

# Model EP-1 Econo Pump

## Instruction Manual

Catalog Numbers

731-8140

731-8142

For Technical Service

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**BIO-RAD**

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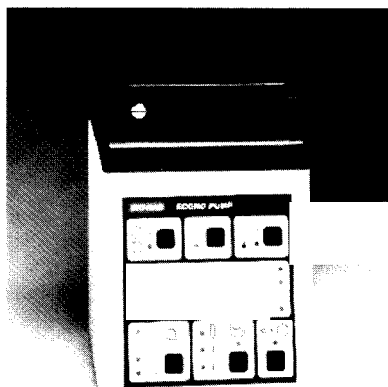
## **Section 1**

### **Safety**



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

## Section 2 Introduction



**Fig. 2.1. Model EP-1 Econo Pump.**

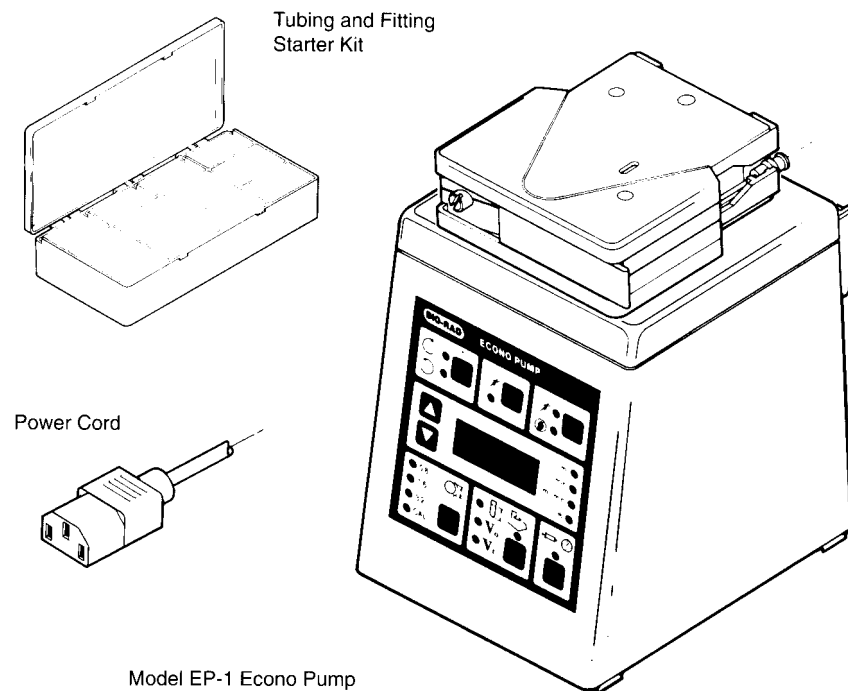
The Model EP-1 Econo Pump is a two-channel, bi-directional, variable speed peristaltic pump for low-pressure chromatography and general laboratory use. It offers a full range of features to facilitate ease of use as a stand alone pump or as an integral part of the Econo System. As a stand-alone pump, the Model EP-1 Econo Pump delivers flow rates from 0.1 to 40  $\mu\text{min}$  with the ability to self-calibrate the flow rate for 0.8, 1.6, and 3.2 mm ID tubing, displaying pump output in  $\text{ml/min}$ . The pump can be programmed to control fraction collector parameters such as fraction size, void volume, and total run volume. A membrane key panel with graphic icon displays allows easy user interface. When coupled with the Model ES-1 Econo System Controller, the Model EP-1 Econo Pump will control the gradient run-time, gradient shape, and peak collection capabilities of the Econo System. When coupled with the Model ES-1 Econo System Controller and Model EV-1 Econo Buffer Selector, the Model EP-1 Econo Pump will control up to 5 buffers, automated sample injection, and method cycling.

## Section 3 Unpacking and Setting Up

### 3.1 Unpacking Instructions

Carefully remove the unit from the shipping box, lifting from the handle on the back of the pump or from the bottom of the instrument. Remove the plastic bag and inspect the instrument for any external damage. Parts included with the Model EP-1 Econo Pump are illustrated in Figure 3.1. Check off all parts against the supplied packing list.

Your Model EP-1 Econo Pump was carefully tested at the factory and was shipped in good working order. If any part is missing or damaged, contact Bio-Rad Laboratories immediately. Refer to Figure 3.1 for the proper identification designation of any missing or damaged part(s).



Also includes: Instruction Manual

**Fig. 3.1. Parts supplied with the Model EP-1 Econo Pump.**

## 3.2 Voltage Conversion



Warning: The Model EP- I Econo Pump 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 wall outlet, verify that the voltage indicated on the power entry module matches your line voltage. If it does not, use the following procedure to make the conversion. Refer to Figure 3.2.

1. Disconnect the power cord from the unit.
2. Remove the fuse drawer with a small-blade screwdriver or similar tool.
3. Pull the fuse holder out of the fuse drawer and, if necessary, replace the fuses with ones having the correct current rating. Use 0.50 A fuses for 100 V and 120 V operation; 0.25 A fuses for 220 V and 240 V operation. Rotate the voltage selector through the window in the fuse drawer until the proper voltage shows.
4. Reinsert the fuse drawer into the power entry module, with the locking tab to the left. The voltage indicator will read right-side-up if the drawer is oriented correctly. Press gently until it snaps into place.
5. Insert the power cord plug into the power entry module. Plug the power cord into a properly grounded outlet.

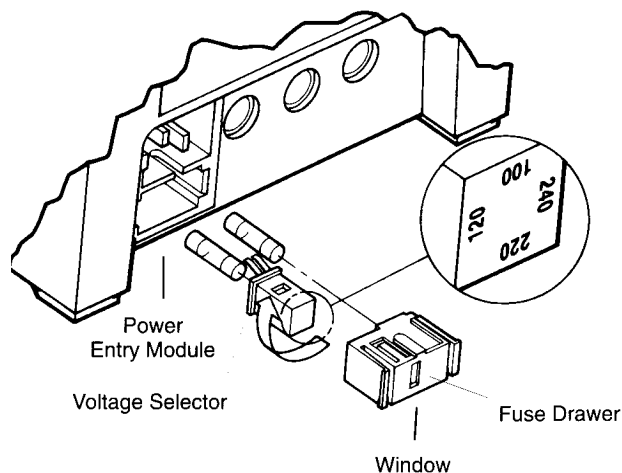


Fig. 3.2. Voltage conversion.

## Section 4 Physical Description and Control Features

### 4.1 Front Panel Functions

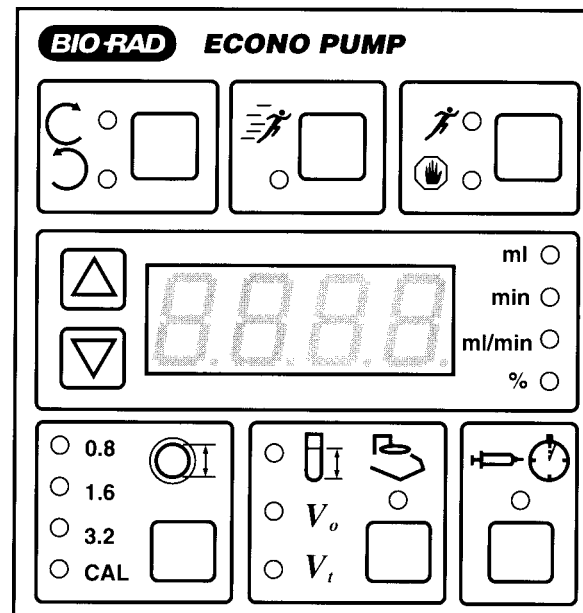
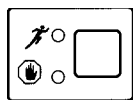


Fig. 4.1. Front panel controls.

Display	Function
LED Display	<p>The four-character display will show various parameters during programming and operation of the Econo Pump, Econo System, and Automated Econo System. The indicator lights located immediately to the right of the display indicate the units displayed: ml, minutes, ml/minute, or percent.</p>
Arrow Keys	<p>These keys are used for setting system parameters when programming the system, and for selecting which parameter to display when running the system.</p>

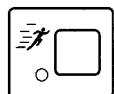
- ml ○ Indicator Lights
- min ○
- ml/min ○
- % ○

These lights indicate the units for the value displayed on the LED display located to the left. A flashing light indicates that a value can be set using the Arrow keys.



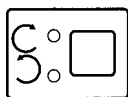
Run/Stop Key

This key is used to start or stop the pump. It also has secondary functions such as holding or aborting a method.



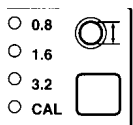
Purge Key

This key is used to prime and purge tubing lines without disturbing the primary speed setting of the pump. When Purge is pressed, the pump will run at maximum speed (25 rpm). The purge key will not operate during a gradient or fraction collection method.



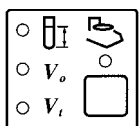
Direction Key

This key changes the direction of pump head rotation. The Econo Pump must be stopped before the direction can be changed.



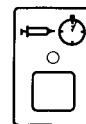
Tubing Calibration Key

This key is used to select pre-programmed calibration settings for three tubing sizes, or allows user calibration for increased flow rate accuracy or non-standard tubing sizes. The pump must be stopped for this key to operate.



Fraction Collector Key

This key is used to set fraction size, void volume (to move a diverter valve to "collect" or "waste" positions), and total run volume. The total run volume (V) may be used to program the pump to automatically shut off after a given volume has been delivered.



Program Run Key

This key is used to control a programmed gradient or fraction collection method. When the indicator light is flashing, pressing this key starts the method. When the indicator light is lit, pressing this key will interrupt the program, which can be continued by pressing again. When the LED displays "FAIL", (indicating a brief power outage has occurred), pressing this key continues the program.

Note: When entering values for tubing calibration or fraction collection procedures, only the flashing keys are active.

## 4.2 Rear Panel Functions

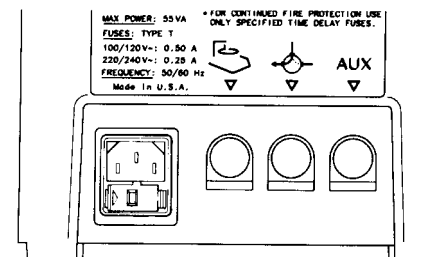
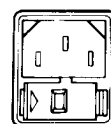


Fig. 4.2. Rear panel sockets.

### Display

### Function



Power Entry Module

Grounded 3-pin receptacle for the power cord. Also contained within is a four-position (100 V/120 V/220 V/240 V) line voltage selector. See Section 3.2.



Fraction Collector Output

This 8-pin connector sends an advance signal to the Model 2110 Fraction Collector via Econo System Cable # 1.



Diverter Valve Output

This 8-pin outlet sends a signal to the Model SV-3 diverter valve, to divert flow between collection devices.

**AUX** Auxiliary Output  
▽

This 8-pin connector is for communication with the Model EM-1 Econo UV Monitor.

### 4.3 Pump Base Features

The base of the Model EP-1 Econo Pump contains a 40-pin connector for connection to the Model ES-1 Econo System Controller via a ribbon cable located on the Model ES-1 Econo System Controller. When connected, the two provide added features such as gradient proportioning and mixing, peak detection, and control of a waste/collect diverter valve. See Section 6 for details.

## Section 5 Tubing Selection and installation

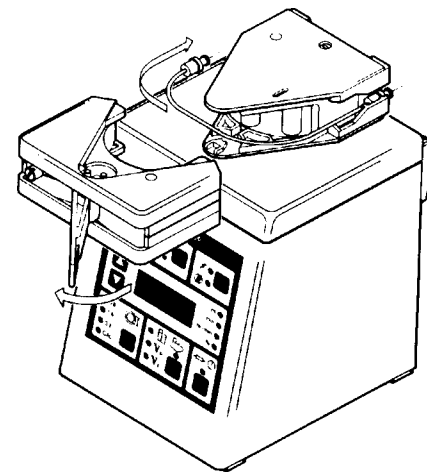
### 5.1 Tubing Selection

The Model EP-1 Econo Pump may be used with most flexible tubing having an inner diameter less than or equal to 3.2 mm (1/8"), and a wall thickness of 1.0 mm or less, including silicone, Tygon, and PharMed. Silicone tubing, the most inert of the three, is suitable for aqueous and polar solutions. Tygon is suitable for most aqueous solutions. It will generally have the shortest lifetime of the three. PharMed is the longest lasting of the three, and will provide the most consistent flow rate over time. Table 5.1 shows approximate flow rate ranges with different tubing sizes. Flow rates above 20 ml/min may be obtained by plumbing two channels of 3.2 mm tubing through the pump and joining them at the output.

**Table 5.1. Approximate Flow Rate Ranges**

Tubing Size (ID x Wall)	Flow Rate Range ml/min																		
	0.1	2	3	4	5	6	7	8	9	10	2	3	4	5	6	7	8	9	10
0.8 mm																			
1.6 mm																			
3.2 mm																			

### 5.2 Installation of Precut Bio-Rad Tubing

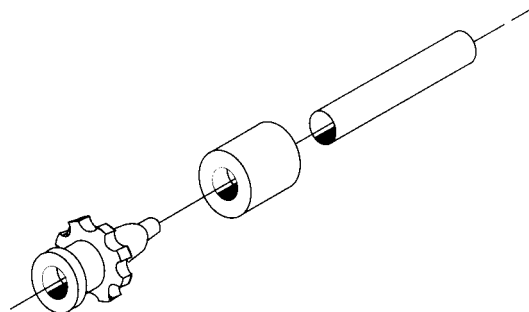


**Fig. 5.1. Tubing installation.**

1. Referring to Figure 5.1, pull the platen cam lever away from the pump head to unlock the platen and slide the platen away from the pump head frame assembly, exposing the rollers.
2. Slip a lock-ring onto one end of the tubing. See below for the size and color of each lock-ring. Insert a barbed female luer-fitting into the same end until the tubing reaches the flange of the fitting. Clamp the luer-fitting into place by sliding the lock-ring along the tubing over the barbed fitting (see Figure 5.2). Repeat on the other end of tubing.

Note: Use of lock-rings is required only when operating at pressures above 10 psi.

Lock-Ring Color	Tubing ID
Red	0.8 mm (1/32")
Orange	1.6 mm (1/16")
Yellow	3.2 mm (1/8")



**Fig. 5.2. Attachment of tubing fittings.**

3. Insert one end of the tubing into the tubing retaining bracket of the pump head. Lightly pull the tubing around the rollers to remove slack. Attach the other end of tubing into the tubing retaining bracket on the opposite side of the pump head.
4. Slide the platen back into the pump head frame assembly until it rests up against the tubing. Press the cam lever in toward the pump head, locking the platen up against the tubing and rollers. Note that the platen can be inserted with the cam lever on the left or the right.
5. Proper adjustment of platen pressure increases flow stability, minimizes flow pulsation, and prolongs the life of the tubing.
  - a. Loosen the platen adjustment screw, located on the front of the platen, counterclockwise until the stop is reached.
  - b. Cut tubing to proper length and install fittings and lock-rings as described in Section 5.2. Install tubing in pump as described in Figure 5.1. Start the pump and set flow rate to the value you expect to use for your application.
  - c. Turn adjustment screw clockwise just until uniform flow is achieved. This will be evident by observing the uniform motion of bubbles in the line (if any) or a motion-free inlet line when operating with the expected backpressure.

Typically, one piece of silicone tubing will perform well with two turns clockwise from stop. One piece of Tygon or PharMed tubing will perform well between three and four turns clockwise from stop. When using two pieces of tubing, approximately 50% more turn clockwise from stop will be required. A clockwise stop will occur at eight turns clockwise.

Note: Overtightening the platen adjustment screw will reduce flow rate and shorten tubing life. If the platen is too loose, flow rate will decrease as backpressure increases.

6. Attach system tubing to the pump tubing using Bio-Rad's luer-type fittings or other suitable connectors. Lock-rings are not necessary for system tubing.

### 5.3 Installation of Uncut Tubing

Tubing length and the amount of tubing prestretch have a significant effect on both flow rate calibration and reproducibility of flow. The PharMed tubing supplied with the Model EP-1 Econo Pump has been cut to a predetermined length to accommodate tubing prestretch. When using any tubing that is not properly sized, the tubing must be cut to accommodate prestretch. Tubing should be cut as follows:

<u>Tubing</u>	<u>Length</u>
Tygon, PharMed	179 mm +/- 1.5 (7.04" +/- 0.05)
Silicone	171 mm +/- 1.5 (6.75" +/- 0.05)

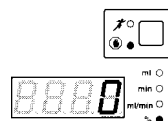
Install tubing onto the pump head as described in Section 5.2.



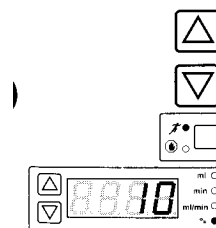
Warning: If using tubing other than the type supplied by Bio-Rad, make sure the wall thickness is not greater than 1.0 mm. Using tubing with a greater wall thickness can damage the pump and void your warranty.

## Section 6 Operation

### 6.1 Start-Up Procedure



1. Plug the Model EP-1 Econo Pump into an appropriate grounded power source. Turn on the power switch on the bottom of the unit. The pump will power up in the Stop mode, with the LED display showing 0% of maximum speed.



2. With tubing in place, set the desired pump speed by pressing the Arrow keys.
3. Press the Run/Stop key to initiate flow. Press once more to stop the flow. Flow rate will be displayed in percent of maximum speed. Change the flow to the desired speed while the pump is running by pressing the Arrow



keys.



- To change the direction of flow, stop the pump by pressing the Run/Stop key. Press the Direction key to choose the new direction. Restart by pressing the Run/Stop key.



- To purge the tubing, press the Purge key. The pump will run at 100% maximum speed. When the tubing is primed, press the Purge key again to stop the purge function and return to the Run mode, or press the Run/Stop key to turn the pump off.

## 6.2 Verification of Econo System Software Version

The Model ES-1 Econo System Controller and Model EP-1 Econo Pump should already be set up.

The Model EP-1 Econo Pump **must** have software version 2.01 or higher to control the Model EV-1 Econo Buffer Selector.

If you do not have a Model EV-1 Econo Buffer Selector, continue with Section 6.3. Otherwise check the software version of your system:

Simultaneously press and hold the Direction Key and the "down" Arrow key on the front panel of the Model EP-1 Econo Pump. The four digit LED display on the front panel of the Pump should display: "v2.01" or higher.

If your pump displays a number lower than 2.01, and you will be using the Model EV-1 Econo Buffer Selector, your pump software should be upgraded. Contact your local Bio-Rad representative for details on how to upgrade software.

If your pump currently features software version 2.01 or higher, insure that all connections between the Model EP-1 Econo Pump, Model ES-1 Econo System Controller, (and Model EV-1 Econo Buffer Selector, if used) have been completed and the system power is on.

## 6.3 Flow Rate Calibration

An uncalibrated Model EP-1 Econo Pump will display pump speed as percent of maximum rpm. The user may also choose to select one of three tubing sizes for which calibration has been programmed at the factory. The Model EP-1 Econo Pump also features a user calibration mode, which is used when improved flow rate accuracy is desired, or when using non-standard size tubing. The pump must be calibrated using one of the methods described above before a fraction collection program may be entered.

### Flow Rate Calibration with Pre-Selected Tubing Sizes (0.8, 1.6, and 3.2 mm ID)

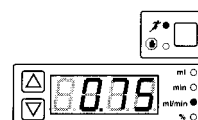
- With the pump in Stop mode, install tubing as described in Section 5.2.



- Press the key in the lower left-front of the pump panel corresponding to the pump calibration feature, and continue pressing until the indicator light corresponding to either 0.8, 1.6, or 3.2 mm ID tubing is lit.



- The LED display reads ml/min for any of these pre-programmed tubing settings. If improved flow rate accuracy is desired, see User Calibration Procedure below.



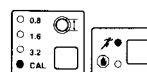
- The pump is now automatically calibrated for the specific tubing size. Press the Run/Stop key to start flow. Increase or decrease the pump speed with the Arrow keys.

### User Calibration Procedure

- Install tubing as described in Section 5.2. Connect pump inlet to a container of water or buffer. Connect a length of tubing to the pump outlet.



- Run pump to purge air from tubing, then stop pump. Place the end of the outlet tubing in an empty graduated cylinder.



- Press Calibration key until "CAL" is displayed. Press the Run/Stop key. Pump will run for 5 minutes at 25% of maximum speed, and the display will count down time.



- When pump stops, read the volume of fluid on the graduated cylinder. Using the Arrow keys, enter this amount on the display. Alternatively, when a suitable volume of liquid has been collected, pressing Run/Stop will turn off the timer and stop the pump. Enter volume collected as described.



- When the value on the display matches the volume collected in the graduated cylinder, press Calibration. The "CAL" indicator light will glow steadily, indicating that the pump is calibrated. DO NOT select a tubing size at this point, even if you are using one of the standard sizes. The pump will "remember" the calibration key even if it is switched off or disconnected from the power line.



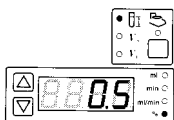
- Set desired flow rate using arrow keys.



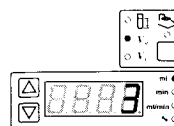
Note: Flow rate depends on condition of tubing, platen adjustment, and back pressure. For maximum flow rate accuracy it may be necessary to recalibrate as the tubing ages, when the tubing is replaced, if the platen is readjusted, or if back pressure changes significantly.

## 6.4 Simple Time-Based Collection with the Model 2110 Fraction Collector

In addition to its features as a stand-alone pump, the Model EP-1 Econo Pump is capable of controlling the Model 2110 Fraction Collector as well as other fraction collectors (for operation with collectors other than the Model 2110 Fraction Collector, see Appendix B). The pump must be calibrated in order to run a fraction collection scheme. See Section 5.3 for calibration. Use Econo System Cable #1 to connect the I/O socket on the rear panel of the fraction collector to the 8-pin connector on the rear of the Model EP-1 Econo Pump (see Figure 4.2).

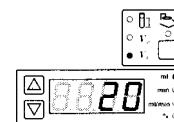


- Press the Fraction Collector key on the pump front panel to enter the fraction collector Edit mode. Note that the fraction size and ml indicator lights are flashing, prompting entry of fraction size. Enter the fraction size in 0.1 ml increments using the Arrow keys. After fraction size is selected, press the Fraction Collector key once more to confirm the fraction size.



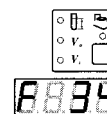
- Enter a void volume (V) in 1 ml increments using the Arrow keys. This feature allows the user to begin collecting fractions only after a pre-set volume of liquid (i.e., the void volume) has passed through the column. Press the Fraction Collector key to confirm this value. If a void volume is not desired, enter 0.

Note: The optional Model SV-3 Diverter Valve (catalog number 731-8235) is required to use the void volume feature of the Model EP-1 Econo Pump.

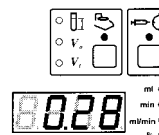


- Select the total run volume (V) in 1 ml increments using the Arrow keys.\* If zero is entered and confirmed, the fraction collection scheme is disabled. To resume data entry, see Step 1 above. All values previously entered remain in the memory until other values are entered to replace them.

\* Note: The Econo Pump will automatically shut off upon reaching the total run volume (V).



- After selecting a V value, press the flashing Fraction Collection key to enter the value. The flashing LED display shows the estimated number of fractions to be collected.



- Press the flashing Fraction Collection key once more to enable the fraction collector. To actuate the fraction collector, press the Program Run key after starting the pump. (The fraction collector can be programmed with the pump running or stopped.) After the fraction collection program is initiated, the LED display shows the progression of the fraction collection scheme in minutes, to the nearest tenth of a minute.

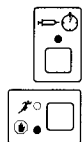


- While a program is running, the user can use the Arrow keys to display the ml of output, the progression of the collection in min, the flow rate in ml/min, or the percent of total run-time. If the Econo Pump is connected to the Econo System Controller and the Gradient Former is enabled, % buffer B can also be viewed while a program is running.



7. To abort the fraction collection scheme at any time during the program, press the Run/Stop key twice. The pump will stop, and the LED display will read OFF, indicating abortion of the fraction collection program.

Note: When a program is aborted, it can only be restarted from the beginning.



8. To place a collection program that has begun on Hold, press the lit Program Run key once. The pump will stop and the program will be held. To resume the collection program, press once again. Pressing the Run/Stop key while the program is on hold will abort the fraction collection scheme.



9. When the fraction collection program is complete, the pump stops and the display reads "END." Press any key to return to the ready mode.

#### Notes on Fraction Collection:

1. After a fraction collection program has begun, the pump cannot be turned off without terminating the fraction collection program.
2. During the V<sub>0</sub> period of the fraction collection scheme (as indicated by the V<sub>0</sub> indicator light), the fraction collector is not active. To collect fractions during this void volume period, cancel V<sub>0</sub>, by pressing the Fraction Collector key. The fraction collector will start, with the LED display indicating the time-progression of the collection scheme.
3. When the fraction collector is disabled by pressing the Fraction Collector key, the fraction collector carousel will advance one tube.
4. When the fraction collector indicator light on the pump is lit, the Model 2110 Fraction Collector will be put into remote mode. Only the manual advance keys will be active, and the Model 2110 display reads ---.
5. The fraction collection control feature of the Model EP-1 Econo Pump can be used to turn off the pump even if a fraction collector is not connected. Simply enter 0 for fraction size. After confirming the V value entered (the V light will be lit solid), start the pump, if not already running; then press the flashing Program Run key. The LED display will show time elapsed. The pump will stop automatically when the total run volume has been delivered.

#### Use of the Diverter Valve

The optional Model SV-3 diverter valve (catalog number 731-8235) provides a means to divert the eluant stream from a fraction collector to a waste receptacle or other collection device during a fraction collection program. It fits conveniently to the Econo System Rack. If the void volume function (V<sub>0</sub>) of the collection scheme is enabled with the diverter valve in place, the eluant stream will be diverted away from the fraction collector during that period. When that period is over, the eluant stream will be diverted to the fraction collector. Whenever the diverter valve changes from waste to collect, or vice versa, an event mark is generated. This will appear as a deflection on the chart recorder. For connection of the diverter valve, see Figure 6.1.

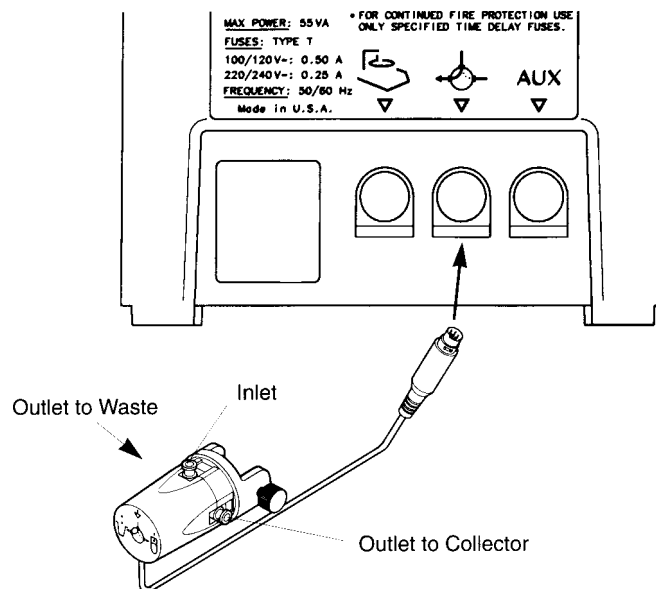


Fig. 6.1. Connection of the Model SV-3 Diverter Valve.

## Section 7 Cleaning and Maintenance

The Model EP-1 Econo Pump requires very little maintenance to assure reliable operation. The procedures outlined below will insure maximum pump life:

- Check tubing regularly for signs of cracking and wear. If any exist, replace the tubing.
- For optimal tubing life, use a slow to medium pump speed. To increase throughput, increase tubing size to obtain the desired output.
- When not in use, tubing should be removed from the pump to prevent deformation of the tubing. Remove the platen and relax the tubing by unhooking one end of the tubing from the tubing bracket.
- To prevent the formation of precipitates around the pump head and on the membrane key panel, promptly remove any spills. Clean with deionized water.

## Section 8 Troubleshooting

<u>Problem</u>	<u>Possible Cause</u>	<u>Solution</u>
Pump displays "OUT"	Power surge or brownout	1. Turn the power switch off. 2. Press and hold down the (up arrow) key and the (CAL) key simultaneously while turning the power switch on. This will reset the pump. If the pump was previously calibrated you will have to recalibrate it.
Pump displays "FAIL"	Power outage	If you wish to continue a run in progress, press (program run) key. Otherwise, press the (run/stop) key.
Pump will not run (no LEDs lit)	No power	Verify that powercord is plugged in and the power switch is turned on.
	Fuses	Check that proper fuses are installed and intact.

<u>Problem</u>	<u>Possible Cause</u>	<u>Solution</u>
Liquid remains stationary in tubing		Insure that the calibration indicatorlight is not flashing. For pump to run, this light must either be off or steadily lit.
	Platen not adjusted	Platen too loose. Turn platen screw clockwise just until liquid begins moving within tubing.
	Clogged tubing, valves, or fittings	Check tubing, fittings, and valves for obstructions.
Flow rate not consistent	Damaged tubing	Check pump tubing for damage. Replace damaged tubing.
	Pump tubing damaged or worn out	Replace tubing.
	Platen adjustment incorrect	Adjust platen.
	Wrong tubing size selected	Re-select tubing size on front panel of pump.
Excessive tubing wear	Large change in back pressure or fluid viscosity	Re-calibrate flow.
	Restriction on inlet side	Remedy
	Platen too tight	Turn platen adjustment screw clockwise to stop flow, then clockwise until flow starts.
Cannot calibrate pump	Pump must be stopped in order to calibrate pump	Insure that pump is stopped.
Error message displayed upon powering up (ER ##)		Contact Bio-Rad Instrument Service Department

OIL

## Appendix A

### Technical Specifications



Number of channels	2
Flow rate range (per channel)	0.1-20 ml/min (depending on tubing diameter)
Pump head speed	25 rpm maximum
Tubing diameter	0.4 mm ID to 3.2 mm ID
Speed adjustment	1
Speed stability	1 % of full scale
Maximum counterpressure	30 psi (2 kg/cm <sup>2</sup> or bars)
Motor	DC speed controlled, 55 watts
Line voltage	90-132 VAC 180-265 VAC 47-63 Hz
Dimensions	143 x 202 x 222 mm (W x D x H) with pumphead
Weight	3.3 kg
Operating temperature	4 to 40 °C
Material of construction	polypropylene and other solvent resistant plastics

## Appendix B

### Operation of the Model EP-1 Econo Pump When Connected to Other Instruments

The Model EP-1 Econo Pump provides a variety of output signals which can be used to control the operation of non Bio-Rad fraction collectors, or to communicate with non Bio-Rad UV monitors and recording devices. Communication is accomplished through two standard 8-pin mini-DIN sockets on the rear panel of the pump. The third socket is for the operation of the Model SV-3 Diverter Valve (see Figure 4.2). Bio-Rad offers an accessory breakout cable (Econo System cable #7), which has an 8-pin mini-DIN connector at one end and loose wires on the other, for connection to non Econo System instruments. Output signals are TTL compatible. To use these signals, you must insure that the circuit external to the Model EP-1 Econo Pump does not draw more than 15 milliamperes of current. The following table describes the two rear panel mini-DIN connector pinouts.

Table B. Rear Panel Pinouts

		<b>AUX</b> 	
<u>Pinout</u>	<u>Signal Type</u>	<u>Pinout</u>	<u>Signal Type</u>
	Shield		Shield
1	Fraction Advance (low-going output)	1	Start/Enable (output)
2	No Contact	2	No Contact
3	No Contact	3	Mark A (output)
4	No Contact	4	No Contact
5	Fraction Advance (high-going output)	5	No Contact
6	No Contact	6	Pen (output)
7	Ground	7	Ground
8	Fraction Advanced Marks to Recorder (low-going input)	8	Mark B (output)

## Appendix C

### Ordering Information

<u>Catalog Number</u>	<u>Product Description</u>
Model EP-1 Econo Pump	
731-8140	Model EP-1 Econo Pump, 110 V (USA power cord), with tubing set and starter fittings kit
731-8142	Model EP-1 Econo Pump, 220 V (no power cord), with tubing set and starter fittings kit
731-8145	Model EP-1 Pumphead Assembly
731-8235	Model SV-3 Diverter Valve
Tubing and Accessories	
731-8210	Silicone Tubing, 0.8 mm ID, 0.8 mm wall, 10 m
731-8211	Silicone Tubing, 1.6 mm ID, 0.8 mm wall, 10 m
731-8212	Silicone Tubing, 3.2 mm ID, 0.8 mm wall, 10 m
731-8214	Tygon®Tubing, 0.8 mm ID, 0.8 mm wall, 10 m
731-8215	Tygon Tubing, 1.6 mm ID, 0.8 mm wall, 10 m
731-8207	PharMed Tubing, 0.8 mm ID, 1.0 mm wall, 10 m
731-8208	PharMed Tubing, 1.6 mm ID, 1.0 mm wall, 10 m
731-8219	PharMed Tubing, 3.2 mm ID, 1.0 mm wall, 10 m
731-8240	Silicone Tubing Kit, 0.8 mm ID, 20 precut lengths and 4 sets of fittings
731-8241	Silicone Tubing Kit, 1.6 mm ID, 20 precut lengths and 4 sets of fittings
731-8242	Silicone Tubing Kit, 3.2 mm ID, 20 precut lengths and 4 sets of fittings
731-8247	PharMed Tubing Kit, 0.8 mm ID, 20 precut lengths and 4 sets of fittings
731-8248	PharMed Tubing Kit, 1.6 mm ID, 20 precut lengths and 4 sets of fittings
731-8249	PharMed Tubing Kit, 3.2 mm ID, 20 precut lengths and 4 sets of fittings

<u>Catalog Number</u>	<u>Product Description</u>
731-8228	Low Pressure Fittings Kit, includes over 250 male and female luer connectors, 2- and 3-way stopcocks, and tubing connectors
Cables	
731-8261	Econo System Cable 1, 8-pin mini-DIN to DB-9 connector. For connection of Model 2110 Econo Fraction Collector to the Econo Pump, Econo UV Monitor, or Econo System Controller
731-8262	Econo System Cable 2, 8-pin mini-DIN to 8-pin standard DIN. For connection of Econo Recorders to the Econo UV Monitor, Econo Pump, Econo Gradient Monitor, or Econo System Controller
731-8263	Econo System Cable 3, 8-pin mini-DIN to 8-pin mini DIN. Connects the Econo Pump to the Econo UV Monitor in the absence of the System Controller
731-8264	Econo System Cable 4, 8-pin mini-DIN to banana cable. To connect Econo UV Monitor to most non-Bio-Rad chart recorders
731-8265	Econo System Cable 5, DB-9 connector to bare wires. For connection of Model 2110 Econo Fraction Collector to non-Econo System components
731-8266	Econo System Cable 6, 8-pin standard DIN to bare wires. To connect Econo Recorder to non-Econo System detectors
731-8267	Econo System Cable 7, 8-pin mini-DIN to bare wires. To connect Econo Pump, Econo UV Monitor, or Econo System Controller to non-Econo System components
731-8268	Econo System Cable 8, 8-pin standard DIN to DB-9 connector. For connection of Econo Recorders to Econo Fraction Collector
731-8269	Econo System Cable 9, 8-pin mini-DIN to Pharmacia Frac-100. For connection of Pharmacia Frac-100 fraction collector to the Econo System
731-8281	Econo System Cable 10, 8-pin mini-DIN to 11-pin connector. For connection of the Model EV-1 Econo Buffer Selector to the Econo System Controller.

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