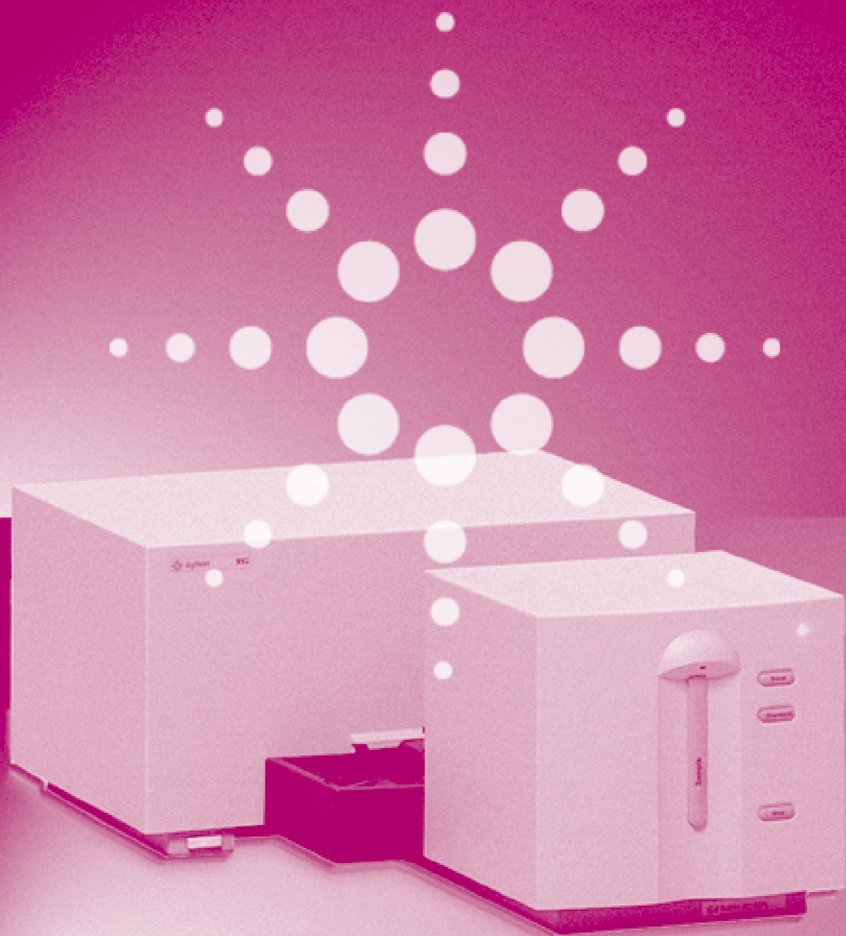
Agilent 8453 UV-visible Spectroscopy System

Service Manual



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Warranty

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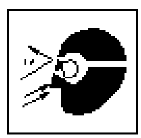
WARNING

For details of safety, see Safety Information on page 154.

Warning Symbols Used In This Book

The apparatus is marked with this symbol when the user should refer to the instruction manual in order to protect the apparatus against damage.



Eye damage may result from directly viewing the light produced by the deuterium lamp used in this product. Always turn off the deuterium lamp before opening the metal lamp door on the side of the instrument.

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Agilent 8453 UV-visible Spectroscopy System

Service Manual

In This Book

This handbook is intended for the technical reader who needs background information about the Agilent 8453 spectrophotometer and potential repairs.

The handbook contains specifications of the spectrophotometer as well as descriptions of front and back panels, for example, where to connect accessories. Electronics are explained at block-diagram level. There is a detailed section about troubleshooting to help find a defective subassembly, such as an electronic board, in case the spectrophotometer does not operate any more. Part replacement procedures as well as an exploded view with part numbers are given for ordering and replacing assemblies.

For information about installation of the system including the spectrophotometer, computer and accessories, see the *Installing Your UV-Visible Spectroscopy System* handbook.

Use Chapter 1 “Specifications” to check the specifications of the spectrophotometer.

Use Chapter 2 “Theory of Operation” if you want an overview of the optics, front and rear panel functions or if you need explainations about the electronics or pin assignment of cables.

Use Chapter 3 “Diagnostics and Troubleshooting” to find explainations of status and error messages and a logical approach to troubleshooting.

Use Chapter 4 “Maintenance and Repair” for exchanging parts, such as lamps and electronical or mechanical items and cleaning lenses,

Use Chapter 5 “Parts and Materials” to locate parts and find out their part numbers.

Use Chapter 6 “Interfacing” to set the 8-bit switch for RS232 comunication and to reset the spectrophotometer in case of problems when loading a new firmware. Use the *Installing Your UV-Visible Spectroscopy System* handbook for information about GPIB settings.

Contents

1

Specifications

Specifications of the Agilent 8453 UV-visible spectrophotometer

Specifications

The Agilent 8453 spectrophotometer is a single-beam, microprocessor-controlled, UV-visible spectrophotometer with collimating optics. With its diode-array technology, the spectrophotometer is much faster than comparable conventional instruments—with more precision, more sensitivity and more reproducible results. Accessories include special cell holders, peristaltic pumps, autosampler, a multicell transport, a Peltier temperature control accessory, and valve unit and valve-pump controller.

The spectrophotometer can be either controlled from HP and non-HP personal computers equipped with Agilent ChemStation software for UV-visible spectroscopy (personal computers used should be certified by UL1950), or from the dedicated handheld controller that comes with the Agilent 8453E UV-vis spectroscopy system.

Physical Specifications

Table 1 Physical Specifications

Type	Specification	Comments
Dimensions	34.4 cm (13.5 inches) wide 56.0 cm (22.0 inches) deep 18.5 cm (7.3 inches) high	
Weight	16.5 kg (36.3 lbs)	
Line voltage	90–264 V AC	Wide-ranging capability
Line frequency	47–63 Hz	
Power consumption	220 VA	Maximum
Ambient operating temperature	0–55 °C (32–131 °F)	See WARNING on page 11
Ambient non-operating temperature	-40–70 °C (-4–158 °F)	
Humidity	<95%, at 25–40 °C (77–104 °F)	Non-condensing
Operating altitude	Up to 2000 m (6,500 ft)	
Non-operating altitude	Up to 4600 m (14,950 ft)	For storing the instrument
Safety standards: IEC, CSA, UL	Installation Category II, Polution Degree 2	

WARNING **If you use the spectrophotometer at environmental temperatures higher than 50 °C (122 °F) the backplane may get hot.**

Performance Specifications

Performance specifications are measured after a minimum 1 hour from cold start or from lamp turn-on, with no cell or filter unless specified, see Table 2. Cold start in this context means that the spectrophotometer had been stored for some hours at room temperature.

Table 2 **Performance Specifications**

Type	Specification	Comments
Wavelength range	190–1100 nm	
Slit width	1 nm	
Resolution	> 1.6	Toluene in hexane, ratio of absorbances at 269 and 266 nm
Stray light	< 1.0 %	At 200 nm, solution of 1.2% KCl, blank scan on air, 5 s integration time; (EP* method)**
	< 0.05 %	At 220 nm, solution of 10 g/l NaI, blank scan on air, 5 s integration time; (ASTM method)
	< 0.03 %	At 340 nm, solution of 50 g/l $NaNO_2$, blank scan on air, 5 s integration time; (ASTM method)
Wavelength accuracy	< ± 0.5 nm	NIST 2034 standard, using transmittance peak minima; wavelength in NIST certificate are interpolated for 1.5 nm bandwidth from the values given for 2 nm and 1 nm bandwidth; uncertainty of standard from NIST certificate (typically ±0.1 nm) is added to the specification; 99-point spline function is used; 0.5 s integration time
Wavelength reproducibility	< ± 0.02 nm	Ten consecutive scans with NIST 2034 standard; 0.5 s integration time
Photometric accuracy	< ± 0.005 AU	NIST 930e standard at 1 AU, at 440.0, 465.0, 546.1, 590.0, and 635.0 nm, the expanded uncertainty from NIST certificate is added to the specification; 0.5 s integration time
Photometric accuracy	< ± 0.01 AU	Potassium dichromate in 0.01 N H_2SO_4 at 235, 257, 313, 350 nm; blank scan on 0.01 N H_2SO_4; 0.5 s integration time (EP method)

Table 2 Performance Specifications, continued

Type	Specification	Comments
Photometric noise	< 0.0002 AU rms	Sixty consecutive scans on air with 0.5 s integration time at 0 AU, 500 nm; 11-point moving average: using equation: Noise(rms)=SQRT((SUM(X-x)^2)/n) where x are measured values, X is a 11-point moving average, n is the number of points
Photometric stability	< 0.001 AU/h	Scan on air at 0 AU, 340 nm, after 1-hour warm up, measured over 1 hour, every 60 s, integration time 5 s; difference between maximum and minimum values are compared to specification; at constant ambient temperature
Baseline flatness	< 0.001 AU rms	Scan on air at 0 AU, 340 nm, 0.5 s integration time
Typical scan time	1.5 s	Full range
Shortest scan time	0.1 s	Full range
Time until next scan	0.1 s	Full range, 0.1 s scan, at least 150 consecutive scans

* EP stands for European Pharmacopoeia
** Apparent absorbance is strongly affected by dissolved oxygen. According to ASTM, bubble pure nitrogen through liquid for several minutes immediately before use. Use only recently distilled water (not demineralized water).

Source of Standards

Wavelength Accuracy

The NIST 2034 Holmium Oxide solution is available from:

U.S. Department of Commerce
National Institute of Standards and Technology
Standard Reference Materials Program
Bldg. 202, Room 204
Gaithersburg
MD 20899
USA
Tel. (301) 975 6776

Photometric Accuracy

The NIST 930e standard is available from NIST, see above address.

Other Standards

All other standards can be prepared using the appropriate material recommended in the EP or ASTM procedures.

Agilent Technologies Standards Kit

All liquid standards required by the EP or ASTM are available in snap-open ampules from Agilent Technologies. These standards are easy to handle, inexpensive and traceable. The OQ/PV chemical standards kit I (order number 5063-6503) contains potassium dichromate, sodium nitrite, sodium iodide and toluene in hexane. The OQ/PV chemical standards kit II (order number 5063-6521) contains holmium oxide in perchloric acid.

2

Theory of Operation

An overview of the instrument, the theory of operation and control, as well as external communication and internal connections

Theory of Operation

This chapter has four sections:

Instrument Overview

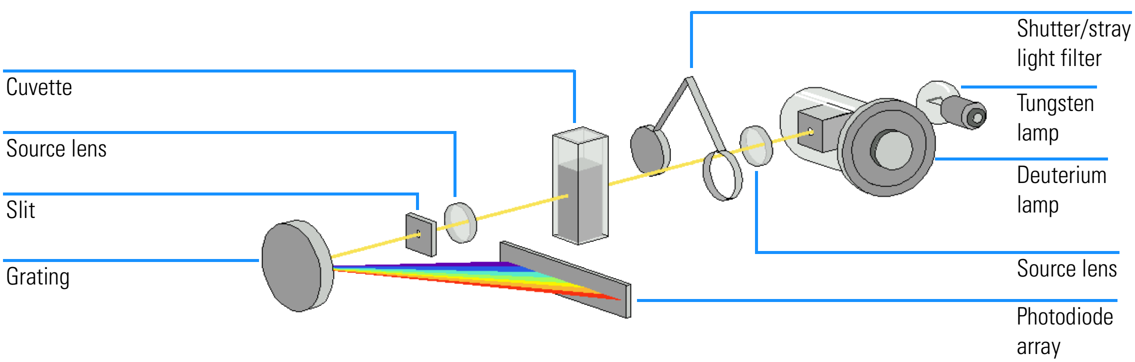
This section gives an overview of the optical system and explains the instrument front and back panel. It also explains the layout and construction of the instrument including the electronic and mechanical assemblies inside the instrument.

Optical System Overview

Optical System

The optical system of the spectrophotometer is shown in Figure 1. Its radiation source is a combination of a deuterium-discharge lamp for the ultraviolet (UV) wavelength range and a tungsten lamp for the visible (VIS) and short wave near-infrared (SWNIR) wavelength range. The image of the filament of the tungsten lamp is focused on the discharge aperture of the deuterium lamp by means of a special rear-access lamp design which allows both light sources to be optically combined and share a common axis to the source lens. The source lens forms a single, collimated beam of light. The beam passes through the shutter/stray-light correction filter area then through the sample to the spectrograph lens and slit. In the spectrograph light is dispersed onto the diode array by a holographic grating. This allows simultaneous access to all wavelength information. The result is a fundamental increase in the rate at which spectra can be acquired.

Figure 1 **Optical System of Spectrophotometer**



Lamps

The light source for the UV wavelength range is a deuterium lamp with a shine-through aperture. As a result of plasma discharge in a low pressure deuterium gas, the lamp emits light over the 190 nm to approximately 800 nm wavelength range. The light source for the VIS and SWNIR wavelength range is a low-noise tungsten lamp. This lamp emits light over the 370 nm to 1100 nm wavelength range.

Source Lens

The source lens receives the light from both lamps and collimates it. The collimated beam passes through the sample (if one is present) in the sample compartment.

Shutter

The shutter is electromechanically actuated. It opens and allows light to pass through the sample for measurements. Between sample measurements it closes to limit exposure of sample to light. If the measurement rate is very fast, you can command the shutter to remain open (ChemStation software) or it stays open automatically (handheld controller software).

Stray-Light Correction Filter

In a standard measurement sequence, reference or sample intensity spectra are measured without and then with the stray-light filter in the light beam. Without the filter the intensity spectrum over the whole wavelength range from 190–1100 nm is measured. The stray-light filter is a blocking filter with 50 % blocking at 420 nm. With this filter in place any light measured below 400 nm is stray light. This stray-light intensity is then subtracted from the first spectrum to give a stray-light corrected spectrum. Depending on the software, you can switch off the stray light correction (ChemStation software) in case you want to do very fast repetitive scans or it is switched off automatically (handheld controller software).

Sample Compartment

The spectrophotometer has an open sample compartment for easier access to sample cells. Because of the optical design a cover for the sample area is not required. The spectrophotometer is supplied with a single-cell cell holder already installed in the sample compartment. This can be replaced with the Peltier temperature control accessory, the thermostattable cell holder, the adjustable cell holder, the long path cell holder or the multicell transport. All of these optional cell holders mount in the sample compartment using the same quick, simple mounting system. An optical filter wheel is also available for use with the spectrophotometer and most of the accessories.

Spectrograph

The spectrograph housing material is ceramic to reduce thermal effects to a minimum. It main components of the spectrograph are the lens, the slit, the grating and the photodiode array with front-end electronics. The mean sampling interval of the diode array is 0.9 nm over the wavelength range 190 nm to 1100 nm. The nominal spectral slitwidth is 1 nm.

Spectrograph Lens

The spectrograph lens is the first of the parts which are collectively known as the spectrograph. It is mounted on the housing of the spectrograph. The spectrograph lens refocuses the collimated light beam after it has passed through the sample.

Slit

The slit is a narrow aperture in a plate located at the focus of the spectrograph lens. It is exactly the size of one of the photodiodes in the photodiode array. By limiting the size of the incoming light beam, the slit makes sure that each band of wavelengths is projected onto only the appropriate photodiode.

Grating

The combination of dispersion and spectral imaging is accomplished by using a concave holographic grating. The grating disperses the light onto the diode array at an angle proportional to the wavelength.

Diode Array

The photodiode array is the heart of the spectrograph. It is a series of 1024 individual photodiodes and control circuits etched onto a semiconductor chip. With a wavelength range from 190 nm to 1100 nm the sampling interval is nominal 0.9 nm.

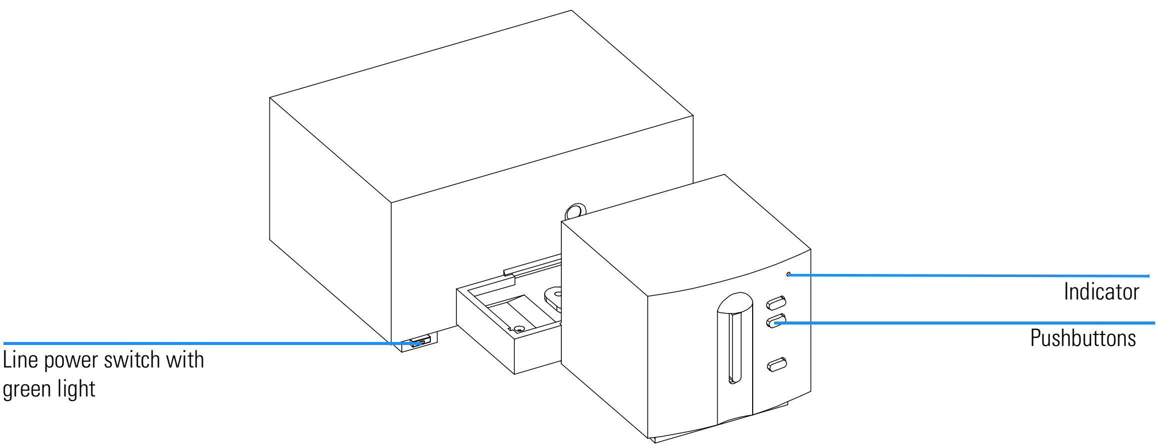
Instrument Description

Your spectrophotometer is very easy to use. It has a line power indicator, a status indicator and some push buttons. All electrical connections are made at the rear of the instrument.

Front View

The front view of the spectrophotometer is shown in Figure 2. Notice that the sample compartment is open. Unlike conventional instruments the Agilent 8453 does not suffer from ambient stray light. The open sample area makes it easier to access for cuvette handling and to connect tubing to a flow cell or thermostattable cell holder. The spectrophotometer is shipped with the standard single-cell cell holder. Standard and accessory cell holders can be removed and replaced in seconds with few or no tools.

Figure 2 **Front View of Spectrophotometer**



The line power switch is located at the lower-left part of the instrument. Pressing it in turns on the instrument. It stays pressed in and shows a green light when the instrument is turned on. When the line power switch stands out and the green light is off, the instrument is turned off.

On the front panel of the spectrophotometer is a status indicator which will display different colors depending of the actual condition of the instrument.

- Green—the instrument is ready to measure.
- Green, blinking—the instrument is measuring.
- Yellow—the instrument is in not-ready state, for example, turning one of the lamps on or if both lamps are switched off.
- Red—error condition, that is, the spectrophotometer does not pass one of the self-tests which are run when the spectrophotometer is turned on or an error occurred during operation. In this case the UV-Visible operating software gives a detailed error message and possible explanations are in the online help system and in Chapter 3 “Diagnostics and Troubleshooting”.
- Red, blinking—error condition of the spectrophotometer processor system. Because in this case there is no communication with the computer there will be no error message. The online help system and Chapter 3 “Diagnostics and Troubleshooting” give more information about troubleshooting.

NOTE When using an Agilent 8453E UV-vis spectroscopy system, you will only have access to the online help of the handheld controller, when there is no power loss at the CAN interface of the Agilent 8453 spectrophotometer.

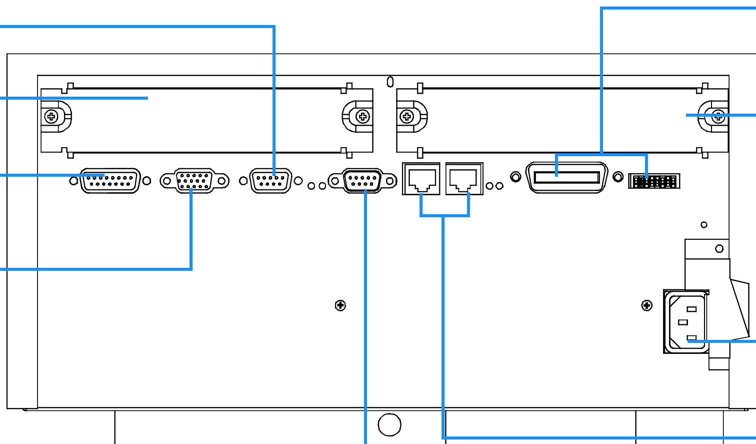
The four measure push buttons on the front panel cause the following actions to be performed and the resulting data being sent to the computer.

- BLANK—the instrument takes a blank measurement. This comprises a reference measurement that is used in all subsequent sample measurements until a new blank measurement is taken. Following the reference measurement the baseline spectrum is measured and displayed on the PC.
- SAMPLE—the instrument takes a sample measurement or starts a series of measurements. This depends on the parameters set in your software.
- STANDARD—the instrument takes a measurement of a standard. Additional information such as concentration and so on, have to be entered in the operating software.
- STOP—the instrument and/or software aborts any ongoing activity and returns to a to ready state. The stop button is not supported when the handheld controller of the Agilent 8453E UV-vis spectroscopy system is used to control the spectrophotometer.

Rear View

All connections are made at the rear of the spectrophotometer, see Figure 3.

Figure 3 **Rear View of Spectrophotometer**



- The multicell connector allows you to connect the cable which comes from the multicell transport.
- The GPIO (general-purpose input/output) connector allow you to control a sipper and autosampler or other accessories depending on the software you are using.
- The remote connector may be used in combination with other analytical instruments from Agilent Technologies if you want to use features such as common shut down and so on.
- The RS232C connector may be used to control the spectrophotometer from a computer through RS232 connection, using appropriate software (for future use). This connector needs to be defined by the configuration switch module next to the GPIB connector. The software needs the appropriate drivers to support this comunication which is intended for future use.

  The RS232C port is used as printer interface to connect the printer, using a serial/parallel cable, of the Agilent 8453E UV-visible spectroscopy system.

- The right CAN bus is used to connect the handheld controller of the Agilent 8453E UV-visible spectroscopy system to the spectrophotometer.
- The GPIB connector is used to connect the spectrophotometer with a computer. The 8-bit configuration switch module next to the GPIB connector determines the GPIB address of your spectrophotometer. The switches are preset to a default address recognized by the operating software from Agilent Technologies.

  The GPIB port is not used when the handheld controller of the Agilent 8453E UV-visible spectroscopy system is connected to the spectrophotometer. However, the 8-bit configuration switch of the port must be set for GPIB communication.
- The MIO board slot is reserved for a LAN interface board.
- The accessory board slot is reserved for future use.
- The power input socket does not have a voltage selector because the power supply has wide-ranging capability, for more information see Chapter 1 “Specifications”. There are no externally accessible fuses, because automatic electronic fuses are implementeded in the power supply. The security lever at the power input socket prevents that the spectrophotometer cover is taken off when line power is still connected.

Side of the Instrument

On the right side of the instrument there is a door for exchanging the lamps. Behind this plastic door there is another sheet-metal door. Two independant safety light switches are implemented. They automatically turn off the lamps when the sheet metal door is opened.

Instrument Layout and Construction

The industrial design of the spectrophotometer incorporates several innovative features. It uses the **E-Pak** concept for the packaging of electronics and mechanical assemblies. This concept is based upon the use of layers foam plastic spacers in which the electronic boards of the spectrophotometer are placed. This pack is then housed in a metal internal cabinet which is enclosed by a plastic external cabinet. The advantages of this packaging technology are:

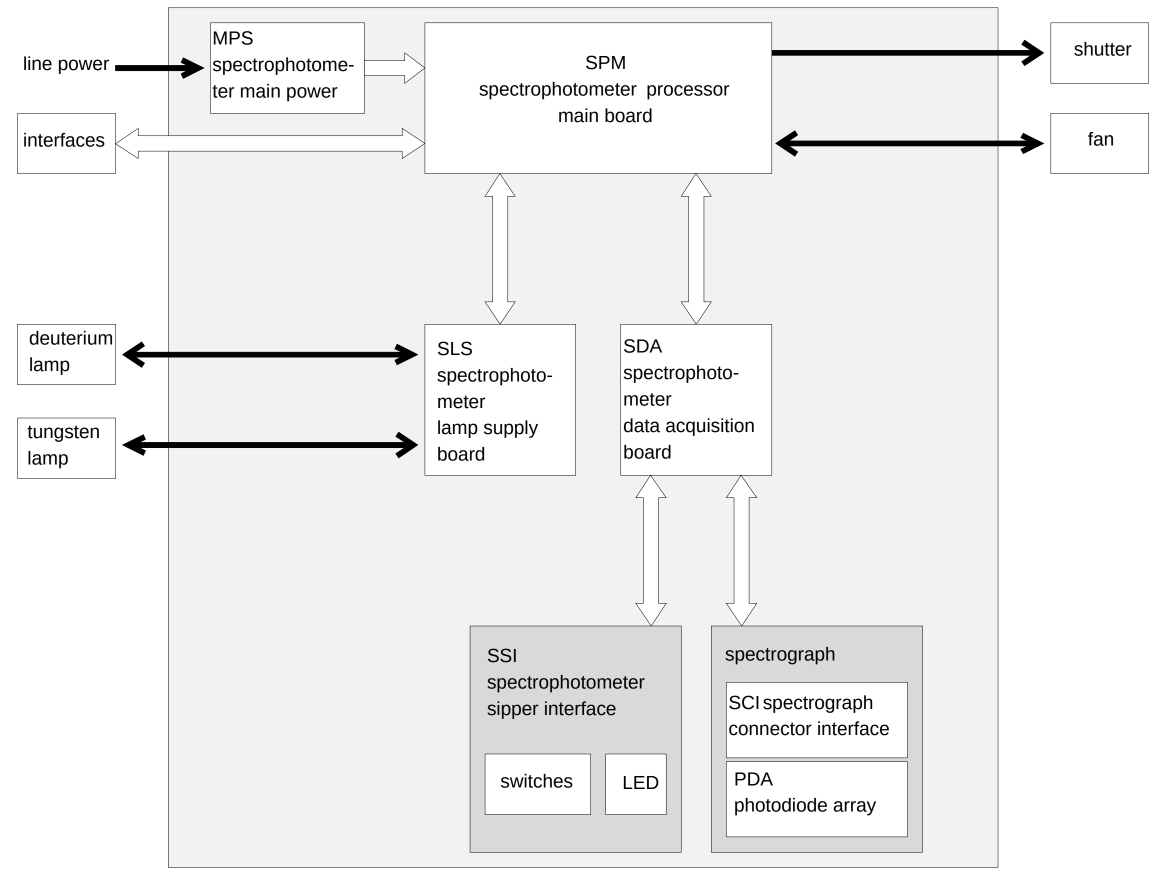
- the plastic layers have air channels molded in them so that cooling air can be guided exactly to the required locations,
- the plastic layers help cushion the electronical and mechanical parts from physical shock, and
- the metal inner cabinet shields the internal electronics from electromagnetic interference and also helps to reduce or eliminate radio frequency emissions from the instrument itself.

Theory of Operation and Control

This section explains the function of the electronics of the spectrophotometer on block-diagram level. Each board and/or functional group is described in a separate module.

Electronics Overview

Figure 4 **Electronics Block Diagram**



The spectrophotometer includes a spectrograph which utilizes a processor-controlled photodiode array. Several processing steps and hardware boards are required to form spectra from the intensity counts derived from the diode array. Full spectra can be acquired, processed and transmitted every 0.1 s continuously, the only bottleneck being the PC speed. The instrument has its own onboard real-time clock and this allows the instrument to perform a series of time-based accessory control actions and measurements without control from the PC and buffer the data until the PC wants to take it.

SPM—Spectrophotometer Processor Main Board

The spectrophotometer processor main (SPM) board receives DC power from the main power supply (MPS) and distributes it to a number of other modules. These include the spectrophotometer lamp supply (SLS) board, spectrophotometer data acquisition (SDA) board and from there the spectrophotometer sipper interface (SSI) board and the spectrograph with the diode array.

The SPM board interfaces to the controller, that is, the computer and other devices, such as pumps, valves, the multicell transport, RS232 and other peripheral devices. Shutter control allows for dark current or sample measurements and utilizes the stray light filter. Stray-light correction is calculated by combining information of two spectra, a spectrum measured with the stray-light correction filter and a spectrum without the stray-light correction filter in the light path. Memory for approximately 100 full spectra is available and two SIMM sockets for extending the memory (to be able to store several hundred spectra) are available.

SLS—Spectrophotometer Lamp Supply Board

The SLS board provides control and regulation for both, the tungsten and deuterium lamps.

Spectrograph

The spectrograph contains the PDA (photodiode array) which gives an analog signal proportional to the light level which falls on the individual photodiode during a defined period of time. The photodiode array is connected to the spectrophotometer data acqisition (SDA) board through the spectrograph connector interface (SCI) board. A temperature sensor is located on the diode-array for temperature compensation, that is, to reduce drift. This is especially important for the SWNIR part of the spectrum where drift with temperature is significant due to variation in the quantum efficiency of the photodiodes.

SDA—Spectrophotometer Data Acquisition Board

On the SDA board, the signals from the photodiode array are adjusted to an appropriate level and converted to digital values by a 16-bit A/D converter. In addition, the SDA board controls the timing of the photodiode array. The firmware automatically converts data points which are taken at a 0.9-nm sampling interval from the diode array to deliver values at 1-nm interval to the controller.

SSI—Spectrophotometer Sipper Interface Board

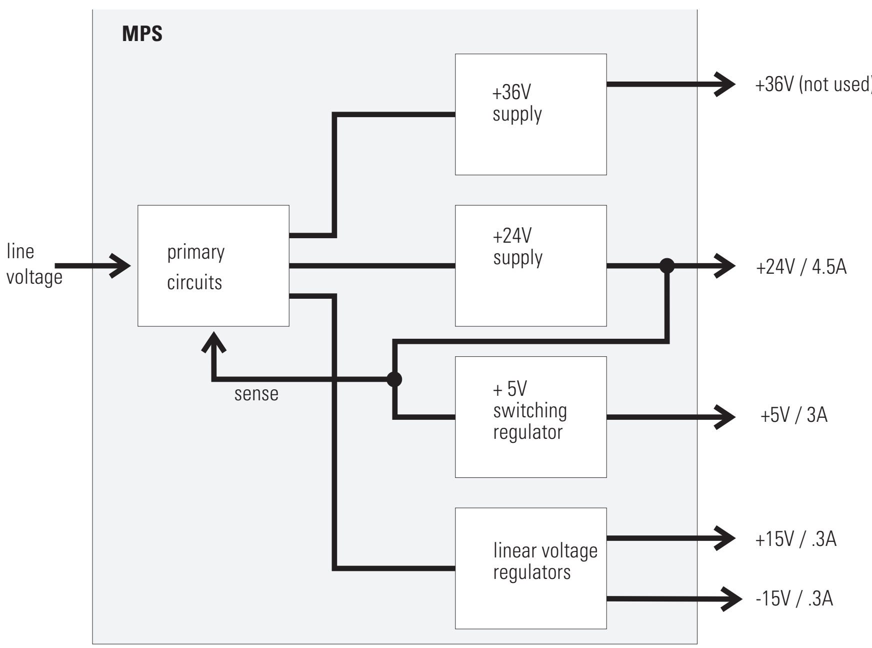
This board collects the signals from the push buttons and controls the three-color LED located on the front panel of the spectrophotometer.

The Main Power Supply Assembly

The main power supply (MPS) comprises a closed assembly (no onsite repair possibility).

The power supply provides all DC voltages used in the spectrophotometer except for the voltages supplied by the lamp power supply to the deuterium and tungsten lamps.

Figure 5 **Main Power Supply (MPS) Block Diagram**



WARNING **To disconnect the instrument from line, pull out the power cord. The power supply still uses some power, even if the power switch on the front panel is turned off.**

No accessible hardware fuse is needed because the main power supply is safe against any shortages or overload conditions on the output lines. When overload conditions occur, the power supply turns off all output voltages.

Turning the line power off and on again resets the power supply to normal operation if the cause of the overload condition has been removed.

An overtemperature sensor in the main power supply is used to turn off output voltages if the temperature exceeds the acceptable limit (for example, if the cooling fan of the instrument fails). To reset the main power supply to normal operating conditions, turn the instrument off, wait until it is approximately at ambient temperature and turn the instrument on again.

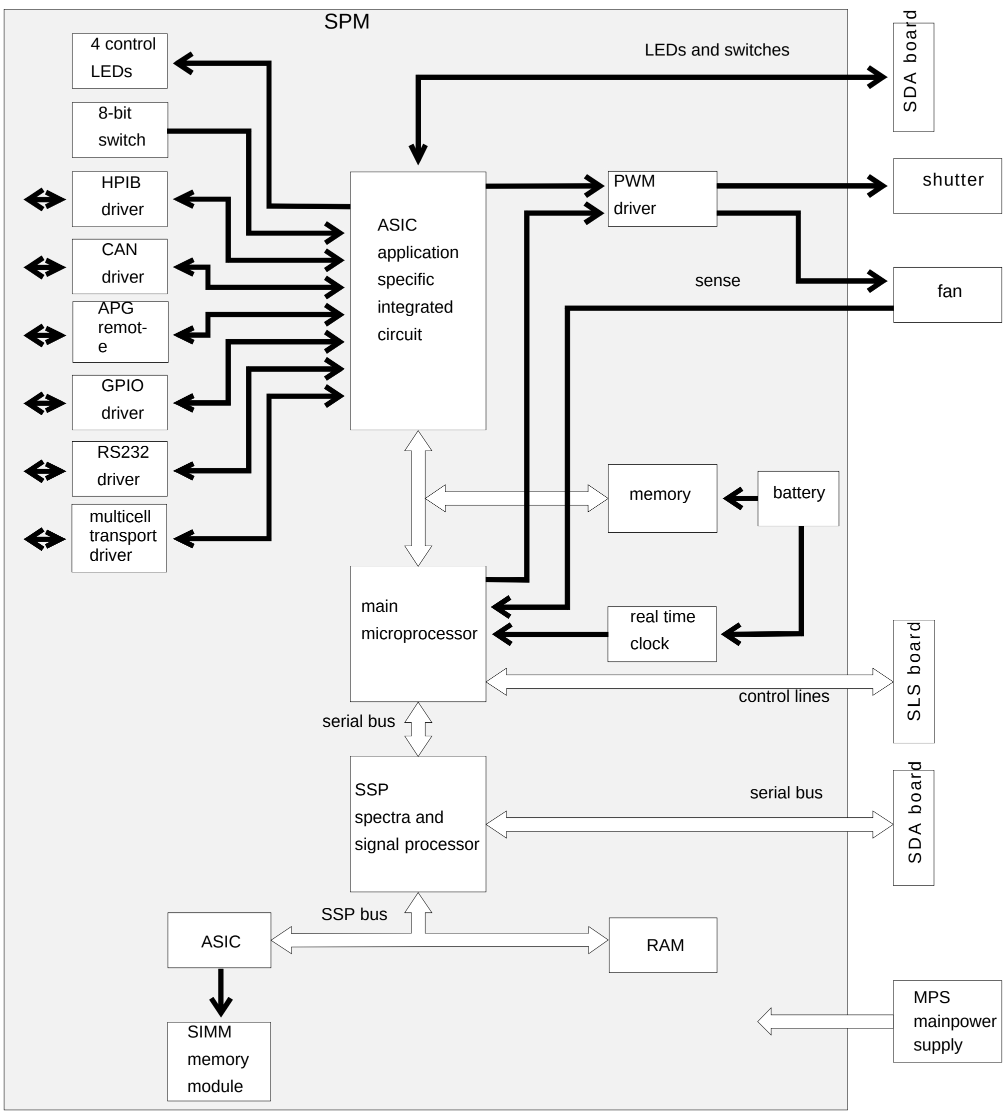
Table 3 gives the specifications of the main power supply.

Table 3 **Main Power Supply Specifications**

Function	Specification	Comment
Line input	100–120 or 220–240 V AC ±10%	Wide-ranging
Line frequency	50 or 60 Hz ±5%	
Output 1	+24 V / 4.5 A	
Output 2	+36 V	Not used
Output 3	+5 V / 3 A	
Output 4	+15 V / 0.3 A	
Output 5	-15 V / 0.3 A	

Spectrophotometer Processor Main (SPM) Board

Figure 6 **SPM Board**



Main Microprocessor

The main microprocessor exchanges data with the ASIC through the core bus as well as with the memory, consisting of the battery backed-up, non-volatile random access memory (NVRAM), the system memory and the program memory. The program memory includes the firmware which can be updated by a download procedure from the computer. The battery for the NVRAM and the real-time clock is designed to last for more than 25 years under normal operating conditions.

Control lines provide communication to the SLS board, which in turn controls the deuterium and tungsten lamps. The main microprocessor comunicates to the SSP (spectra and signal processor) through a parallel bus.

ASIC—Application-Specific Integrated Circuit

The 304-pin application specific integrated circuit (ASIC) provides interfacing to external devices through drivers, including GPIB, CAN, APG Remote, and GPIO. It is also connected to the four control LEDs located near the connectors on the SPM board and the 8-bit configuration switch which is used to configure the address for the GPIB communication, baud rate for RS232 transfer, and so on. For switch settings, refer to the *Installing Your UV-Visible Spectroscopy System* handbook.

In addition it controls the shutter and cooling fan through the PWM (pulse width modulation) driver. Operation of the cooling fan is sensed by the microprocessor.

SSP—Spectra and Signal Processor

The spectra and signal processor (SSP) uses a dedicated ASIC and RAM of 3×128 KB and converts the 1024 raw data values from the SDA board to intensity and absorbance values. Conversion and subsequent calculation to achieve absorbance values include the following tasks, listed in the sequence of processing:

1 dark current correction,

2 offset correction,

3 PDA temperature compensation,

4 stray-light correction,

5 absorbance calculation,

6 signal averaging (over integration time), and

7 variance calculation.

Communication between the spectra and signal processor (SSP) and the PDA front end processor (PFP) on the SDA board is established by a serial communication link. Processed data and synchronization signals for the PFP clock frequency are exchanged through the serial bus.

SIMM Memory Module

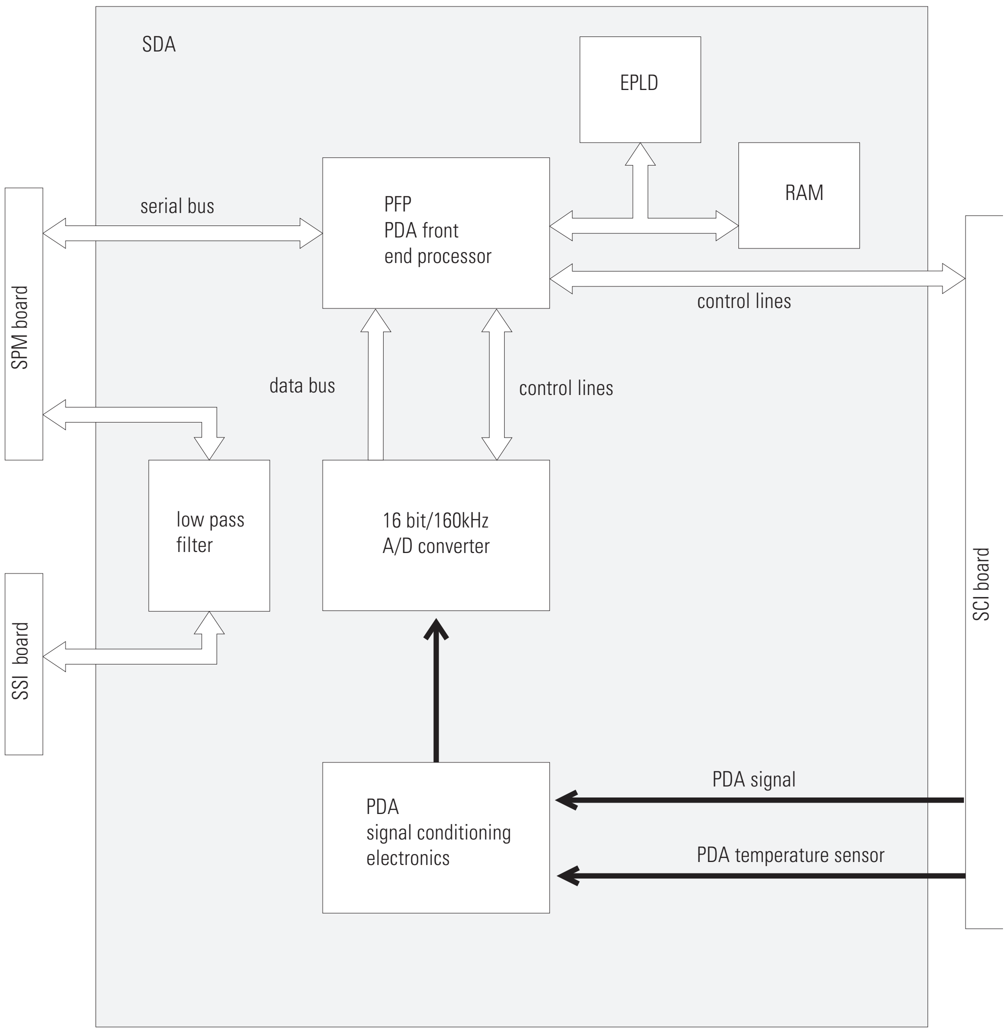
The SIMM memory module controlled by the dedicated ASIC is used to expand the memory to 2 MB (add 1 MB module, part number 1818-4271) or 2 × 4 MB (part number 1818-5784) to accomodate more spectra.

Firmware

For an outline of the firmware, see “Firmware Description” on page 43.

Spectrophotometer Data Acquisition (SDA) Board

Figure 7 **SDA Board**



SCI—Spectrograph Connector Interface Board

The PDA, which includes control electronics for readout of the individual photodiodes, is mounted on the SCI (spectrograph connector interface) board. Gain switching is used to optimize the signal level to the dynamic range of the A/D converter on the SDA board. In addition, wavelength calibration data from the manufacturing process are stored in the resident EEPROM to provide both wavelength precision and accuracy.

PDA Signal Conditioning Electronics

Data is transferred from the photodiode array (PDA) through the spectrograph connector interface (SCI) board to the PDA signal conditioning electronics. The PDA signal conditioning electronics adjusts the signal levels to provide an appropriate output signal.

A/D Converter

The output signal from the PDA signal conditioning electronics is directed to the 16 bit /160 kHz A/D converter. Multiplexing is used to monitor the signal from the PDA temperature sensor which is used for temperature compensation.

PFP–PDA Front-End Processor

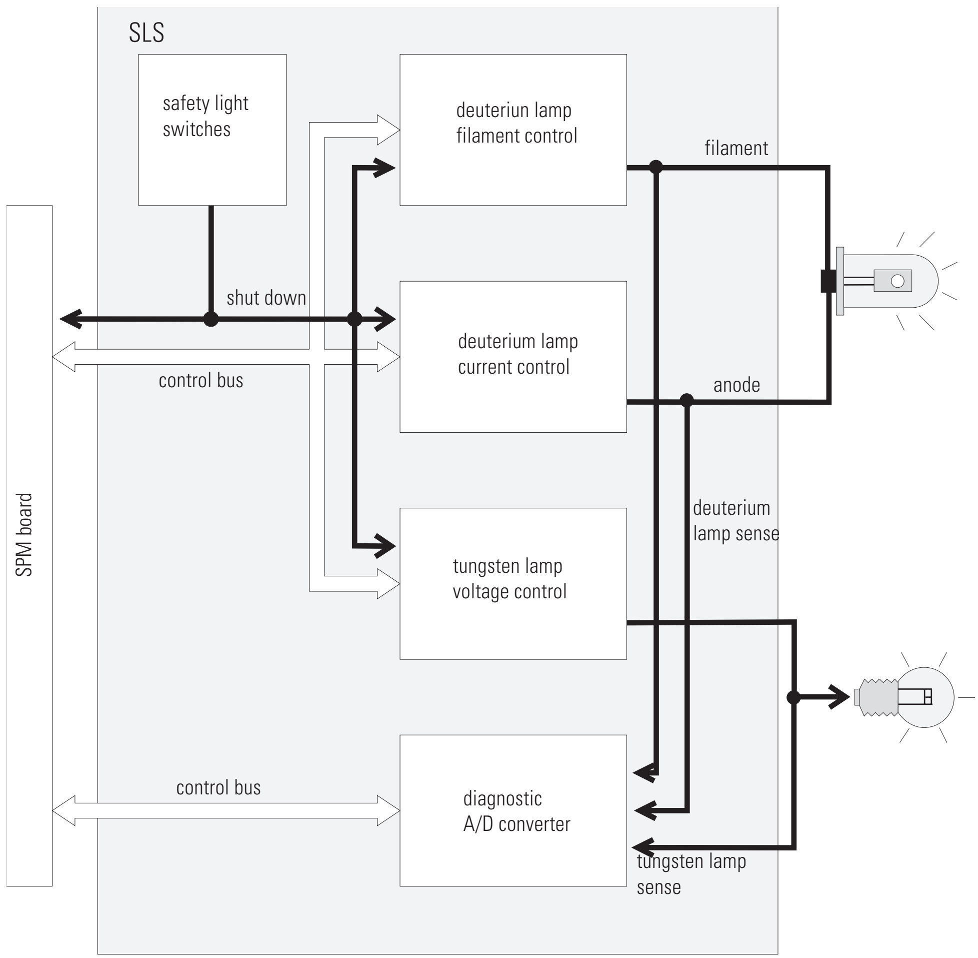
The PDA front end processor (PFP) utilizing an on board RAM and the EPLD (electronically programmable logic device) forwards the data from the 16 bit A/D converter to the SPM board. It provides timing and control for the photodiode readout and the A/D conversion.

Low-Pass Filter

Signals between the SPM board and the switches and LED on the spectrophotometer sipper interface (SSI) board are routed through a low-pass filter for RFI (radiated frequency interference) improvement.

Spectrophotometer Lamp Supply (SLS) Board

Figure 8 **SLS Board**



Deuterium Lamp Filament Control

During the ignition cycle two different voltage levels are applied to the filament of the deuterium lamp by the deuterium lamp filament control circuit. This control circuit is enabled by the processor on the SPM board.

Deuterium Lamp Current Control

The deuterium lamp current control circuit comprises two parts. One generates an ignition pulse of 600 V DC for the lamp, resulting in lamp ignition. After the ignition process this voltage is disabled. The second is a constant current source of 320 mA at an operating voltage between 50 and 105 V DC for stable operating conditions and light emission of the deuterium lamp. The deuterium lamp current control circuit is supervised by the processor on the SPM board.

Igniting the Deuterium Lamp

The deuterium lamp is heated with a voltage of 1.7 V DC for 1 s and afterwards a voltage 2.5 V DC for 9 s with currents between 2–10 A prior to ignition. The deuterium lamp current control circuit provides an ignition pulse to the lamp, resulting in lamp ignition. The filament control circuit disables the filament voltage if the lamp has been successfully ignited.

If the deuterium lamp has failed to ignite, the whole sequence is repeated. If after the second attempt the deuterium lamp did not ignite, an error message occurs.

Tungsten Lamp Voltage Control

Voltage to the tungsten lamp is generated by the tungsten lamp voltage control circuit which is enabled by the processor, resident on the SPM board. This circuit provides a constant voltage of 6 V DC with currents between 0.7–0.9 A to light the tungsten lamp.

Diagnostic A/D Converter

The diagnostic A/D converter senses currents and voltages of the deuterium and tungsten lamps and converts the analog signals into digital values. The digital values are transferred via the control bus to the SPM board. When values are outside of the normal range, an appropriate error message is generated.

Safety Light Switches

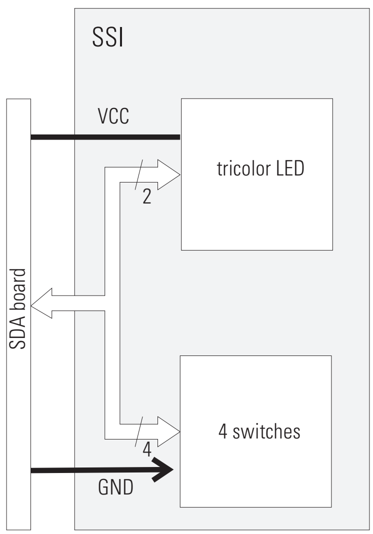
When the sheet metal lamp door is removed and the instrument is still on, the safety light switches are activated and result in turn off of the deuterium and tungsten lamps.

The safety light switches provide shutdown in two different ways. One is a direct line to the deuterium lamp filament and current control circuits as well as the tungsten lamp voltage control circuit. The second is through the processor on the SPM board. The different ways are used to provide maximum reliability and safety.

Spectrophotometer Interface (SSI) Board

The SSI board controls the push buttons and the LED located at the front panel of the instrument.

Figure 9 **SSI Board**



Switches are pulled to GND when pressed, and provide a signal to the SPM board through the low-pass filter on the SDA board. The LED is driven from the SPM board through the low-pass filter on the SDA board.

Firmware Description

The firmware of the instrument comprises two parts. One part is used by the MP 68332 processor on the SPM board, that is, to boot the instrument and use the basic functions of the processor for memory control and input-output control. The other part for the DSP on the SPM board is used to make the instrument operate as a spectrophotometer.

Firmware updates of the instrument-specific part can be done by a download procedure from the computer. Updates will be provided on flexible disk.

Resident Part of the Firmware

If the instrument is configured to stay in the resident part of the firmware, it does not react as a spectrophotometer but uses only the basic functionality of the microprocessor system. In this case the firmware is used to establish the communication to the computer, that is, for data communication through the GPIB, CAN and RS232 interfaces. For reseting the instrument that it stays in the resident part of the firmware and forced cold start, see Chapter 6 “Interfacing”.

Instrument-Specific Part of the Firmware

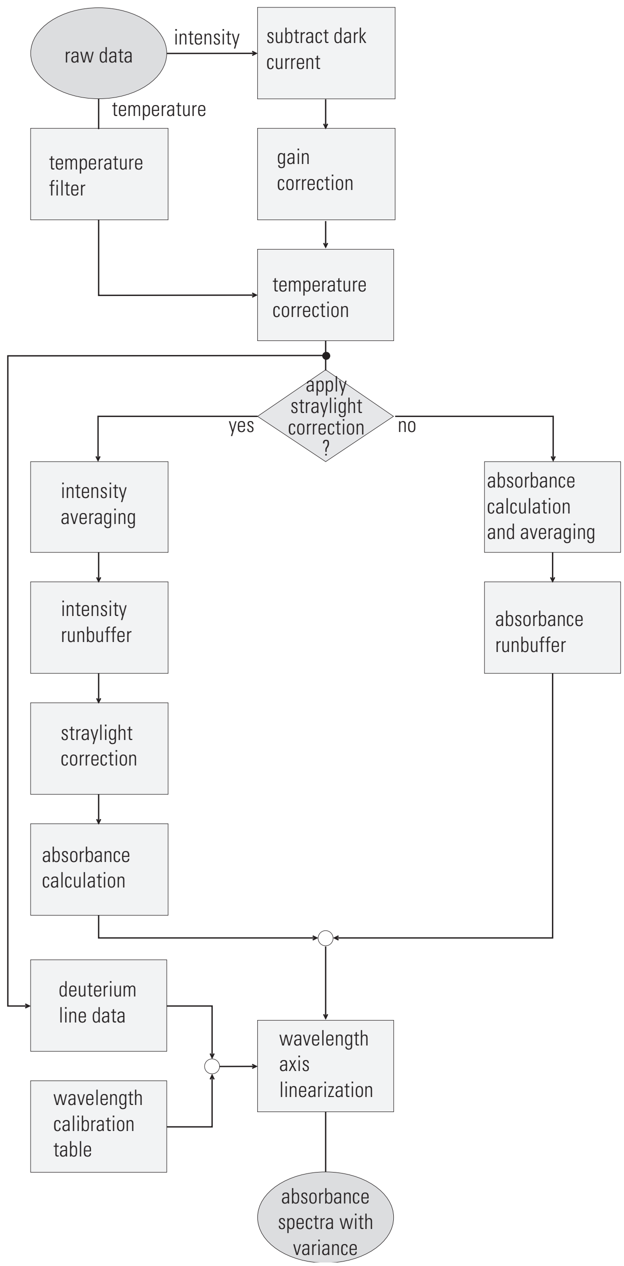
The instrument-specific part of the firmware is used to supervise:

- interface control for multicell transport, GPIO lines and APG remote,
- MIO board and accessory board control,
- internal events such as lamp turn-on cycle and shutter and filter movements,
- diagnostic functions, and
- raw data conversion to absorbance.

Raw Data Conversion to Absorbance

The raw data flow (from the photodiode array) and conversion to absorbance spectra with variance for each data point is a multiple-step process. This process is outlined in this section

Figure 10 **Firmware Flow Diagram**



Subtract Dark Current

Raw data coming from the photodiode array through the signal conditioning electronics (which includes a variable gain amplifier) are read from the A/D converter, see on page 37. This raw data are intensity values of each photodiode of the array.

During a blank measurement a dark current and electronic offset measurement is performed for every diode on the photodiode array. This offset spectrum is stored and subtracted from all subsequent intensity spectra to give dark-corrected intensity spectra.

Gain Correction

Also during a blank measurement every photodiode is assigned a gain value, depending of the amount of light falling on the diode array. These gain values are stored in a table. They are used to adjust the amplification factor in the signal conditioning electronics, see “Spectrophotometer Data Acquisition (SDA) Board” on page 37. This process is used to adjust the signal level to the optimum range of the A/D converter on the SDA board.

The DSP firmware uses the gain table to adjust the dark-corrected intensity spectra.

Temperature Correction

The quantum efficiency of the photodiode array depends on the temperature and is different for each wavelength. The temperature dependency follows an e-function over the wavelength scale, for example, it increases with the longer wavelengths.

To correct the intensity spectrum for temperature effects, the temperature on the photodiode array is averaged over 5–10 s. With the help of a table which stores correction coefficients for each wavelength, correction factors for the current temperature are calculated and used for the temperature correction of the intensity spectrum.

Temperature Filter

The temperature filter determines if temperature correction has to be applied. If temperature changes of more than 0.004 K occur, update is performed at a minimum interval of 5–10 s.

Apply Stray-Light Correction

By default a stray-light correction is always used. However, for very fast measurements stray-light correction can be turned off by the user interface of the *ChemStation software*.

The stray light correction is automatically turned off by the *software of the handheld controller* whenever low cycle times are set for data acquisition.

Absorbance Calculation and Averaging

In case stray-light correction is not applied, this part of the firmware is used to calculate an absorbance spectrum, the logarithm of the intensity spectrum of the reference is subtracted from the logarithm of the intensity spectrum of the sample.

Spectral averaging is used for noise reduction. If an integration time of more than 100 ms is used, multiple spectra—dependent upon the selected integration time—are measured. Absorbance values of each wavelength are averaged to form one absorbance spectrum with variance for each wavelength.

Absorbance Run Buffer

Absorbance spectra with their variances are intermediately stored here if the acquisition of spectra is faster than the processing and data communication to the ChemStation (intensity values can also be stored for special purposes, for example, diagnostic reasons.) or handheld controller.

Intensity Averaging

In case stray-light correction is applied, this part of the firmware is used. Averaging of the intensity spectra is used for noise reduction. If an integration time of more than 100 ms is used, multiple spectra—dependent upon the selected integration time—are measured. Intensity values of each wavelength are averaged to form one intensity spectrum with variance for each wavelength.

Intensity Run Buffer

ChemStation Software

Intensity spectra with their variances are intermediately stored in the intensity run buffer if the acquisition of spectra is faster than the processing and data transfer to the ChemStation.

Handheld Controller Software

The intensity run buffer is not used by the Agilent 8453E UV-visible spectroscopy system, because measuring time resolved intensity spectra is not supported by the handheld controller software.

Stray-Light Correction

Two intensity spectra are used for stray-light correction, one is measured with the stray-light filter in the light path and one without. Both spectra are combined to form one stray light corrected, temperature corrected, gain corrected, dark current corrected intensity spectrum.

Absorbance Calculation

To form an absorbance spectrum, the stray-light corrected intensity spectrum of the reference is divided by the stray-light corrected intensity spectrum of the sample and the logarithm is calculated, see “Optical System Overview” on page 19.

Wavelength Axis Linearization, Deuterium Line Data, Wavelength Calibration Table

Photodiodes are located on the array to give a sampling interval of nominal 0.9 nm over the *whole* wavelength range in the UV wavelength range. In the visible and short wave near infrared wavelength ranges the sampling interval is slightly higher. To correct for this optical non-linearity and to convert from discrete diode distances to a continous, linear scale, an interpolation algorithm is applied. This algorithm uses a wavelength calibration table and actual wavelength data, derived from the deuterium emission lines at 486 nm and 656 nm.

- Wavelength calibration is done for each individual spectrograph during the production process using emission lines of a mercury lamp, deuterium lamp, and a zinc-argon lamp. The individual calibration coefficients are stored in the wavelength calibration table in an EEPROM (electrically-erasable PROM) which is part of the spectrograph electronics. During each start-up of the spectrophotometer, each discrete wavelength value is assigned to a photodiode of the array.

- Recalibration of the wavelength scale can be performed to compensate for minor deviations from initial production conditions. Recalibration is achieved using the deuterium line data, that is, the exactly-known positions of the deuterium emission lines at 486.0 nm and 656.1 nm. Because of the real-pass band function of the spectrophotometer, which is different from the theoretical one, the maximum positions of the two emission lines cannot be used. Instead the line centroids are used for the calibration/recalibration process. A description of this method is given in section Wavelength Calibration in Appendix A of NBS Publication 260-66 from NIST (National Institute of Standards and Technology). For the address of NIST, see “Source of Standards” on page 14.

  Upon request of the operator through the user interface of the software the new parameters are used together with the wavelength calibration table to calculate a table of correction coefficients which are applied to each spectrum.

External Communication

This section gives the definition of the connections to the computer and peripherals of the spectrophotometer. Connectors with pin assignments and cables are described in detail.

WARNING **Only use cables supplied by Agilent Technologies to make sure the instrument functions properly and complies with safety or EMC regulations.**

The signal levels are defined as:

- standard TTL levels (0 V is logic true, + 5 V is false)
- Input load is 2.2 kOhm against + 5 V

Output are open collector type, inputs/outputs (wired-or technique).

External Cables

Sipper-GPIO Cable

The sipper-GPIO cable (part number G1103-61609) is used to connect the single-channel peristaltic pump to the GPIO connector at the rear of your spectrophotometer.

Table 4 **Sipper-GPIO Cable (G1103-61609)**

GPIO Connector	Pump Connector	Function
1	1	Direction, counter-clockwise (-)*
2	2	Pump on, clockwise (-)
14		Status, jumper to 15
15	3	DGND

* (-) means active low (negative true logic)

Sipper/Sampler-GPIO Cable

The sipper/sampler-GPIO cable (part number G1103-61608) is a cable with three connectors. It is used to connect the single-channel peristaltic pump and the autosampler to the GPIO connector at the rear of your spectrophotometer.

Table 5 **Sipper/Sampler-GPIO Cable (G1103-61608)**

	GPIO Connector	Pump Connector	Autosampler Connector	Function
Out	1	1		Direction, counter-clockwise (-)*
	2	2		Pump on, clockwise (-)
	3		2	Advance tray (-)
	4		3	Raise pipette (-)
	5		4	Lower pipette (-)
	6		5	Pipette to sample (-)
	7		6	Pipette to wash (-)
In	9		10	Rack in motion
	10		11	Stop position
	11		12	Pipette up
	12		13	Pipette down
	13		14	Pipette to sample
	14			Status, jumper to 15
	15	3	1	DGND

* (-) means active low (negative true logic)

Multichannel Pump-GPIO Cable

The multichannel pump-GPIO cable (part number G1103-61607) is used to connect the 8-channel peristaltic pump to the GPIO connector at the rear panel of your spectrophotometer.

Table 6 **Multichannel Pump Cable (G1103-61607)**

GPIO Connector	Pump Connector	Function
1	4	Direction, counter-clockwise (-)*
2	3	Pump on, clockwise (-)
14		Status, jumper to 15
15	1–2, connected	DGND

* (-) means active low (negative true logic)

Valve Controller-GPIO Cable

The valve controller-GPIO cable (part number G1103-61610) is used to connect the valve/pump controller to the GPIO connector at the rear panel of your spectrophotometer.

Table 7 **Valve Controller-GPIO Cable (G1103-61610)**

	Valve Connector	GPIO Connector	Function
Out	1	15	DGND
	2	1	A0
	3	2	A1
	4	3	A2
	5	9	D0IN
	6	10	D1IN
	7	11	D2IN
	8	4	R/W(-)*
In	9	5	DV(-)
	12	12	Rdy(-)
	13	6	D0OUT
	14	7	D1OUT
	15	8	D2OUT

* (-) means active low (negative true logic)

General-Purpose-GPIO Cable

The general-purpose-GPIO cable (part number G1103-61611) has only a connector on the spectrophotometer side. It is used to connect any custom made device with parallel I/O to the GPIO connector at the rear panel of your spectrophotometer.

Table 8 **General Purpose Cable (G1103-61611)**

Pin	Function	Pin	Function
1	OUT [0]	9	IN [0]
2	OUT [1]	10	IN [1]
3	OUT [2]	11	IN [2]
4	OUT [3]	12	IN [3]
5	OUT [4]	13	IN [4]
6	OUT [5]	14	IN [5]
7	OUT [6]	15	DGND
8	OUT [7]		

External Connectors

GPIB Connector

The GPIB core design is used as talker/listener and a controller which is usually the computer with Agilent ChemStation software loaded. It supports all GPIB functionality except passing control between different devices. The connector needs to be activated and configured by the 8-bit configuration switch next to the GPIB connector. For switch settings, refer to the *Installing Your UV-Visible Spectroscopy System* handbook.

APG Remote Connector

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

A 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.

Table 9 **APG Remote Signal Distribution**

Pin	Signal	Function
1	DGND	Digital ground
2	PREPARE	(L) Request to prepare for analysis (e.g. calibration, detector lamp on). Receiver is any module performing preanalysis activities.
3	START	(L) Request to start run / timetable. Receiver is any module performing runtime controlled activities.

Table 9 **APG Remote Signal Distribution**

Pin	Signal	Function
4	SHUT DOWN	(L) System has serious problem. Receiver is any module capable to reduce safety risk.
5		Not used
6	POWER ON	(H) All modules connected tosystem are switched on. Receiver is any module relying on operation of others.
7	READY	(H) System is ready for next analysis. Receiver is any sequence controller.
8	STOP	(L) Request to reach system ready state as soon as possible (e.g. stop run, abort or finish and stop injection). Receiver is any module performing runtime controlled activities.
9	START REQUEST	(L) Request to start injection cycle (e.g. by start key on any module). Receiver is the autosampler.

Multicell Transport Connector

Table 10 **Multicell Transport Connector**

Pin	Function	Pin	Function
1	Status	9	Limit switch (nc)
2	OUT [4]	10	Case
3	OUT [4]	11	OUT [2]
4	OUT [1]	12	OUT [2]
5	OUT [1]	13	OUT [3]
6	DGND	14	OUT [3]
7	DGND	15	Shield
8	Limit switch (no)		

CAN Connector

The CAN is a high speed communication interface. It is a two-wire serial bus system supporting data communication with realtime requirements. This CAN interface is used to connect the handheld controller of the Agilent 8453E UV-visible spectroscopy system to the spectrophotometer.

RS232C Connector

The RS232 is designed as DCE (Data Communication Equipment) with a 9 pin male SUB-D type connector. When controlling the spectrophotometer through the RS232 interface, the connector needs to be activated and configured by the 8-bit configuration switch next to the GPIB connector. For switch settings, refer to Chapter 6 “Interfacing”.

Table 11 **RS232 Connector**

Pin	Function	Pin	Function
1	DCD	6	DSR
2	RxD	7	RTS
3	TxD	8	CTS
4	DTR	9	RI
5	GND		

Using a serial/parallel printer cable, an HP printer can be connected to the spectrophotometer. This option is only used by the Agilent 8453E UV-visible spectroscopy system. The 8-bit configuration switch has to be set to GPIB communication and **not** to RS232 communication.

GPIO Connector

The GPIO port is a TTL Input/Output port which is used to control accessories like the pumps.

Table 12 GPIO Connector

Pin	Function	Pin	Function
1	Out bit 0	9	In bit 0
2	Out bit 1	10	In bit 1
3	Out bit 2	11	In bit 2
4	Out bit 3	12	In bit 3
5	Out bit 4	13	In bit 4
6	Out bit 5	14	In bit 5
7	Out bit 6	15	DGND
8	Out bit 7		

If no other accessory is used, the GPIO port can be used to trigger a measurement from an external device. The trigger lines use the GPIO connector pins as shown in Table 13.

Table 13 Trigger Inputs

Pin	Function
9	Trigger blank measurement
10	Trigger sample measurement
11	Trigger standard measurement
12	Trigger stop
13	Trigger kinetics measurement
15	Ground

UV-vis ChemStation Software

Measurements are activated on contact closure to ground (pin 15). By default these trigger lines are **inactive**. To activate the GPIO lines as trigger lines, type the following command on the command line of the Agilent ChemStation:

```
EnableGPIOButtons 1
```

This activation is not resident and has to be done every time the ChemStation is started or the Agilent 8453 is switched on again.

The general purpose cable G1103-61611 is recommended for connecting external hardware devices to the GPIO interface of the spectrophotometer.

Handheld Controller Software

Measurements are activated on contact closure to ground (pin 15). By default these trigger lines are **active**.

Pin 12 (Trigger Stop) and Pin 13 (Trigger kinetics run) are not supported by the software of the handheld controller.

The general purpose cable G1103-61611 is recommended for connecting external hardware devices to the GPIO interface of the spectrophotometer.

Internal Connections

This section gives the definition of the connections inside the instrument including pin assignments of the connectors. Only those connectors are described which may be important for troubleshooting.

Connector Definitions

Main Power Supply Connector

The main power supply is connected to the spectrophotometer processor main (SPM) board by a cable that is fixed to the main power supply.

Table 14 **Power Supply Cable to SPM Board**

Pin	Function	Pin	Function
1	Power failure	7,8	+24 V
2	Analog ground (AGND)	9,10	+36 V (not used)
3	-15 V	11	Digital ground (DGND)
4	+15 V	12	+5 V
5,6	Power ground (PGND)		

Fan Connector

The fan is connected to the spectrophotometer processor main (SPM) board.

Table 15 **Fan Connector**

Pin	Function
1	Fan Power
2	Fan Rotation Sensor
3	GND

Shutter Assembly Connector

The shutter assembly is connected to the spectrophotometer processor main (SPM) board.

Table 16 **Shutter Assembly Connector**

Pin	Function
1,2	Coil Filter
3,4	Coil Dark
5,6	GND
7,8	Coil Common
9,10	GND

Deuterium Lamp Connector

The deuterium lamp is connected to the spectrograph lamp supply (SLS) board.

Table 17 **Deuterium Lamp Connector**

Pin	Function
1	Heater
2	Cathode
3	Anode

Tungsten Lamp Connector

The tungsten lamp is connected to the spectrograph lamp supply (SLS) board.

Table 18 **Tungsten Lamp Connector**

Pin	Function
1	Vis Sense +
2	Vis Lamp +
3	Vis Lamp -
4	Vis Sense -

Diagnostics and Troubleshooting

Explainations of status and error messages and a logical approach to troubleshooting

Diagnostics and Troubleshooting

For different stages of troubleshooting, the startup test of the spectrophotometer, instrument self-test, and various diagnostic tests are used.

Instrument start-up tests are implemented in the spectrophotometer firmware. They are used to check if the instrument electronics are functioning during start up and operation of the instrument and create error messages or symptoms on the front panel status LEDs. Self-test and diagnostic tests are implemented in the operating software. For explanation of these tests, see your software documentation and online help in the software.

This chapter covers the following topics related to troubleshooting the spectrophotometer:

- front panel status and power switch LEDs,
- error messages, and
- general troubleshooting hints.

This chapter gives information about how to troubleshoot the instrument. For detailed procedures about cleaning lenses, disassembling the spectrophotometer and exchanging individual electronic items, see Chapter 4 “Maintenance and Repair”.

Front Panel Status and Power Switch LEDs

A general description of the functionality of the status and power switch LEDs is given in Chapter 2 “Theory of Operation”. This section describes typical LED symptoms in case of failures of the instrument.

Power switch LED off

The line power switch with the power switch LED is located at the lower left part of the instrument. If the line power switch is pressed in but the green light is off:

- the instrument may not be connected to line power, or
- the main power supply (MPS) is defective.

Refer to Table 20 through Table 34 for detailed troubleshooting information.

Red front panel LED

The spectrophotometer does not pass one of the self-tests which are run when the spectrophotometer is turned on or an error occurred during operation. Most of the causes have to do with ignition of lamps, open lamp door, multicell transport problems or spectrophotometer hardware problems.

If your controller is running (personal computer or handheld controller) and connected to the spectrophotometer, you may get an error message. This message will tell you more about the cause of the error. For details about error messages, see Table 20 through Table 34 or the help system.

Red, blinking front panel LED

Error condition of the spectrophotometer processor system. Because in this case there is no communication with the computer there will be no error message. Turn the instrument off and on again. If the error appears again, possible causes are shown in Table 19.

Table 19 **Error Condition of Spectrophotometer Processor System**

Possible Causes	Action
Spectrophotometer main processor (SPM) board defective	Exchange SPM board
Spectrophotometer data acquisition (SDA) board defective	Exchange SDA board

Error Messages

Error messages are a series of text messages which appear in your software. These messages notify you that either the spectrophotometer is not functioning correctly or, in case you are using your own customized programs, that you have made a mistake in the commands which you have given to the spectrophotometer.

The following is an overview of the error messages. For suggestions regarding causes and courses of action, see Table 20 through Table 34.

- Multicell Transport Home Position Not Found
- No Filament Current On Deuterium Lamp
- Deuterium Lamp Ignition Failed
- No Current Sensed On Deuterium Lamp
- No Voltage Sensed On Deuterium Lamp
- No Current Sensed On Tungsten Lamp
- No Voltage Sensed On Tungsten Lamp
- Cooling Fan Defective
- Lamp Door Open (Lamps are switched off)
- Digital Signal Processor Error
- Wavelength Calibration Data Rejected
- Excessive Dark Current Detected On Photodiodes
- Raw Data Buffer Overflow
- Power Fail

Most of these error messages are stored with the Agilent 8453 spectrophotometer logbook and can be recalled through the operating software.

Table 20 through Table 34 show the error messages with their meanings. The tables explain the instrumental conditions required to generate the message and potential causes which lead to generation of the message. There is a list of suggested actions to correct the instrument state when necessary.

Table 20 **Multicell Transport Home Position Not Found**

Possible Causes	Action
The multicell transport mechanism is jammed.	Make sure the carriage can move freely along its entire path and that there are no obstructions
	Check that the two screws which fix the multicell transport in the spectrophotometer are not pushed up into the path of the mechanism (e.g. this is the case when putting the transport beside the instrument).
Electronics failed.	Check for defective HOME-switch, defective multicell transport cable, defective motor, or defective spectrophotometer processor main (SPM) board.

Table 21 **Lamp Door Open (Lamps Are Switched Off)**

Possible Causes	Action
Lamp door is open.	Close lamp door.
Lamp door is bent. Light switch tab is positioned incorrectly.	Bend light switch tab on lamp door to correct tab position.
Light switch or electronics have failed.	Replace spectrophotometer lamp power supply (SLS) board.

Table 22 **Invalid Data Points In Spectrum**

Possible Causes	Action
Blank has higher absorbance than sample measurement. Solvent or chemical matrix of blank has higher absorbance than solvent/matrix of sample.	Ensure sample and blank use the same solvent or chemical matrix. Measure blank on water. In kinetics mode of ChemStation software: **1** Under Options & Information in the Method menu, select Adjust gains separately from blank measurement. **2** Under Set Gains in the Measure menu, select water or air
Bubble in flow cell absorbing during blank.	Use cell cleaning fluid to prevent air bubbles sticking on the window surface of the flow cell.
Floating particle(s) in cell	Clean cell or wait untill particle(s) have settled
Variation in sample absorbance during the measurement process due to chemical or physical processes.	Select a shorter integration time.
Fluorescent sample.	Use fixed gain settings in your advanced software for the Agilent ChemStation. This feature is not implemented in the software of the handheld controller.
Electronics failed.	Replace the spectrophotometer data acquisition (SDA) board. Replace optical unit.
Bad blank.	Repeat blank measurement.

Table 23 **No Filament Current Through Deuterium Lamp**

Possible Causes	Action
Lamp is defective.	Replace deuterium lamp.
Electronics failed.	Replace spectrophotometer lamp power supply (SLS) board.

Table 24 **Deuterium Lamp Ignition Failed**

Possible Causes	Action
Lamp is defective.	Replace deuterium lamp.
Electronics failed.	Replace spectrophotometer lamp power supply (SLS) board.

Table 25 **No Current Through Deuterium Lamp**

Possible Causes	Action
If diagnostics in your software indicate that lamp voltage is available, the lamp is defective.	Replace deuterium lamp.
Electronics failed.	Replace spectrophotometer lamp power supply (SLS) board.

Table 26 **No Voltage At Deuterium Lamp**

Possible Causes	Action
Lamp is defective.	Replace deuterium lamp.
Electronics failed.	Replace spectrophotometer lamp power supply (SLS) board.

Table 27 **No Current Through Tungsten Lamp**

Possible Causes	Action
If diagnostics in your software indicate that lamp voltage is available, the lamp is defective.	Replace tungsten lamp.
Electronics failed.	Replace spectrophotometer lamp power supply (SLS) board.

Table 28 **No Voltage At Tungsten Lamp**

Possible Causes	Action
Lamp is defective.	Replace tungsten lamp.
Electronics failed.	Replace spectrophotometer lamp power supply (SLS) board.

Table 29 **Cooling Fan Defective**

Possible Causes	Action
Number of cycles per minute sensed at fan is too low. Fan is defective.	Replace cooling fan.
Number of cycles per minute sensed at fan is too low. Electronics failed.	Replace spectrophotometer processor main (SPM) board.

Table 30 **Digital Signal Processor Error**

Possible Causes	Action
SIMM memory module on SPM board missing or in wrong position.	Make sure a module of minimum 1 MB is plugged into the position located towards the front panel of the instrument.
Communication error between the main processor and one of the digital signal processors located on the SPM or SDA board. Cable between SDA board and SPM board disconnected or defective.	Reconnect or replace cable.
Communication error between the main processor and one of the digital signal processors located on the SPM or SDA board. Electronics failed.	Replace spectrophotometer processor main (SPM) board. Replace the spectrophotometer data acquisition (SDA) board.

Table 31 **Wavelength Calibration Data Invalid**

Possible Causes	Action
Communication error between EEPROM of spectrograph and SDA board. Cable between spectrograph and SDA board disconnected or defective.	Reconnect or replace cable.
Wavelength calibration data from EEPROM of spectrograph rejected or communication of calibration data disrupted.	Replace the spectrophotometer data acquisition (SDA) board.
Wavelength calibration data in EEPROM of spectrograph corrupted.	Replace optical unit

Table 32 **Wavelength Recalibration Data Lost**

Possible Causes	Action
8-bit configuration switch sets the instrument to resident mode.	Correct 8-bit configuration switch settings and turn instrument off, then on again. Perform a wavelength recalibration with your software.
When doing a firmware upgrade, wavelength recalibration data are lost. The factory wavelength calibration is still valid.	Perform a wavelength recalibration with your software.
When exchanging the SPM board, wavelength recalibration data are lost. The factory wavelength calibration is still valid.	Perform a wavelength recalibration with your software.

Table 33 **Excessive Dark Current Detected On Photodiodes**

Possible Causes	Action
Spectrophotometer data acquisition (SDA) board failure.	Replace spectrophotometer data acquisition (SDA) board.
Photodiode array electronics failure.	Replace optical unit.

Table 34 **Raw Data Buffer Overflow**

Possible Cause	Action
Attempting to acquire large amounts of data within too short of a time period.	Change data acquisition rate, and/or change cycle time, and/or change wavelength range.

Table 35 **Power Fail**

Possible Causes	Action
Instrument power fail.	Check that instrument power indicator in on.
No interface link to PC	Check that the GPIB cable is properly connected to both Agilent 8453 and PC.
Incorrect interface settings.	Check that the GPIB interface setting on the spectrophotometer (see section “Installing your Agilent 8453 Spectrophotometer“ in the handbook *Installing Your UV-visible Spectroscopy System*), on the GPIB interface in PC (see section “Installing an GPIB Interface Board in the PC“ in the handbook *Installing Your UV-visible Spectroscopy System*), and in the software configuration (see section “Installing the UV-visible Operating Software“ in the handbook *Installing Your UV-visible Spectroscopy System*) are correct.
Loss of communication	This may occur because of exceptional power line conditions (spikes or drop-outs). Check that the power supply to the instrument is good.

General Troubleshooting Hints

Instrument problems may not always result in error messages. Proper instrument performance is determined by the quality of the results. Even if your instrument turns on, passes its self tests, and operates without generating error messages, it may not be functioning perfectly. The results of measurements can provide hints for troubleshooting if measurement results are less than optimal.

Typical power on sequence failed

During a typical power on sequence the following events occur:

- the power switch LED will ignite and remain on,
- the front panel LED will turn yellow, then flash red, green, and stay yellow,
- the fan speed will decrease,
- the shutter will close, if you listen carefully you may here a *click*,
- the front panel LED will turn green.

The green front panel LED indicates successful completion of the self test sequence.

NOTE

Your software may be set so that lamp ignition does not automatically occur during power on. In this case use your software to ignite the deuterium and tungsten lamps.

If any or all of the above listed actions do not occur, there may be a problem with your instrument. Refer to Table 36 through Table 41 for further troubleshooting information.

Table 36 **Power Switch LED Off — Front Panel LED Off**

Possible Causes	Action
Instrument power disconnected.	Connect instrument to power.
Overcurrent or overvoltage condition. Spring below optical unit may be bent. This may result in a short circuit on the SDA board.	Remove optical unit. Bend spring back and turn instrument off and on again to reset main power supply.
Overcurrent or overvoltage condition. Electronics failure.	Turn instrument off and on again to reset main power supply. If the error condition remains, disconnect internal boards one by one, repetitively turning the instrument off and on, to find the defective board.
Main power supply (MPS) defective.	Replace main power supply (MPS).

Table 37 **Power Switch LED Off — Front Panel LED On**

Possible Cause	Action
LED in main power supply (MPS) defective.	Replace main power supply (MPS).

Table 38 **Power Switch LED On — Front Panel LED Off — Shutter Clicks**

Possible Causes	Action
Front panel keyboard (SSI board) disconnected or cable defective.	Reconnect or replace cable.
Front panel keyboard (SSI board) defective.	Replace front panel keyboard (SSI board).

Table 39 **Power Switch LED On — Front Panel LED Off — Shutter Does Not Click**

Possible Causes	Action
8-bit configuration switch sets the instrument to resident mode.	Correct 8-bit configuration switch settings and turn instrument off, then on again. Because the wavelength recalibration is lost, perform a wavelength recalibration with your software.
Spectrophotometer data acquisition (SDA) board disconnected or defective.	Connect or replace spectrophotometer data acquisition (SDA) board.
Main power supply (MPS) not connected to spectrophotometer processor main (SPM) board.	Connect main power supply (MPS) to spectrophotometer processor main (SPM) board.
Main power supply (MPS) or spectrophotometer processor main (SPM) board defective.	Replace main power supply (MPS) or spectrophotometer processor main (SPM) board.

Table 40 **Power Switch LED Flickering — Front Panel LED Off — Shutter Does Not Click**

Possible Cause	Action
Main power supply (MPS) not connected to spectrophotometer processor main (SPM) board.	Connect main power supply (MPS) to spectrophotometer processor main (SPM) board.

Table 41 **Front Panel LED Red**

Possible Cause	Action
An appropriate error message should occur in your software. For explanation of error messages, see “Error Messages” on page 71.	
Lamp door open or missing.	Close or replace door.
Lamp door sensor defective.	Replace spectrophotometer lamp power supply (SLS) board.
Shutter failed or disconnected.	Connect or replace shutter.
Spectrograph disconnected or defective.	Connect or replace spectrograph.
Spectrophotometer lamp power supply (SLS) board disconnected or defective.	Connect or replace spectrophotometer lamp power power supply (SLS) board.

Measurement Results Indicate Excessive Noise Over The Whole Spectral Range

Ensure that the lamps are turned on when making measurements. Measurements taken with both lamps off exhibit excessive noise over the whole wavelength range. In addition, the self test (only Agilent ChemStation software), lamp intensity, and stability diagnostics within the software can aid in diagnosing problems within the optical system which contribute to excessive noise. Causes and solutions for excessive noise over the whole wavelength range are shown in Table 42.

Table 42 Excessive Noise Over Whole Wavelength Range

Possible Causes	Action
Light path is blocked.	Ensure that the light path is free and clear of all obstructions
Cuvette or flow cell not installed correctly.	Check and correct cell installation.
Air bubble sticking on the quartz window of the flow cell.	Use cell cleaning fluid to passivate flow cell.
Source lens or spectrograph lenses dirty or fogged.	Clean lenses.
Shutter not functioning or partly blocking light.	Exchange shutter assembly.
Spectrophotometer data acqusition (SDA) board may be defective.	Exchange SDA board.
Spectrophotometer lamp supply (SLS) board may be defective.	Exchange SLS board.
Main power supply (MPS) may be defective.	Exchange MPS.
Spectrograph electronics may be defective.	Exchange the optical unit.

Measurement Results Indicate Excessive Noise in Part of the Spectrum

The selftest (only Agilent ChemStation software), lamp intensity, and stability diagnostics within the software can aid in diagnosing problems within the optical system which contribute to excessive noise. Low intensity in one wavelength range may not preclude you from using the spectrophotometer at another wavelength range where the intensity is acceptable. Causes and solutions for excessive noise in part of the spectrum are shown in Table 43.

Table 43 Excessive Noise in Part of Spectrum

Possible Causes	Action
One of the lamps may be turned off when making measurements. Measurements taken with the deuterium lamp off exhibits excessive noise in the UV wavelength range. Measurements taken with the tungsten lamp off exhibits excessive noise in the visible wavelength range.	Switch on proper lamp.
Noise in the UV wavelength range may be caused by a weak or defective deuterium lamp.	Exchange the lamp. Lifetime of the deuterium lamp may be influenced by the number of ignitions.
Flow cells and cuvettes, which reduce and/or distort the colimated light beam used in the spectrophotometer, can result in low lamp intensity at the spectrograph.	Change cell to standard type. Glass absorbs in the low UV region and causes high noise. Make sure that your flow cells and cuvettes are made from quartz.
Solvent or buffer blocks light in a certain wavelength range.	If information is required in such a wavelength range, a solvent or buffer that is transparent in that range should be used.
Fingerprints on cuvettes or flow cells typically absorb light in the UV range of the spectrum.	Clean your flow cells or cuvettes with a lens cleaning tissue.
Source lens or spectrograph lenses dirty or fogged.	Clean lenses.
Spectrophotometer lamp supply (SLS) board may be defective.	Exchange SLS board.

Table 43 Excessive Noise in Part of Spectrum, continued

Possible Causes	Action
Spectrophotometer data acqusition (SDA) board may be defective.	Exchange SDA board.
Spectrograph electronics may be defective.	Exchange optical unit.

Measurement Results Indicate Excessive Drift

The selftest (only Agilent ChemStation software), lamp intensity, and stability diagnostics within the software can aid in diagnosing problems within the optical system which contribute to excessive drift. Causes and solutions for excessive drift are shown in Table 44.

Table 44 Excessive Drift

Possible Causes	Action
Variations in temperature.	Ensure that the environment in which the spectrophotometer is being used is stable. The photodiode array temperature may be monitored from within the software to verify PDA temperature stability.
Sample degrades with time and/or exposure to light.	Use the spectrophotometer without sample. If the problem is found to be sample related, i.e. sample exposure to light, limit the amount of light by the environment and/or shorten the integration time to limit the amount of light during the measurement or use filter wheel to cut out the energetic low UV range.
Floating particles in the cell.	Filter sample before measurement.
Deuterium lamp may burn unstable.	Exchange lamp.
Tungsten lamp may burn unstable	Exchange lamp.
Spectrophotometer lamp supply (SLS) board may supply unstable power.	Exchange SLS board.
Spectrophotometer data acqusition (SDA) board may be defective.	Exchange SDA board.
Main power supply (MPS) may supply unstable power.	Exchange MPS.
Spectrograph electronics may be defective.	Exchange optical unit.

Excessive Spikes or Glitches on Spectra

Causes and solutions for excessive spikes or glitches on spectra are shown in Table 45.

Table 45 **Excessive Spikes or Glitches on Spectra**

Possible Causes	Action
BLANK on air, SAMPLE on cuvette.	Measure Blank on the same solvent as used for the sample.
Dramatic changes in the refractive index from BLANK to SAMPLE.	Measure Blank on the same solvent as used for the sample.
Wedge shaped cuvettes (low quality cuvettes, mostly (not always) plastic cuvettes; there are non-wedge shaped plastic cuvettes available).	Use high quality quartz cuvettes.
Bubbles in the cell (even very small ones are sufficient to create spikes).	Try to get rid of the bubbles by gently knocking the cell on a desk. Rinsing the cells with a cleaning and pasivating solution makes the bubbles less sticky to the windows. Sometimes the use of degassed solvent prevents the building of bubbles and make to time between filling the cells and the measurement as short as possible.
Floating particles in the cell (from cleaning tissues, or the application, or other kind of dirt).	Cells have to be cleaned using cleaning and pasivating solution. Use optical tissues to wipe the outer surface of the cells.
Any kind of addionally mounted optical devices put into the light path of the instrument.	The manipulation of the optical characteristics can cause some decrease in optical performance. No corrective action execpt the remove of the optical active device can change the behavior.
Turbid samples (especially in kinetics when a mixing process occurs during measurement).	Avoid turbidity, e.g. by filtration.

Table 45 **Excessive Spikes or Glitches on Spectra, continued**

Possible Causes	Action
Apertured cells	For single cell holder: For cells with apertures of 2 mm or smaller, always use flow cells and avoid removing it between measurements. For multicell transport: Never use a multicell transport as a single cell holder when apertured cuvettes are in use (BLANK on position number 1 and SAMPLE on all other positions) without doing a zero cells measurement. Avoid removing and replacing the cells during a series of measurements. Be sure that the clamp of the multicell (89075D) is always closed then doing a measurement. In general use only cells with blackened walls.

Excessive Stray Light or Nonlinearity

Causes and solutions for excessive stray light or nonlinearity are shown in Table 46.

Table 46 **Excessive Stray Light or Nonlinearity**

Possible Causes	Action
Non-blackened apertured cells (so called flourescence cells or plastic cells)	Use only cells with blackened walls.
Weak intensity in the UV region of the spectrum.	Check Deuterium lamp intensity.

Measurements are not Reproducible

Causes and solutions for measurements not being reproducible are shown in Table 47.

Table 47 Measurements are not Reproducible

Possible Causes	Action
Very low sample concentration	Increase integration time to improve signal-to-noise ratio.
Variations in the sample	Check that the sample does not: • contain particulates that float in and out of the light beam (filter if necessary) • shows signs of bubble formation though chemical reaction or degassing • show signs of thermal or photochemical degradation.
One lamp switched off	Check that both lamps are switched on if measurement over whole spectral range is required. If spectra in the UV range only are being measured then deuterium lamp must be on. If spectra in the Visible range only are being measured then tungsten lamp must be on.
Weak lamp	Use diagnostics intensity test to check if lamp intensity is too low and change lamp if necessary.

Measured Values are Different to those of Another Instrument

Causes and solutions for measured values being different to those of another instrument are shown in Table 48.

Table 48 **Measured Values are Different to those of Another Instrument**

Possible Causes	Action
Very low sample concentration	Increase integration time to improve signal-to-noise ratio.
Variations in the sample	Check that the sample does not: • contain particulates that float in and out of the light beam (filter if necessary) • shows signs of bubble formation though chemical reaction or degassing • show signs of thermal or photochemical degradation.
One lamp switched off	Check that both lamps are switched on if measurement over whole spectral range is required. If spectra in the UV range only are being measured then deuterium lamp must be on. If spectra in the Visible range only are being measured then tungsten lamp must be on.
Weak lamp	Use diagnostics intensity test to check if lamp intensity is too low and change lamp if necessary.

4

Maintenance and Repair

Procedures for exchanging parts, such as lamps and electronic or mechanical items, and for cleaning lenses

Maintenance

This section describes maintenance procedures such as cleaning the instrument, exchanging the deuterium and tungsten lamps and cleaning lenses. Always disconnect the instrument from line power before maintenance.

WARNING **To disconnect the instrument from line, pull out the power cord. The power supply still uses some power, even if the power switch on the front panel is turned off.**

Cleaning the Instrument

The spectrophotometer case and sample compartment should be kept clean. Cleaning should be done with a soft cloth slightly dampened with water or a solution of water and a mild detergent. Do not use an excessively damp cloth that liquid can drip into the spectrophotometer.

WARNING **Do not let liquid drip into the instrument. It could cause shock hazard and it could damage the instrument.**

Exchanging the Deuterium or Tungsten Lamp

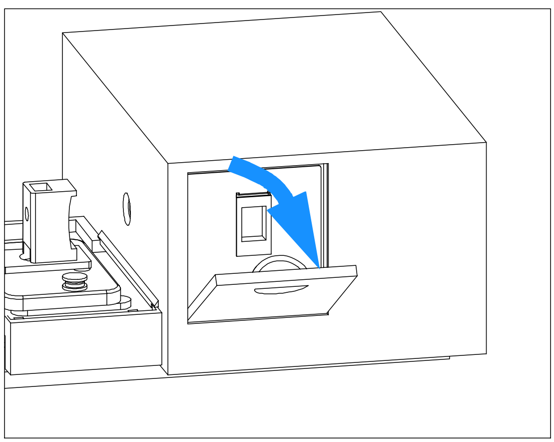
You exchange the deuterium or the tungsten lamp when the intensity test, which is executed through your software, falls below the specified level or when one of the lamps no longert ignites.

Removing the Deuterium or Tungsten Lamp

1 Turn off the spectrophotometer and disconnect the power cord.

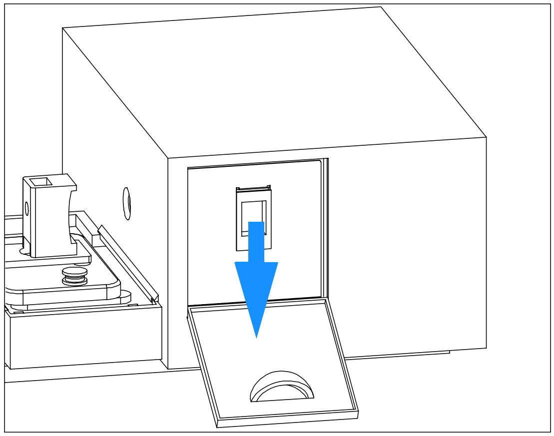
2 Open the plastic lamp door at the right side of the instrument.

Figure 11 **Opening the Plastic Lamp Door**



3 To open the metal door behind the plastic door, slide the lock mechanism down and simultaneously pull the door out.

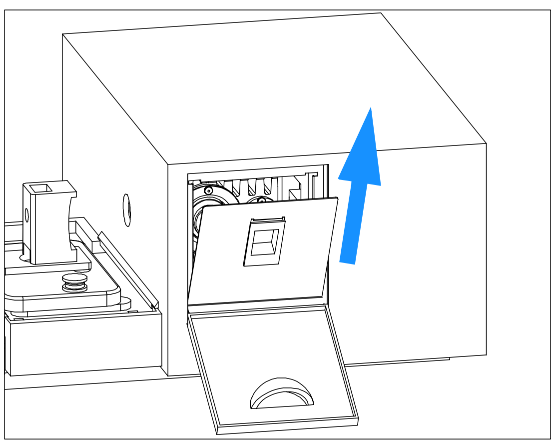
Figure 12 **Opening the Metal Lamp Door**



4 Slide the metal door out to have access to the lamps.

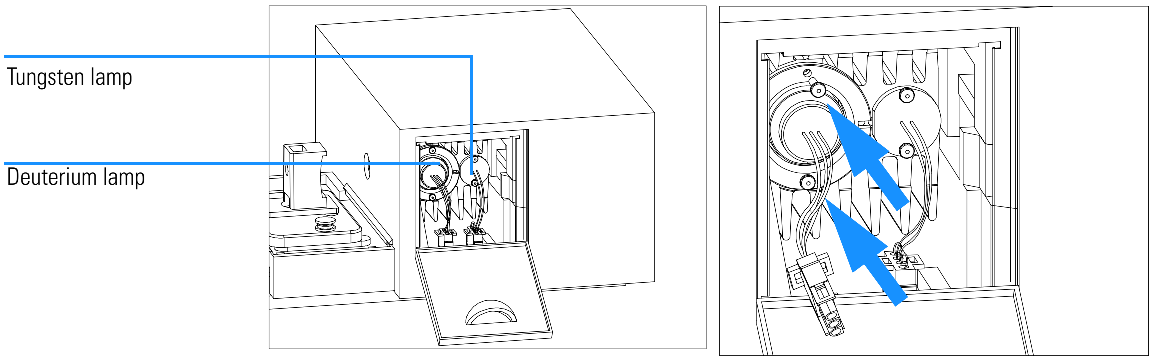
WARNING **The light emitted by the deuterium lamp in this instrument may cause damage to the naked eye. Always turn off the deuterium lamp before removing the deuterium lamp.**

Figure 13 **Sliding Out the Metal Lamp Door**



5 To disconnect the lamp cables, press the plug which connects the tungsten or deuterium lamp to the printed circuit together on both sides and lift it up.

Figure 14 **Disconnecting the Lamp Cables and Removing the Lamps**



WARNING **If you have been using the instrument, the lamp may be hot. Wait five minutes until the lamp cools down.**

Further, a hot lamp collects dust when taking it out. In case you reuse the lamp this dust would enter the optical system.

6 Use a Pozidriv screwdriver to open the two screws that hold each lamp and take it out holding it at the lamp ring.

7 Place the lamp(s) on a clean optical tissue or another place where it cannot collect dust.

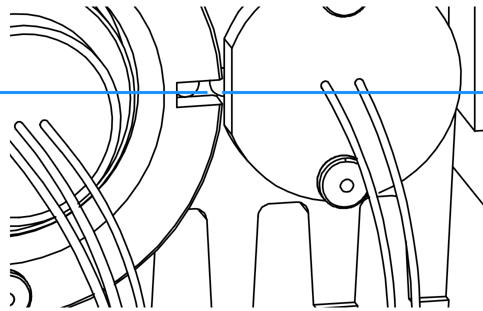
CAUTION Never touch the quartz envelope of the deuterium lamp with your fingers. Fingerprints absorb UV light and may be burnt in, thus reducing lifetime of the lamp.

If you have accidentally touched it, use isopropanol to wipe the fingerprint off.

Replacing the Deuterium or Tungsten Lamp

1 Holding the lamp(s) at the lamp ring, carefully slide it into the lamp housing, and avoid touching the quartz envelope of the deuterium lamp, see CAUTION on page 98. The tungsten lamp ring has a flat part which has to show towards the deuterium lamp location. The deuterium lamp has a recessment for a location pin on the lamp housing.

Figure 15 **Replacing the Lamps**

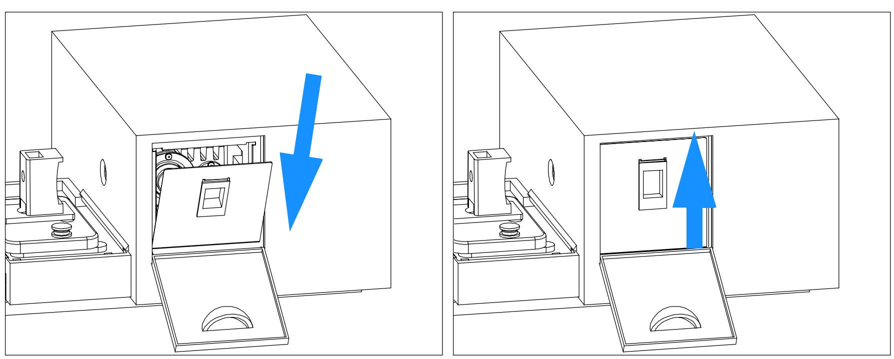


2 Take a Pozidriv screwdriver and fix the two screws which fix each lamp.

3 Connect the plug(s) of the lamp(s) to the electronic board, see Figure 14. There is only one way to get the plug(s) in.

4 Slide in the metal door and close so that it is locked. Close the plastic door.

Figure 16 **Sliding In and Closing the Metal Door and Closing**



5 Reconnect line power and turn on the instrument. Check that the spectrophotometer passes its self-test, this means that the green light on the front panel comes on and that you can do a blank measurement from your software.

Cleaning the Stray Light Filter

Cleaning the stray light filter is recommended at one-yearly intervals, or more frequently when you operate the spectrophotometer in particularly dirty environment. An indication for a dirty stray light filter is when

- —after exchanging the lamps—the intensity test executed by your operating software still falls below the specified level,
- one of the stray light tests fails,
- the photometric accuracy test fails.

Removing the Shutter Assembly

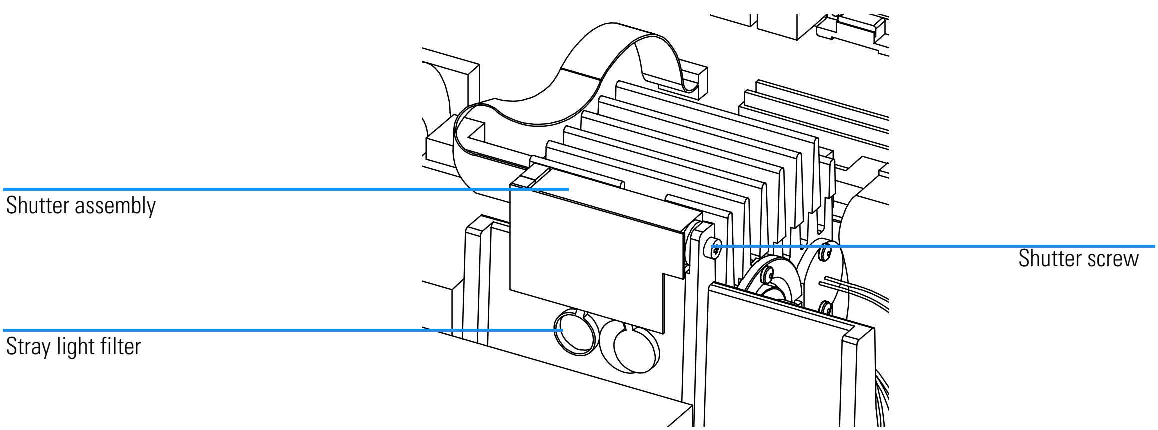
1 Turn off the spectrophotometer and disconnect the power cord. Take the plastic and sheet metal rear covers off, see “Removing and Replacing Covers” on page 109.

2 Remove any accessory board or MIO board that may be plugged in from the rear side of the instrument.

3 Remove the upper rear foam block

4 Disconnect the shutter cable from the SPM board. Open the screw that fixes the shutter assembly to the optical unit and remove the shutter assembly.

Figure 17 **Removing the Shutter Assembly**



Cleaning the Stray Light Filter

1 Dampen a lint-free, surgical cotton swab with reagent grade isopropanol (isopropyl alcohol) and gently swab the surface of the stray light filter. Repeat several times with clean swabs and alcohol each time.

2 Use a canister of compressed oil-free air (like those used to clean photographic lenses) to further clean the stray light filter. If you do not have a compressed air canister, you can use a photographic lens cleaning brush.

Replacing the Shutter Assembly

1 Position the shutter assembly above the source lens and fix the screw that holds it at the optical unit, see Figure 39. Connect the shutter cable to the SPM board.

2 Replace the upper rear and upper front foam blocks.

3 If available, replace any accessory board or MIO board (plugged in from the rear side of the instrument).

4 Replace the plastic and sheet metal rear covers. Push the plastic rear cover down so that it locates on both sides, see “Removing and Replacing Covers” on page 109.

5 Reconnect line power and turn on the instrument. Check that the spectrophotometer passes its self-test, this means that the green light on the front panel comes on and that you can do a blank measurement from your software.

Cleaning the Lenses

Cleaning the lenses which are accessible from the sample compartment is recommended at one-yearly intervals, or more frequently when you operate the spectrophotometer in a particularly dirty environment. An indication for dirty lenses is when—after exchanging the lamps—the intensity test executed by your operating software still falls below the specified level.

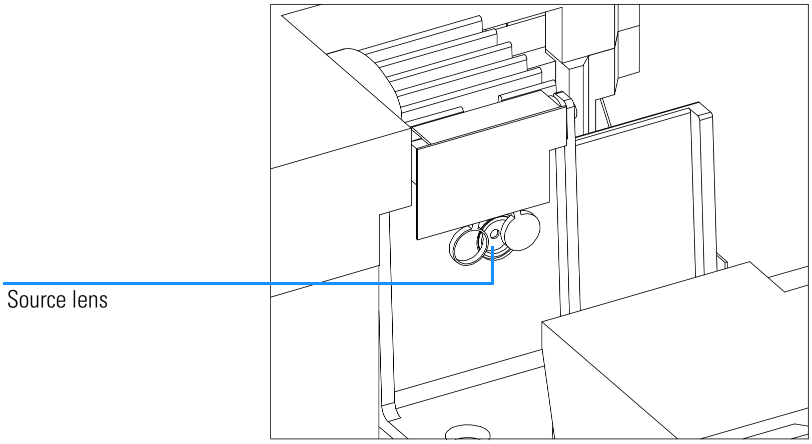
Cleaning the Source Lens

The source lens is a lens system which has one optical surface accessible from inside the lamp housing. The other optical surface is behind the shutter, thus accessible from the sample compartment.

Cleaning the Source Lens from the Sample Compartment Side

1. Turn-off the spectrophotometer and disconnect the power cord.
2. Remove any cuvette holder from the sample compartment.
3. To have better access you may want to take the plastic and metal rear covers off, see “Removing and Replacing Covers” on page 109.
4. Dampen a lint-free, surgical cotton swab with reagent grade isopropanol (isopropyl alcohol) and gently swab the surface of the source lens. Repeat several times with clean swabs and alcohol each time.

Figure 18 **Cleaning the Source Lens from the Sample Compartment Side**



5 Use a canister of compressed oil-free air (like those used to clean photographic lenses) to further clean the source lens. If you do not have a compressed air canister, you can use a photographic lens cleaning brush.

6 If you have taken the covers off, replace them.

7 Replace the cuvette holder. Reconnect line power and turn on the instrument. Check that the spectrophotometer passes its self-test, this means that the green light on the front panel comes on and that you can do a blank measurement from your software.

Cleaning the Source Lens from the Lamp Side

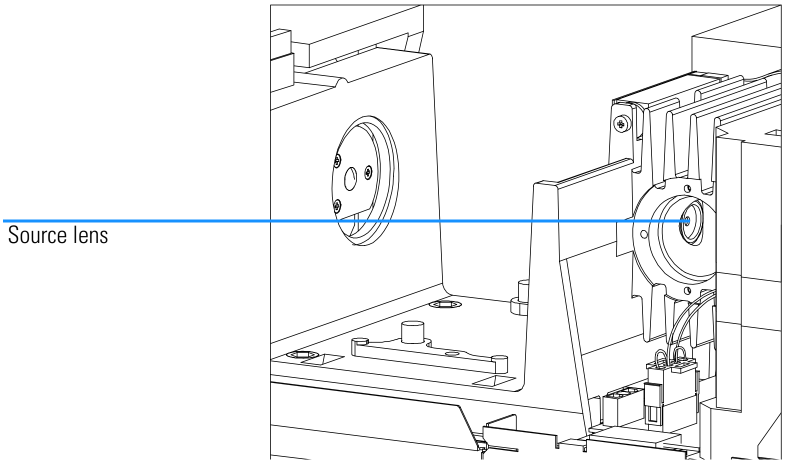
It is not recommended to clean this lens at regular intervals, because the lamp housing is sealed against dust. Therefore the source lens is not very likely to get dirty from this side. However, if you have cleaned the other lenses and your intensity test in your operating software still falls below the specified level, try the procedure below.

1 Turn-off the spectrophotometer and disconnect the power cord.

2 To remove the Deuterium lamp, see “Exchanging the Deuterium or Tungsten Lamp” on page 96.

3 Dampen a lint-free, surgical cotton swab with reagent grade isopropanol (isopropyl alcohol) and gently swab the surface of the source lens. Repeat several times with clean swabs and alcohol each time.

Figure 19 **Cleaning the Source Lens from the Lamp Side**



4 Use a canister of compressed oil-free air (like those used to clean photographic lenses) to further clean the source lens. If you do not have a compressed air canister, you can use a photographic lens cleaning brush.

5 To replace the Deuterium lamp, see "Exchanging the Deuterium or Tungsten Lamp" on page 96.

6 Reconnect line power and turn on the instrument. Check that the spectrophotometer passes its self-test, this means that the green light on the front panel comes on and that you can do a blank measurement from your software.

Cleaning the Spectrograph Lens

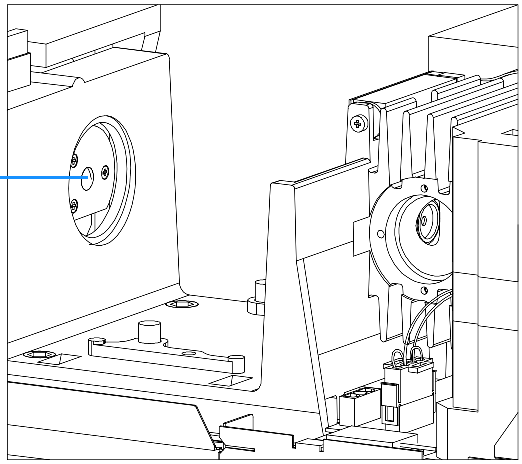
1 Turn off the spectrophotometer and disconnect the power cord.

2 Remove any cuvette holder from the sample compartment.

3 To have better access you may want to take the plastic and metal front covers off, see "Removing and Replacing Covers" on page 109.

4 Dampen a lint-free, surgical cotton swab with reagent grade isopropanol (isopropyl alcohol) and gently swab the surface of the spectrograph lens. Repeat several times with clean swabs and alcohol each time.

Figure 20 **Cleaning the Spectrograph Lens**



5 Use a canister of compressed oil-free air (like those used to clean photographic lenses) to further clean the spectrograph lens. If you do not have a compressed air canister, you can use a photographic lens cleaning brush.

6 If you have taken the covers off, replace them. Replace the cell holder in the sample compartment.

7 Reconnect line power and turn on the instrument. Check that the spectrophotometer passes its self-test, this means that the green light on the front panel comes on and that you can do a blank measurement from your software.

Repair Procedures

This section gives detailed descriptions of procedures to repair the instrument. Always disconnect the instrument from line power before repair.

WARNING

To disconnect the instrument from line, pull out the power cord. The power supply still uses some power, even if the power switch on the front panel is turned off.

For exchange of electronic assemblies we recommend to use an antistatic grounding kit (part number 9300-0933) to prevent the electronics from damage by electrostatic discharge.

- Before you unpack any electronic replacement parts, connect yourself electrically to the instrument with the help of a wrist strap.
- Connect the packing material with the electronic replacement part to the instrument.
- Touch electronic boards only on the corners and avoid touching the metal traces and electronic items on the board.
- When you remove electronic assemblies from the instrument, always put them back into the antistatic bags or place them on a material that has an electrical connection to the instrument.

Removing and Replacing Covers

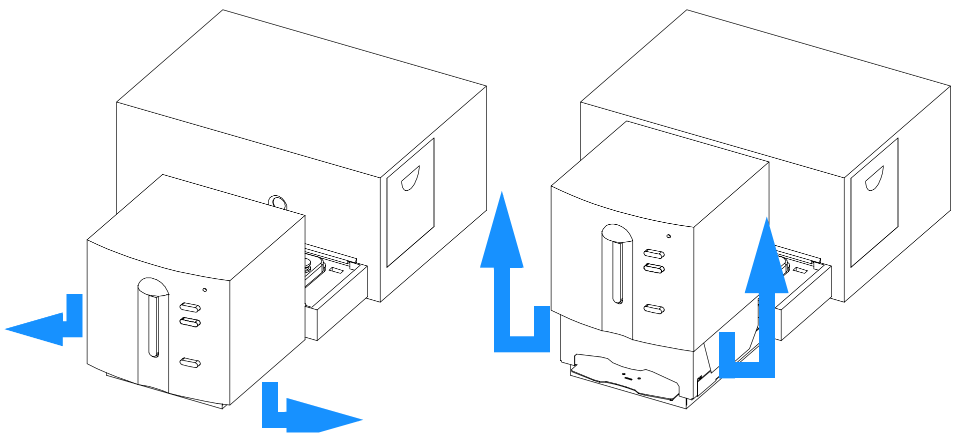
Use the following procedures to access the electronic items in case of a repair and for troubleshooting reasons.

Removing the Front Covers

1 Turn off the spectrophotometer and disconnect the power cord.

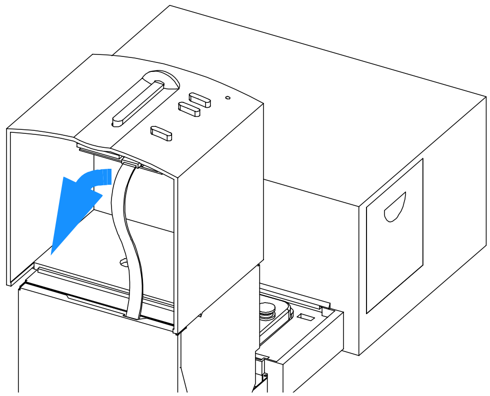
2 To remove the plastic front cover, hold the plastic cover on the lower edge with two hands from the left and right of the instrument. Pull the lower edges of the cover in opposite directions and simultaneously lift up.

Figure 21 **Removing the Plastic Front Cover**



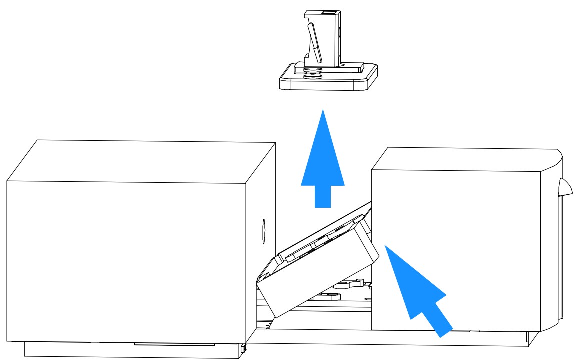
3 Remove the keyboard cable from the spectrophotometer-sipper interface (SSI) board, located inside the plastic front cover.

Figure 22 **Removing the Keyboard Cable**



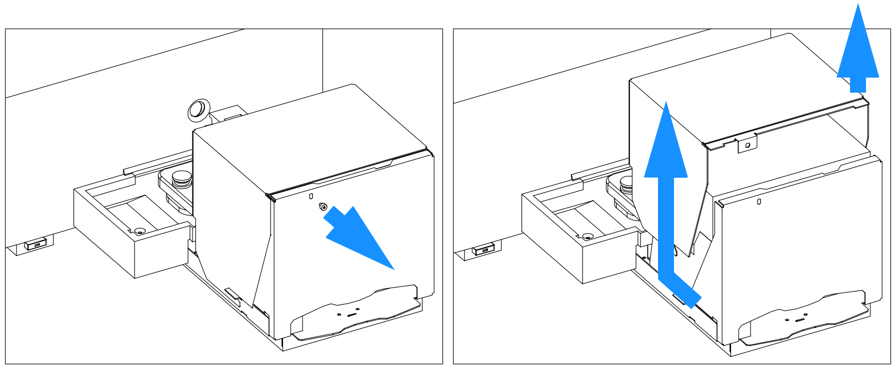
4 Remove the cuvette holder and sample pan from the sample compartment.

Figure 23 **Removing Cuvette Holder and Sample Pan**



5 To remove the sheet metal front cover, untighten the screw near the top of the cover using a Pozidriv screwdriver.

Figure 24 **Removing the Sheet Metal Front Cover**

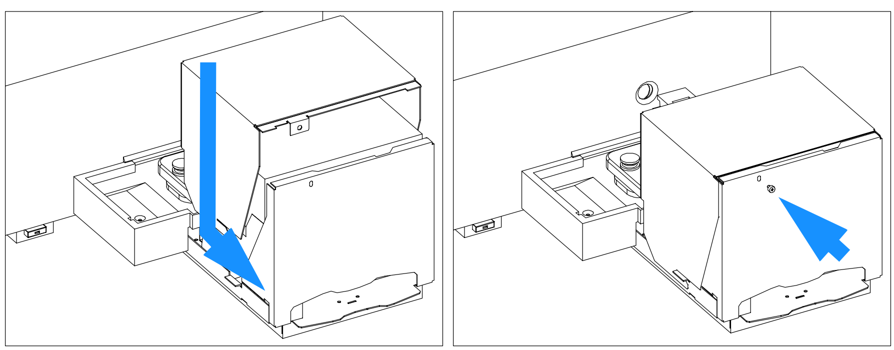


6 Slide the sheet metal front cover towards the rear of the instrument and lift it up.

Replacing the Front Covers

1 Slide in metal front cover so that it locates on the bottom first. Slide it in further so that it locates on top.

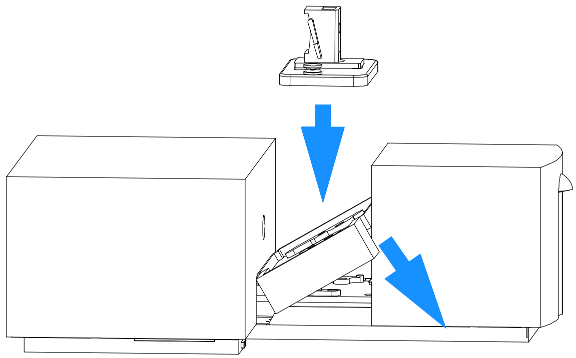
Figure 25 **Replacing the Metal Front Cover**



2 Tighten the screw near the top of the cover using a Pozidriv screwdriver.

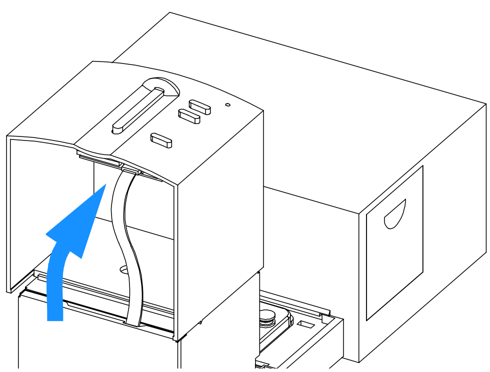
3 Replace the sample pan and cuvette holder in the sample compartment.

Figure 26 **Replacing the Sample Pan and Cuvette Holder**



4 Place the plastic front cover on top of the sheet metal cover so that you are able to connect the cable to the keyboard (SSI board).

Figure 27 **Connecting the Keyboard Cable**



5 Push the plastic cover down so that it locates on both sides.

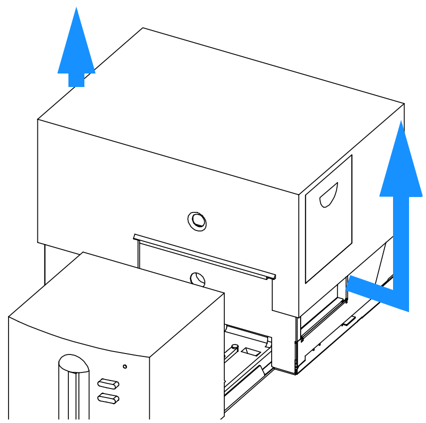
6 Reconnect line power and turn on the instrument. Check that the spectrophotometer passes its self-test, this means that the green light on the front panel comes on and that you can do a blank measurement from your software and the keyboard of the spectrophotometer.

Removing the Rear Covers

1 Turn off the spectrophotometer and disconnect the power cord.

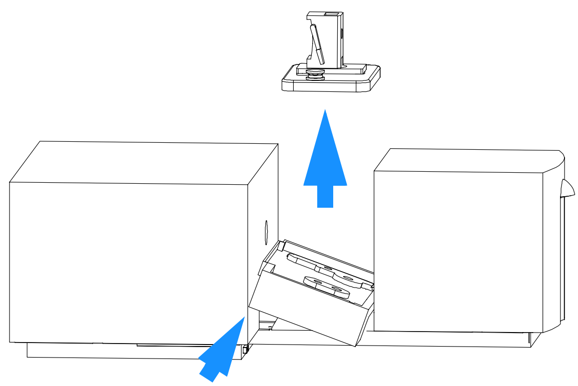
2 To remove the plastic rear cover, hold the plastic cover on the lower edge with two hands from the left and right of the instrument. Pull the lower edges of the cover in opposite directions and simultaneously lift up.

Figure 28 **Removing the Plastic Rear Cover**



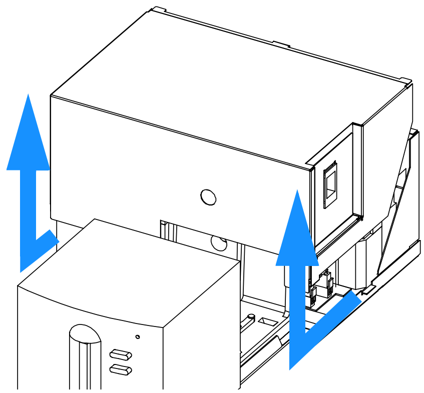
3 Remove the cuvette holder and sample pan from the sample compartment.

Figure 29 **Removing Cuvette Holder and Sample Pan**



4 To remove the sheet metal rear cover, untighten the screw near the top of the cover using a Pozidriv screwdriver.

Figure 30 **Removing the Sheet Metal Rear Cover**

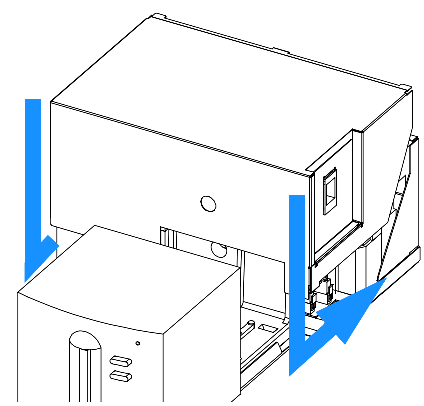


5 Slide the sheet metal rear cover towards the front of the instrument and lift it up.

Replacing the Rear Cover

1 Slide in metal rear cover so that it locates on the bottom first. Slide it in further so that it locates on top.

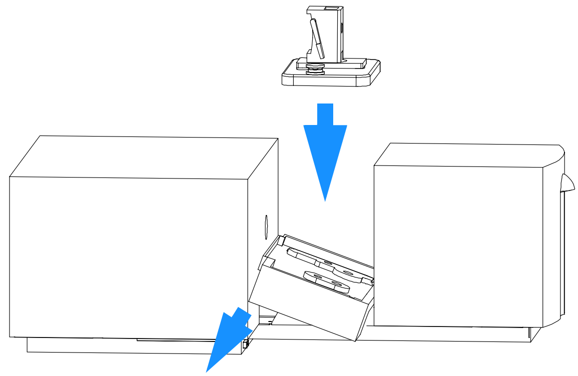
Figure 31 **Replacing the Metal Rear Cover**



2 Tighten the screw near the top of the cover using a Pozidriv screwdriver.

3 Replace the sample pan and cuvette holder in the sample compartment.

Figure 32 **Replacing Sample Pan and Cuvette Holder**



4 Replace the plastic cover and push it down so that it locates on both sides.

5 Reconnect line power and turn on the instrument. Check that the spectrophotometer passes its self-test, this means that the green light on the front panel comes on and that you can do a blank measurement from your software.

Exchanging Keyboard and Key Pad

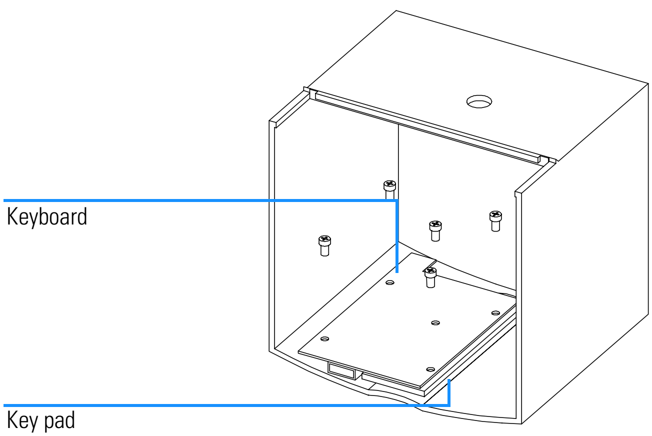
The keyboard is part of the plastic front cover and comprises the key pad (part number G1103-44901) and the spectrophotometer-sipper interface (SSI) board (part number G1103-66505).

Removing Keyboard and Key Pad

1 Turn off the spectrophotometer and disconnect the power cord. Take the plastic front cover off, see“Removing and Replacing Covers” on page 109 and disconnect the cable to the SSI board.

2 Open the screws that hold the SSI board in place and remove the SSI board and the keypad.

Figure 33 **Exchanging Keyboard and Keypad**



Replacing Keyboard and Key Pad

1 Position the key pad and the keyboard inside the front cover and tighten the screws that hold the keyboard in place, see Figure 33.

2 Connect the cable to the SSI board. Replace the plastic cover and push it down so that it locates on both sides, see “Removing and Replacing Covers” on page 109.

3 Reconnect line power and turn on the instrument. Check that the spectrophotometer passes its self-test, this means that the green light on the front panel comes on and that you can do a blank measurement from your software and the keyboard of the spectrophotometer.

Exchanging or Upgrading Internal Memory

Additional memory can be used in the spectrophotometer in case of very fast repetitive measurements of huge amounts of spectra, e.g. for fast kinetics measurements. Two sizes of memory are available, 1 MByte memory (part number 1818-4271) and 4 Mbyte memory (part number 1818-5784).

You can use the following combinations of memory modules: 1 × 1 MByte, 2 × 2 MByte, 1 × 4 MByte or 2 × 4 MByte.

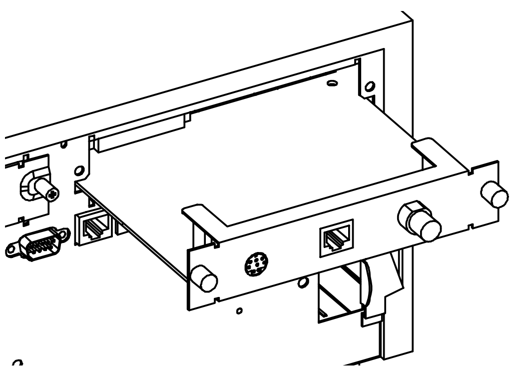
Use the following procedure for removing and replacing memory.

Removing SIMM Memory Modules

1 Turn off the spectrophotometer and disconnect the power cord. Take the plastic and sheet metal rear covers off, see “Removing and Replacing Covers” on page 109.

2 Remove any accessory board or MIO board that may be plugged in from the rear side of the instrument.

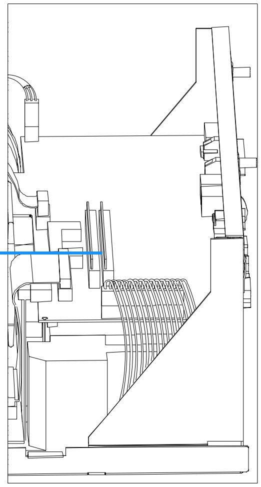
Figure 34 **Removing MIO or Accessory Boards**



3 Remove the upper rear foam block.

4 On the two sides of the SIMM socket, move the two springs in opposite directions that the memory module is released and you can move the memory module towards the rear of the spectrophotometer..

Figure 35 **Removing SIMM Memory Modules**



5 Remove the memory module and repeat the last step in case there is a second memory module installed.

Replacing SIMM Memory Modules

1 Place the memory module in the SIMM socket on the SPM board that the components of the memory module are facing to the rear of the spectrophotometer. The memory module is now positioned at an angle in the SIMM socket.

2 Press the memory module towards the front of the spectrophotometer that it snaps in behind the two springs on either side of the SIMM socket.

3 Replace the upper rear foam block.

4 If available, replace any accessory board or MIO board (plugged in from the rear side of the instrument).

5 Replace the plastic and sheet metal rear cover. Push the plastic rear cover down so that it locates on both sides, see “Removing and Replacing Covers” on page 109.

6 Reconnect line power and turn on the instrument. Check that the spectrophotometer passes its self-test,this means that the green light on the front panel comes on and that you can do a blank measurement from your software.

Exchanging the SPM Board

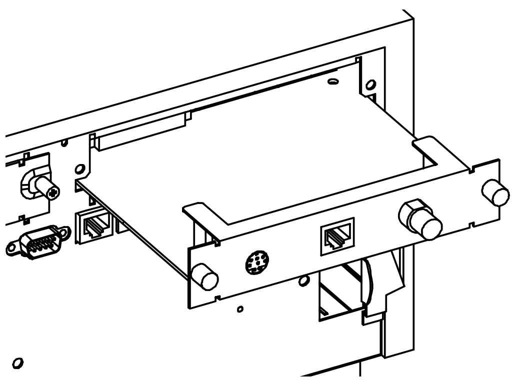
The spectrograph processor board (SPM) board (part number G1103-69500) is located in the top rear part of the spectrophotometer.

Removing the SPM Board

1 Turn off the spectrophotometer and disconnect the power cord. Take the plastic and sheet metal rear covers off, see “Removing and Replacing Covers” on page 109.

2 Remove any accessory board or MIO board that may be plugged in from the rear side of the instrument.

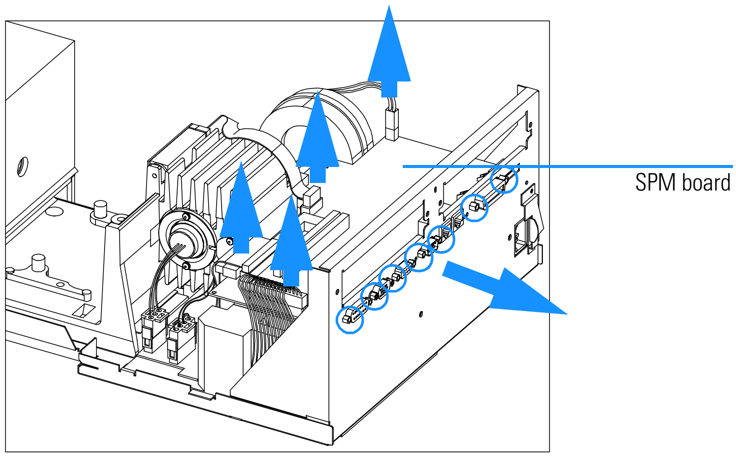
Figure 36 **Removing MIO or Accessory Boards**



3 Remove the upper rear foam block.

4 Disconnect the connector from the power supply to the SPM board (right), the flat ribbon cables from the SDA and LPS boards which are above each other, the shutter cable and the fan cable.

Figure 37 **Removing Connectors and Screws from SPM Board**



5 Unscrew two screws each, at the GPIB connector, at the APG remote connector and at the multicell connector and remove the SPM board.

Replacing the SPM Board

1 Position the SPM board on the middle rear foam block.

2 Connect the connector from the power supply to the SPM board (right), the flat ribbon cables from the SDA and LPS boards which are above each other, the shutter cable and the fan cable, see Figure 37.

3 Fix two screws each, at the GPIB connector, at the APG remote connector and at the multicell connector.

4 Replace the upper rear foam block.

5 If available, replace any accessory board or MIO board (plugged in from the rear side of the instrument).

6 Replace the plastic and sheet metal rear cover. Push the plastic rear cover down so that it locates on both sides, see "Removing and Replacing Covers" on page 109.

7 Reconnect line power and turn on the instrument. Check that the spectrophotometer passes its self-test, this means that the green light on the front panel comes on and that you can do a blank measurement from your software.

Exchanging the Optical Unit

The optical unit (part number G1103-69002) includes spectrograph, optics bench, shutter and lamp housing and it is exchanged as one item.

Removing the Optical Unit

1 Turn off the spectrophotometer and disconnect the power cord. Take the plastic and sheet metal rear and front covers off, see “Removing and Replacing Covers” on page 109.

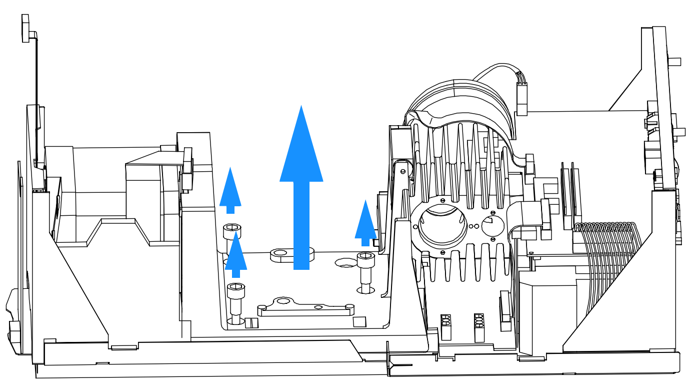
2 Remove any accessory board or MIO board that may be plugged in from the rear side of the instrument.

3 Remove the upper rear and upper front foam blocks.

4 Remove the Deuterium and Tungsten lamps, see “Exchanging the Deuterium or Tungsten Lamp” on page 96.

5 Disconnect the shutter cable from the SPM board and the flat ribbon cable from the spectrograph.

Figure 38 **Removing the Optical Unit**



6 Remove the three hexagonal screws that hold the optical unit on the chassis of the instrument. Take the screws out to be able to lift up the optical unit.

7 Lift the optical unit out of the instrument and place it on the bench.

Replacing the Optical Unit

1 Place the optical unit onto the bottom chassis of the instrument. Tighten the three hexagonal screws that hold the optical unit on the chassis of the instrument, see Figure 38.

2 Connect the shutter cable to the SPM board and the flat ribbon cable to the spectrograph, see Figure 38.

3 Replace the deuterium and tungsten lamps, see “Exchanging the Deuterium or Tungsten Lamp” on page 96.

4 Replace the upper rear and upper front foam blocks.

5 If available, replace any accessory board or MIO board (plugged in from the rear side of the instrument).

6 Replace the plastic and sheet metal front and rear covers. Push the plastic front and rear covers down so that they locate on both sides, see “Removing and Replacing Covers” on page 109.

7 Reconnect line power and turn on the instrument. Check that the spectrophotometer passes its self-test, this means that the green light on the front panel comes on and that you can do a blank measurement from your software.

Exchanging the Shutter Assembly

The shutter assembly (part number G1103-61904) is located in the top rear part of the spectrophotometer.

Removing the Shutter Assembly

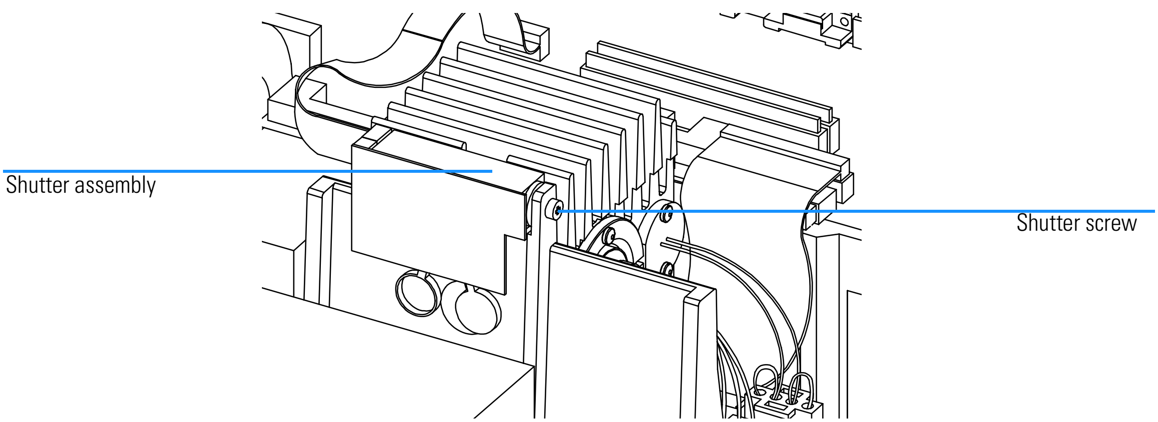
1 Turn off the spectrophotometer and disconnect the power cord. Take the plastic and sheet metal rear covers off, see “Removing and Replacing Covers” on page 109.

2 Remove any accessory board or MIO board that may be plugged in from the rear side of the instrument.

3 Remove the upper rear foam block

4 Disconnect the shutter cable from the SPM board. Open the screw that fixes the shutter assembly to the optical unit and remove the shutter assembly.

Figure 39 **Removing the Shutter Assembly**



Replacing the Shutter Assembly

1 Position the shutter assembly above the source lens and fix the screw that holds it at the optical unit, see Figure 39. Connect the shutter cable to the SPM board.

2 Replace the upper rear and upper front foam blocks.

3 If available, replace any accessory board or MIO board (plugged in from the rear side of the instrument).

4 Replace the plastic and sheet metal rear covers. Push the plastic rear cover down so that it locates on both sides, see “Removing and Replacing Covers” on page 109.

5 Reconnect line power and turn on the instrument. Check that the spectrophotometer passes its self-test, this means that the green light on the front panel comes on and that you can do a blank measurement from your software.

Exchanging the Fan Assembly

The fan assembly (part number 3160-1103) is located in the top rear part of the spectrophotometer.

Removing the Fan Assembly

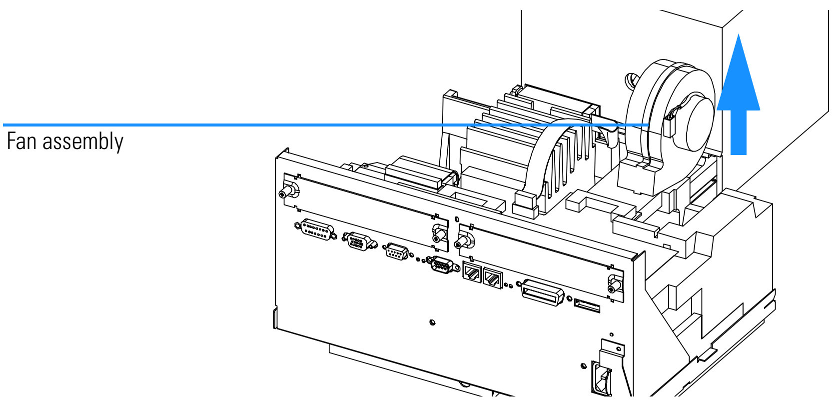
1 Turn off the spectrophotometer and disconnect the power cord. Take the plastic and sheet metal rear covers off, see "Removing and Replacing Covers" on page 109.

2 Remove any accessory board or MIO board that may be plugged in from the rear side of the instrument.

3 Remove the upper rear foam block.

4 Disconnect the fan cable from the SPM board and remove the fan assembly.

Figure 40 **Removing the Fan Assembly**



Replacing the Fan Assembly

1 Position the fan assembly in its recessment in the middle rear foam block and connect the fan cable to the SPM board.

2 Replace the upper rear and upper front foam blocks.

3 If available, replace any accessory board or MIO board (plugged in from the rear side of the instrument).

4 Replace the plastic and sheet metal rear cover. Push the plastic rear cover down so that it locates on both sides, see “Removing and Replacing Covers” on page 109.

5 Reconnect line power and turn on the instrument. Check that the spectrophotometer passes its self-test, this means that the green light on the front panel comes on and that you can do a blank measurement from your software.

Exchanging SDA Board

The SDA board (part number G1103-69504) is located below the optical unit of the spectrophotometer.

Removing the SDA Board

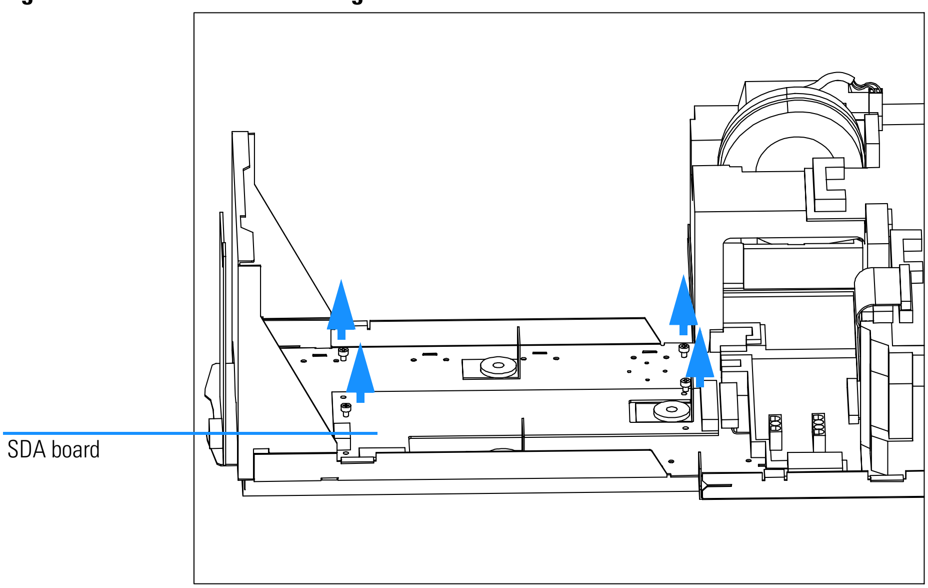
1 Turn off the spectrophotometer and disconnect the power cord. Take the plastic and sheet metal front and rear covers off, see “Removing and Replacing Covers” on page 109.

2 To remove the optical unit, see “Removing the Optical Unit” on page 122.

3 Remove the lower front foam block.

4 Disconnect the three cables from the SDA board and remove the five scews that hold the board in place.

Figure 41 **Removing the SDA Board**



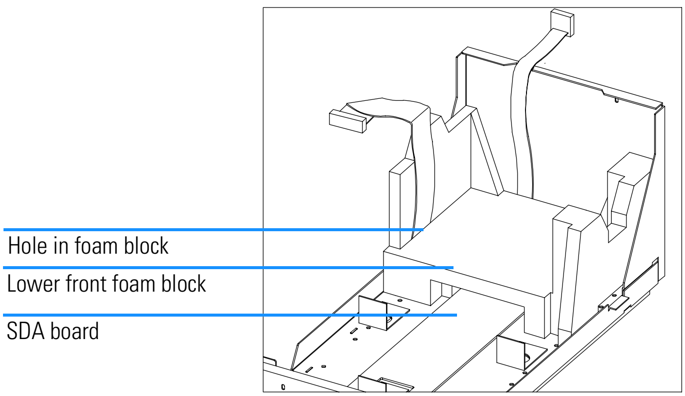
Replacing the SDA Board

1 Position the SDA board on the bottom chassis of the instrument and fix the three scews that hold the board in place.

2 Connect the three cables to the SDA board, see Figure 41.

3 On the side which is near the front of the instrument, feed the broader cable through the hole in the lower front foam block and place the foam block on the chassis of the instrument.

Figure 42 **Replacing SDA Board and Cables**



4 To replace the optical unit, see “Replacing the Optical Unit” on page 123.

5 Replace the plastic and sheet metal rear cover. Push the plastic rear cover down so that it locates on both sides, see “Removing and Replacing Covers” on page 109.

6 Reconnect line power and turn on the instrument. Check that the spectrophotometer passes its self-test, this means that the green light on the front panel comes on and that you can do a blank measurement from your software.

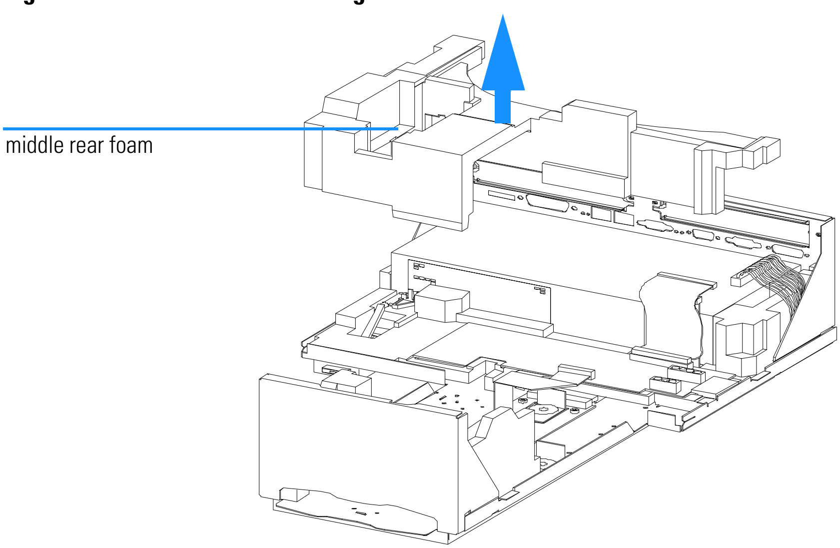
Exchanging SLS Board

The SLS board (part number G1103-69502) is located below the SPM board in the rear part of the spectrophotometer.

Removing the SLS Board

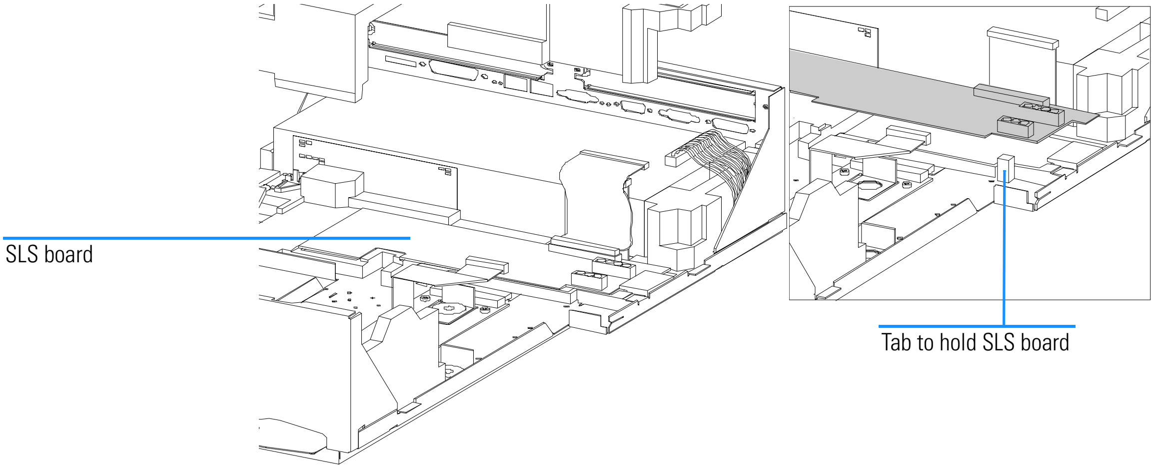
1 Turn off the spectrophotometer and disconnect the power cord. Take the plastic and sheet metal front and rear covers off, see “Removing and Replacing Covers” on page 109.
2 To remove the optical unit, see “Removing the Optical Unit” on page 122.
3 To remove the fan, see “Removing the Fan Assembly” on page 126.
4 To remove the SPM board, see “Removing the SPM Board” on page 120.
5 Remove the middle rear foam block.

Figure 43 **Removing the Middle Rear Foam Block**



6 To slide the SLS board out of the tab on the right side, lift up the SLS board on the left side a little and slide it to the left.

Figure 44 **Removing the SLS Board**



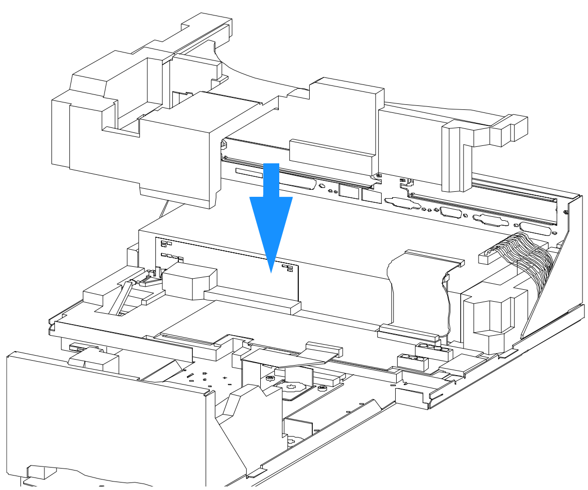
Replacing the SLS Board

1 Slide the SLS board into the tab on the right side and push it down, see figure above.

2 Connect the flat ribbon cable that leads to the SPM board.

3 Replace the middle rear foam block.

Figure 45 **Replacing the Middle Rear Foam Block**



4 To replace the SPM board, see “Replacing the SPM Board” on page 121.

5 To replace the fan, see “Replacing the Fan Assembly” on page 126.

6 To replace the optical unit, see on page 123.

7 Replace the plastic and sheet metal rear cover. Push the plastic rear cover down so that it locates on both sides, see “Removing and Replacing Covers” on page 109.

8 Reconnect line power and turn on the instrument. Check that the spectrophotometer passes its self-test, this means that the green light on the front panel comes on and that you can do a blank measurement from your software.

Exchanging the Main Power Supply

The main power supply (MPS) (part number 0950-2528) is located below the SPM board in the rear part of the spectrophotometer.

The main power supply (MPS) is in a separate housing. It does not contain any servicable parts inside. In case it is defective, it must not be opened but has to be exchanged as a complete assembly.

Removing the Main Power Supply

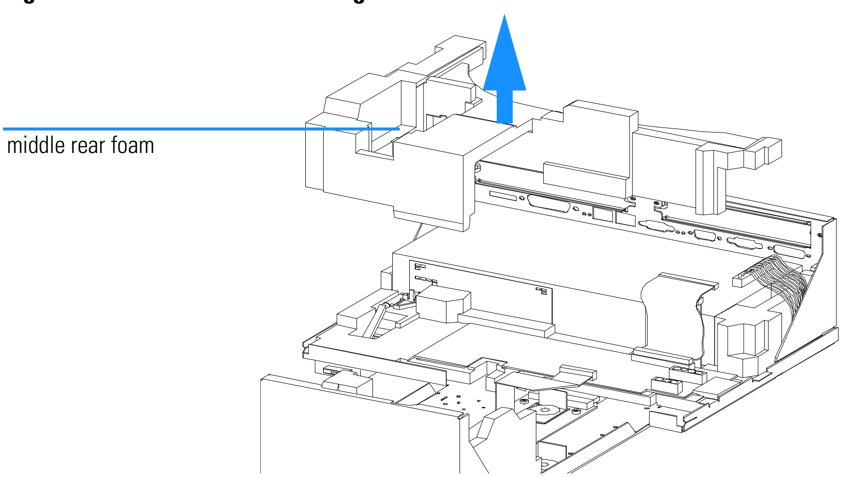
1 Turn off the spectrophotometer and disconnect the power cord. Take the plastic and sheet metal front and rear covers off, see “Removing and Replacing Covers” on page 109.

2 To remove the fan, see “Removing the Fan Assembly” on page 126.

3 To remove the SPM board, see “Removing the SPM Board” on page 120.

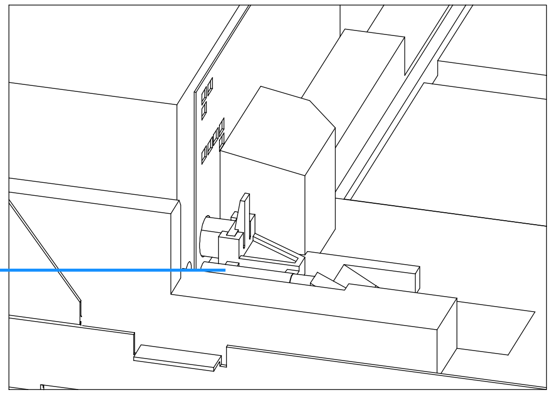
4 Remove the middle rear foam block.

Figure 46 **Removing the Middle Rear Foam Block**



5 To remove the light pipe, take the snap mechanism between two fingers and press it together to release the light pipe from the coupler on the main power supply. Remove the light pipe with the power button.

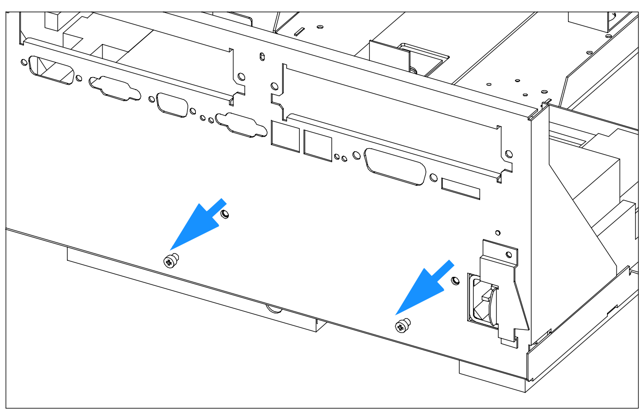
Figure 47 **Removing the Light Pipe**



Light pipe

6 Open the two screws from the rear panel of the instrument that hold the main power supply in place and slide the main power supply out.

Figure 48 **Removing the Main Power Supply Screws**

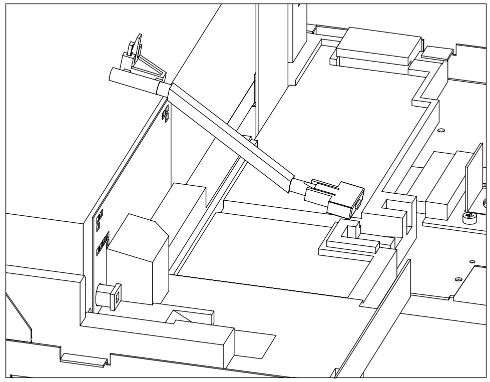


Replacing the Main Power Supply

1 Place the main power supply on the bottom foam in the rear part of the instrument and fix the two screws from the rear panel of the instrument that hold the main power supply in place, see figure above.

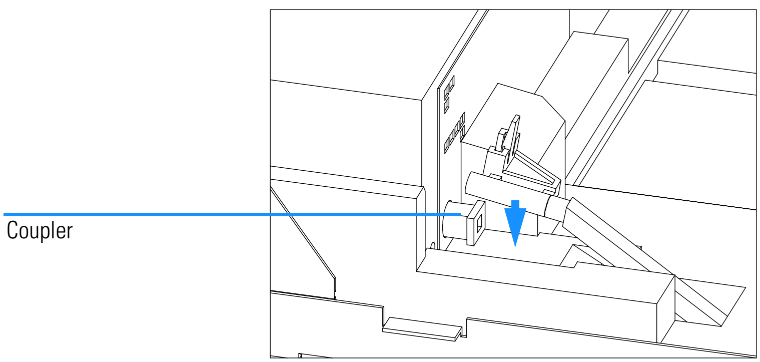
2 Attach the power button to the light pipe and slide the light pipe with the power button into the hole of the bottom foam part that the power button comes out of the hole at the base of the instrument.

Figure 49 **Sliding in the Light Pipe**



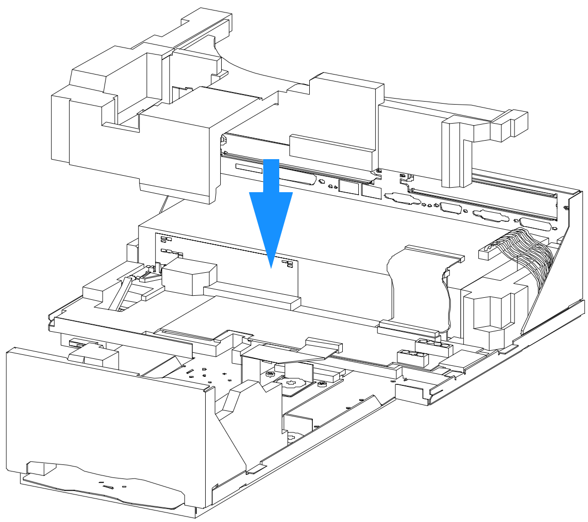
3 Take the snap mechanism between two fingers and press it together to get the light pipe end into the coupler on the main power supply.

Figure 50 **Attaching Light Pipe to Main Power Supply**



4 Replace the middle rear foam block.

Figure 51 **Replacing the Middle Rear Foam Block**



5 To replace the SPM board, see “Replacing the SPM Board” on page 121.

6 To replace the fan, see “Replacing the Fan Assembly” on page 126.

7 Replace the plastic and sheet metal rear cover. Push the plastic rear cover down so that it locates on both sides, see “Removing and Replacing Covers” on page 109.

8 Reconnect line power and turn on the instrument. Check that the spectrophotometer passes its self-test, this means that the green light on the front panel comes on and that you can do a blank measurement from your software.

5

Parts and Materials

Exploded views of repairable parts and part number listings for ordering replacement and exchange parts

Exploded Views and Part List

Parts are listed in the respective tables with their part numbers. Assemblies shown do not contain any parts around them, unless otherwise specified.

Figure 52 **Spectrophotometer Upper Parts**

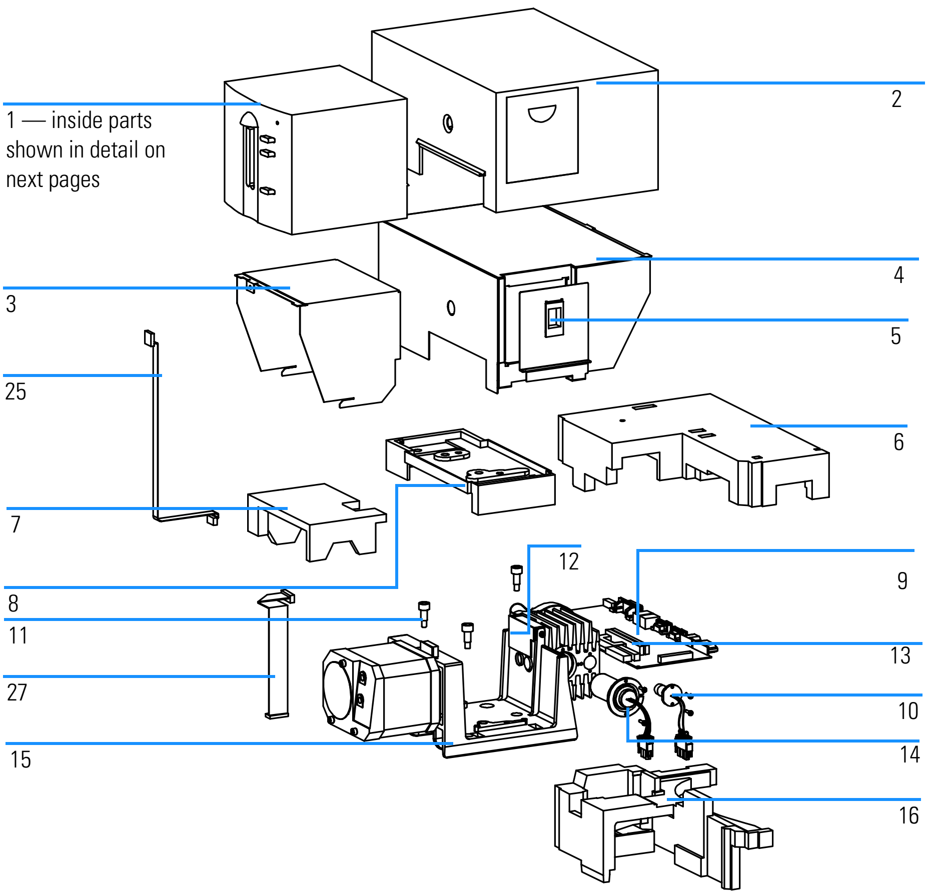


Table 49 **Instrument Parts Breakdown**

Item	Description	Part Number
1	Plastic cover front	G1103-44101
2	Plastic cover rear	G1103-68706
	Name plate (not shown in Figure 52)	G1103-44300
3, 4, 5	Sheet metal kit, containing: Metal top front, metal top rear, metal lamp door, (chassis bottom is included and shown in Figure 53)	G1103-68701
	Metal cover screw (not shown in Figure 52)	5022-2112
5	Metal lamp door	G1103-00301
6, 7, 16	EPP foam parts kit, containing: Foam front top, foam rear top, foam rear middle, (foam front bottom and foam rear bottom are included and shown in Figure 53)	G1103-68702
8	Sample pan	G1103-44501
9	SPM board (spectr. proccessor main board)	G1103-69500
10	Tungsten lamp	G1103-60001
11	Screw M8 × 30 mm	0515-2520
12	Shutter assembly	G1103-61904
13	1 MB memory for SPM board	1818-4721*
13	4 MB memory for SPM board	1818-5784**
14	Deuterium lamp	2140-0605
15	Optical unit (including spectrograph, optical bench and shutter)	G1103-69002

* Part number may be subject to change.
** Part number may be subject to change.

Figure 53 **Spectrophotometer Lower Parts**

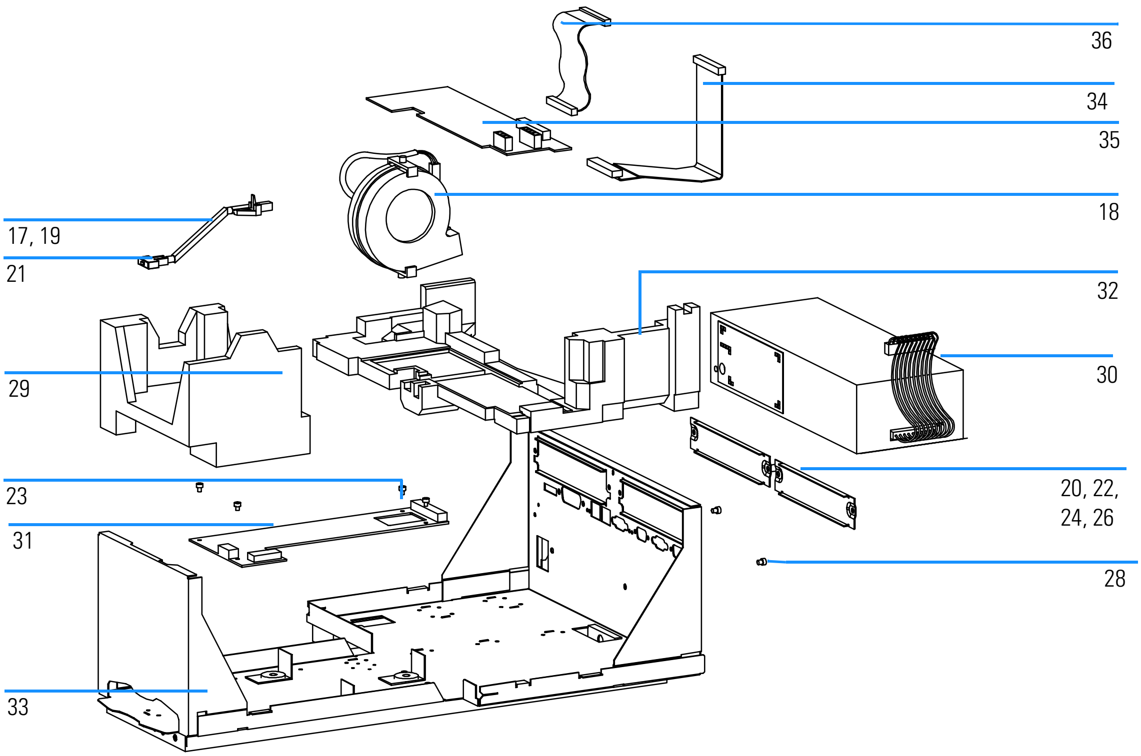


Table 50 **Instrument Parts Breakdown**

Item	Description	Part Number
17	Power switch coupler	5041-8383
18	Fan assembly	3160-1103
19	PWR switch light pipe	G1103-44602
20	Accessory slot cover	5001-3772
21	Power push button	5041-8381
22	GPIB standoff, 0.255 inch (not shown in Figure 53)	0380-0643
	Washer (not shown in Figure 53)	3050-0893
23	Screw M3 × 8 mm	0515-1105
24	Remote standoff (not shown in Figure 53)	1251-7788
25, 27, 34, 36	Cable assembly kit	G1103-68704
26	Screw set (not shown in Figure 53)	1251-0218
28	Screw M4 x 8 mm	0515-0910
	Washer (not shown in Figure 53)	2190-0409
29, 32	EPP foam parts kit, containing: foam front bottom, foam rear bottom, (foam front top, foam rear top, foam rear middle are included and shown in Figure 52)	G1103-68702
30	Main power supply	0950-2528
31	SDA board (spectr. data acquisition board)	G1103-69504
33	Sheet metal kit, containing: chassis bottom, (metal top front, metal top rear, metal lamp door are included and shown in Figure 52)	G1103-68701
	Metal cover screw (not shown in Figure 53)	5022-2112
35	SLS board (spectr. lamp supply board)	G1103-69502

Figure 54 **Front Cover Parts**

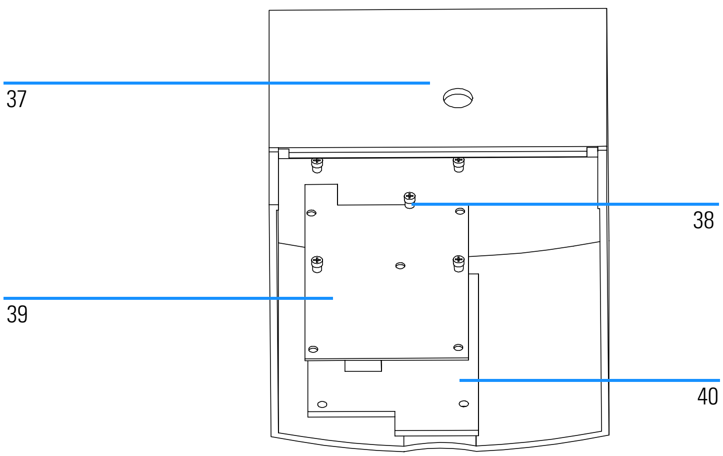


Table 51 **Front Cover Parts Breakdown**

Item	Description	Part Number
37	Plastic Cover Front	G1103-44101
38	Tapping Screw	0515-2734
39	SSI Board	G1103-66505
40	Key Pad	G1103-44901

Parts not shown in the illustrated parts breakdown are given in Table 52.

Table 52 **Additional Parts**

Description	Part Number
Standard cell holder	08451-60104
Sipper/sampler-GPIO cable	G1103-61608
Multichannel pump-GPIO cable	G1103-61607
Controller-GPIO cable	G1103-61610
General purpose-GPIO cable	G1103-61611
Waste tubing	0890-1711
GPIB cable (1m)	10833A
APG remote cable (start, stop, error, ready,shut down, power on)	5061-3378
Handheld controller with flexible CAN interface cable and documentation	G1819A

6

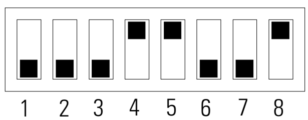
Interfacing

Communicating and interfacing through GPIB and RS-232C

Setting the 8-Bit Configuration Switch

The 8-bit configuration switch is located next to the GPIB connector. Switch settings provide configuration parameters for GPIB address, serial comunication protocol and instrument specific initialization procedures

Figure 55 **8-Bit Configuration Switch.**



If you just want to change the GPIB address and need a detailed procedure, refer to the *Installing Your UV-Visible Spectroscopy System* handbook. Default GPIB address is set to 25 equal to a binary setting of 0 0 0 1 1 0 0 1 (where 0 means that the switch is down and 1 means that the switch is up; the binary code of the address starts with the least significant bit at switch number 8).

Table 53 **8-Bit Configuration Switch**

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

Switches 1 and 2 define which set of parameters (for example, for GPIB, RS232 and so on) will be changed. Once the change has been completed, the instrument must be powered up again in order to store the values in the non-volatile memory.

In the non-volatile random access memory (NVRAM) the parameters are kept, independantly if you turn the instrument off and on again. They will be kept until the same set of parameters is subsequently changed and power is reset. All other previously stored configuration settings are still being kept in non-volatile random access memory (NVRAM).

In this manner you can store more than one set of parameters, for example, for GPIB and RS232, using the same 8-bit configuration switch twice.

Forced Cold Start Settings

Firmware update procedures may require this mode in case of firmware loading errors.

Unlike GPIB and RS232C settings, using these settings does not force storage of this set of parameters in non-volatile random access memory (NVRAM). Returning the switches 1 and 2 to other positions (other than being both up) will allow for normal operation.

CAUTION

Forced cold start erases all methods and data stored in non-volatile memory. Exceptions are diagnose and repair log books which are save from being erased.

If you use the following switch settings and power the instrument up again, a forced cold start has been completed.

Table 54 **Forced Cold Start Settings**

Mode Select	1	2	3	4	5	6	7	8
TEST/BOOT	1	1	0	0	0	0	0	1

To return to normal operation, set switches back to your GPIB or RS 232 configuration settings.

Stay Resident Settings

Firmware update procedures may require this mode in case of firmware loading errors.

Unlike GPIB and RS232C settings, using these settings does not force storage of this set of parameters in non-volatile random access memory (NVRAM). Returning the switches 1 and 2 to other positions (other than being both up) will allow for normal operation.

If you use the following switch settings and power the instrument up again, the instrument firmware stays in the resident part, that is, it is not operable as a spectrophotometer, but only uses basic functions of the operating system, for example, for comunication and so on.

Table 55 **Stay Resident Settings**

Mode Select	1	2	3	4	5	6	7	8
TEST/BOOT	1	1	0	0	1	0	0	0

To return to normal operation, set switches back to your GPIB or RS 232 configuration settings.

Comunication Settings for RS232 Comunication

The comunication protocol used in this instrument supports only hardware handshake (CTS/RTR).

Switches 1 in down and 2 in up position define that the RS232 parameters will be changed. Once the change has been completed, the instrument must be powered up again in order to store the values in the non-volatile memory.

Table 56 **Communication Settings for RS232 Communication**

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

Use the following tables for selecting the setting which you want to use for RS232 comunication. The number 0 means that the switch is down and

1 means that the switch is up. Please note that there are two possible switch settings for 9600 baud

Table 57 **Baudrate Settings**

Switches			Baud Rate
3	**4**	**5**	
0	0	0	9600
0	0	1	1200
0	1	0	2400
0	1	1	4800

Switches			Baud Rate
3	**4**	**5**	
1	0	0	9600
1	0	1	14400
1	1	0	19200
1	1	1	38400

Table 58 **Data Bit Settings**

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

Table 59 **Parity Settings**

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

Warranty Statement

All Chemical Analysis Products

Agilent Technologies (Agilent) warrants its chemical analysis products against defects in materials and workmanship. For details of the warranty period in your country, call Agilent. During the warranty period, Agilent will, at its option, repair or replace products which prove to be defective. Products that are installed by Agilent are warranted from the installation date, all others from the ship date.

If buyer schedules or delays installation more than 30 days after delivery, then warranty period starts on 31st day from date of shipment (60 and 61 days, respectively for products shipped internationally).

Agilent warrants that its software and firmware designed by Agilent for use with a CPU will execute its programming instructions when properly installed on that CPU. Agilent does not warrant that the operation of the CPU, or software, or firmware will be uninterrupted or error-free.

Limitation of Warranty

Onsite warranty services are provided at the initial installation point. Installation and onsite warranty services are available only in Agilent service travel areas, and only in the country of initial purchase unless buyer pays Agilent international prices for the product and services. Warranties requiring return to Agilent are not limited to the country of purchase.

For installation and warranty services outside of Agilent’s service travel area, Agilent will provide a quotation for the applicable additional services.

If products eligible for installation and onsite warranty services are moved from the initial installation point, the warranty will remain in effect only if the customer purchases additional inspection or installation services, at the new site.

The foregoing warranty shall not apply to defects resulting from:

1. improper or inadequate maintenance, adjustment, calibration, or operation by buyer,
2. buyer-supplied software, hardware, interfacing or consumables,
3. unauthorized modification or misuse,

4 operation outside of the environmental and electrical specifications for the product,

5 improper site preparation and maintenance, or

6 customer induced contamination or leaks.

THE WARRANTY SET FORTH IS EXCLUSIVE AND NO OTHER WARRANTY, WHETHER WRITTEN OR ORAL, IS EXPRESSED OR IMPLIED. AGILENT SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Limitation of Remedies and Liability

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. IN NO EVENT SHALL AGILENT BE LIABLE FOR DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES (INCLUDING LOSS OF PROFITS) WHETHER BASED ON CONTRACT, TORT OR ANY OTHER LEGAL THEORY.

Responsibilities of the Customer

The customer shall provide:

1 access to the products during the specified periods of coverage to perform maintenance,

2 adequate working space around the products for servicing by Agilent personnel,

3 access to and use of all information and facilities determined necessary by Agilent to service and/or maintain the products (insofar as these items may contain proprietary or classified information, the customer shall assume full responsiblity for safeguarding and protection from wrongful use),

4 routine operator maintenance and cleaning as specified in the Agilent operating and service manuals, and

5 consumables such as paper, disks, magnetic tapes, ribbons, inks, pens, gases, solvents, columns, syringes, lamps, septa, needles, filters, frits, fuses, seals, detector flow cell windows, and so on.

Responsibilities of Agilent Technologies

Agilent Technologies will provide warranty services as described in the following table.

Table 60 Warranty Services

Services During Warranty*	Warranty Period**	Type
Agilent CE instruments, Agilent 1100 Series LC modules, Agilent 8453 UV-visible spectrophotometers	1 Year	Onsite
CE, LC, UV-visible supplies and accessories	90 Days	Onsite
Columns and consumables***	90 Days	Return to Agilent
Gas discharge and tungsten lamps	30 Days	Return to Agilent
Repairs performed onsite by Agilent****	90 Days	Onsite

* This warranty may be modified in accordance with the law of your country. Please consult your local Agilent office for the period of the warranty, for shipping instructions and for the applicable wording of the local warranty.

** Warranty services are included as specified for chemical-analysis products and options purchased concurrently provided customer is located within a Agilent-defined travel area. Agilent warranty service provides for 8 a.m. to 5 p.m. onsite coverage Monday through Friday, exclusive of Agilent holidays.

*** Columns and consumables are warranted to be free from defects for a period of 90 days after shipment and will be replaced on a return-to-Agilent basis if unused.

**** Agilent repair warranty is limited to only the item repaired or replaced.

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.

General

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

Operation

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

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

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

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

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

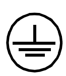
Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

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

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

Safety Symbols

Table 61 **Safety Symbols used on Instruments and in Manuals**

Symbol	Description
	The apparatus is marked with this symbol when the user should refer to the instruction manual in order to protect the apparatus against damage.
	Indicates dangerous voltages.
	Indicates a protected ground terminal.
	Eye damage may result from directly viewing light produced by deuterium lamps used in detectors and spectrophotometers. Always turn off the deuterium lamp before opening the lamp door on the instrument.

WARNING

A warning alerts you to situations that could cause physical injury or damage to the equipment. 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 a possible loss of data. Do not proceed beyond a caution until you have fully understood and met the indicated conditions.

Solvent Information

Observe the following recommendations on the use of solvents.

Flow Cells

Avoid the use of alkaline solutions (pH > 9.5) which can attack quartz and thus impair the optical properties of flow cells.

Solvents

Always filter solvents, small particles can permanently block capillaries. 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 nitric acid, sulfuric acid especially at higher temperatures (replace, if your analysis 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:

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

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

Radio Interference

Manufacturer's Declaration

This is to certify that this equipment is in accordance with the Radio Interference Requirements of Directive FTZ 1046/1984. The German Bundespost was notified that this equipment was put into circulation, the right to check the series for compliance with the requirements was granted.

Test and Measurement

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

Sound Emission

Manufacturer’s Declaration

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

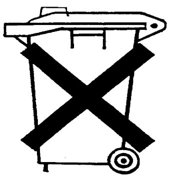
This product has a sound pressure emission (at the operator position) < 70 dB.

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

Lithium Batteries Information

WARNING

Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the equipment manufacturer.



Do not dispose of lithium batteries in domestic waste.

Transportation of discharged lithium batteries through carriers regulated by IATA/ICAO, ADR, RID, IMDG is not allowed. Discharged lithium batteries must be disposed of locally according to national waste disposal regulations for batteries.

Agilent Technologies on Internet

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

http://www.agilent.com/go/chem

Index

Agilent Technologies
Innovating the HP Way

In This Book

This handbook is intended for the technical reader who needs background information about the Agilent 8453 spectrophotometer and potential repairs.

The handbook contains specifications of the spectrophotometer as well as descriptions of front and back panels, for example, where to connect accessories. Electronics are explained at block-diagram level. There is a detailed section about troubleshooting to help find a defective subassembly, such as an electronic board, in case the spectrophotometer does not operate any more. Part replacement procedures as well as an exploded view with part numbers are given for ordering and replacing assemblies.

For information about installation of the system including the spectrophotometer, computer and accessories, see the *Installing Your UV-Visible Spectroscopy System* handbook.

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