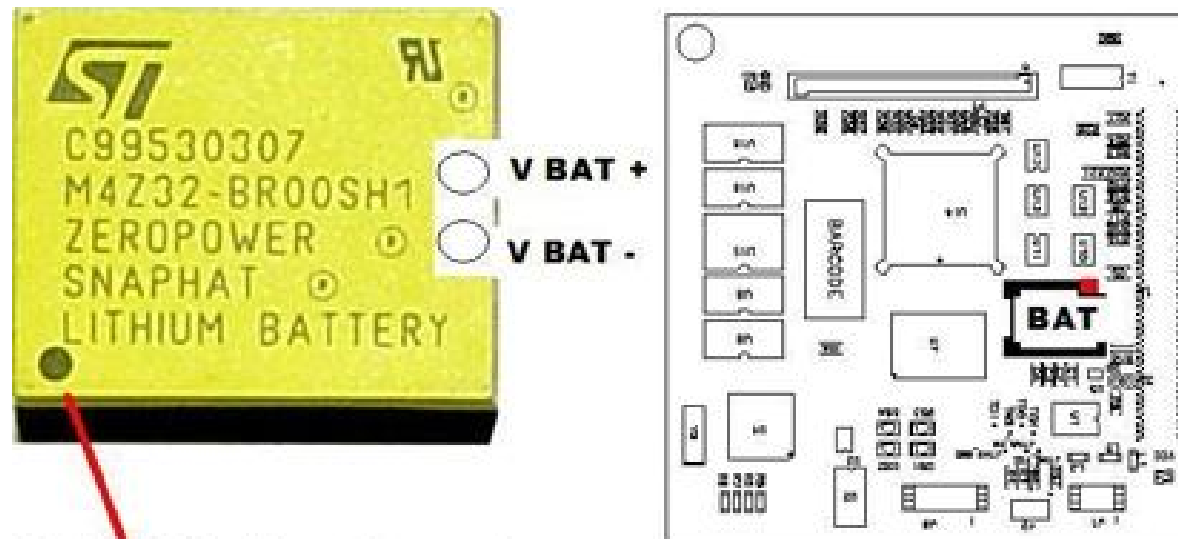
High Brightness Lamp Power Supply Connections			
Channel #	Terminal #	Connection	Function
CN1	1	Input Power Supply +24Vdc +/- 10%	+24Vdc Input Supply Side
CN1	2	Input Power Supply +24Vdc Return Ground	+24Vdc Return Ground Side
CN2	1	Signal Input + 5Vdc (+)	External Control +5Vdc Lamp Turn Off. 0 Vdc Lamp Ignite
CN2	2	Signal Input +5Vdc Return (-)	External Control +5Vdc Lamp Turn Off. 0 Vdc Lamp Ignite
CN2	3	Display Light (+)	Lamp Status Signal
CN2	4	Display Light (-)	Lamp Status Signal
CN3	AN	Lamp Anode	Anode Output
CN3	AP	Lamp Auxiliary Electrode	Trigger Output
CN4	Heat	Lamp Filament	Heater Output
CN4	Ground	Lamp Filament	GND

PDA Personality PCB

- Acquity PDA Personality PCB
 - Part Number 700002784
- CPU 2000
 - Part Number 700001518
- The Personality/CPU connects:
 - Charge Amp Interface
 - Lamp Control
 - User Interface
 - Thermal sensor
 - Filter Wheel



CPU 2000 Battery



Battery Pin 1 Location marker

V BAT -	Negative Voltage
V BAT +	Positive Voltage

Battery should be removed with a Dip Extractor tool

Personality PCB in Bracket

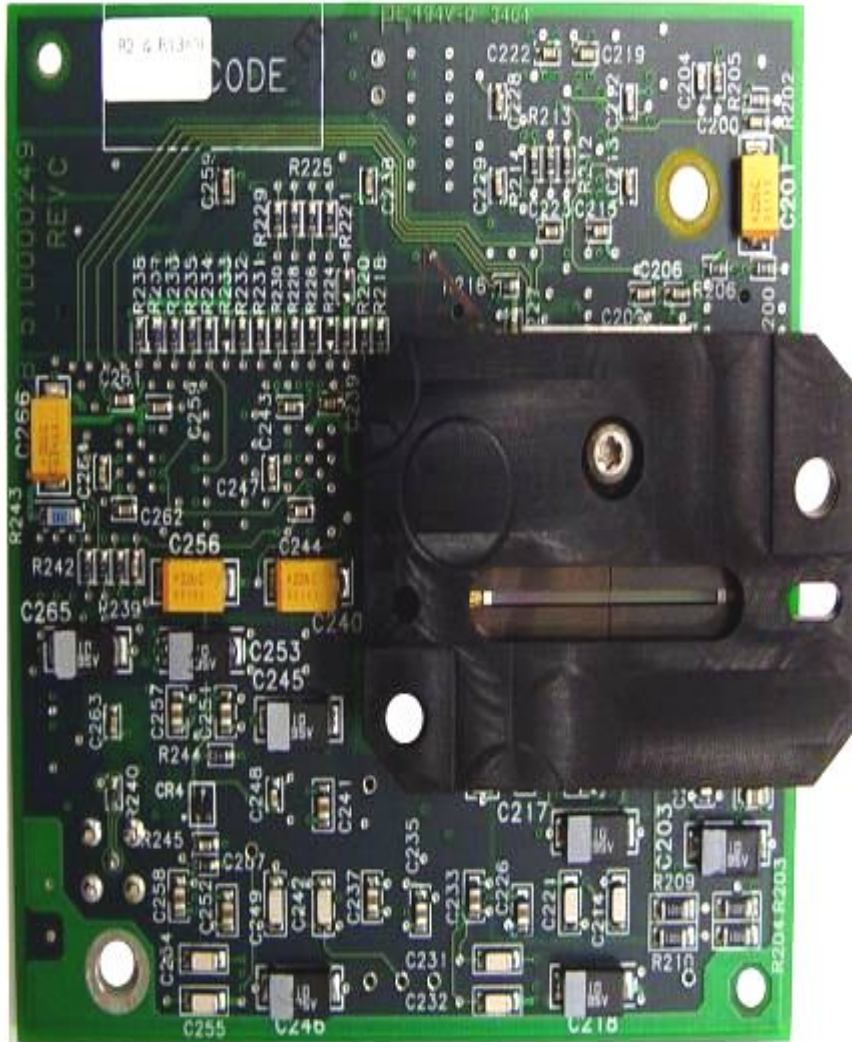


Charge Amp Board

- The Charge Amp board interfaces the Photo Diode Array assembly to the personality board.
- Provides signal conditioning and A/D conversion services.
- At the end of each Exposure Time it is activated to readout the PDA and send the pixel data to the personality board.



Photo Diode Array

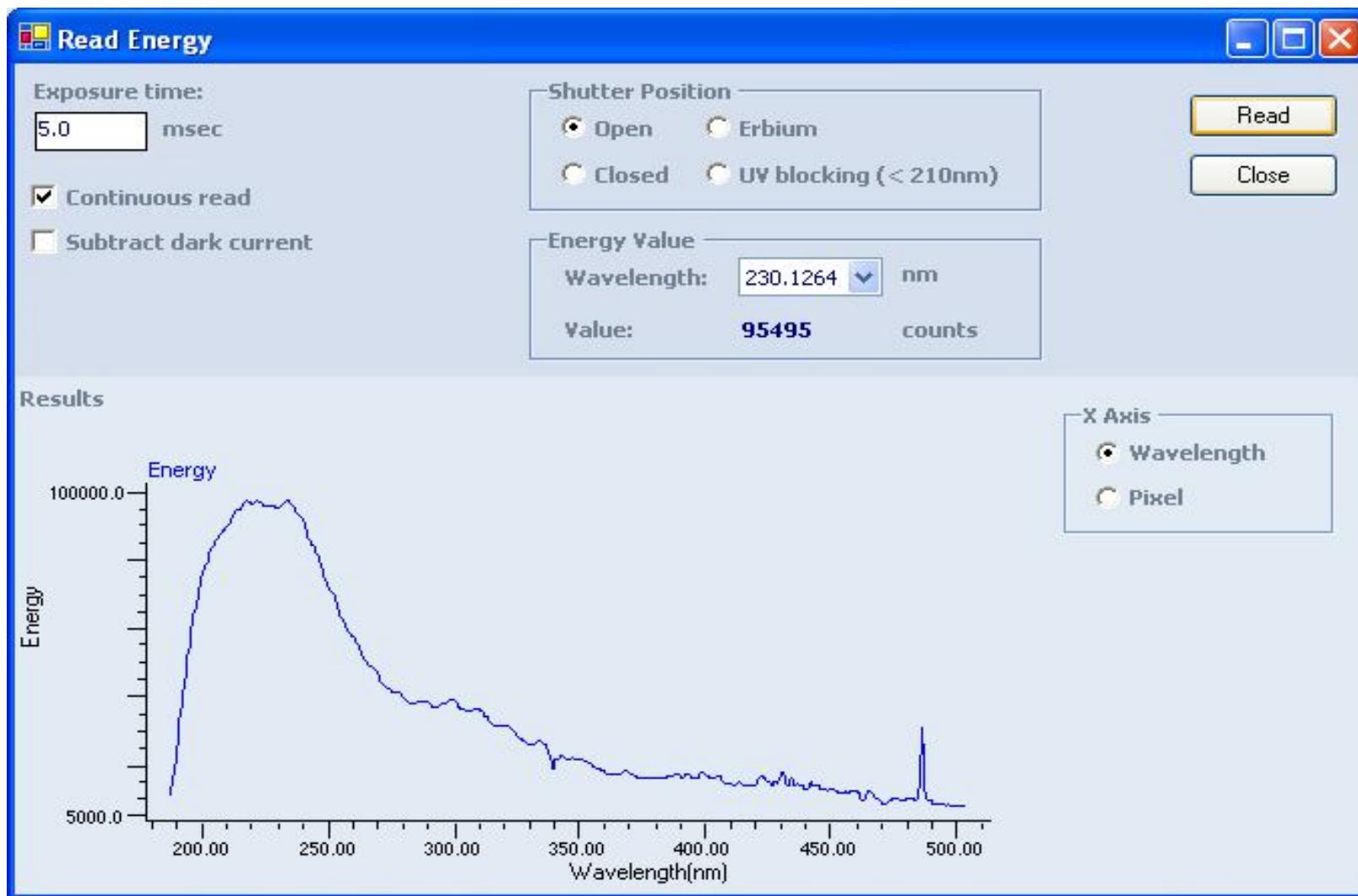


- Photo Diode Array
 - A vector of light sensitive diodes.
 - In this detector there are 512 diodes sensitive to light.
- The ACQUITY PDA is specified from 190-500nm
- The ACQUITY e λ PDA is specified from 190-800nm



PDA #700002783
e λ PDA #700004034

Example of Energy Spectrum



Pre-Installation

- Before installing the ACQUITY UPLC System and Detector ensure:
 - the site requirements have been met
 - all of the required components are present
 - none of the shipping containers or unpacked items are damaged
 - Report all damage immediately to Waters Corporation.
- Prior to installation you should refer to the following documents:
 - ACQUITY UPLC System Guide Site Preparation Guide
 - Part Number 715000878
 - ACQUITY UPLC PDA Getting Started Guide.

Installation

- Installation:
 - Set up & installation considerations
 - Plumbing the detector
 - Making Ethernet Connections
 - I/O signal connections
 - Verifying Detector Operation
- All detailed in the ACQUITY UPLC PDA Getting Started Guide.
 - 71500108703 rev. A
 - Or at the Connections Elite site.

Requirements

- **Requirement:**

- If the ACQUITY PDA detector is the last detector in the system, the backpressure regulator is required for optimum performance.

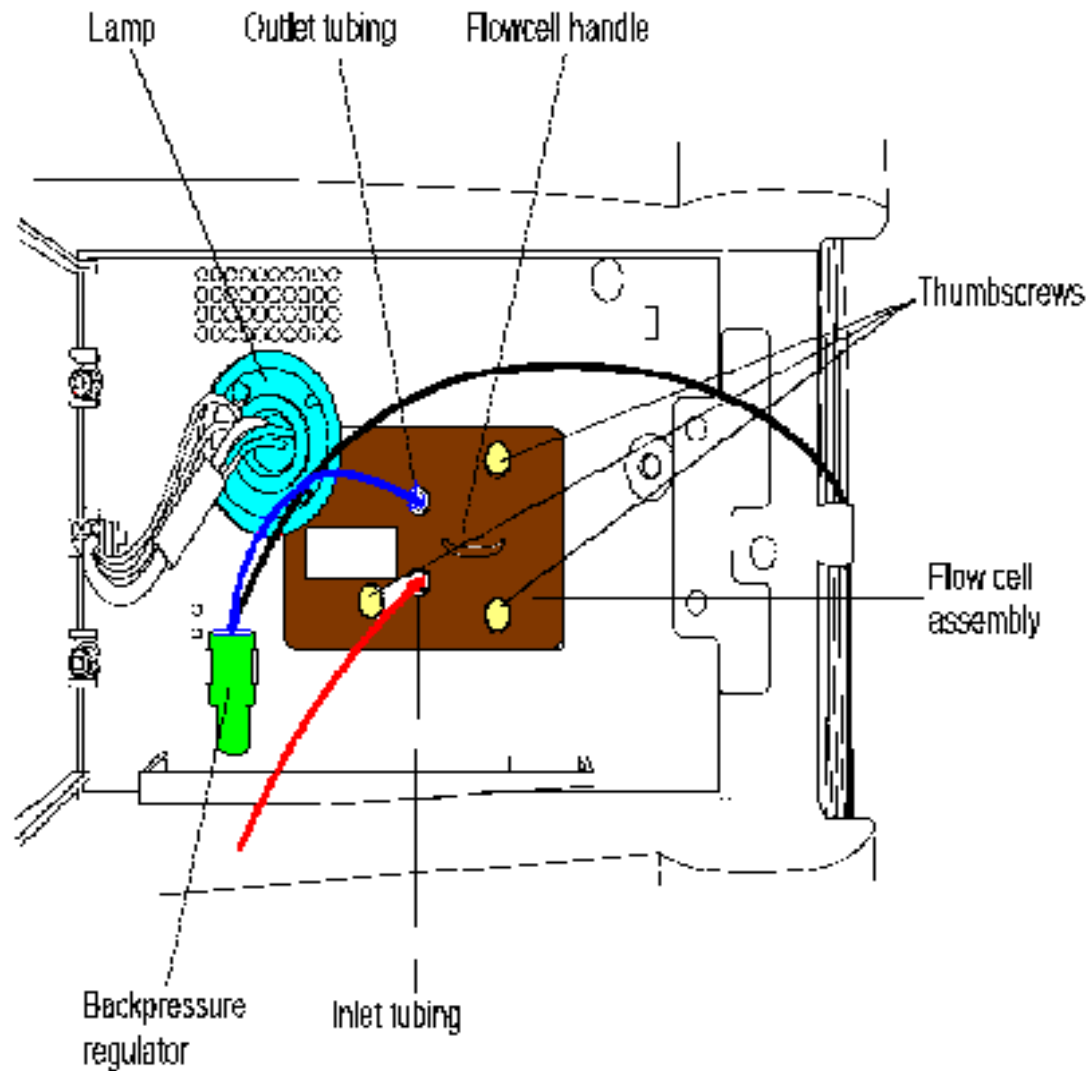
- **Requirement:**

- Make certain that eluent is flowing through flow cell prior to powering-on the detector.

- **Recommendation:**

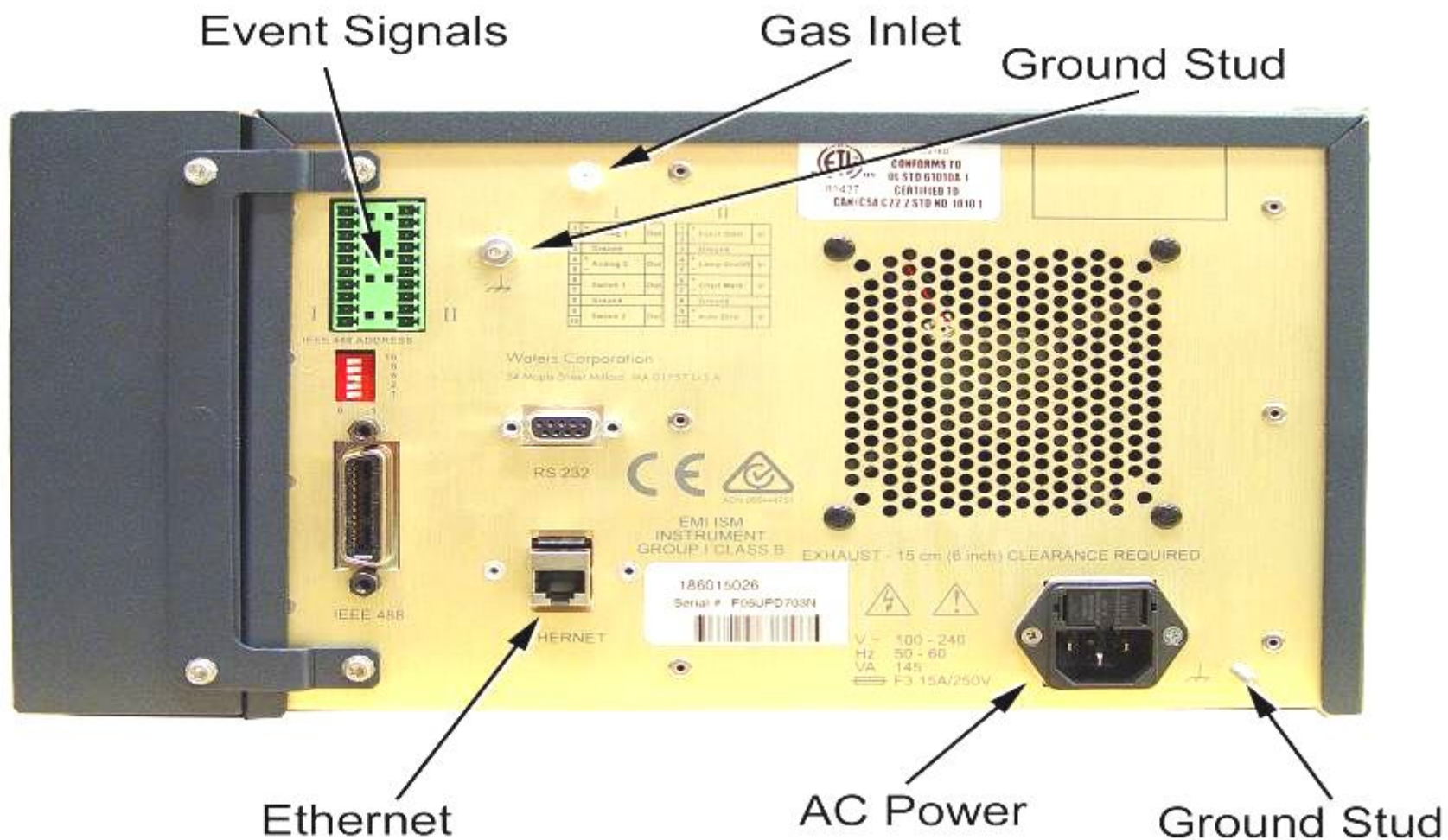
- In order to avoid particulate contamination in the flow cell, you should flush any columns you are connecting to the detector before connecting them.

Plumbing the UPLC PDA



- Inlet Tube assembly from column to flow cell.
 - Part number 430001226
- Back Pressure Regulator
 - Part number 700002571

UPLC PDA Rear Panel



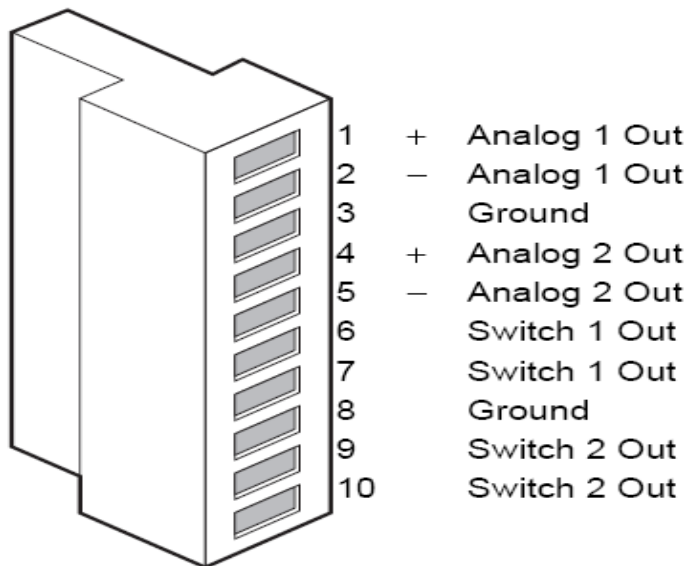
Signal Connectors

I/O signal connectors

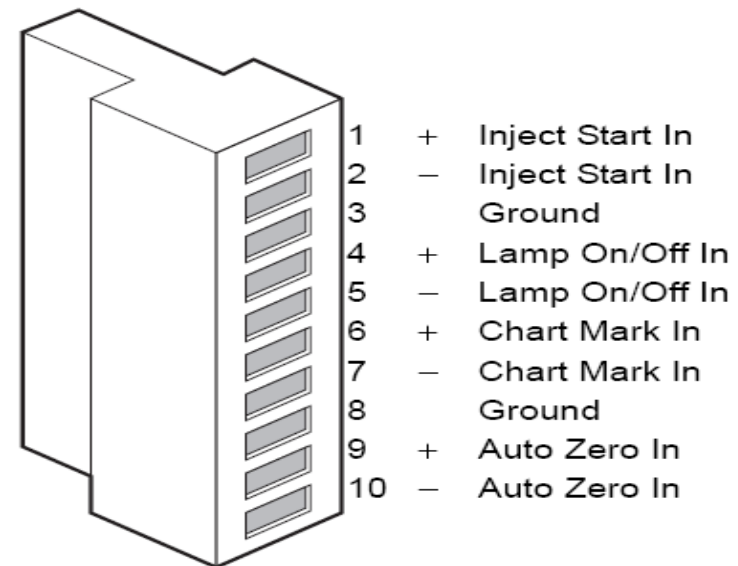
The detector's rear panel includes two removable connectors that hold the screw terminals for I/O signals. These connectors are keyed so that they can receive a signal cable inserted only one way.

I/O signal connectors

Connector I



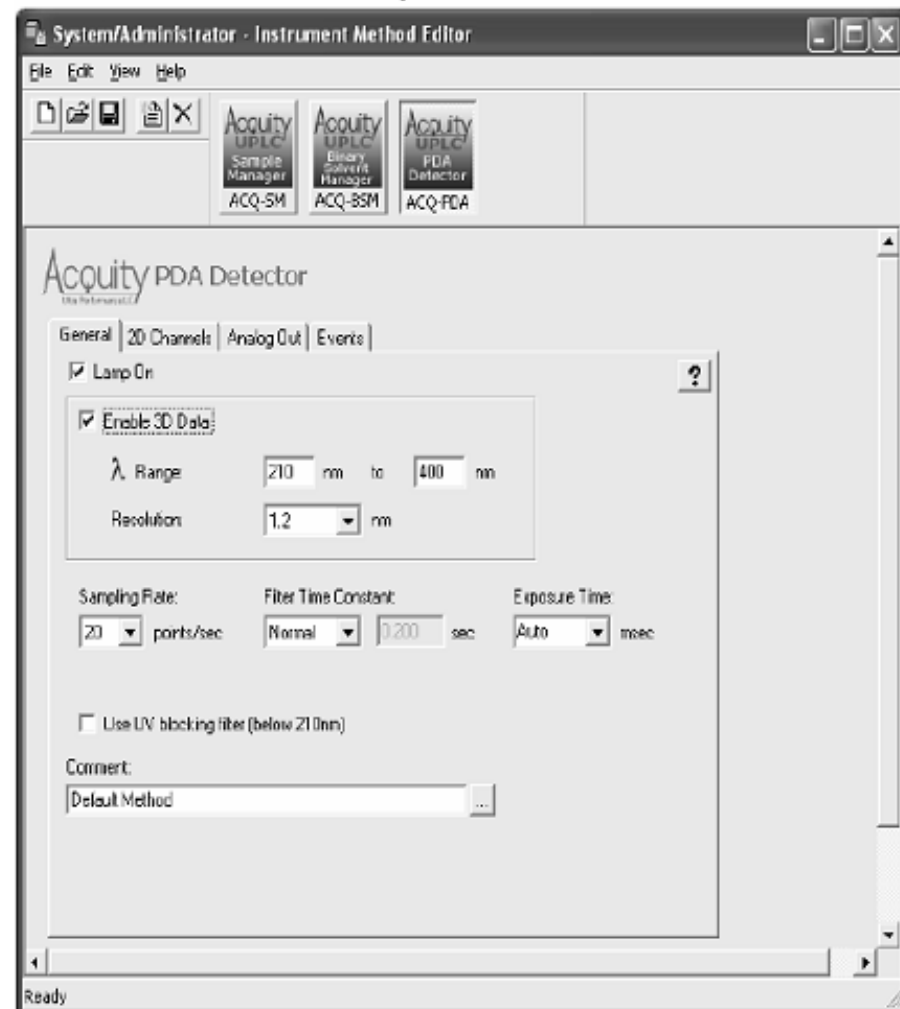
Connector II



Detector Operation

- The Detector verifies calibration at each power up
- Verifying Detector Operation
- Creating Test Methods

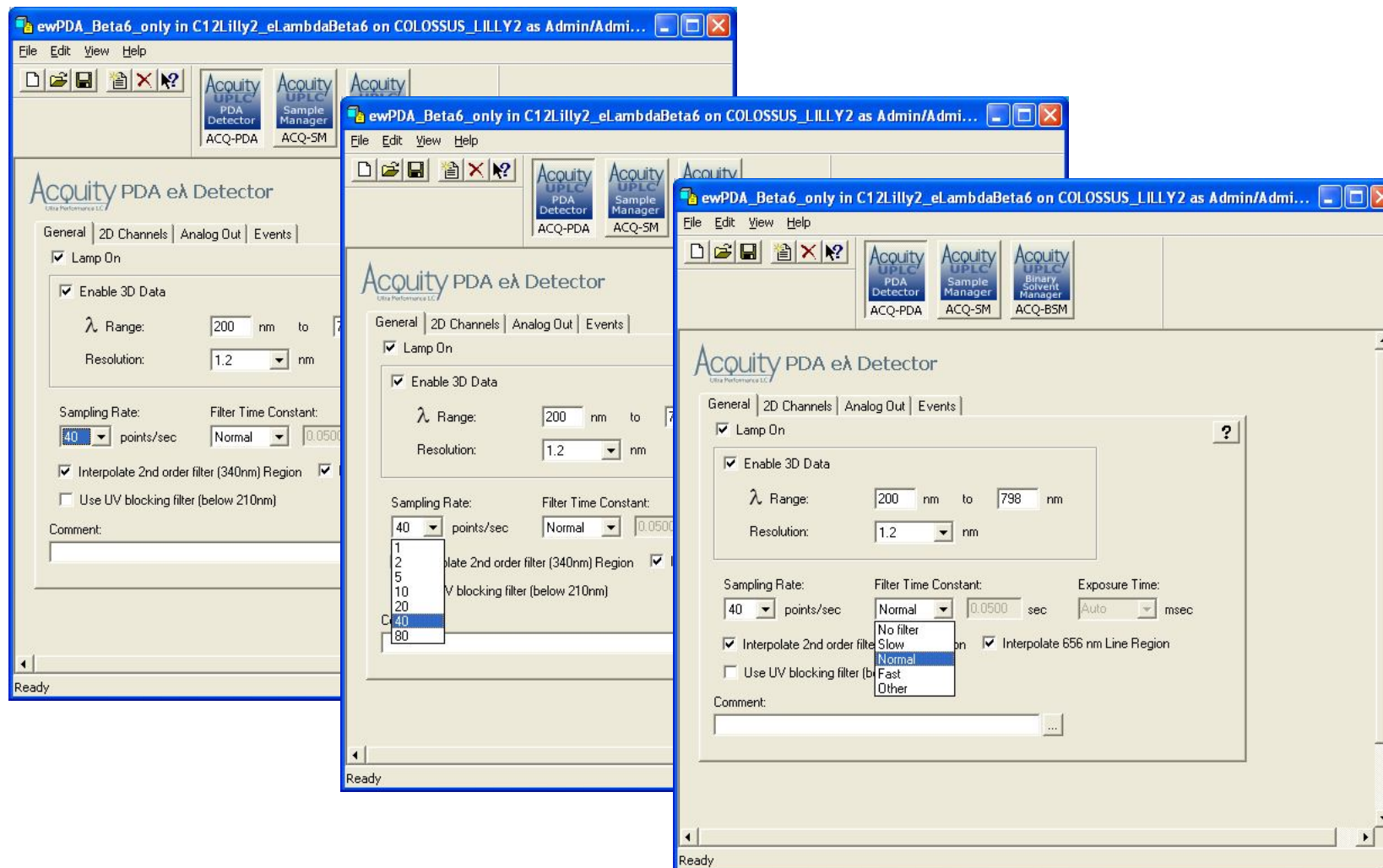
PDA detector instrument parameters:



PDA and eλ PDA Instrument Methods

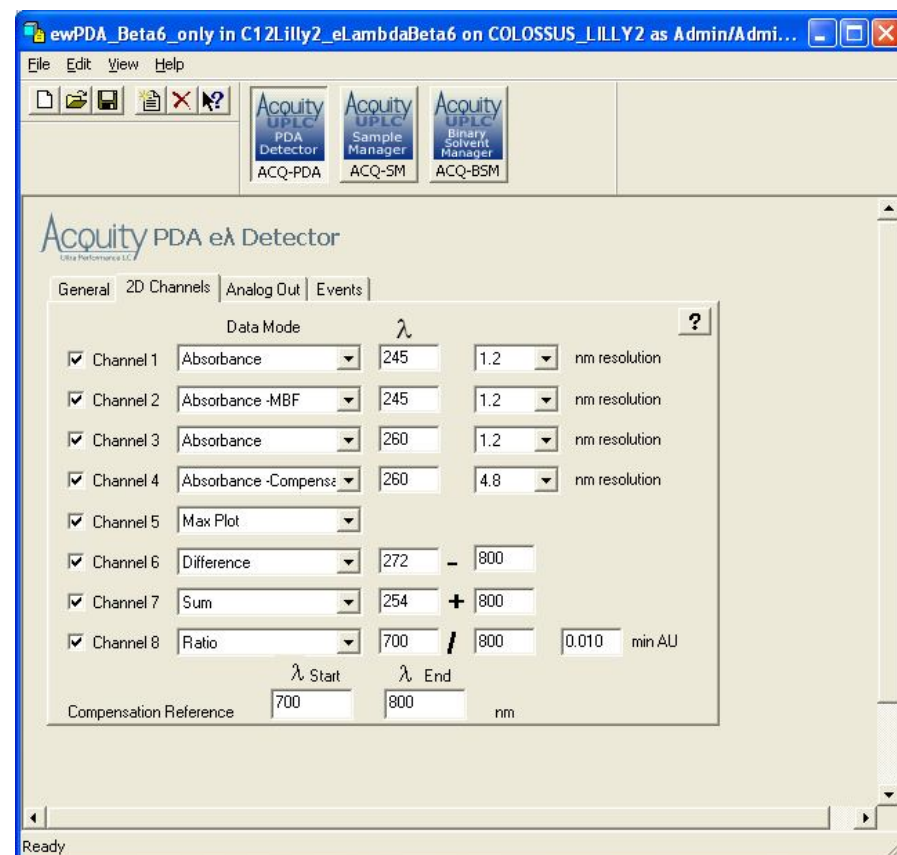


General Tab



2D Channels

- Absorbance
- Absorbance Compensation
 - Compensation Reference
- Maxplot
- Wavelength subtraction
- Wavelength addition
- Ratio



ACQUITY 2996 PDA Detector



ACQUITY 2996 PDA Detector

- This is a 2996 CapLC Detector with a New ACQUITY Chassis
- New 500nl 10mm path length flow cell
- Low flow and std flow cells are available.
- This is the only component of the system That will require IEEE to Ethernet converter box.(Empower only, Mass Lynx systems will use the GPIB)
- Use spares list for 2996 CapLC Detector

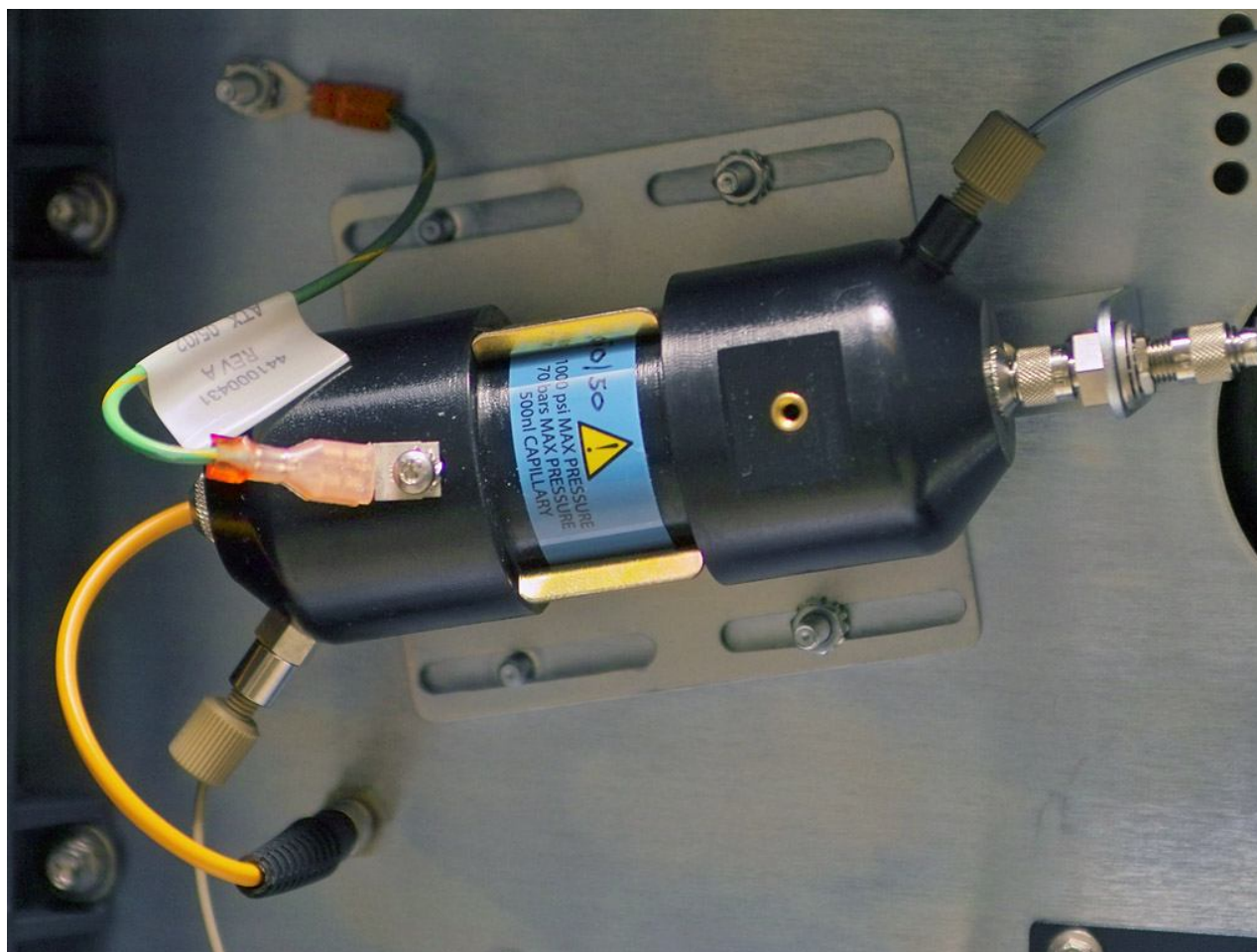
IEEE to Ethernet converter



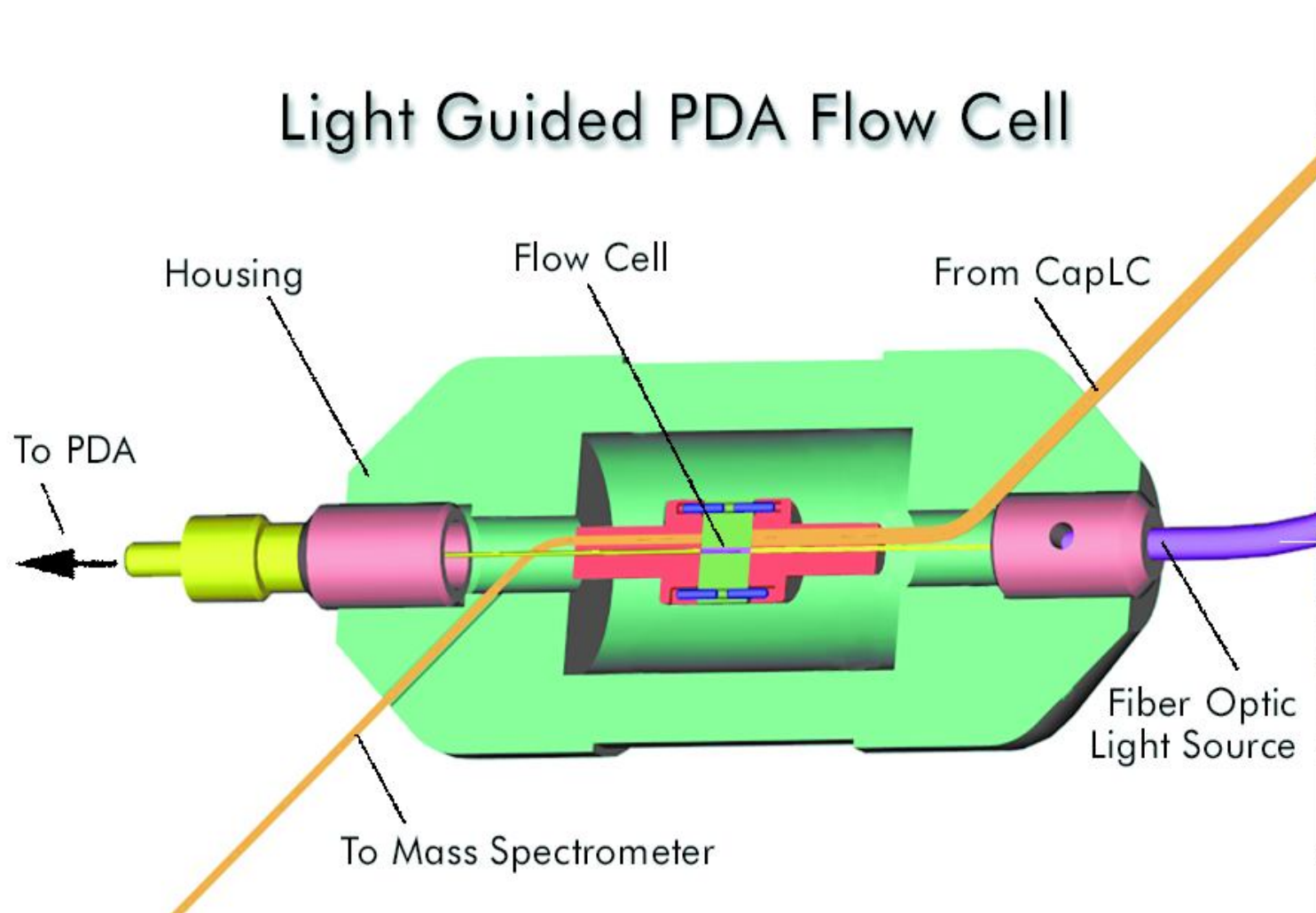
Inject start cable needed



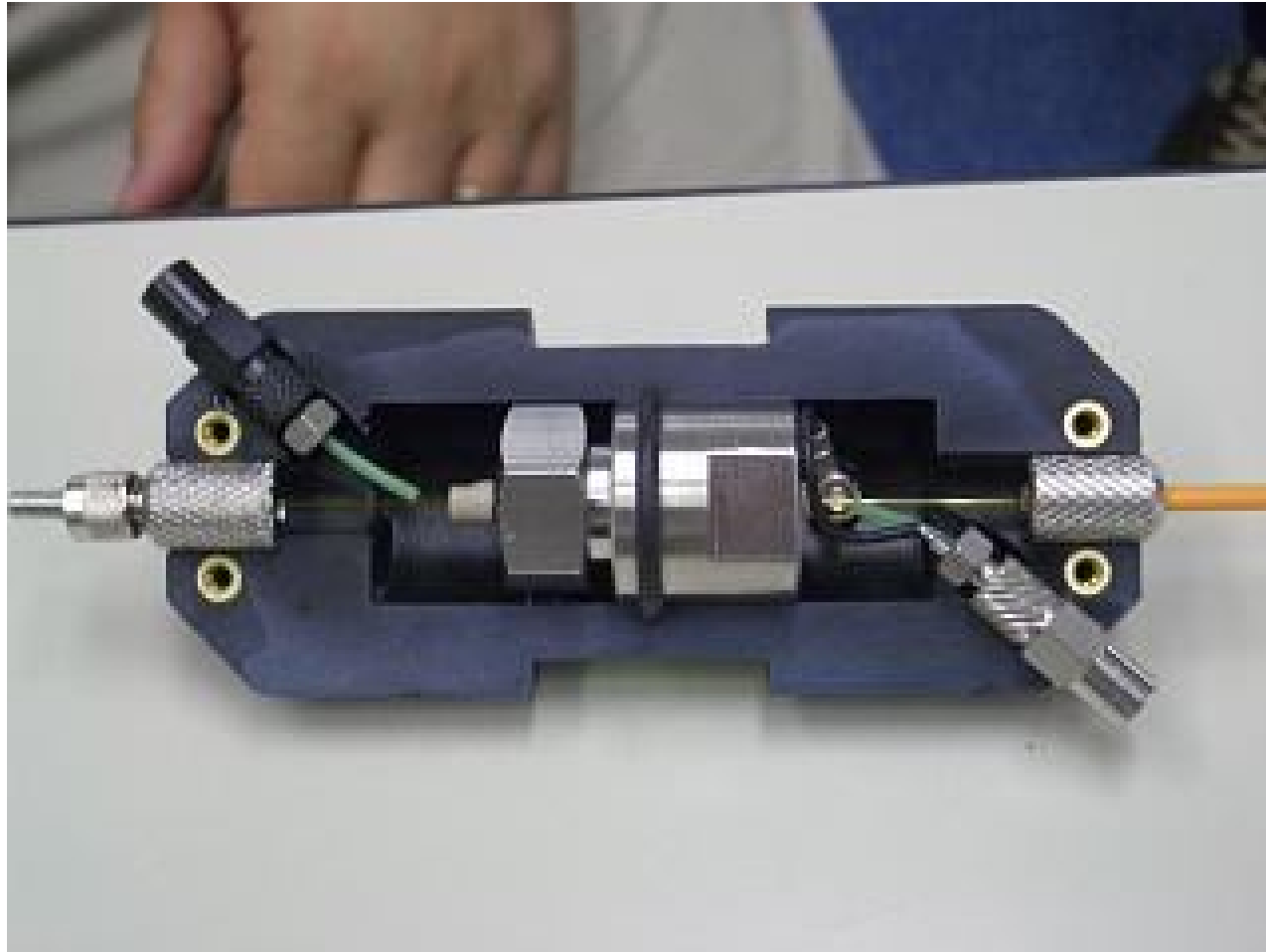
ACQUITY 2996 Flow cell



Flow cell design

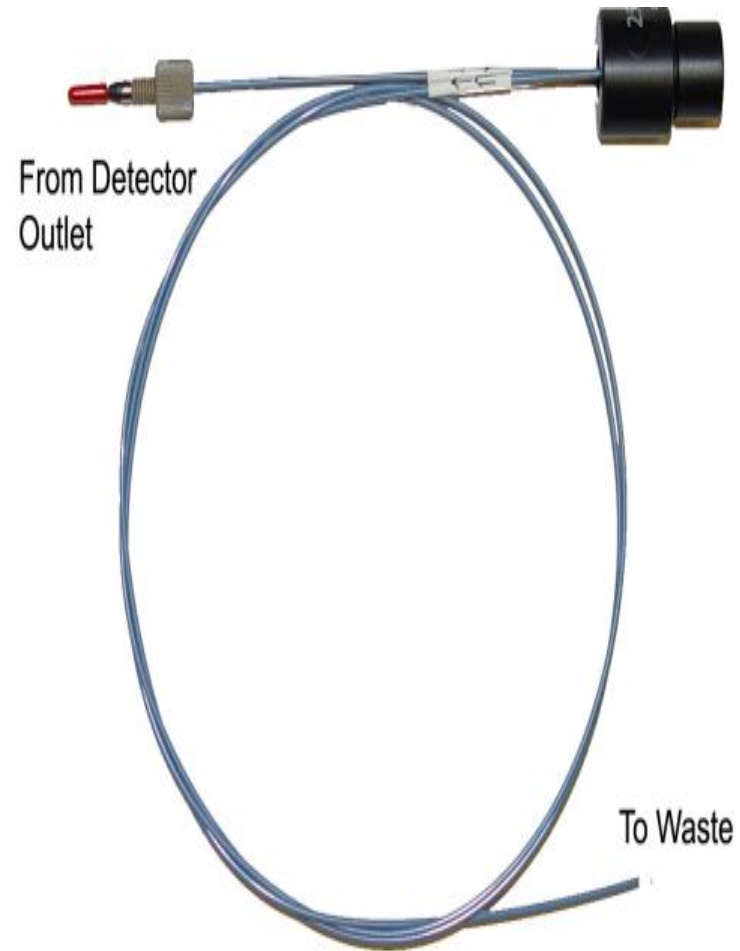


Flow cell (inner)



Back Pressure Regulator

- Maintains a constant 250 psi of back pressure on the flow cell
- Reduces band spreading
- Not used with a Mass Spectrometer
- Used with both detector models.



Things to know

- You will need flow in order for the Detector to pass start up diagnostics.
- Although the detector uses a IEEE to Ethernet converter it is still a IEEE device. The converter must be configured with a ethernet address. The use of this converter enables us to collect data at 20 hz.
- The Diagnostics are accessed the same way a 2996 diagnostics are accessed and work the same way, Through Empower or through the Empower Bin Directory.
- Flow cell not repairable.
- Inject start cable must be used for the PDA only!
- A small PCB has been added to the design to mimic the Red/Green LED pattern that is used by the TUV. The LED on the left is now a power on indicator, Not a Lamp on as in the CapLC 2996.

LED chart

- Left LED- Green when power is on
- Right LED- Flashing green during boot up
- Right LED- Flashing red is a confidence test failure
- Right LED- Solid red is a major failure, No communication to the Detector is possible

PDA optics

- Modular optic bench design. Unlike the standard 2996, This bench consists of two castings. (see Light path for details)
- Utilization of fiber optic cables defines the focusing capabilities or the optic design minimizing stray light problems
- The design is identical to the Waters CapLC 2996 Detector.
- Like all 2996 detectors, the optic bench is calibrated with a mercury lamp. The lambda numbers are put on a label on the bench casting. These numbers must be re-entered when the CPU is replaced.

Bench coefficients

