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Model EP-1 Econo Pump

Instruction Manual

Catalog Numbers

731-8140

731-8142

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

BIO-RAD

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Warranty

Model _____

Serial Number _____

Date of Delivery _____

Warranty Period _____

The Model EP-1 Econo Pump is warranted 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.
2. Repair or modification done by anyone other than Bio-Rad Laboratories or their authorized agent.
3. Use with tubings or fittings not specified by Bio-Rad Laboratories for use with this pump.
4. Deliberate or accidental misuse.
5. Damage caused by disaster.
6. Damage due to use of improper solvent or sample.

This warranty does not apply to tubing, fittings, and fuses.

For inquiry or request for 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.

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.

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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 a part of the BioLogic System. As a stand-alone pump, the Model EP-1 Econo Pump delivers flow rates from 0.1 to 40 ml/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 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.

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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).

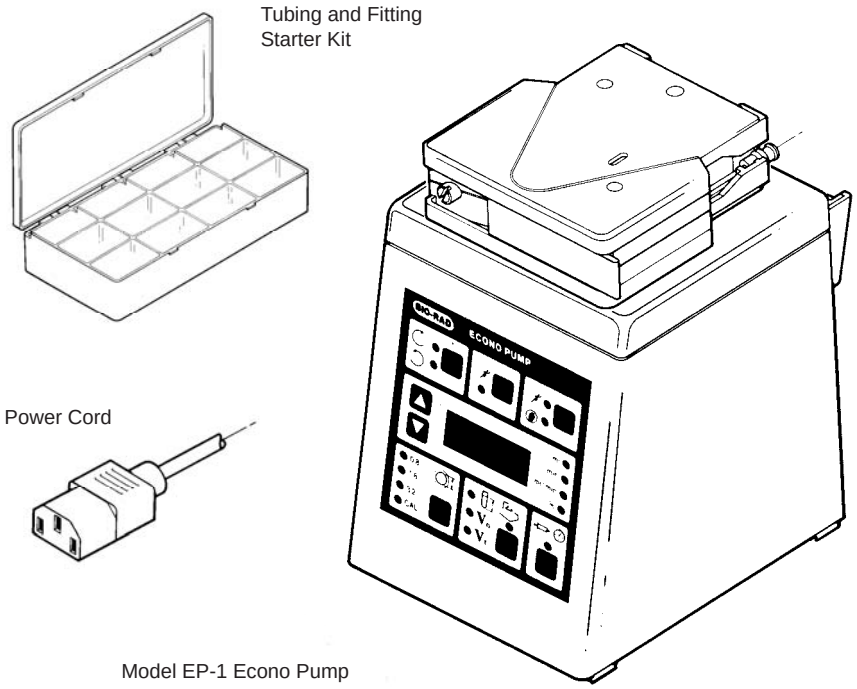


Fig. 3.1. Parts supplied with the Model EP-1 Econo Pump.

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3.2 Voltage Conversion

Warning: The Model EP-1 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.

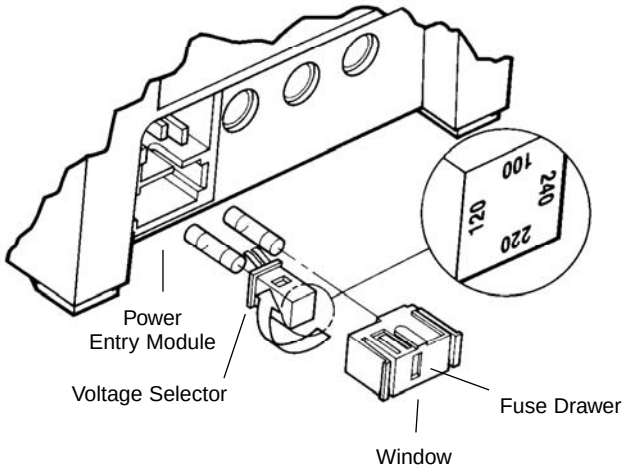


Fig. 3.2. Voltage conversion.

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Section 4
Physical Description and Control Features

4.1 Front Panel Functions

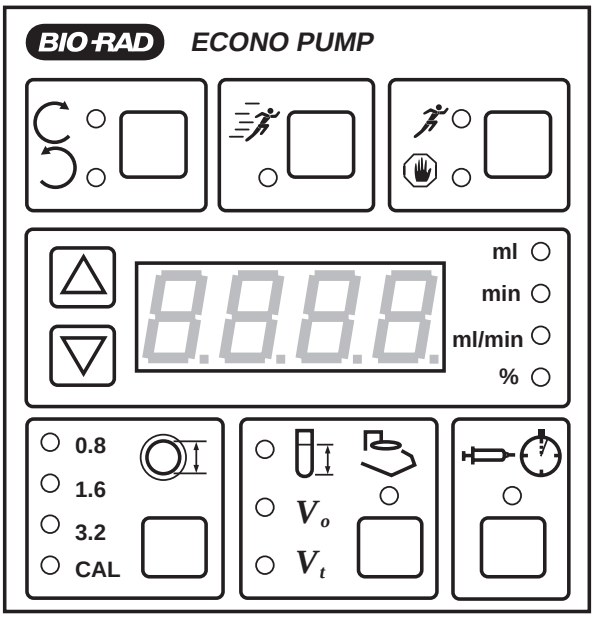


Fig. 4.1. Front panel controls.

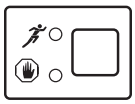
	Display	Function
	LED Display	The four-character display will show various parameters during programming and operation of the Econo Pump. The indicator lights located immediately to the right of the display indicate the units displayed: ml, minutes, ml/minute, or percent.
	Arrow Keys	These keys are used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

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Indicator Lights

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.



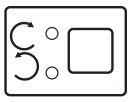
Run/Stop Key

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



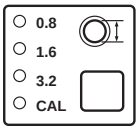
Purge Key

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 fraction collection method.



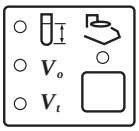
Direction Key

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



Tubing Calibration Key

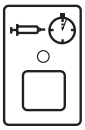
This key is used to select pre-programmed calibration settings for three tubing sizes, or allows user calibration for increased flow rate accuracy or non-standard tubing sizes. The pump must be stopped for this key to operate.



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_t) may be used to program the pump to automatically shut off after a given volume has been delivered.

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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

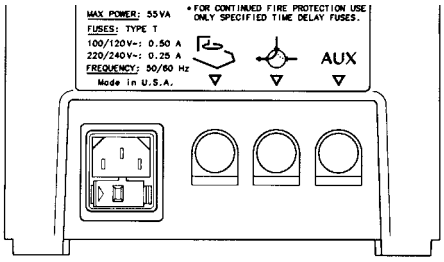


Fig. 4.2. Rear panel sockets.

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 System Cable 1.

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	Diverter Valve Output	This 8-pin outlet sends a signal to the Model SV-3 diverter valve, to divert flow between collection devices.
	Auxiliary Output	This 8-pin connector is for communication with the Model EM-1 Econo UV Monitor and the BioLogic System.

4.3 Pump Base Features

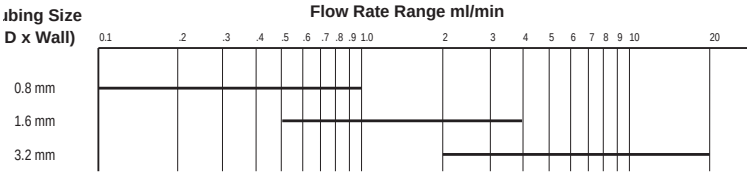
The base of the Model EP-1 Econo Pump contains a 40-pin connector for connection of the Econo Pump to the (discontinued) Econo System Controller. This connector is not currently used with any systems sold by Bio-Rad Laboratories, and should remain unused.

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 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 Econo Pump has been cut to a predetermined length to accommodate tubing prestretch. (Silicon tubing in precut lengths is also available from Bio-Rad. See ordering information in appendix C.)

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When using tubing other than precut tubing from Bio-Rad, the tubing must be cut to the following lengths to accommodate prestretch:

Tubing	Length
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.

5.2 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.

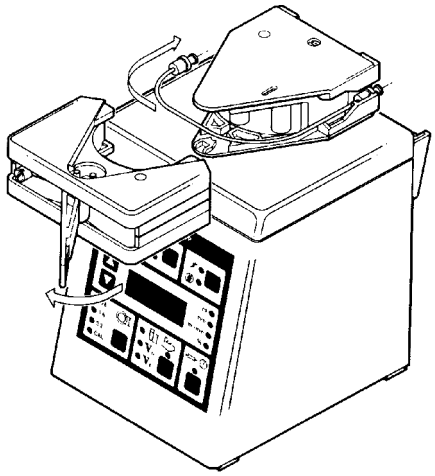


Fig. 5.1. Tubing installation.

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.

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

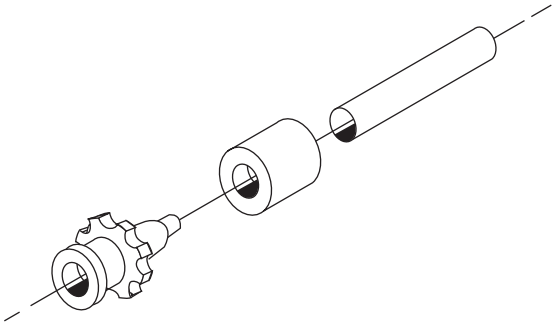


Fig. 5.2. Attachment of tubing fittings.

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.

5.3 Platen Adjustment

Proper adjustment of the platen pressure increases flow stability, minimizes flow pulsation, and prolongs the life of the tubing.

Once the tubing is installed in the pumphead, loosen the platen adjustment screw, located on the front of the platen, counterclockwise until the stop is reached. For one piece of either PharMed or Tygon tubing, the platen is properly adjusted at three to four full turns clockwise from stop. For one piece of silicon tubing, the platen is properly adjusted two full turns clockwise from stop. When using two pieces of tubing, approximately 50% more turns clockwise from stop will be required.

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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.

Section 6
Stand Alone Operation

The Model EP-1 Econo Pump functions as a stand-alone pump. By specifying the pump tubing size, it allows you to enter a flow rate rather than a nominal pump speed setting. (An uncalibrated Econo Pump will display pump speed as percent of maximum rpm.) There are two ways to calibrate the pump: through a preset tubing size or through a user calibration procedure.

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

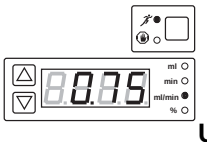
1. With the pump in Stop mode, install tubing as described in Section 5.2.



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.



3. 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.



4. 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.

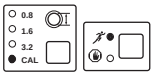
User Calibration Procedure

1. 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.

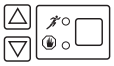


2. Run pump to purge air from tubing, then stop pump. Place the end of the outlet tubing in an empty graduated cylinder.

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3. 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.



4. 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.



5. 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.



6. 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.

Section 7
Operation with other Instruments

The Model EP-1 Econo Pump can be used with other chromatography components (Model 2110 and Model 2128 fraction collectors), or with the BioLogic System, the high resolution liquid chromatography system. Each of these applications is discussed below.

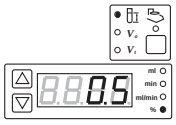
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7.1 Use of the Econo Pump with the Model 2110 Fraction Collector

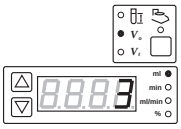
The Econo Pump is capable of controlling the Model 2110 Fraction Collector. The pump must be calibrated in order to run a fraction collector program. See Section 6 for calibration instructions.

Use System Cable 1 (catalog number 731-8261) to connect the Econo Pump to the fraction collector. Connect the 9-pin "D" connector to rear of the Model 2110, and the mini-DIN plug to the rear port of the Econo Pump with the collector icon. (See Figure 4.2.)

To program a simple time-based collection method, follow these instructions.

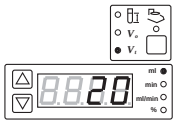


1. Press the Fraction Collector key on the pump front panel to enter the fraction collector Edit mode. Note that the fraction size and ml indicator lights are flashing, prompting entry of fraction size. Enter the fraction size in 0.1 ml increments using the Arrow keys. After fraction size is selected,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



2. Enter a void volume (V_o) 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.

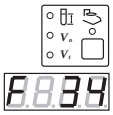
   Note: The optional Model SV-3 Diverter Valve (catalog number 731-8235) is required to use the void volume feature of the Model EP-1 Econo Pump.



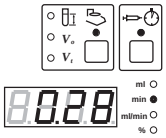
3. Select the total run volume (V_t) in 1 ml increments using the Arrow keys.* If zero is entered and confirmed, the fraction collection scheme is disabled. To resume data entry, see Step 1 above. All values previously entered remain in the memory until other values are entered to replace them.

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

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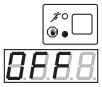
4. After selecting a V_t value, press the flashing Fraction Collection key to enter the value. The flashing LED display shows the estimated number of fractions to be collected.



5. 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.

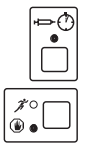


6. While a program is running, the user can use the Arrow keys to display the ml of output, the progression of the collection in min, the flow rate in ml/min, or the percent of total run-time.



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.

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2. During the V_o period of the fraction collection scheme (as indicated by the V_o indicator light), the fraction collector is not active. To collect fractions during this void volume period, cancel V_o 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_t value entered (the V_t 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. If the void volume function (V_o) 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 7.1.

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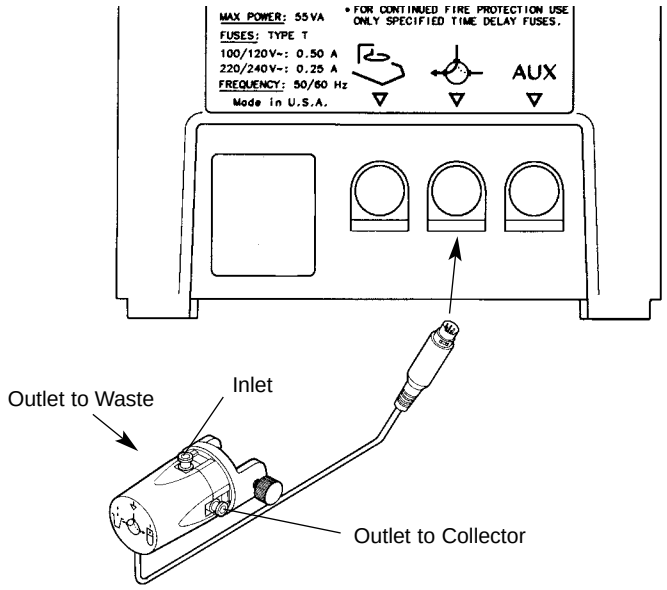


Fig. 7.1. Connection of the Model SV-3 Diverter Valve.

7.2 Use of the Econo Pump with the Model 2128 Fraction Collector

The Econo Pump is capable of controlling the Model 2128 Fraction Collector. The pump must be calibrated in order to run a fraction collector program. See Section 6 for calibration instructions.

Use System Cable 15 (catalog number 731-8286) to connect the Econo Pump to the Model 2128 Collector. If the SV-3 diverter valve is used, connect it as shown in Figure 7.1. If the Model 2128 Diverter Valve is used, connect one end of System Cable 3 to the diverter valve port on the Econo Pump, and connect the other end to the mini-DIN port on the Model 2128 Fraction Collector. This cable transmits flow diversion information from the Econo Pump to the collector. Program collection as demonstrated in Section 7.1. For more information about the Model 2128 Fraction Collector, consult the user manual.

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7.3 Use of the Econo Pump with the BioLogic System

The Econo Pump can be controlled by the BioLogic System and used as a sample loading pump.

Note: The Econo Pump must have v2.12 software in order to accept on/off commands from the BioLogic System. See Section 10.1 for instructions on how to check the software version. If an upgrade is required, contact your local Bio-Rad representative.

To connect the Econo Pump to the BioLogic, use System Cable 7 (catalog number 731-8267). Connect the mini-DIN end of the cable to the AUX port of the Econo Pump, and make a bare wire connection to the AUX port of the BioLogic Workstation (RED to port 6, BLUE to port 9).

To connect the wires to the AUX port of the BioLogic System, turn the small flathead screwdriver counterclockwise to back out the screw. Insert the bare wire into the port and turn the screwdriver clockwise to secure the connection. Be sure to calibrate the pump and set a flow rate prior to using the Econo Pump with the BioLogic System, since the BioLogic sends only "on/off" commands to the Econo Pump. To program the Econo Pump as a sample loading pump with the BioLogic System, refer to the BioLogic System user manual.

Section 8
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.

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Section 9
Troubleshooting

Problem	Possible Cause	Solution
Pump displays "OUT"	Power surge or brownout	1. Turn the power switch off. 2. Press and hold down the down 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.
		Insure that the calibration indicatorlight is not flashing. For pump to run, this light must either be off or steadily lit.
Liquid remains stationary in tubing	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.
	Damaged tubing	Check pump tubing for damage. Replace damaged tubing.
Flow rate not consistent	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.

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Problem	Possible Cause	Solution
	Large change in back pressure or fluid viscosity	Re-calibrate flow.
	Restriction on inlet side	Remedy
Excessive tubing wear	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 Technical Service

Section 10
Embedded Functions

During a technical service call, you may be asked to perform tasks which require you to press combinations of keys. These tasks are defined below.

10.1 Software Confirmation

To check the version of software installed in the Econo Pump, simultaneously hold down the direction key (in the upper left corner) and the "down" arrow key on the front panel of the Econo Pump. The four digit display should display "**v2.01**" or higher.

10.2 Warm Reboot

You may be asked to perform a warm reboot if the Econo Pump software is not functioning properly. To initiate a warm reboot, press the Tubing Calibration and Down Arrow keys simultaneously and hold for 3 seconds.

10.3 Cold Reboot

A cold reboot may be necessary if the warm reboot was unsuccessful. Turn off the pump and hold the Tubing Calibration and Down Arrow keys while turning the pump back on. Hold the two keys until the display stabilizes.

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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/cm2 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
Regulatory	CSA: C22.2 No.151-M1986
Compliance	TÜV: EN61010-1:1993 CE: EN55011:1991 Class A EN50082-2:1995

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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 (System Cable 7), which has an 8-pin mini-DIN connector at one end and loose wires on the other, for connection to other 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



Pinout	Signal Type
*	Shield
1	Fraction Advance (low-going output)
2	No Contact
3	No Contact
4	No Contact
5	Fraction Advance (high-going output)
6	No Contact
7	Ground
8	Fraction Advanced Marks to Recorder (low-going input)



Pinout	Signal Type
*	Shield
1	Start/Enable (output)
2	No Contact
3	Mark A (output)
4	No Contact
5	No Contact
6	Pen (output)
7	Ground
8	Mark B (output)

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Appendix C

Ordering Information

Catalog Number	Product Description
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
731-8209	**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

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Catalog Number	Product Description
731-8220	**Low Pressure Fittings Kit**, includes over 250 male and female luer connectors, 2- and 3-way stopcocks, and tubing connectors

Cables

731-8261	**System Cable 1**, 8-pin mini-DIN to DB-9 connector. For connection of Model 2110 Fraction Collector to the Econo Pump, to the BioLogic LP
731-8262	**System Cable 2**, 8-pin mini-DIN to 8-pin standard DIN. For connection of Model 1327 Chart Recorder to the Econo UV Monitor
731-8264	**System Cable 4**, 8-pin mini-DIN to banana cable. To connect Econo UV Monitor to the Model 1327 Chart Recorder
731-8267	**System Cable 7**, 8-pin mini-DIN to bare wires. To connect Econo Pump to the BioLogic System

Model 2110 Fraction Collector

731-8122	**Model 2110 Fraction Collector**, 100/120 V
731-8120	**Model 2110 Fraction Collector**, 220/240 V

Model 2128 Fraction Collector

731-8123	**Model 2128 Fraction Collector**, 100/120 V
731-8124	**Model 2128 Fraction Collector**, 220/240 V

Bio-Rad sells a complete line of integrated chromatography systems for protein purification. For more information on the BioLogic System family of products, contact your local Bio-Rad representative.

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