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**PowerPac™ HC**  
**Power Supply**  
**Instruction Manual**

**Catalog Number**  
**164-5052**

**BIO-RAD**

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## Safety

### Caution/Warning



PowerPac power supplies use high output voltages that are electrically isolated from earth ground through a protective impedance to minimize the risk of electrical shock to the user. The following guidelines should be observed and followed when using a PowerPac power supply.



PowerPac power supplies have passed test for operation at temperatures between 0° and 40°C, with relative humidity between 0 and 95% non-condensing. Operating the power supply outside these conditions is not recommended by Bio-Rad and will void the warranty.

1. To ensure adequate cooling of the power supply, be sure that there is at least 6 cm clearance around the power supply. Do not block the fan vents at the rear of the unit.
2. Always connect the power supply to a 3-prong, grounded AC outlet, using the 3-prong AC power cord provided with the power supply.
3. Bio-Rad electrophoresis cells have molded two-prong plugs that are inserted into the power supply's high voltage output jacks. These plugs have been EN 61010\* certified for safety compliance for use with PowerPac power supplies. Use of other plugs or banana jacks is done at the user's own risk and is not recommended by Bio-Rad. When inserting and removing the molded two-prong plug, always grasp the plug by the molded support at the rear of the plug. Do not grasp the individual prong ends.
4. Do not operate the power supply in extreme humidity (>95%) or where condensation can short the internal electrical circuits of the power supply.
5. When taking the power supply into a cold room, the unit can be operated immediately. However, when removing the power supply from the cold room, let the unit equilibrate to room temperature for a minimum of 2 hours before using it.
6. Never connect a high voltage output lead to earth ground. This defeats the floating electrical isolation of the power supply and exposes the user to potentially lethal high voltages.

### Important

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 on the same circuit as those appliances. The user should be aware of this potential and take appropriate measures to avoid interference.

Bio-Rad's PowerPac power supplies are designed and certified to meet EN 61010\* safety standards. Certified products are safe to use when operated in accordance with the instruction manual. This safety certification does not extend to electrophoresis cells or accessories that are not EN 61010 certified, even when connected to this power supply.

This instrument should not be modified or altered in any way. Alteration of this instrument will void the manufacturer's warranty, void the EN 61010 certification, and create a potential safety hazard for the user.

Bio-Rad is not responsible for any injury or damage caused by the use of this instrument for purposes other than those for which it is intended, or by modifications of the instrument not performed by Bio-Rad or an authorized agent.

\*EN 61010 is an internationally accepted electrical safety standard for laboratory instruments.

# Section 1 Introduction

## 1.1 Overview

The PowerPac HC power supply is designed to provide constant voltage, current or power for electrophoresis applications. The power supply operates at the value specified for the constant parameter, with limits for the other parameters. To prevent damage to the electrophoresis cell, the PowerPac HC provides automatic crossover to constant current, constant voltage, or constant power, depending on which set limit is first reached. If the set limit of the non-constant parameter is reached, the power supply will switch, making the limiting non-constant parameter the new constant.

### Output specifications:

- Voltage: Adjustable from 5 to 250 volts (V), in 1 V increments
- Current : Adjustable from 0.01 to 3.00 amperes (A), in 0.01 A increments
- Power: Adjustable from 0.05 to 300 watts (W) in 1 W increments
- Output jacks: Four sets of output jacks are provided to facilitate connection of up to 4 identical electrophoresis cells simultaneously

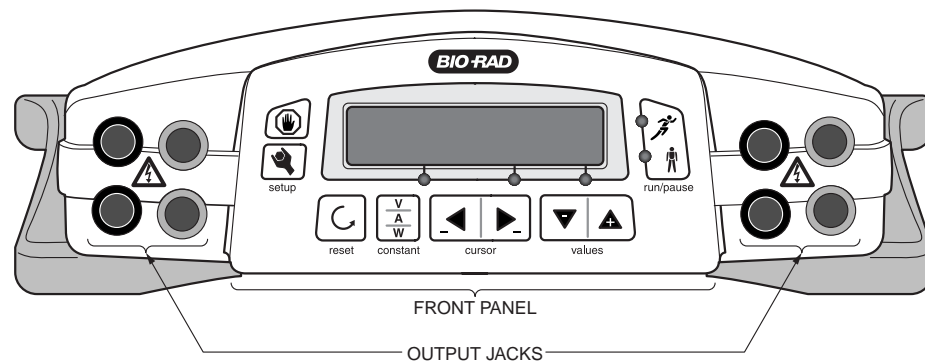


Fig. 1. Front View.

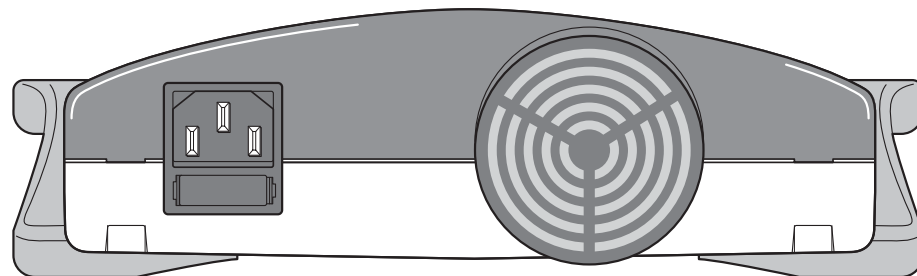


Fig. 2. Rear View.

The PowerPac HC power supply has the following features:

- Programmable constant voltage, constant current or constant power operation with automatic crossover.
- LCD screen displays all running parameters at once.
- Timer control to 99 hr, 59 min.
- Programmable methods with up to 3 steps.
- Pause mode for editing run parameters.
- Safety Features include automatic detection of no-load, short circuit, rapid resistance change, ground leak, fan failure and system overheating.
- Automatic completion of a run interrupted by power failure.
- Adjustable LCD display contrast.
- Input power 100–120/220–240 VAC, auto-switching
- Four output terminals.
- Stackable case with adjustable viewing angle via flip down legs (See Figure 3)

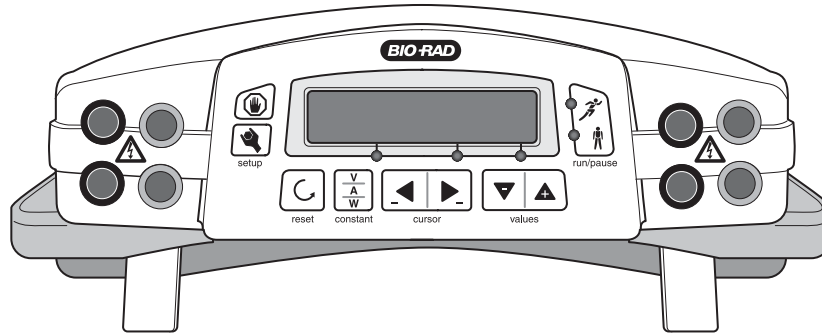


Fig. 3. Front View with Legs in Lowered Position.

## 1.2 Unpacking

When you receive your power supply, carefully inspect the container for any damage which may have occurred in shipping. Severe damage to the container may indicate damage to the power supply itself. If you suspect damage to the unit, immediately file a claim with the carrier in accordance with their instructions before contacting Bio-Rad Laboratories.

The PowerPac HC is shipped in a protective AirBox™. Follow the directions printed on the AirBox to unpack the PowerPac HC.

Remove the plastic film from the translucent green top case. The plastic film may leave a residue. If so, clean with a soft, damp cloth. Also remove the die-cut plastic film covering the display window. Contents include:

- PowerPac HC power supply
- Power cord
- Instruction manual
- Warranty card
- Declaration of conformity

If any part is missing or damaged, contact Bio-Rad Laboratories immediately.

Note: AirBox is a trademark of Air Packaging Technologies, Inc., Valencia, California, USA, and is covered in the USA under patents 4,072,558-4,949,530-4,872,558-6,283,296 and in some embodiments patents 5,711,691-5,272,856-5,588,532-5,487,470 and some foreign and pending patents.

## Section 2 Control Features

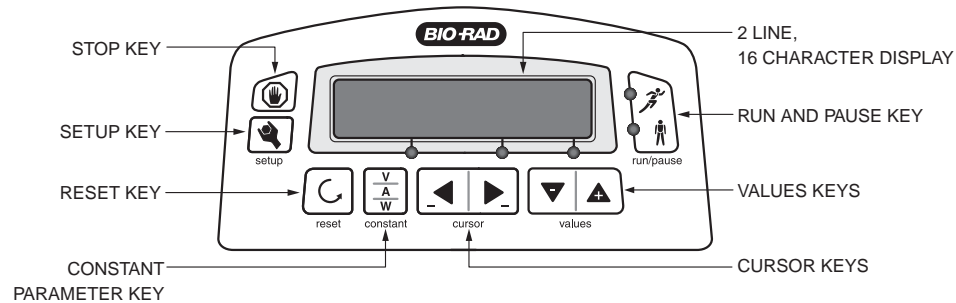





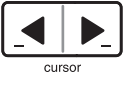
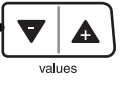


Fig. 4. Front Panel.

Key	Description
	<p><b>Run/Pause Key</b></p> <ul style="list-style-type: none"> <li>Starts or pauses a run. Pausing allows editing of the run parameter values.</li> <li>The corresponding LED indicates the status of the power supply</li> </ul>
	<p><b>Stop Key</b></p> <ul style="list-style-type: none"> <li>Stops the run. The display will show final run values alternating with the "Run Stopped" screen.</li> <li>A second stroke to the stop key clears the final run values of the previous run and prepares the screen to repeat the run.</li> </ul>
	<p><b>Reset Key</b></p> <ul style="list-style-type: none"> <li>The reset key can be used at any time during programming to clear previous run parameters and reset to the default startup screen.</li> <li>In the setup menu, the reset key returns settings to default values.</li> </ul>
	<p><b>Setup Key</b></p> <ul style="list-style-type: none"> <li>Setup key accesses the set up menu. The setup menu allows changes to defaults such as power failure detection, rapid resistance change detection, alarm, and display contrast. See pages 6–7 for details.</li> </ul>
	<p><b>Constant Key</b></p> <ul style="list-style-type: none"> <li>Selects constant voltage, constant current or constant power.</li> <li>The lighted LED below the parameters on the screen indicates the constant parameter selected.</li> </ul>
	<p><b>Cursor Keys</b></p> <ul style="list-style-type: none"> <li>Navigates among the different entry fields on the screen.</li> </ul>
	<p><b>Values Keys</b></p> <p>Changes the value of the selected parameter (indicated by the cursor). If the values key is pressed continuously for more than 10 counts in either direction, +/-, the value will increase/decrease in increments of 10 to reach the desired value faster.</p>

## Section 3 Setup and Operation

### 3.1 Setup and Programming a Run


This section guides the user through setting up the power supply for a run, connecting the electrophoresis cell(s), programming, and running.

STEP	PROCEDURE	DESCRIPTION
------	-----------	-------------

- |    |                 |  |
|----|-----------------|--|
| 1. | Connect cell(s) |  |
|----|-----------------|--|



The power leads are color coordinated to the output terminals.

 indicates high voltages.

**Note:** Power leads must be inserted perpendicular to the curve of the case.

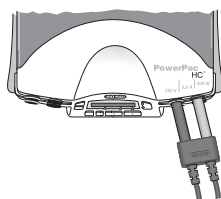


Fig. 5. Power Leads Connected Correctly.

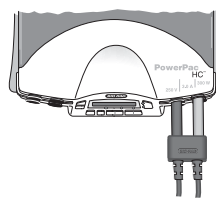
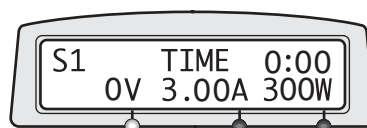


Fig. 6. Power Leads Connected Incorrectly.

- |    |                |  |
|----|----------------|--|
| 2. | Turn power on. |  |
|----|----------------|--|

Press the power switch located on the right side of the unit to the ON ( I ) position.

The default settings are indicated in the home screen below:



**Note:** The firmware version number appears on the screen momentarily when the unit is turned ON.

- |    |                           |  |
|----|---------------------------|--|
| 3. | Select constant parameter |  |
|----|---------------------------|--|


Press the constant key which toggles between volts (V), amperes (A), or watts (W).

An LED indicates the constant parameter: V, A, and W. The cursor also indicates the selected constant parameter, activating the field to enter a value. The non-constant parameters display maximum values as a default and will act as output limits (see step 6 to change output limits).

**Note:** Constant voltage is the default setting in the startup screen.

4.	Enter constant value	Press the Values keys to increase or decrease the selected value. The keys change the value in increments of 1, however after a few seconds of holding the key in either direction, +/-, the value changes in increments of 10. If the run is going to be untimed or continuous, and the limits are the maximum output, proceed to step # 9.
5.	Program time (optional)  0:00 hr:min	Move the cursor to the time field using the left/right arrow keys and enter the values as in step 4.  <b>Note:</b> Time is comprised of two fields for hours and minutes. If values increase past 59 min in the minutes field, an hour will be added in the hours field and the minutes field will restart at 00.  If no time is entered the run will be considered untimed or continuous.
6.	Change limits (optional)	Move the cursor to the fields of the non-constant parameters and enter the values as in step 4.
7.	Add a step or steps (optional)	After time has been entered in the first step, up to 2 additional steps may be added. Move the cursor to the step field in the upper left of the screen and press the + Value key to add a step, then proceed to enter run parameters as in steps 3–6 above. <b>Note:</b> To review a multistep program, use the cursor keys to move the cursor to the step field and use +/- Values keys to scroll through the steps.
8.	Reset	The Reset key may be pressed at any time during the programming process to clear all entries and return to the startup screen (single step with default values).
9.	Start the run	Press the start/pause key.  The run may be started at any time after step 4.

### 3.2 Editing Run Parameters During a Run

STEP	PROCEDURE	DESCRIPTION
1.	Pause  	Press the start/pause key while a run is in progress.  <b>Note:</b> The LED next to the standing man lights up and the timer on the screen stops.



STEP	PROCEDURE	DESCRIPTION
2.	Editing	Use the cursor keys and values keys to change parameters. For multiple-step runs, future steps may be accessed and changed, yet the original number of steps cannot be changed.
3.	Resume the run	Resume the run by pressing the start/pause key again.

### 3.3 Ending a Run

A run may be terminated in several ways: by user intervention, automatically if time was programmed, or due to a power failure (if power failure detection (PFd) is not enabled). The display will indicate how the run was ended as well as its final parameters.

Run	MESSAGE	EXPLANATION
Timed or continuous	Run Stopped	Run manually stopped by pressing the stop key
Timed	Run Completed	Timed run ends automatically
Timed PFd ON	Run Completed after power fail	Run ends automatically, a power failure occurred during the run which was resumed automatically.
Timed or continuous PFd ON	Stopped after power fail	Run manually stopped by pressing the stop key, a power failure occurred during the run which was resumed automatically.
PFd OFF	Aborted after power fail	A power failure occurred and the run was terminated.

When the stop key (or any key) is pressed again, the original settings will appear and the PowerPac is ready to start the run again (except after a power failure with PFd off. See Troubleshooting for details). Changes made during Pause mode will be lost.

### 3.4 Changing System Defaults using the Setup Menu

The setup menu allows the user to activate the automatic power recovery function, turn off the rapid resistance change safety function, turn off the alarm, and adjust the display contrast.

#### Power Failure Detection (PFd)

The default setting for Power Failure Detection (PFd) is OFF. If a power failure (or multiple power failures) occurs during a run when PFd is ON, the PowerPac HC will automatically resume the run when power is restored. This occurs whether the run is timed or continuous. After the run has been completed or stopped, PFd is reset to its default setting, OFF.









**Note:** The PowerPac HC cannot distinguish between a power failure and being turned off at the power switch. If PFd is ON, and the PowerPac HC is turned off at the power switch during a run, the power supply will resume the run when turned back on, possibly creating an unsafe condition. Therefore, it is important always to stop a run before turning off the power supply.

### Rapid Resistance Change Detection (RRCd)

The Rapid Resistance Change Detection safety feature alerts the user when the resistance load detected by the PowerPac HC has changed by more than 25% over a brief time-period, possibly indicating an unsafe condition. Certain applications, such as use with the DCode or DGene systems, might exhibit resistance changes  $\geq 25\%$  and trigger a shutdown erroneously before completion of the run if RRCd is not turned off. For these applications, RRCd should be turned off. After a run has been completed or stopped with RRCd turned OFF, RRCd is reset to its default setting, ON.

### Alarm and Contrast Settings

The PowerPac HC has an alarm that signals when a timed run is started, completed, or when an error message occurs. The alarm can be turned off in the setup menu, if desired. If the alarm is turned off, it will not signal error messages. The display contrast can also be adjusted through the PowerPac HC's setup menu. Both of these user adjustments are preserved in memory, regardless of completion of the run or power shutdown. The Reset key may be used to return these settings to their defaults in the setup menu.

STEP	PROCEDURE	DESCRIPTION
1.	Access the setup menu 	Press the Setup key. This key is not active during run and pause modes.  Default settings are as follows:   <b>Note:</b> The setup menu cannot be accessed during a run.
2.	Select feature  <small>cursor</small>	Use the cursor keys to select a feature to modify. Four can be adjusted. <ol style="list-style-type: none"> <li>1. PFd: Power failure detection.</li> <li>2. RRCd: Rapid Resistance Change Detection</li> <li>3.  : Alarm</li> <li>4.  : Contrast</li> </ol>
3.	Change values  <small>values</small>	The Values keys toggle between ON/OFF for Pfd, RRCd, and alarm setting, and adjust screen contrast from 1 through 9.
4.	Reset, if needed.  <small>reset</small>	Press the reset button to return to default values:  
5.	Exit the Setup menu	Press the Setup key again.

## Section 4 Maintenance and Troubleshooting

### 4.1 Maintenance

The PowerPac HC requires little maintenance to assure reliable operation. To clean the case, first unplug the power supply. Use a damp cloth to wipe down the outer case. Ethanol may be used to wipe the case, however, prolonged contact or use may cloud the green translucent case.

### 4.2 Troubleshooting

#### 4.2.1 Basic Troubleshooting

Problem	Cause	Solution
No display/lights/fan	1. No AC power.  2. Blown fuse.	1. Check if PowerPac HC is unplugged, or problem with AC power source, or power switch is in off position "O".  2. Replace fuse. See Section 4.3 for details.
Repeated blown fuses	Hardware failure	Contact Bio-Rad Technical Resources.
Leads from cell are not long enough to fit output jacks	Output terminals for the PowerPac HC are recessed 16 mm to meet safety regulations. Some leads are not long enough to make electrical connection.	Use the PowerPac Adaptor, (Catalog number 165-5061) which accommodates most standard 4 mm banana plugs, to make a secure electrical connection. <b>Note:</b> Use of the PowerPac Adaptor voids EN61010 safety provisions.

#### 4.2.2 Power Failure Detection (PFd)

Power failure related messages provide information in the event of a power interruption during a run. The power supply and the electrophoresis cell are not at fault, and there is no actual corrective action.

The power failure detection default setting is OFF. That means that if a power outage occurs during a run, the run will be aborted and the run parameters will be lost. According to the application and user preferences, PFd may be turned ON, which will enable the PowerPac HC to resume the run automatically when power is restored.

If a power failure occurs during a run, there are several possible scenarios which are described as follows:

Message Displayed	Explanation
RUN ABORTED AFTER POWER FAIL  *PRESS STOP KEY TO RESET	PFd was OFF. The run, either timed or continuous, was aborted after a power failure occurred. After pressing the stop key to reset, the original run parameters are no longer available.
RUN STOPPED AFTER POWER FAIL  (Message alternates with final run parameters)	PFd was ON when a power failure occurred and the run was resumed automatically. The run, either timed or continuous, has been terminated by pressing the stop key. After pressing the stop key to reset, the original run parameters are available for re-run. <b>Note:</b> PFd defaults automatically to OFF after pressing the stop key.
RUN COMPLETED AFTER POWER FAIL  (Message alternates final run parameters)	PFd was ON when a power failure occurred and the run was resumed automatically. The run was timed and automatically terminated when the set run time was completed. After pressing the stop key to reset, the original run parameters are available for re-run. <b>Note:</b> PFd defaults automatically to OFF when the run is completed.

#### 4.2.3 User Serviceable Error Messages

The following user serviceable messages may appear, interrupting a run. Refer to this section for their cause and solution. Follow instructions on the screen to clear the error message and resume operation.

Problem/error message	Cause	Solution
E01 NO LOAD DETECTED  ✓ CELL & CABLES * PRESS STOP KEY	No load detected. <ul style="list-style-type: none"> <li>Electrophoresis cell not connected to the power supply.</li> <li>The current load is less than 0.01 A.</li> </ul>	Verify all electrical connections. Verify buffer levels are appropriate.  Verify the electrophoresis application's power requirements match PowerPac HC output range.
E02 SHORT CIRCUIT  ✓ CELL & CABLES * POWER OFF/ON	Short circuit detected (over current, load current is greater than 3.0 A). <ul style="list-style-type: none"> <li>Accidental shorting of output leads.</li> <li>Shorting due to wrong connections.</li> </ul>	<ul style="list-style-type: none"> <li>Insure all electrical connections are making good contact and the cables and wire electrodes are in good shape.</li> <li>Verify buffer levels are appropriate.</li> </ul>
E04 REGULATING BELOW 5V  ✓ METHOD VALUES * PRESS STOP KEY	Regulation Error. Current drawn by the electrophoresis system exceeds the set current limit of the unit, at less than 5 V.	Ensure the electrophoresis application settings and power requirements match PowerPac HC output range

<b>Problem</b>	<b>Cause</b>	<b>Solution</b>
<p>E09 RESISTANCE CHANGE DETECTED</p> <p>✓ CELL &amp; CABLES * PRESS STOP KEY</p>	<p>Change in load resistance detected. The PowerPac HC detects drastic changes in resistance which may indicate failure of the cell's power leads or a loose output connection.</p> <ul style="list-style-type: none"> <li>Loose output connections leading to intermittent connection to the loads.</li> <li>Cells added or removed during the run.</li> </ul> <p><b>Note:</b> Certain applications exhibit intrinsic fluctuations in resistance that can trigger the Resistance Change error message. If this is the case, the Resistance Change detection feature can be deactivated to allow an uninterrupted completion of the run. See Section 3.4 for details on turning off RRCd.</p> <p><b>Caution:</b> Deactivating this safety feature increases the possibility that a failure of the power leads or loose output connections will not be detected.</p>	<p>Check and correct any potential resistance problem. Verify all electrical connections. Verify buffer levels are appropriate.</p>
<p>E11 GROUND LEAK DETECTED</p> <p>✓ CELL &amp; CHILLER * POWER OFF/ON</p>	<p>Insulation failure in the electrical connections outside the power supply has caused a current flow that may create an unsafe condition.</p>	<p>Check electrical connections and check cell/chiller system for leaks. Ensure that the electrophoresis cell rests on an insulated, dry surface.</p>
<p>E16 FAN FAILURE</p> <p>✓ FAN GRID * POWER OFF/ON</p>	<p>The fan is not working, either due to a electrical failure or physical obstruction.</p>	<p>Inspect the fan grid to check if the fan blade is rotating when the power supply is turned "ON". Make sure no foreign material has penetrated the fan vent. If problem persists, contact Bio-Rad.</p>
<p>E17 SYSTEM OVERHEATING</p> <p>✓ FAN &amp; RM. TEMP * POWER OFF/ON</p>	<p>Fan vents blocked and or ambient temperature too high.</p>	<p>Clear a space of at least 6 cm around the fan vents to improve airflow. Press any key to go to the home screen to restart. Operate the unit within the recommended temperature range (0 to 40°C)</p>

#### 4.2.4 Bio-Rad Serviceable Error Messages

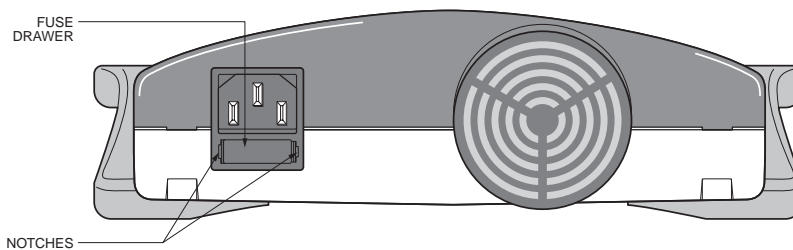
Error code	Cause	Solution
ERROR 03 * POWER OFF/ON	Output regulation problem	Restart the unit by turning the power switch OFF and ON. Contact Bio-Rad Technical Resources if problem persists.
ERROR 08 * POWER OFF/ON	Output regulation problem	
ERROR 99 * POWER OFF/ON	Hardware failure	
ERROR 98 * POWER OFF/ON	Hardware failure	

### 4.3 Replacing a fuse

If there is no display, lights, or fan, and the PowerPac HC is plugged into a working AC power outlet with the power switch in the "ON" position, the fuse may need to be replaced.

1. Disconnect the power cord from the electrical outlet.
2. Insert a flat blade screwdriver into the notches of the power entry module's fuse drawer to release it. See Figure 7.
3. Remove the fuse from the fuse drawer. Replace it with 8A, 250 V, 5x20 mm, type T fuse (Bio-Rad part number 900-8933).
4. Re-insert the fuse drawer into its position. Press the fuse drawer gently until it snaps into place.

The unit is now ready for use.



**Fig. 7. Rear View Showing Fuse Drawer with Notches.**

**Note:** Repeated blowing of the fuse indicates a hardware failure. Contact Bio-Rad Technical Support.

### 4.4 Expediting Technical Support

Make sure the following information is readily available before contacting Bio-Rad.

**Product model no:** Located in the sticker on the bottom of the unit (example: PowerPac HC Power Supply).

**Serial number:** Located in the sticker on the bottom of the unit (example: xxxBRxxxxx).

**Software version:** The PowerPac HC displays the software version momentarily after switching the power ON (example: Firmware 1.00).

State clearly the error code, error message or anomaly, and the conditions that originated the problem, including run parameters (V, A, and W) as well as the electrophoresis cell and buffer system.

## Appendix A Specifications

Output specifications	250 V, 3.0 A, 300 W
Output range (programmable)	5–250 V, fully adjustable in 1 V increments 0.01–3.0 A, fully adjustable in 0.01 A increments 1–300 W, fully adjustable in 1 W increments
Type of output	Constant voltage, current, or power with automatic crossover
Output terminals	4 pair recessed banana jacks in parallel
Timer	up to 99 hr, 59 min
Pause/resume function	yes
Display	2 line, 16 character backlit LCD
Operating conditions	0–40°C; 0–95% humidity in the absence of condensation
Safety compliance	EN61010
EMI	Conforms to CE standards for emissions and immunity class A, tested only at 230 V. TÜV EMC certification
Safety features	No load detection; sudden load change detection; ground leak detection; overload/short circuit detection; overvoltage protection; overheating protection
Input protection	Fuse on hot and neutral
Input power (nominal)	100–120/220–240 VAC, autoswitching
Dimensions (D x W x H)	28.5 X 25 X 8 cm
Weight	2.0 kg

## **Appendix B Warranty and Ordering Information**

### **Warranty**

The PowerPac HC is warranted for 1 year against defects in materials and workmanship. If any defects should occur during this warranty period, Bio-Rad Laboratories 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 cables or connectors not specified by Bio-Rad Laboratories for this power supply.
4. Deliberate or accidental misuse.
5. Damage caused by disaster.

For inquiry or request for repair service, contact your local Bio-Rad office.

### **Warranty Information**

Model: \_\_\_\_\_

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

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

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

### **Ordering Information**

<b>Catalog Number</b>	<b>Description</b>
164-5052	PowerPac HC power supply, 100–120/220–240V
165-5061	PowerPac Adaptor, qty 1
165-5066	PowerPac Adaptor, qty 2
900-8933	Replacement Fuse, 8 A, 250 V, 5 x 20 mm, Type T, 1





**Bio-Rad  
Laboratories, Inc.**

*Life Science  
Group*

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