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# **Model EM-1 Econo UV Monitor Instruction Manual**

**Catalog Numbers**

**731-8160**

**731-8162**

For Technical Service  
Call Your Local Bio-Rad Office or  
in the U.S. Call **1-800-4BIORAD**  
(1-800-424-6723)

**BIO-RAD**

## Warranty

Model \_\_\_\_\_

Serial Number \_\_\_\_\_

Date of Delivery \_\_\_\_\_

Warranty Period \_\_\_\_\_

Unless otherwise specified, instruments sold by Bio-Rad Laboratories are under warranty for 1 year against defects in materials and workmanship.

If any defects should occur during this warranty period, Bio-Rad will replace the defective parts without charge. However, the following defects are specifically excluded:

1. Defects caused by improper operation, accident, or misuse.
2. Repair or modification done by anyone other than Bio-Rad Laboratories or their authorized agent.
3. Deliberate or accidental misuse
4. Damage caused by disaster.
5. Damage due to use of improper solvent or sample.
6. Damage due to spills.

This warranty does not apply to flow cell, UV lamp, fittings, tubing, and fuses.

For inquiry or request for instrument repair service, contact Bio-Rad Laboratories after confirming the model and serial number of your instrument.

For Technical Service Call Your Local Bio-Rad Office or in the U.S. Call **1-800-4BIORAD** (1-800-424-6723).

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## Section 1 Safety



Disconnect supply before servicing. No user serviceable parts inside. Refer servicing to Bio-Rad service personnel.



Disconnect supply before removing optics module connector.



Optics module produces ultraviolet radiation. Disconnect supply before changing filter or flow cell.

This instrument is intended for laboratory use only.

This product conforms to the “Class A” standards for electromagnetic emissions intended for laboratory equipment applications. It is possible that emissions from this product may interfere with some sensitive appliances when placed nearby or in the same circuit as those appliances. The user should be aware of this potential and take appropriate measures to avoid interference.

## Section 2 Introduction



**Fig. 2.1. Model EM-1 Econo UV Monitor.**

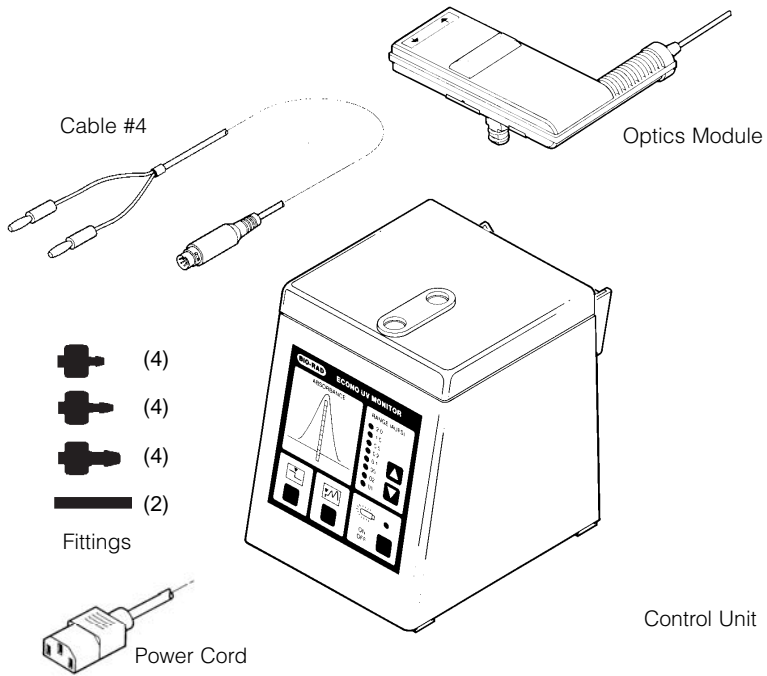
The Model EM-1 Econo UV Monitor is a high quality dual wavelength detector for liquid chromatography. The monitor consists of a control unit and a portable optics module. The optics module comes equipped with two interchangeable filters (280 nm and 254 nm), a user-serviceable mercury lamp, and a 2 mm pathlength flow cell. All filters and flow cells are easily changed in minutes, and polypropylene luer connectors allow rapid tubing connections. The Model EM-1 Econo UV Monitor functions as a stand-alone instrument, or as an integral part of a low pressure chromatography system.

For technical specifications, refer to Appendix D.

## Section 3 Unpacking

Carefully remove the contents of the shipping box, and check for any obvious damage or problems with the instrument. Figure 3.1 shows the parts included with the Model EM-1 Econo UV Monitor. Check off all parts against the supplied packing list.

If any parts are missing or damaged, contact Bio-Rad Laboratories immediately.



Also includes: Instruction Manual

**Fig. 3.1. Parts supplied with the Model EM-1 Econo UV Monitor.**

## Section 4 Description and Features

The Model EM-1 Econo UV Monitor consists of two units. The control unit houses the controls and the majority of the electronics, while the optics unit contains the UV lamp, the flow cell, and filter tray, which contains both 254 nm and 280 nm filters.

The following tables and illustrations describe the features of the Model EM-1 Econo UV Monitor. For additional functions available when operating with other low pressure components, refer to Section 7.

### 4.1 Front Panel Functions

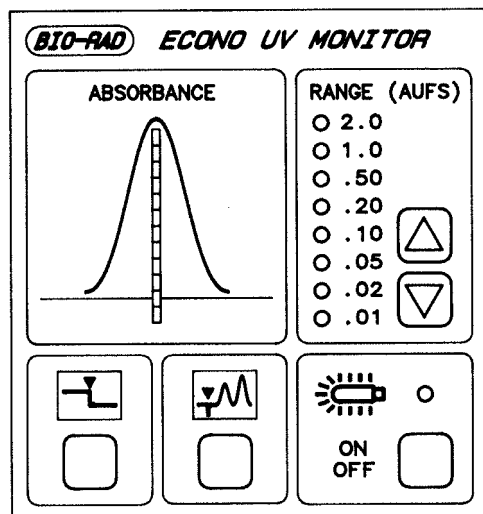
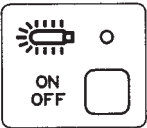
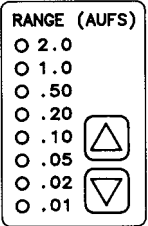
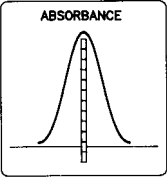
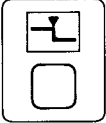
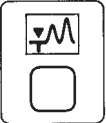


Fig. 4.1. Front panel controls.

Display	Function
	<p>UV Lamp On/Off</p> <p>Pressing this key will turn the UV lamp on. Pressing and holding it for 3 seconds will turn the lamp off. The indicator light is lit whenever the UV lamp is on and functioning properly. It turns off if the lamp is off, and flashes if the lamp has low output. <b>Note: The indicator will flash for a few minutes when the UV lamp is first turned on.</b></p>



Display	Function
	<p><b>Range Selector</b></p> <p>Allows the user to select one of eight range settings between 0.01 and 2.00 AUFS (Absorbance Units Full Scale).</p>
	<p><b>Level Indicator</b></p> <p>This bar graph is a convenient graphic representation of the % AUFS. Each green segment equals 10% full scale.</p>
	<p><b>Auto-Zero</b></p> <p>Sets output voltage to 0.00 and defines that as the baseline. (A maximum of 0.25 AUFS can be zeroed out.)</p>
	<p><b>Event Mark</b></p> <p>Causes a mark to be superimposed on the recorder trace.</p>

## 4.2 Rear Panel Sockets

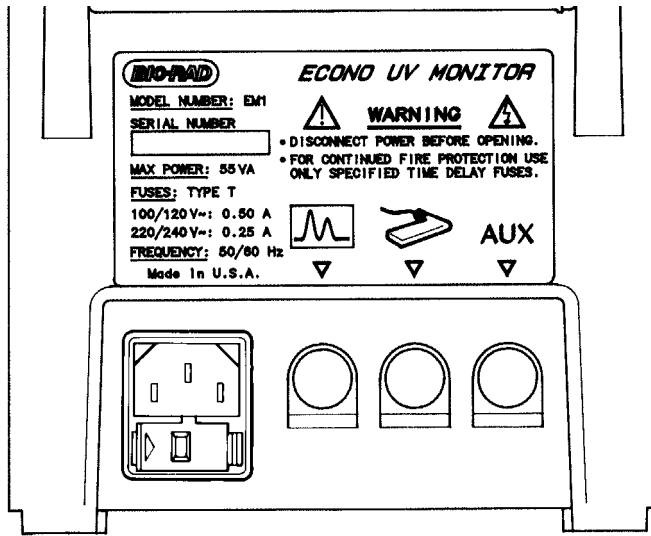
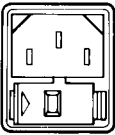




Fig. 4.2. Rear panel sockets.

The rear panel of the Model EM-1 Econo UV Monitor control unit contains four sockets for electrical connections (see Figure 4.2). Below is a brief description of each socket. For a more technical description of each socket, see Appendix C.

Socket	Function
	<b>Power Entry Module</b> IEC power entry module with four-position international voltage selector. The monitor is shipped in its 120 V or 220 V version. For operation at other voltages, refer to Section 5.1. <b>Note: Power switch is on bottom panel.</b>
	<b>Signal Output</b> For connection of chart recorders, integrators, and computers to the Model EM-1 Econo UV Monitor, using standard Bio-Rad cables, see Section 5.4 and Appendix C.
	<b>Optics Module Socket</b> 12-pin socket for connection of the optics module.

	Socket	Function
<b>AUX</b> ▽	<b>Auxiliary Socket</b>	Input/output to allow the UV monitor to be used with equipment other than the Bio-Rad components. See Section 7 and Appendix C.

### 4.3 Optics Module

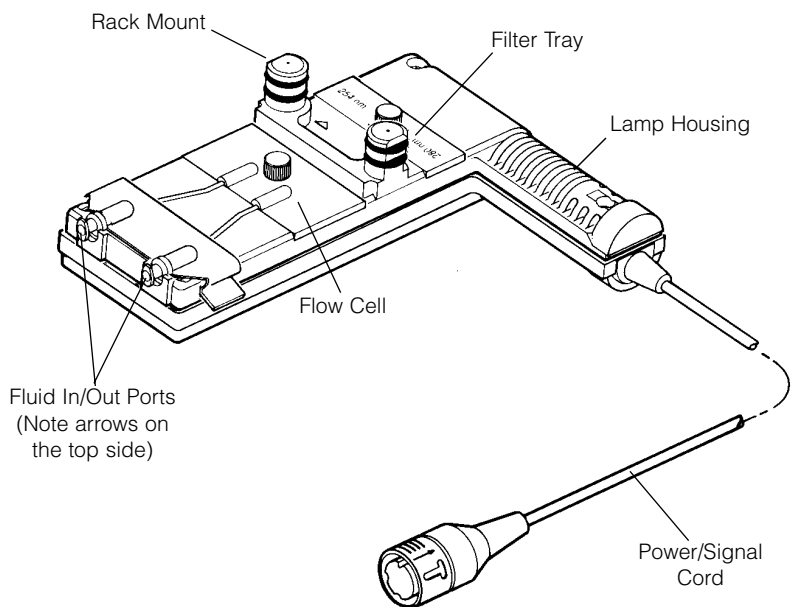



Fig. 4.3. The optics module.

<b>Filter Tray</b>	Contains filters for 254 nm and 280 nm. See Section 5.2 for wavelength selection.
<b>Fluid In/Out Ports</b>	Female luer fittings allow convenient plumbing. (Slip fittings have been provided to facilitate the use of Teflon <sup>®</sup> tubing.)
<b>Rack Mount</b>	Allows simple mounting on a rack or the top of control unit.
<b>Power/Signal Cord</b>	For connection of the optics module to the  socket on the rear panel of the control unit.
<b>Lamp Housing</b>	See Appendix B for lamp replacement.
<b>Flow Cell Compartment</b>	See Appendix A for flow cell replacement.

## Section 5 Setting Up

### 5.1 Voltage Conversion



**Warning:** The Model EM-1 Econo UV Monitor is shipped in its 120 V or 220 V version. To operate at other voltages, refer to the procedure below. Failure to follow this procedure may result in damage to the unit and invalidation of the warranty.

Prior to connecting the power cord to the power entry module and the mains outlet, make sure that the voltage setting showing on the power entry module matches your line voltage. If these voltages do not match, use the following procedure to make the conversion. Refer to Figure 5.1.

Remove the fuse drawer with a small-blade screwdriver or similar tool.

Pull the fuse holder out of the fuse drawer and, if necessary, replace the fuses with ones having the correct rating. Use 0.5 A fuses for 100 V and 120 V operation, and 0.25 A fuses for 220 V and 240 V operation. Units shipped in the 120 V and 220 V version are fused properly prior to shipment.

Reinsert the fuse holder into the fuse drawer so that the proper mains voltage is showing through the window of the fuse drawer.

Reinsert the fuse drawer into the power entry module. Press gently until it snaps into place.

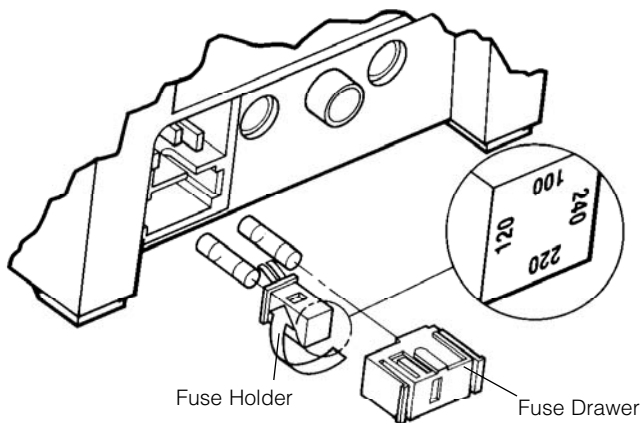


Fig. 5.1. Voltage conversion.

## 5.2 Wavelength Selection

The Model EM-1 Optics Module Assembly is shipped with a filter tray containing filters for both 254 nm and 280 nm (note markings on the filter unit). It is shipped in the 280 nm configuration. To change from one wavelength to another, loosen the retaining screw and remove the filter tray. Rotate the tray 180° and reinsert (do not over-tighten the thumb screw). The light path is indicated by the  $\Delta$  on the bottom of the case.

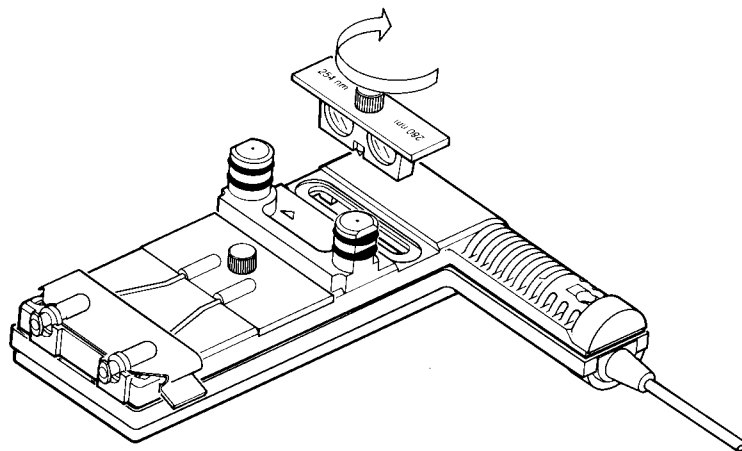


Fig. 5.2. Filter selection.



**Warning:** To avoid exposure to UV radiation, make sure that the UV lamp is off when changing filters and flow cells.

## 5.3 Optics Module Installation

1. Place the optics module as close as possible to the column outlet and connect the power/signal cord to the  $\square$  socket on the rear panel of the control unit.
2. Connect the inlet port of the optics module to the column outlet using tubing that has a male luer fitting. Keep this section of tubing as short as possible. Direction of flow through the flow cell is indicated by raised arrows on top of the optics module. Observe flow direction carefully, as the flow cell may tend to trap bubbles if flow direction is reversed.
3. Connect the exit port of the optics module to a collection apparatus using the shortest length of tubing possible.

## 5.4 Connecting the Model EM-1 Econo UV Monitor to Recording Equipment

The Model EM-1 Econo UV Monitor is shipped with a cable (System Cable 4) that allows connection of the monitor to devices that use banana plug connectors. System Cable 2 is available separately to connect the Model EM-1 Econo UV Monitor to the Model 1327 Chart Recorder. Following is a description of connections to recording instruments.

### Connecting the Model EM-1 Econo UV Monitor to the Model 1327 Chart Recorder

Use System Cable 2 (supplied separately) to connect the remote-control socket on the rear panel of the Model 1327 Chart Recorder to the  $\mu$  socket on the rear panel of the Model EM-1 Econo UV Monitor. (If you do not have Cable 2, use Cable 4 supplied with the UV monitor and read the next two paragraphs.) Set the input range on the Model 1327 Chart Recorder to 1 V full scale.

### Connecting the Model EM-1 Econo UV Monitor to Other Chart Recorders

If the Model EM-1 Econo UV Monitor is to be used with a chart recorder other than the Model 1327 Chart Recorder, System Cable 4 should be used to make the connection.

Insert the 8-pin connector into the  $\mu$  socket on the rear panel of the Model EM-1 Econo UV Monitor. At the other end of the cable are two banana plugs. The red plug is the positive output, and the black plug is the negative, or ground. These plugs should fit directly into the input sockets of most chart recorders. Set the input range on the chart recorder to 1 V full scale.

### Connecting the Model EM-1 Econo UV Monitor to Integrators and Computers

Refer to Appendix C.

## Section 6 General Operation

1. Turn on instrument by pressing power switch on the underside of the control case.
2. Turn the UV lamp on (if it is not already on) by pressing the On/Off key on the front panel of the control unit. The lamp indicator light should start flashing, and may continue to do so for several minutes.

When the light stops flashing and remains lit, the Model EM-1 Econo UV Monitor is ready for use. Wait at least 20 minutes if an AUFS setting of 0.05 or less is to be used.

**Note:** If the Model EM-1 Econo UV Monitor is used in a cold room or cold box, leave the lamp on continuously to prevent the formation of condensation.

3. Start the flow of buffer or solvent, and continue for several minutes prior to starting a separation or measurement.
4. Select an AUFS range using the arrow selector keys on the front panel of the control unit.
5. Press the Auto-Zero key on the front panel until the yellow light at the bottom of the graphic display starts flashing. When it stops flashing, adjust the chart recorder baseline.

## Section 7 Care and Maintenance

The Model EM-1 Econo UV Monitor requires very little maintenance to assure reliable operation. Following are general procedures for maintenance of the UV monitor and optics module.

**Model EM-1 Econo UV Monitor control unit and optics module case:** During normal operation, spills and splashes may cause residues to form on the component cases. Use a squirt bottle and soapy water to wash down the outer cases of the instruments. The instruments are resistant to spills. However, unplug first, and take care to prevent water from entering the vents.

**Optics module:** Clean the outside surfaces of the optics module as described above. The 280 nm and 254 nm filters in the optics unit should be cleaned only when necessary with a dry lens tissue and replaced in the optics module. Use of a dilute ethanol or isopropanol solution will assist in the removal of contaminants. When the optics module is not in use, disconnect and clean out dissolved salts and protein from the flow cell using a syringe filled with distilled water. Store the flow cell by injecting a dilute solution (10-25%) of ethanol or isopropanol into the cell to prevent microbial growth. Use the end caps provided to seal the flow cell's inlet and outlet lines. To prevent the formation of salt crystals and solute deposits, do not allow the flow cell to dry out.

Avoid letting the flow cell become dry, as dissolved solids may precipitate and attach to the walls. This will result in baseline drift and possibly a noisy signal.



If the flow cell becomes dirty, it should be cleaned with an appropriate solvent. (SDS, 1M HCl, 1M NaOH, ethanol, acetone, and methylene chloride will not harm Model EM-1 Econo UV Monitor flow cells.) If NaOH is used, it should not be left in the flow cell for more than 20 minutes.

The control unit may be left on continually (power consumption is negligible).

## Section 8 Troubleshooting

Problem	Possible cause	Solution
Base line drift or noisy signal	Bubbles in flow cell	Clear by using pump purge mode, and intermittently pinching the outlet tubing, holding momentarily, and releasing.  Insure that flow direction is correct.  Use degassed buffers.
	Lamp not warmed up before use.	Wait 20 minutes
	Filter tray is loose Flow cell is loose Case screws are loose	Adjust fixture screws; these components should be snug, <u>not tight</u> .
	Dirty flow cell	Clean flow cell; insure that buffers are free of particulate material.
	Aging lamp	Replace lamp (see Appendix B). Note: When using the 254 nm filter, the lamp LED will blink before baseline becomes noisy.



<b>Problem</b>	<b>Possible cause</b>	<b>Solution</b>
Lamp will not light, or lamp LED on continues blinking	Optics module not plugged in	Plug optics module into the  socket rear of UV monitor.
	Lamp burned out	Replace lamp (see Appendix B).
Chart recorder not responding	Chart recorder is plugged into AUX socket	Plug chart recorder into the  socket.
	Full scale of recorder set too high	Set recorder range to 1 V.
	Recorder has bottomed out	Readjust pen position.
	Power adaptor not plugged in	Check that recorder power adaptor is plugged in properly.
No power	Faulty power connection	Check power cable connection.
	Blown fuse	Check fuses.

## Appendix A

### Flow Cell Replacement

1. Remove the retaining clip from the bottom of the optics module and pull the luer connectors away from their holders as shown in Figure A-1.
2. Unscrew thumbscrew and remove the old flow cell.
3. Reinsert the new flow cell following the above steps in reverse order. (Do not over-tighten the thumb screw.)



**Warning:** To avoid exposure to UV radiation, make sure that the UV lamp is off when changing filters and flow cells.

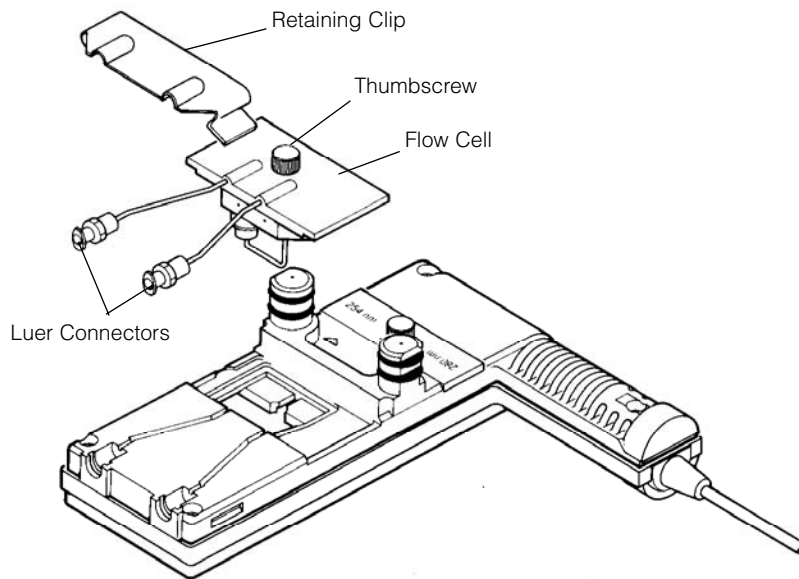


Fig. A-1. Flow cell replacement.

## Appendix B

### UV Lamp Replacement

The coated low pressure mercury lamp has an expected lifetime of at least 2,000 hours. To replace a lamp, proceed as follows, referring to Figure B-1:

1. Unplug the optics module from the rear panel of the control unit.



**Warning:** Failure to unplug the optics module from the control unit may expose the user to high voltage and UV radiation.

2. If the UV lamp has been on, allow the optics module to cool for 10 minutes before continuing.
3. Remove the filter tray (see Section 5.2) and the flow cell (see Appendix A).
4. Remove the screws holding the optics module together and remove the bottom half of the case.
5. Pull the old UV lamp out of its holder and unplug it from its connector.
6. Plug the new UV lamp into its connector and insert it into the lamp holder. Never handle the quartz surface of the UV lamp. Grease and fingerprints will destroy the lamp.
7. Reassemble the optics module (do not over-tighten the screws).

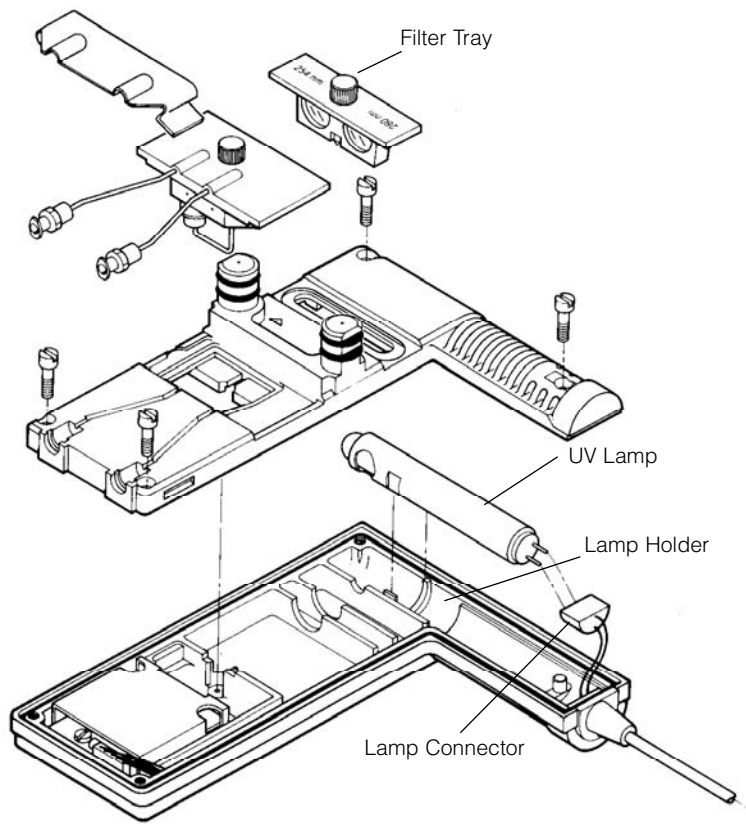




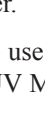

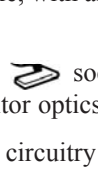
Fig. B-1. UV lamp replacement.


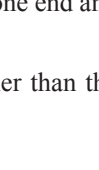


## Appendix C Rear Panel Connections

Both the signal  output and the AUX sockets are 8-pin circular mini-DINs. The following information is provided for those wishing to interface the Model EM-1 Econo UV Monitor with other equipment such as integrators and non Bio-Rad fraction collectors. System Cable 7 may be used as a breakout cable, with an 8-pin mini-DIN at one end and loose wires at the other.

Do not attempt to use the  socket for anything other than the Model EM-1 Econo UV Monitor optics unit.

All digital inputs use TTL circuitry and are active LOW.

	Pin #	Function	Notes
   pin configuration	1	Connects to AUX Pin 1	Paper stop
	2	No Contact	
	3	No Contact	
	4	Integrator (+)	0 to 1 V = 0 to 2 AU
	5	Chart Recorder (+)	0 to 1 V = Full scale
	6	Connects to AUX Pin 6	Pen down
	7	Ground	
	8	No Contact	

	Pin #	Function	Notes
<b>AUX</b>   pin configuration	1	Connects to  Pin 1	
	2	Auto-Zero	
	3	Large Mark	Marks chart recorder signal only
	4	Integrator (+)	0 to 1 V = 0 to 2 AU
	5	No Contact	
	6	Connects to  Pin 6	
	7	Ground	
	8	Small Mark	Marks chart recorder signal only

## Appendix D Technical Specifications

<b>Wave length</b>	254 nm and 280 nm
<b>Operating mode</b>	AU
<b>Lamp</b>	Low pressure mercury lamp with phosphor screen
<b>Filters</b>	Interference type 280 nm 254 nm
<b>Operating temperature</b>	+4° to 40° C
<b>Baseline offset</b>	± 0.25 AU Auto-Zero
<b>Time constant</b>	1.5 sec to 90% of full response at all ranges
<b>Sensitivity ranges</b>	2.0, 1.0, 0.5, 0.2, 0.1, 0.05, 0.02, 0.01 AUFS
<b>Output signal</b>	0-1 V, impedance 150 ohms
<b>Power requirements</b>	90-132 VAC (120 V at delivery) 180-265 VAC (220 V at delivery)
<b>Power consumption</b>	15 watts
<b>Dimensions</b>	Base unit 14.55 x 18.64 x 20.24 cm (W x H x D) Optics unit 13.21 x 15.24 x 3.81 cm (W x L x H)
<b>Weight</b>	Base unit 2.2 kg (4.8 lb) Optical unit 311 g (11 oz)
<b>Flow cell</b>	Optical path 2 mm Internal volume 80 µl Illuminated volume 3 µl
<b>Noise</b>	1.0 x 10 <sup>-4</sup> AU max peak to peak (dry cell) 2 x 10 <sup>-4</sup> AU max peak to peak (flowing liquid)
<b>Linearity</b>	3% to 2 AU at 254 nm
<b>Long term drift</b>	< 1 mAU/hr-deg C
<b>Warm-up time</b>	1 hour to meet drift specification
<b>Flow sensitivity</b>	<200 µAU/(ml/min)
<b>Regulatory</b>	CSA: C22.2 No.151-M1986
<b>Compliance:</b>	TÜV: EN61010-1: 1993 CE: EN55011:1991 Class A EN50082-2: 1995

## Appendix E Product Information

### Model EM-1 Econo UV Monitor

Catalog Number	Product Description
731-8160	<b>Model EM-1 Econo UV Monitor</b> , 110 V (USA power cord), with starter fittings kit
731-8162	<b>Model EM-1 Econo UV Monitor</b> , 220 V (no power cord), with starter fittings kit
731-8165	<b>Model EM-1 Flow Cell</b>
731-8166	<b>Model EM-1 Lamp</b>
731-8167	<b>Model EM-1 Filter Assembly</b>
731-8168	<b>Model EM-1 Optics Module Assembly</b>

#### Cables

731-8262	<b>System Cable 2</b> , 8-pin mini-DIN to 8-pin standard DIN
731-8267	<b>System Cable 7</b> , 8-pin mini-DIN to bare wires

#### Tubing

731-8210	<b>Silicone Tubing</b> , 0.8 mm ID, 0.8 mm wall, 10 m
731-8211	<b>Silicone Tubing</b> , 1.6 mm ID, 0.8 mm wall, 10 m
731-8212	<b>Silicone Tubing</b> , 3.2 mm ID, 0.8 mm wall, 10 m
731-8214	<b>Tygon Tubing</b> , 0.8 mm ID, 0.8 mm wall, 10 m
731-8215	<b>Tygon Tubing</b> , 1.6 mm ID, 0.8 mm wall, 10 m
731-8207	<b>PharMed Tubing</b> , 0.8 mm ID, 1.0 mm wall, 10 m
731-8208	<b>PharMed Tubing</b> , 1.6 mm ID, 1.0 mm wall, 10 m
731-8209	<b>PharMed Tubing</b> , 3.2 mm ID, 1.0 mm wall, 10 m

#### Fittings

731-8220	<b>Low Pressure Fittings Kit</b> , includes over 17 different fittings and stopcocks (250 fittings in all)
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