

**Model 1326  
Dual Pen  
Econo Recorder**

**Instruction  
Manual**

**BIO-RAD**

## Warranty

Model \_\_\_\_\_

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

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

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

The Model 1326 Econo Recorder 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. Damage caused by improper operation.
2. Damage caused by repair or modification done by anyone other than Bio-Rad Laboratories or their authorized agent.
3. Damage caused by deliberate or accidental misuse.
4. Damage caused by disaster.

This warranty does not apply to fuses, pens, and paper.

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

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## Section 1 Introduction

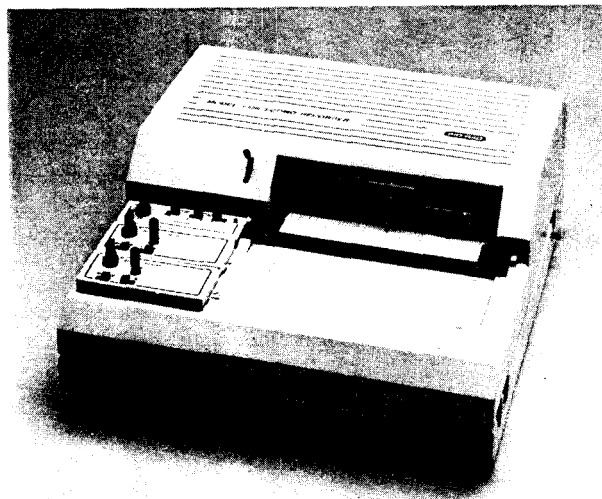


Fig. 1.1. Model 1326 Econo Recorder.

The Model 1326 Econo Recorder is a high quality dual-pen flat-bed chart recorder for the laboratory environment, and specifically for use as an integral part of Bio-Rad's Econo System for monitoring two signals simultaneously. It has 10 input settings ranging from 1mV to 20 V for each channel, 16 chart speeds from 1 cm/hr to 60 cm/min, and can be used with most UV/Vis monitors, conductivity monitors, RI monitors, pH meters, and a host of other instruments. When used as an integral part of the Econo System, the pen lift and paper feed functions are controlled automatically.

## Section 2 Unpacking

### 2.1 Unpacking Instructions

Carefully remove the contents of the shipping box and check for any obvious damage or problems with the instrument. Figure 2.1 illustrates all of the parts included with the Model 1326 Econo Recorder. Check off all parts against the supplied packing list. If any parts are missing or damaged, contact Bio-Rad Laboratories immediately.

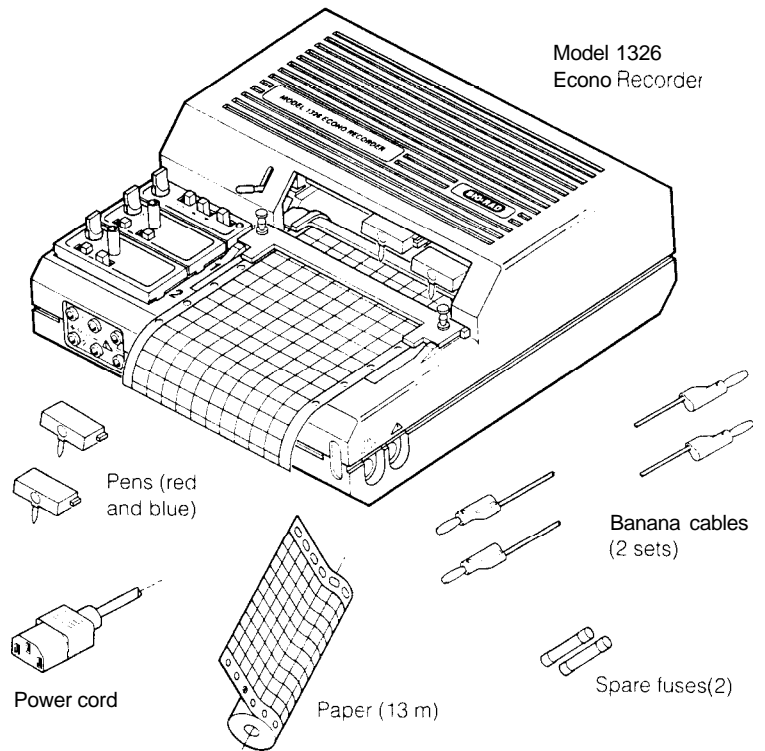
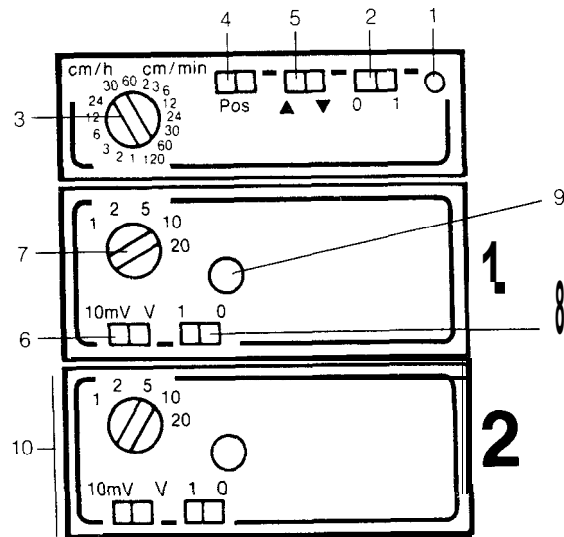


Fig. 2.1. Parts supplied with the Model 1326 Econo Recorder.

### Section 3 Description of Functions

The following tables and illustrations describe the Model 1326 Econo Recorder's functions and controls. For additional functions available when operating with Econo System components, refer to Section 6.

#### 3.1 Top Panel Controls



- |                                 |                                  |
|---------------------------------|----------------------------------|
| 1. Power On/Off LED             | 6. Sensitivity Switch, channel 1 |
| 2. Paper Start/Stop Switch      | 7. Range Selector, channel 1     |
| 3. Chart Speed Selector         | 8. Record Switch                 |
| 4. Paper Feed Switch            | 9. Baseline Adjustment           |
| 5. Chart Advance/Reverse Switch | 10. Channel 2 Controls           |

Fig. 3.1. Top panel controls.

**Table 3.1. Functional Description of Top Panel Controls**

Control	Setting	Function
I. Power On/Off LED		Indicates that power is on. It is not dependent on chart drive.
2. Paper Start/Stop Switch	1	Paper start.
	0	Paper stop.
3. Chart Speed Selector	16 settings	Sets paper speed from 1 cm/hr to 60 cm/min.
4. Paper Feed Switch	2 settings	In the pos. setting, the paper is transported at max. speed.
5. Chart Advance/Reverse Switch		Chart advance. Chart reverse.
6. Sensitivity Switch, Channel I	10 mv	Sets range selector for channel I to read in mV DC.
	V	Sets range selector for channel I to read in V DC.
7. Range Selector, Channel I	8 settings	In conjunction with the sensitivity switch, this dial sets the range of full scale deflection from 1 mV to 20 v.
8. Record Switch	1	Normal operating position.
	0	This position allows a zero control measurement without physically disconnecting the signal.
9. Baseline Adjustment	variable	For the adjustment of the baseline position. (See Record Switch.)
10. Channel 2 Controls		Range, baseline, and sensitivity control for Channel 2 See Channel 1 control descriptions



### 3.2 Front Panel Sockets

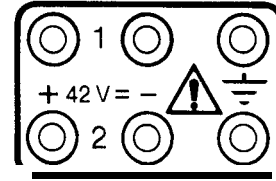


Fig. 3.2. Front panel sockets.

Function	Comment
Generic Signal Input	<p>The "+" socket should be connected to the signal positive (+) output of the detection device using the red banana cable. The "-" socket should be connected to the signal ground, or negative using the black banana cable.</p> <p>The <math>\text{⏏}</math> socket can be used for instruments requiring a third connection for a shield or earth ground.</p> <p><b>-WARNING- THIS RECORDER SHOULD NOT BE USED TO MEASURE SIGNALS GREATER THAN 24 VAC or 42 VDC.</b></p>

### 3.3. Side Panel Sockets

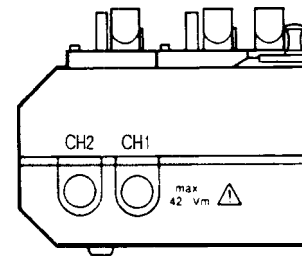


Fig. 3.3. Side panel sockets.

Function	Comment
Econo System Remote Control Sockets	<p>Pen lift, chart drive, event marks, fraction marks, and analog inputs are accessible through these 8-pin standard DIN sockets. It is through these sockets that Econo System control of chart functions is attained.</p> <p>Section 6 of this manual contains detailed information on the use of the Model 1326 Econo Recorder with other Econo System components. See Appendix A for technical information regarding the use of these sockets with other equipment.</p>

### 3.4 Rear Panel Functions

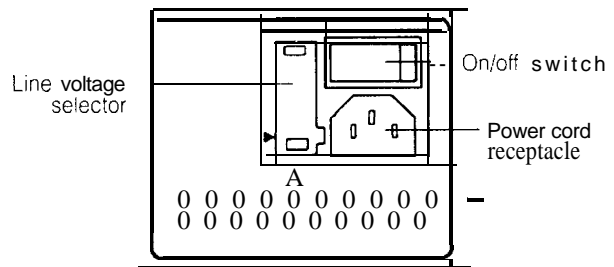


Fig. 3.4. Rear panel functions.

Function	Comment
On/Off Switch	A two-position rocker switch. I is on; 0 is off.
Power Cord Receptacle	Grounded three-pin receptacle for the power cord.
Fuse Holder/Line Voltage Selector	Two position 110 V (90 V- 132 V)/220 V (180 V-265 V) line voltage selector and fuse holder. A notch on the lower left portion of the fuse holder/line voltage selector points to the selected voltage range.

## Section 4 Setting Up

### 4.1 Voltage Conversion

**Warning:** The Model 1326 Econo Recorder is shipped in its 110 V or 220 V version for operation at voltages of 90 V-132 V and 180 V-265 V, respectively. To switch between these two voltage ranges, follow 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 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 4.1.

1. Using a screwdriver or similar tool, pry open the fuse holder cover.
2. Pull the voltage selector out of the fuse drawer.
3. Reinsert the voltage selector into the fuse drawer so that the notch on the lower left portion of the fuse holder/line voltage selector housing points to the selected voltage range. The proper mains voltage should be displayed right-side up at the bottom of the voltage selector.

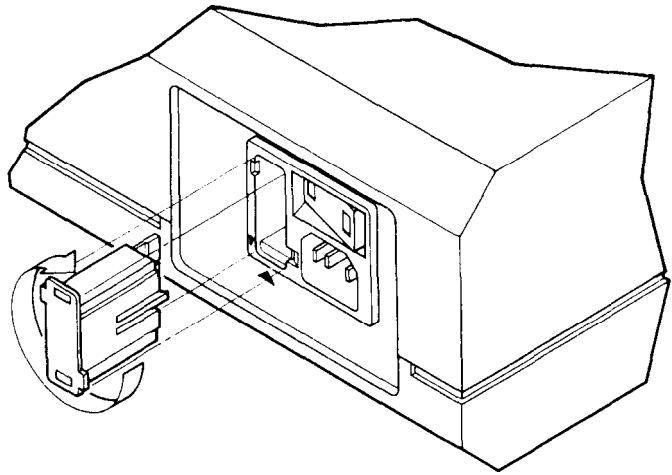


Fig. 4.1. Voltage conversion.

## 4.2 Chart Paper Installation

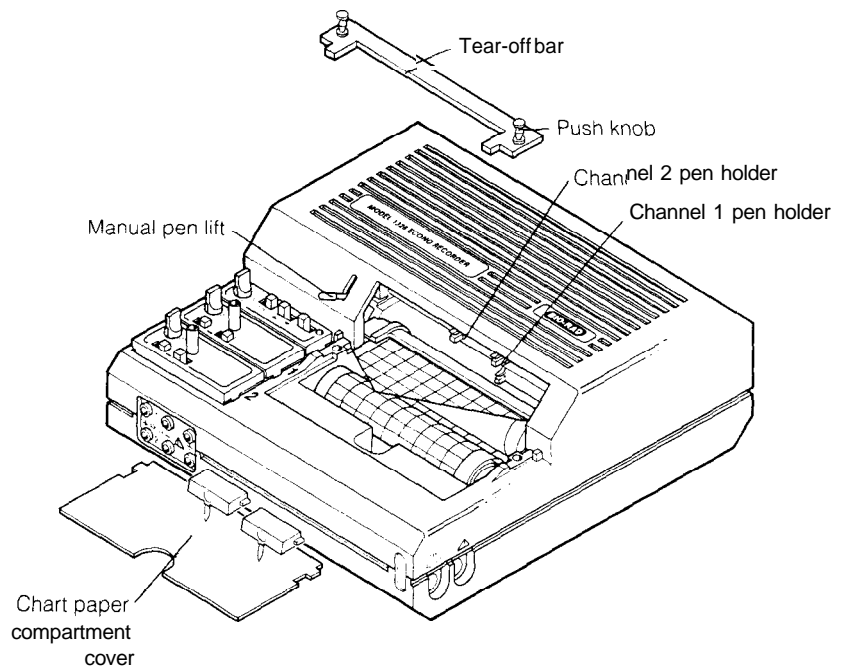


Fig. 4.2. Chart paper installation.

1. Insure that pens are in the "up" position.
2. Remove the tear off bar by pulling up on the two push knobs on both sides of the bar.
3. Lift out the paper compartment lid.
4. Insert a roll of chart paper into the paper compartment.
5. Feed the paper from below, between the chart drum and the guide panel, toward the top. For easier insertion, form the paper into an arrow. Hold the paper by the tip, switch on the fast chart advance, and bring the paper over the chart table. Watch for parallel feed of paper. Left and right sprocket holes must be aligned horizontally.
6. Turn chart drive to the Stop position and replace the paper compartment lid.
7. Position the tear-off bar over the guide holes and push down on the two push knobs. The paper is now between the paper table and the tear-off bar and ready for use.

### 4.3 Pen Installation

Place penlift in the Up position. Remove the pen cap. Insert the fiber tip pen into the holder (see Figure 4.2) and push the pen back until it snaps into the clamp. Remove the pen in the reverse order. Be sure to replace the pen cap when the pen is not in use.

### 4.4 Analog Signal Connection

If the Model 1326 Econo Recorder is to be used with the Econo System or any of its components, refer to Section 6 of this manual.

With other equipment, use the black lead of the banana cable to connect the negative (-) output, or ground, to the black (-) input socket of one channel on the front panel of the Model 1326 recorder (see Figure 3.2). Use the red lead of the banana cable to connect the positive (+) output to the red (+) input socket of the same channel on the front panel of the recorder. The  $\equiv$  socket can be used for instruments requiring a third connection for a shield or earth ground.

## Section 5 Operation

There are a number of ways to collect data using the Model 1326 Econo Recorder. To some extent the method of data collection will depend upon the application and other instruments being used. Below is one scenario suitable in most situations.

1. Set up the Model 1326 Econo Recorder as described in Section 4. Turn on recorder using the power switch on the rear of the recorder. A lit LED indicates power on.
2. Turn on the instrument that will be providing the analog signal and allow it to warm up. Before adjusting the chart recorder, make sure that baseline conditions have been established.
3. Using the sensitivity switch and the range selector, set the input range of one channel to 20 V.
4. Select an appropriate paper speed using the paper speed dial.
5. Set the record switch for that channel to the 1 position
6. Use the baseline adjustment knob to move the pen to a position over the 50% mark on the chart paper. Reduce the input range one setting at a time (20 V, 10 V, 5 V, etc.) until the proper setting for the instrument providing the analog signal is reached. If the pen starts to move away from center, use the baseline adjustment knob to return it to the 50% mark.

7. When the proper range setting is reached, use the baseline adjustment dial to position the pen to the desired position.
8. Repeat steps 3, 5, 6, and 7 for the second channel, if the second channel is to be used.
9. The Model 1326 Econo Recorder is now ready for recording. Push down on the pen lift to lower the pen, and move the paper start/stop switch to the 1 position to start the paper. Set the proper paper feed and direction.

If you are using other Econo System components and want to take advantage of system features, refer to Section 6.

## Section 6 Operating the Model 1326 Econo Recorder with Other Econo System Components

When the Model 1326 Econo Recorder is used with the Econo System, all routine chart functions can be controlled automatically. If the Model 1326 Econo Recorder is used with just one or two Econo System components, only the appropriate functions will be controlled (i.e., event marks from the UV monitor, fraction marks from the fraction collector, and pen and paper control from the pump).

**For all automated Econo System connections, control features should be set as follows:** power switch in the I, or on position (LED will be lit), input range at 1 V (10 x 0, I VI) and record switch in the I position on all channels being used, chart paper set in the advance position, and pens in the up position.

### Using the Model 1326 Econo Chart Recorder with the Model EM-1 Econo UV Monitor

Use Cable 2 to connect the channel 1 remote control socket on the side of the Model 1326 Econo Recorder to the signal output socket  $\overline{M}$  on the rear panel of the Model EM-1 Econo UV Monitor. Set the input range for channel 1 on the Model 1326 Econo Chart Recorder to 1 V full scale.

### Using the Model 1326 Econo Recorder with the Model EG-1 Conductivity Monitor

Use Cable 2 to connect the channel 2 remote control socket on the side of the Model 1326 Econo Recorder to the signal output socket  $\overline{M}$  on the rear panel of the Model EG-1 Conductivity Monitor. Set the input range for channel 2 on the Model 1326 Econo Recorder to 1 V full scale.


### **Using the Model 1326 Econo Recorder with the Model 2110 Fraction Collector**


To get fraction marks directly from the Model 2110 Fraction Collector, use Cable 8 to connect either channel 1 or channel 2 remote control sockets on the side panel of the Model 1326 Econo Recorder to the I/O socket on the rear panel of the Model 2110 Fraction Collector.

### **Using the Model 1326 Econo Recorder with the Model EP-1 Econo Pump**

In order to control the pen lift and chart drive of the Model 1326 Econo Recorder automatically, the recorder must be connected to the Model EP-1 Econo Pump. Use Cable 2 to connect the channel 1 remote control socket on the side panel of the Model 1326 Econo Recorder to the AUX socket on the rear panel of the Model EP-1 Econo Pump.


### **Using the Model 1326 Econo Recorder with the Model EM-1 Econo UV Monitor and Model EG-1 Conductivity Monitor**

Use Cable 2 to connect the channel 1 remote control socket on the side of the Model 1326 Econo Recorder to the signal output socket  on the rear panel of the Model EM-1 Econo UV Monitor. Set the input range for channel 1 on the Model 1326 Econo Recorder to 1 V full scale.

Use Cable 2 to connect the channel 2 remote control socket on the side of the Model 1326 Econo Recorder to the signal output socket  on the rear panel of the Model EG-1 Conductivity Monitor. Set the input range for channel 2 on the Model 1326 Econo Recorder to 1 V full scale.


### **Using the Model 1326 Econo Recorder with the Model EM-1 Econo UV Monitor and Model 2110 Fraction Collector**

Use Cable 1 to connect the I/O socket on the rear panel of the Model 2110 Fraction Collector to the AUX socket on the rear panel of the Model EM-1 Econo UV Monitor.


Use Cable 2 to connect the channel 1 remote control socket on the side panel of the Model 1326 Econo Recorder to the signal output socket  on the rear panel of the Model EM-1 Econo UV Monitor. Set the input range on chart recorder channel 1 to 1 V full scale.

### **Using the Model 1326 Econo Recorder with the Model EM-1 Econo UV Monitor and Model EP-1 Econo Pump**

Use Cable 3 to connect the AIJX sockets on the rear panels of both the Model EM-1 Econo UV Monitor and the Model EP-1 Econo Pump.

Use Cable 2 to connect the channel 1 remote control socket on the side panel of the Model 1326 Econo Recorder to the signal output socket  on the rear panel of the Model EM-1 Econo UV Monitor. Set the input range on chart recorder channel 1 to 1 V full scale.


### **Using the Model 1326 Econo Recorder with the Model EP-1 Econo Pump and Model 2110 Fraction Collector**


To get fraction advance marks from the Model 2110 Fraction Collector, as well as automatic control of pen lift and chart drive, use Cable 1 to connect the I/O socket on the rear panel of the Model 2110 Fraction Collector to the fraction collector socket  on the rear panel of the Model EM-1 Econo Pump.

Use Cable 2 to connect the channel 1 remote control socket on the side panel of the Model 1326 Econo Recorder to the AUX socket on the rear panel of the Model EP-1 Econo Pump.

### **Using the Model 1326 Econo Recorder with the Model EM-1 Econo UV Monitor, the Model EG-1 Conductivity Monitor, and Model EP-1 Econo Pump**


Use Cable 3 to connect the AUX sockets on the rear panels of both the Model EM-1 Econo UV Monitor and the Model EP-1 Econo Pump.

Use Cable 2 to connect the channel 1 remote control socket on the side panel of the Model 1326 Econo Recorder to the signal output socket  on the rear panel of the Model EM-1 Econo UV Monitor. Set the input range on chart recorder channel 1 to 1 V full scale.


Use Cable 2 to connect the channel 2 remote control socket on the side of the Model 1326 Econo Recorder to the signal output socket  on the rear panel of the Model EG-1 Conductivity Monitor. Set the input range for channel 2 on the Model 1326 Econo Recorder to 1 V full scale.




**Using the Model 1326 Econo Recorder with the Model EM-1 Econo UV Monitor, the Model EG-1 Conductivity Monitor, the Model EP-1 Econo Pump, and the Model 2110 Fraction Collector**



Use Cable 1 to connect the I/O socket on the rear panel of the Model 2110 Fraction Collector to the fraction collector socket  on the rear panel of the Model EM-1 Econo Pump.

Use Cable 3 to connect the AUX sockets on the rear panels of both the Model EM-1 Econo UV Monitor and the Model EP-1 Econo Pump.

Use Cable 2 to connect the channel 1 remote control socket on the side panel of the Model 1326 Econo Recorder to the signal output socket  on the rear panel of the Model EM-1 Econo UV Monitor. Set the input range on chart recorder channel 1 to 1 V full scale.

Use Cable 2 to connect the channel 2 remote control socket on the side of the Model 1326 Econo Recorder to the signal output socket  on the rear panel of the Model EG-1 Conductivity Monitor. Set the input range for channel 2 on the Model 1326 Econo Recorder to 1 V full scale.

**Using the Model 1326 Econo Recorder with a Complete Econo System**

Use Cable 2 to connect the channel 1 remote control socket on the side panel of the Model 1326 Econo Recorder to the signal output socket  on the rear panel of the Model EM-1 Econo UV Monitor. Use Cable 2 to connect the channel 2 remote control socket on the side panel of the Model 1326 Econo Recorder to the signal output socket  on the rear panel of the Model EG-1 Conductivity Monitor, if present. Insure that all chart recorder settings are as described above for automated use with the Econo System.

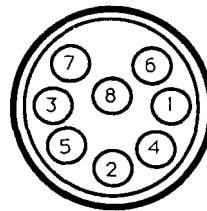
## Appendix A Remote Control Sockets

The two remote control sockets on the side of the Model 1326 Econo Recorder are 8-pin standard sockets (DIN 45 326) that allow the Econo System to control the chart recorder functions via Cable 2 (see Section 6). The following information is provided for those wishing to use these sockets with non-Econo System equipment. Cable 6 (8-pin standard DIN connector to bare wires) may be used as a breakout cable to access these functions.

All control functions can be controlled by TTL signals or by contact closure to ground. All inputs are active LOW. Table A-1 gives the pin assignments for the remote control sockets.

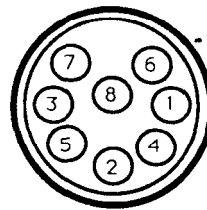
**Table A-1. Remote Control Socket Pin Assignments**

Channel 1:



Function	Pin	Notes
Paper stop	1	
Reverse paper	2	
Ground	3	Digital ground
No contact	4	
Signal positive	5	42 V maximum
Signal negative	6	
Pen down	7	
Event mark	8	

Channel 2:



Function	Pin	Notes
No contact	1	
No contact	2	
Ground	3	
No contact	4	
Signal positive	5	42 V maximum
Signal negative	6	
No contact	7	
Event mark	8	

## Appendix B Technical Specifications

### General Information

Number of channels	2
Recording width	120 mm
Recording medium	Chart paper, 50 divisions
Pen types	Disposable felt tip
Remote control	Paper feed, paper direction, pen lift, and event marks
Chart speed	1. 2. 3. 6. 12. 24. 30. 60 cm/h 1, 2, 3, 6, 12, 24, 30. 60 cm/min
Measuring range	10, 20, 50, 100, 200 mV 1, 2, 5, 10, 20 v
Rise time	0.35 sec for 90% of writing width
Accuracy	0.3%
Monitor output	1 volt output for full scale
Zero shift	- 100% to +200%
Voltage supply	90-132 V, 180-265 V
Fuses	160 mA slow blow for 220 V 315mA slow blow for 110 V
Dimensions	266 x 290 x 110 mm (W x L x H)
Weight	5 kg

## Appendix C Product Information

- 731-8191 **Model 1326 Econo Recorder**, dual pen, 90-132 V, includes 1 roll chart paper (13 m), 2 fiber tip pens (red and blue), spare fuses, 2 sets banana cables
- 731-8193 **Model 1326 Econo Recorder**, dual pen, 180-265 V, includes 1 roll chart paper (13 m), 2 fiber tip pens (red and blue), spare fuses, 2 sets banana cables
- 731-8199 **Chart Paper**, 2 rolls, 120 mm x 13 m
- 731-0218 **Red Fiber Tip Pens, 3**
- 731-0219 **Blue Fiber Tip Pens, 3**
- 731-8190 **Model 1325 Econo Recorder**, with US power adaptor, includes dust cover, 1 roll chart paper, 1 fiber tip pen, 1 spare fuse, 1 set banana cables
- 731-8192 **Model 1325 Econo Recorder**, without power adaptor, includes dust cover, 1 roll chart paper, 1 fiber tip pen, 1 spare fuse, 1 set banana cables
- 731-8261 **Cable 1**, 8-pin mini-DIN to DB-9 connector, for connecting Econo Fraction Collector to the Econo Pump, Econo UV Monitor, or Econo System Controller
- 731-8262 **Cable 2**, 8-pin mini-DIN to 8-pin standard DIN, for connecting Econo Recorders, to the Econo UV Monitor, Econo Pump, Econo Gradient Monitor, or Econo System Controller
- 731-8263 **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 **Cable 4**, 8-pin mini-DIN to banana cable, to connect Econo UV Monitor to most non-Bio-Rad chart recorders
- 731-8266 **Break-out Cable 6**, 8-pin standard DIN to bare wires, to connect Econo Recorders to non-Econo System components
- 731-8268 **Cable 8**, 8-pin standard DIN to DB-9 connector, for connecting Econo Recorders to Econo Fraction Collector