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**PowerPac™ HV  
Power Supply  
Instruction Manual**

**Catalog Numbers  
164-5056  
and  
164-5059**

**BIO-RAD**



## Technical Support

For Technical Support contact your local Bio-Rad office. In the US call 1-800-4BIORAD (1-800-424-6723).

Please have the following information available.

**Model number:** Located on the sticker on the bottom of the unit.

**Serial number:** Located on the sticker on the bottom of the unit.

**Firmware version:** The PowerPac HV displays the software version momentarily after switching the power ON.

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

Calibration and Service agreements are available through Technical Support.

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### Read this page before proceeding.

Bio-Rad 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.

This product is intended for laboratory use only. It is not intended for use in residential or commercial environments. 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.

PowerPac power supplies use high output voltages that are electrically grounded to minimize the risk of electrical shock. PowerPac power supplies have passed tests 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.

The following guidelines should be observed and followed.

1. Do not block the fan vents at the rear of the unit. There must be at least 6 cm clearance around the power supply during operation.
2. The power supply must be kept away from wet surfaces. Avoid splashing or leaking solutions into the power supply.
3. Always connect the power supply to a grounded AC outlet. An acceptable power cord is provided with the instrument.
4. 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.
5. Do not operate the power supply in extreme humidity (>95%) or where condensation can short the internal electrical circuits of the power supply.
6. When taking the power supply from room temperature into a cold room, the unit can be operated immediately. When removing the power supply from a cold room, the unit must be at room temperature for a minimum of 2 hours before operation.
7. Never connect a high-voltage output lead to earth ground. This cancels the floating ground of the power supply and exposes the user to potentially lethal high voltages.



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

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



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## Section 1 Introduction

### 1.1 Overview

The PowerPac HV power supply is designed to provide constant voltage, current, or power for a wide range of electrophoresis applications, including IEF and SDS PAGE. It also provides temperature control for DNA sequencing with the Sequi-gen cell.

The PowerPac HV operates at the constant value specified by the user. If a non-constant parameter becomes limiting, the PowerPac HV will automatically cross over and continue operating at the limiting parameter.

#### Output range

<b>Voltage</b>	20–5,000 Volts (V) Adjustable in 0.1 V increments from 20.0 to 99.9 V Adjustable in 1 V increments from 100 to 5000 V
<b>Current</b>	0.01–500 mA. Adjustable in 0.01 mA steps from 0.01 to 9.99 mA Adjustable in 1 mA increments from 10 to 500 mA
<b>Power</b>	0.1–400 W Adjustable in 0.1 Watt increments from 0.1 to 9.9 W Adjustable in 1 W increments from 10 to 400 W
<b>Output jacks</b>	Four sets of output jacks are provided to facilitate connection of up to four identical electrophoresis cells simultaneously

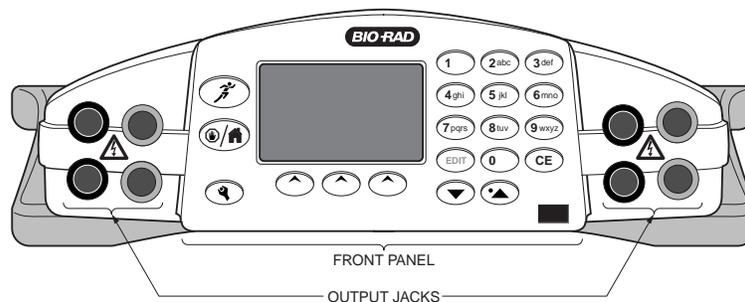


Fig. 1. Front view.

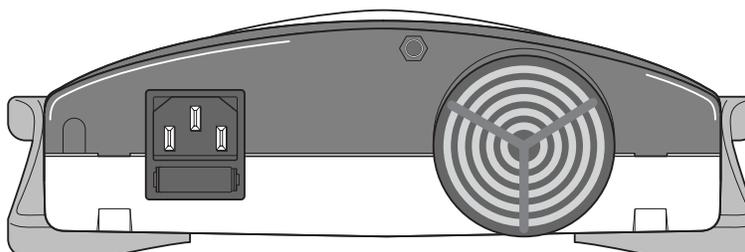
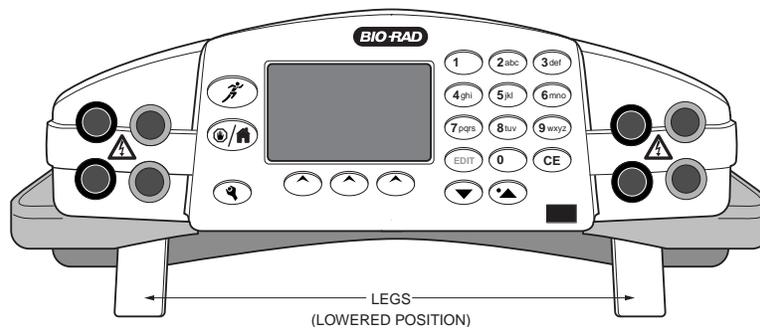


Fig. 2. Rear view.

## **1.2 Features**

The PowerPac HV has the following features:

- Constant voltage, voltage ramping, constant current or constant power operation with automatic crossover and temperature control mode
- Backlit LCD screen
- Continuous display of all parameters
- Continuous, timed and Volthours run control
- Nine (9) programmed runs, each containing up to nine steps
- Pause mode for editing running parameters
- Automatic detection of no-load, short circuit, rapid resistance change, ground leak, fan failure and system overheating
- Automatic completion (if desired) of a run interrupted by AC power failure
- Stackable case with adjustable viewing angle (Figure 3)
- Adjustable LCD display contrast
- EN 61010 international safety certification
- Input power 100–120/220–240 VAC, 50/60 Hz, auto-switching
- Four output terminals



**Fig. 3. Front panel with legs.**

### **1.3 Unpacking**

When the power supply is received, 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.

Unpack the PowerPac HV. 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.

Contents include:

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

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

## Section 2 Control Panel

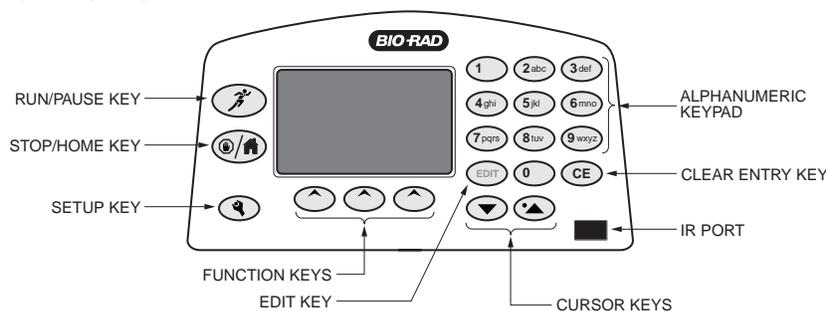


Fig. 4. Front Panel.

Key	Description
 Run/Pause	Starts or pauses a run. When paused, the run parameters for the current or subsequent step(s) may be edited. The modified method may be stored to permanent memory by pressing <b>SAVE</b> at the end of the run.
 Stop/Home	Terminates the run in progress and displays the final run parameters, or if no run is active, changes the display to the Home screen. <b>Note:</b> If a method has been edited during a run, <b>SAVE</b> must be pressed at the end of the run to save the changes.
 Setup	The <b>SETUP</b> menu allows the operator to set preferences. Press Setup key again to exit the <b>SETUP</b> menu.  Preferences include: power failure detection, rapid resistance change detection, no load detection, IR Data acquisition, contrast, key sound, temperature probe check date and time settings (see Section 3.2).
 EDIT Key	Toggles soft key assignments between those used to set the run mode (constant voltage, constant current, or constant power), run limits (voltage, current, or power) and time mode (hours, volt-hours, or untimed).
 Up & down arrows and decimal point	Used to scroll through method list or method protocol. An asterisk (*) is used to identify the selected method or step. The up arrow is used to enter decimal point during parameter programming.
 CE	Clears alphanumeric characters from a parameter value or method name. It can be considered the backspace key.
Alphanumeric keypad	Used to enter parameter values and method names. When method names are entered, the manner in which keys are pressed determines the characters entered and their placement. Rapid repetitive strokes on a single key, toggles the character displayed at the cursor position. The cursor position advances each time a different key is pressed or when there is a pause between strokes of a single key. The "0" key accesses the "pH" and hyphen "-" sequence.
Function or Soft keys	The function of the three soft keys is indicated by the legend displayed directly above the key. This will vary with the menu tree.

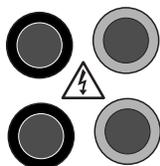
## Section 3 Product Setup

### 3.1 Power Supply Connections

This section describes how the PowerPac HV power supply is connected to an electrophoresis cell or cells.

Step	Procedure	Description
1.	Connect the power cord	Connect one end of the included power cord to the rear of the instrument. Connect the other end to a compatible power source.

2. Connect cells



Insert power leads into one of the output terminals located on the front of the power supply (shown to the left). Note that the  symbol indicates high voltages and that the power leads must be inserted perpendicular to the curve of the case (see below).

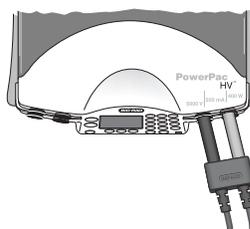


Fig. 5. Power Lead Connected Correctly

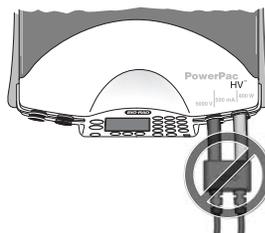
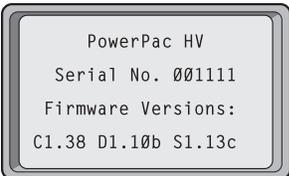
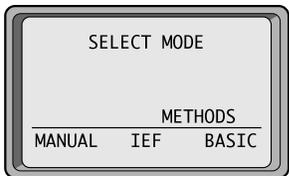
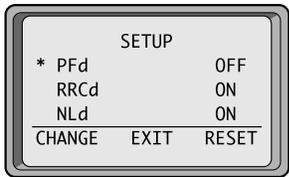


Fig. 6. Power Leads Connected Incorrectly

Step	Procedure	Description
3.	Turn power on	Use the switch located on the right side of the power supply to power on. Initially, the unit will display the firmware version and serial number for a few seconds, then go to the Home screen. The Home screen soft keys are used to select operation modes; Manual (Section 4.1), IEF Methods (Section 4.3), and Basic Methods (Section 4.2).
		
		To access the Temperature mode insert the leads of the thermocouple probe into the connections at the rear of the power supply (Section 4.4).

### 3.2 Preferences Setup

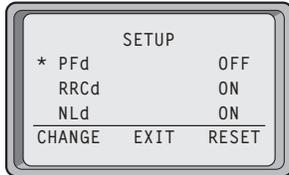
The PowerPac HV offers customizing options to enable and disable safety features and infrared (IR) port, as well as LCD display contrast adjustment, key sound, and set local time and date.

Step	Procedure	Description
1.	Open the Setup editor 	Press <b>SETUP</b> to start the Setup editor. <b>SETUP</b> can be pressed from any screen except the run screen.
2.	Select the <b>SETUP</b> preference	Scroll through the <b>SETUP</b> preferences using the arrow keys. The asterisk indicates the selected preference.
		The soft key <b>CHANGE</b> toggles between the different options or settings for the selected preference.
3.	<b>EXIT</b>	The <b>RESET</b> soft key allows the user to change all the preference settings to the default values, except for time and date. Pressing the <b>EXIT</b> soft key or the <b>SETUP</b> key accepts any changes made, and exits the <b>SETUP</b> menu.

### 3.3 Explanation of Safety Features and Setup Options

#### 3.3.1 Pfd: Power Failure Detection

Preference	Options	Description
<b>PFd</b> Power Failure Detection	OFF (Default) NEXT RUN ON	<b>OFF:</b> Turns power failure detection <b>OFF</b> . In this mode, the run is terminated if a power failure occurs.

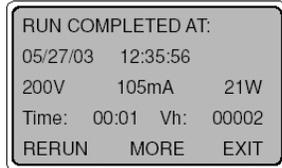


**NEXT RUN:** Turns power failure detection on for a single run. PFd will show on the upper right corner of the Run screen.

**ON:** Turns power failure detection mode on in all runs. If there is a power failure in this mode, then the run will resume when the power is restored. PFd will show on the upper right corner of the Run screen.

**Warning:** Turning the power supply off (Stopping a run in progress with PFd enabled, is regarded as a power failure.) The "interrupted" run will resume automatically when the power is restored.

1.

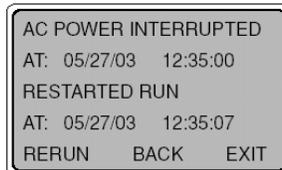


If a power failure occurred during the run with PFd enabled, the **MORE** soft key is displayed on the Run Completed screen.

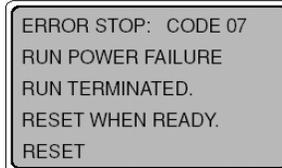
Press **MORE** to display details about the most recent power outage and when power was restored.

Press **RERUN** to restart the run.

Press **BACK** to return to the Run Completed screen. Press **EXIT** to go to the Method screen.



2.



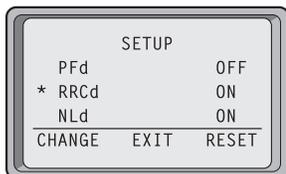
Displayed if PFd = OFF

This error screen is displayed if a run has terminated due to a power failure.

Press **RESET** to return to the Home screen.

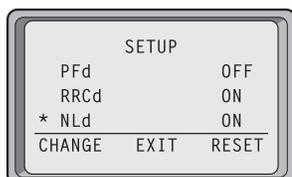
### 3.3.2 RRCd: Rapid Resistance Change Detection

Preference	Options	Description
RRCd Rapid Resistance Change detection	ON (Default) OFF	<b>ON:</b> Detection of a sudden resistance change greater than 20% will cause an alarm to sound, the run to pause, and error message code 09 to be displayed. (See Section 6.3)  <b>OFF:</b> All resistance changes are ignored and the run does not stop. When running in this mode, the  symbol is displayed on the run screen as a reminder that this safety feature has been turned off.  <b>Note:</b> Completion of certain electrophoresis applications using cells, such as the DCode™ and Rotofor®, may require <b>RRCd</b> to be turned off.

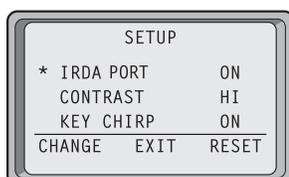


### 3.3.3 Nld: No Load Detection

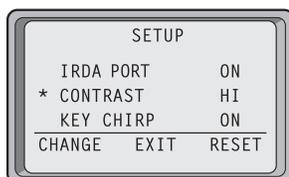
NLd No Load Detection	ON (Default) OFF	<b>ON:</b> A drop in the current below a set threshold will cause the run to pause, an alarm to sound and the error code 01 to be displayed (see Section 6.3). For example, if an electrophoresis cell is not connected or the current is too low (less than 0.02mA for Manual or Basic Methods and 0.005mA for IEF methods).  <b>OFF:</b> All load changes are ignored and the run does not stop. When running in this mode, the  symbol is displayed on the Run screen as a reminder that this safety feature has been turned off. Some IEF applications may run at a current lower than 0.005 mA, therefore, the No Load detection may need to be disabled in order to complete the run.
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IRDA Port Infrared (IR) port communication	ON (Default) OFF	<b>ON:</b> Enables IR port communication.  <b>OFF:</b> Disables IR port communication to prevent communication interference with other nearby IR devices, e.g., another PowerPac power supply
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Display CONTRAST	HI (Default) ME LO	Adjusts the display contrast to accommodate different illumination conditions.  HI   =   High contrast ME   =   Medium contrast LO   =   Low contrast
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## **Section 4 Operation**

The PowerPac HV has four operation modes:

1. Manual: Single-step run, not stored in memory. (see Section 4.1)
2. Basic Methods: Nine (9) methods with up to nine steps can be stored. (see Section 4.2)
3. IEF Methods: Nine (9) methods with up to nine (9) steps can be stored. This mode allows direct programming for high-voltage, low-current applications; also allows voltage ramping and run delay. (see Section 4.3)
4. Temperature: Incorporates temperature sensing as a limiting parameter and adjusts power output in order to control temperature in the electrophoresis cell. (see Section 4.4)

### 4.1 Manual Mode

Manual mode allows the user to program and start a single-step method with a minimum number of keystrokes. This single-step method is not stored in permanent memory.

This section describes how to program and perform a run in Manual mode.

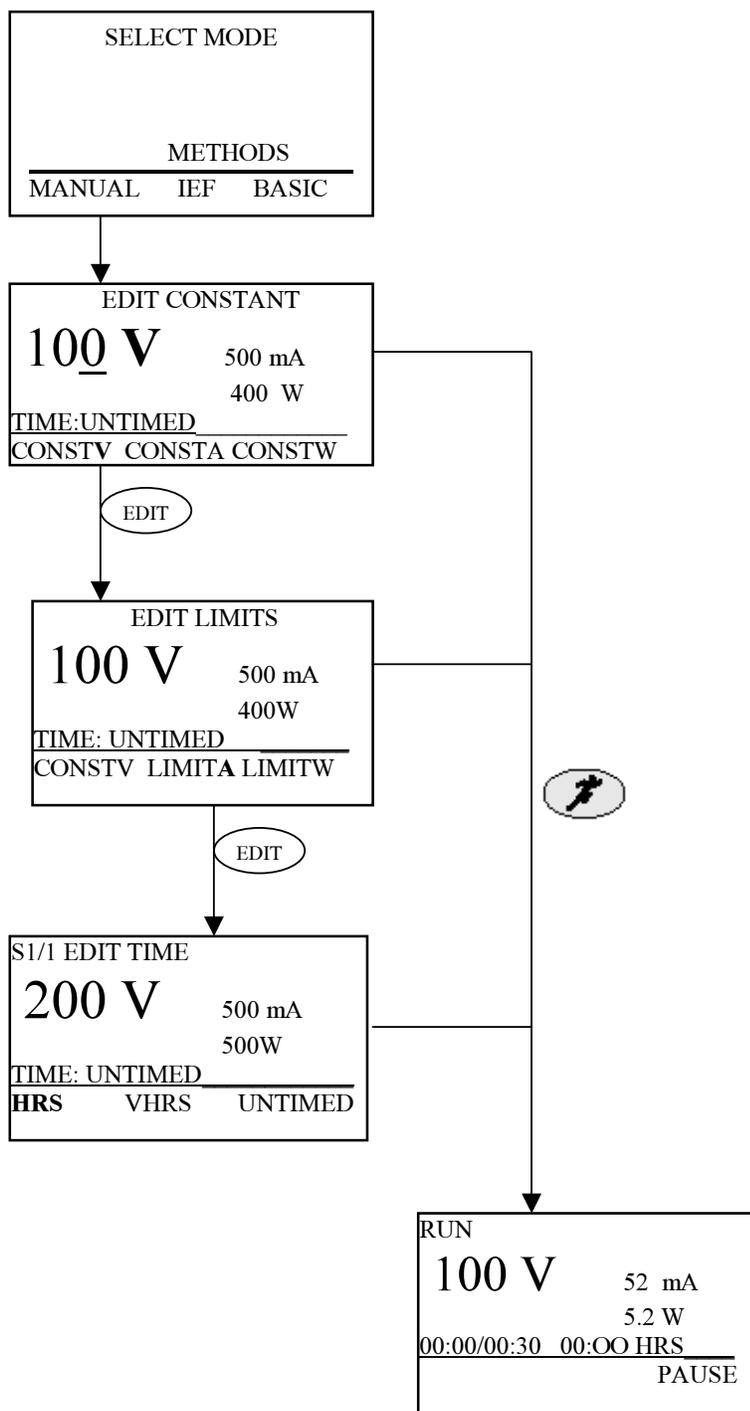
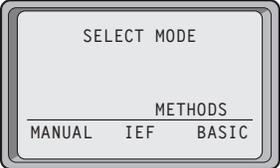
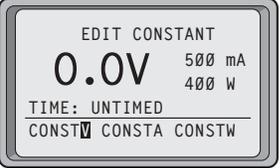
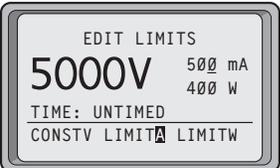
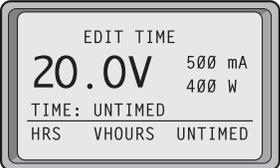
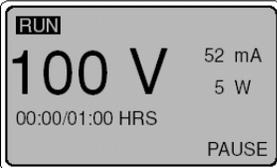
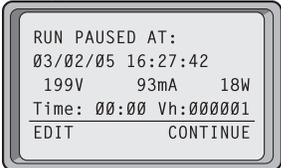


Fig. 7. Menu Overview for Manual Mode.

**4.1.1 Create, Edit and Run in Manual Mode**

<b>Step</b>	<b>Procedure</b>	<b>Description</b>
1.	Set up the power supply	Refer to Section 3 for instrument setup.
2.	Select the mode 	From the Home screen, press the <b>MANUAL</b> soft key to perform a single-step run in Manual mode. When in doubt, press <b>EDIT</b> to toggle between screens without losing entered values.
3.	Select a constant parameter 	Use the soft keys to select which parameter will be constant and the alphanumeric keypad to enter its value.  <b>CONSTV:</b> Operates with constant voltage. <b>CONSTA:</b> Operates with constant current. <b>CONSTW:</b> Operates with constant power.  Press <b>EDIT</b> to enter the value and to proceed to the <b>EDIT LIMITS</b> screen. (Step 4)  If the run will be untimed at the currently displayed constant value and limits (shown to the right of the constant parameter), go to step 6.
4.	Enter limits for the nonconstant parameters 	Use the soft keys to select a nonconstant parameter and the keypad to enter its value. Press <b>EDIT</b> key twice to go back to step 3.  <b>CONSTV, A or W:</b> Press <b>CONST</b> soft key to change the parameter value.  <b>LIMITV, A, or W:</b> Press <b>LIMIT</b> soft key to change the parameter value.  Press <b>EDIT</b> to enter the values and to proceed to the <b>EDIT TIME</b> screen.  If the run will be untimed at the currently displayed constant value and limits (shown to the right of the constant parameter), go to step 6.
5.	Select the time mode. 	Use the soft keys to select the time mode and the keypad to enter the run time.  <b>HRS:</b> Run time is in units of hours <b>VHOURS:</b> Run time is in units of volthours. <b>Untimed:</b> Run is continuous  The selected mode is shown above the line next to time. Use the soft keys to select and the keypad to enter <b>HRS</b> AND <b>VHOURS</b> .

Step	Procedure	Description
6.	Start the run  	Press  to start a run. A run may be started from any screen of the EDIT loop as long as a valid constant parameter value has been entered.
7.	Monitor the run  	The run screen displays the elapsed time versus the programmed time (timed runs), elapsed time (untimed run), voltage, current and power values.
8.	Pause  	<p>Press the soft key PAUSE or the  key to pause the run in progress.</p> <p>The run parameters and user preferences may be edited during pause.</p> <p>Press <b>EDIT</b> to change run parameters</p> <p>Press <b>SETUP</b> to change user preferences.</p> <p>Press the soft key CONTINUE or the  key to resume the run.</p>

## 4.2 Basic Methods Mode

Basic Methods Mode is used to create, run and store basic methods. It has the same programming options (edit loop) as the Manual mode. The method list stores up to nine methods, with up to nine steps each. These methods may also be transferred to or from a PDA, through the PowerPac IR port as described in Section 5.

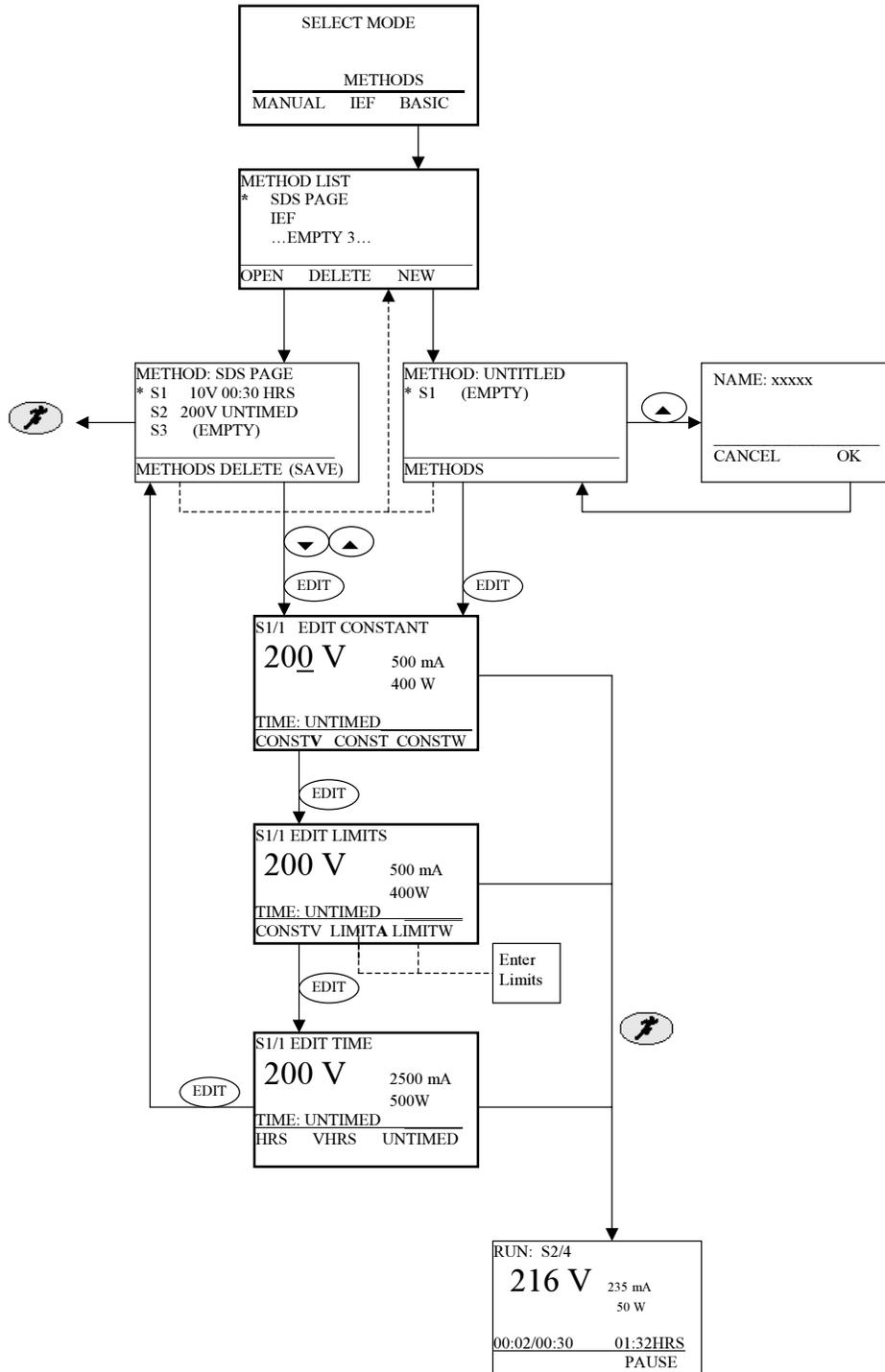
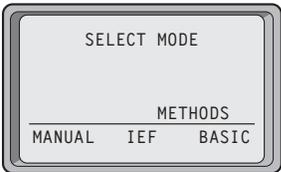
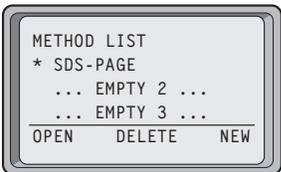
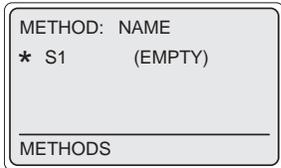
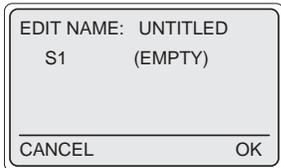
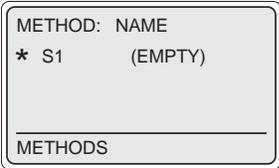
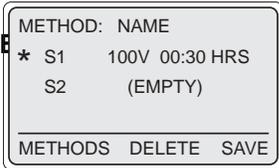
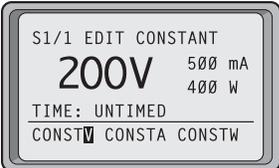
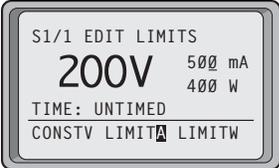


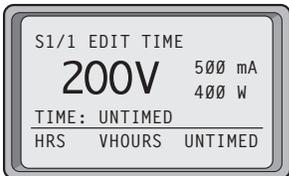
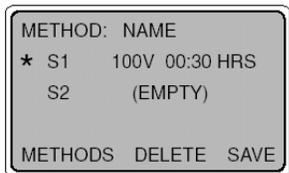
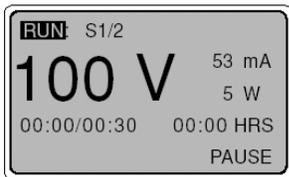
Fig. 9. Menu Overview for Basic Methods Mode.

### 4.2.2 Create, Edit and Run a Basic Method

This section describes how to create, open, modify and run Basic Methods.

Step	Procedure	Description
1.	Set up the power supply	Refer to Section 3 for instrument setup.
2.	Select the operation mode	At the Home Screen:  Press the <b>BASIC METHODS</b> soft key to display the Method List screen.
		
3.	Basic Method List	Options: <ul style="list-style-type: none"> <li>Press <b>NEW</b> to create a new method (go to step 4).</li> <li><b>OPEN</b> a stored method. An asterisk indicates the selected method. Select a stored method using the arrow scroll keys and press the <b>OPEN</b> soft key. Go to step 4 to edit method, otherwise go to step 10 to start the run.</li> <li><b>DELETE</b> a stored method. Select a stored method using the arrow scroll keys and press the <b>DELETE</b> Soft key. An asterisk indicates the selected method.</li> </ul> <p><b>Note:</b> If the method list is full (nine methods), a method needs to be deleted before a new method can be added to the list.</p>
		
4.	Name the Method	Press the up arrow key to select the method name field.  Use the <b>CE</b> button to clear the name field and the alphanumeric keypad to enter a method name. Refer to Section 2 for help using the keypad.  Press <b>OK</b> to accept the new name and return to the <b>METHOD SCREEN</b> with new or edited run name.  Press <b>CANCEL</b> to abort naming the method and return to the <b>METHOD SCREEN</b> .
	  	

Step	Procedure	Description
5.	<p>Method steps</p> <p><b>New method</b></p>  	<p>Press <b>EDIT</b> to enter the edit loop.</p> <ul style="list-style-type: none"> <li>Press the up and down arrows to select an existing step or select the (EMPTY) step to add a new step</li> <li>Press <b>EDIT</b> again to enter the edit loop for the selected step</li> </ul>
6.	<p>Set the constant parameter for the current step</p> 	<p>Use the soft keys to select the constant parameter and the keypad to enter its value. Note that the non-constant values are listed on the right side of the screen and the time mode at the bottom.</p> <p>The S## indicates which step is being modified. In this case, S1/1 means editing step 1 of 1.</p> <p><b>CONSTV:</b> Operates with constant voltage.  <b>CONSTA:</b> Operates with constant current.  <b>CONSTW:</b> Operates with constant power.</p> <p>Press <b>EDIT</b> to continue.</p>
7.	<p>Enter limits for the non-constant parameters for the current step</p> 	<p>Use the soft keys to select a parameter and the alphanumeric keypad to enter its value.</p> <p>The soft keys <b>CONST_</b> or <b>LIMIT_</b> change according to the constant parameter selected in the EDIT CONSTANT screen.</p> <p><b>Note:</b> The constant parameter value can be changed at this point. Press its soft key and enter a new value.</p> <p><b>LIMITV</b> Change the voltage limit (or constant) (<b>CONSTV</b>): value.  <b>LIMITA</b> Change the current limit (or constant) (<b>CONSTA</b>): value.  <b>LIMITW</b> Change the power limit (or constant) (<b>CONSTW</b>): value.</p> <p>Press <b>EDIT</b> to continue.</p>

Step	Procedure	Description
8.	Select the time mode 	Use the soft keys to select a time mode and the alphanumeric keypad to enter the run time. <b>HRS:</b> Run time is in units of hours. <b>VHOURS:</b> Run time is in units of volt-hours. <b>UNTIMED:</b> Run is continuous. <b>Note:</b> Steps programmed after an untimed step are ignored. Press <b>EDIT</b> to return to the Method Screen.
9.	Add a new step or save the method 	To program additional steps press the down arrow key to select the empty step and repeat Steps 5–8. If the method will not be saved, go directly to Step 10. Press <b>SAVE</b> and then go to Step 10. Press <b>DELETE</b> to delete a selected step. Press the <b>METHOD</b> soft key to return to the Method List.
10.	Start the run	Press  to start a run.
11.	Monitor the run 	The <b>RUN</b> screen is used to monitor run parameters or to pause a run. The current step, Volts, mA and Watts values, elapsed time versus the programmed time, and total elapsed time are displayed on the <b>RUN</b> screen. The method step is also indicated. This run is executing Step 1 of 2. The run may be paused by pressing the <b>PAUSE</b> soft key or the  key. To edit the run parameters during <b>PAUSE</b> see Section 4.5. Edits made during the run may be saved, if the <b>SAVE</b> soft key is pressed at the end of the run. Otherwise the method will remain as originally created. To terminate the run, press the  key.
12.		The Run Completed or Run Terminated screen is displayed at the end of a run. Press <b>RERUN</b> to repeat the run or <b>EXIT</b> to display the method step list.

### 4.3 IEF Methods Mode

The IEF Method mode is used to create, run and store Isoelectric focusing (IEF) methods. The method list stores up to nine methods, with up to nine steps each. Special programming options such as voltage ramping and run delay in the first step, allow better control during IEF separations. These methods may also be transferred to or from a PDA, through the PowerPac IR port as described in Section 5.

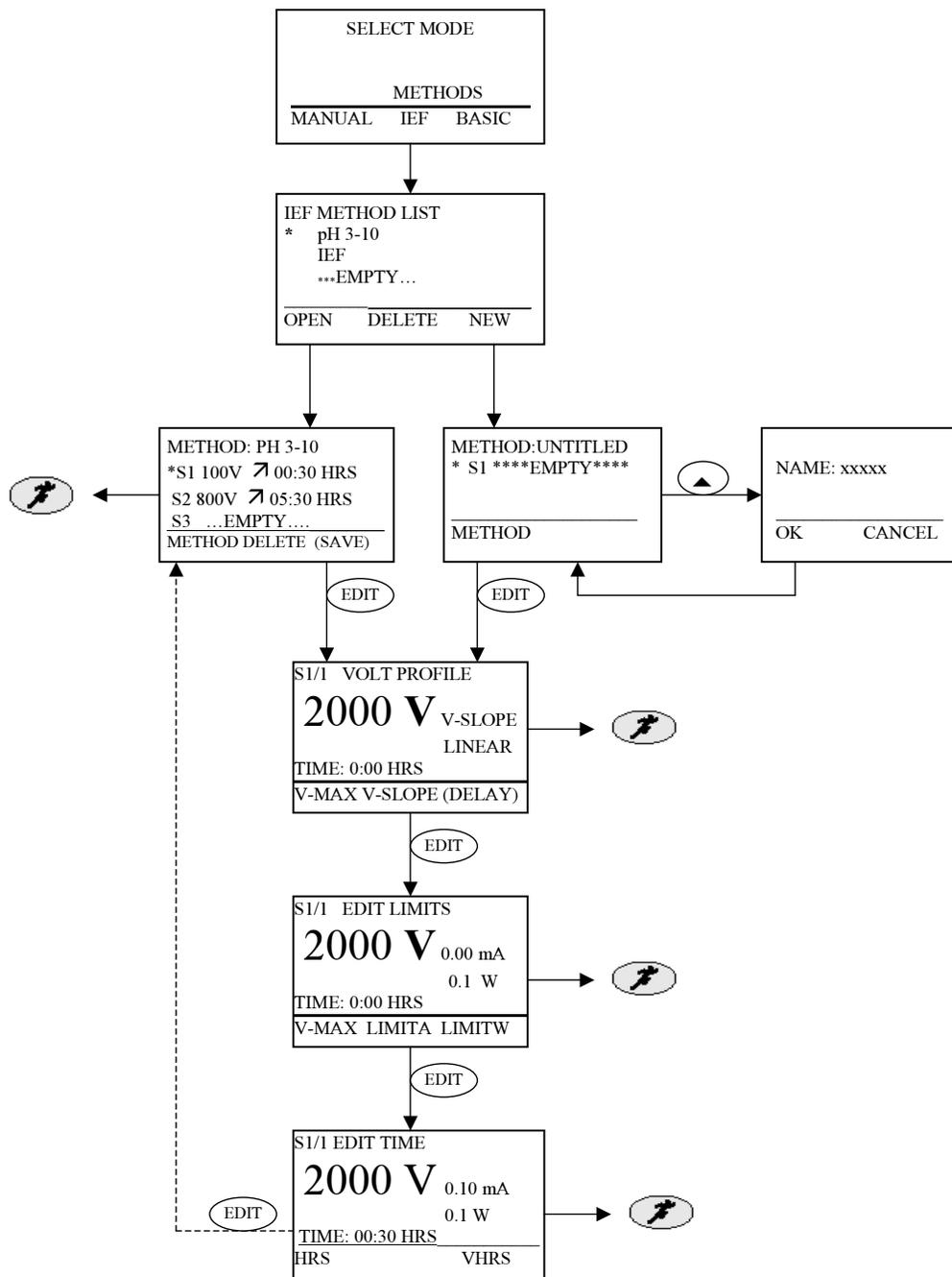
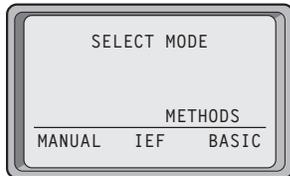


Fig. 9. Menu Overview for IEF Methods

**4.3.1 Create, Edit, and Run an IEF Method**

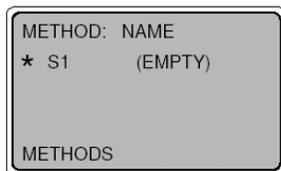
This section describes how to create and edit methods.

Step	Procedure	Description
1.	Set up the power supply	Refer to Section 3 for instrument setup.
2.	Select the operation mode	At the Home screen, press the <b>IEF METHODS</b> soft key to display the IEF Method List screen.

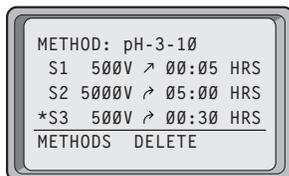
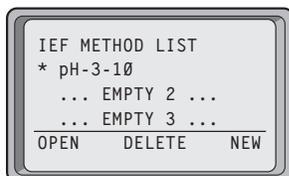


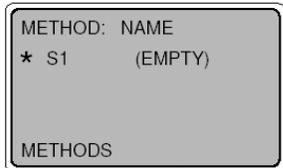
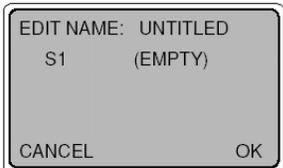
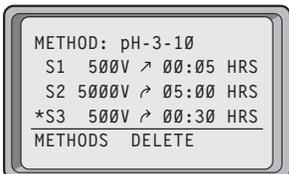
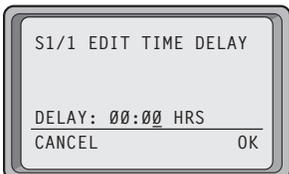
3.	IEF Method List	Options: <ul style="list-style-type: none"> <li>• Press <b>NEW</b> to create a new method (go to step 4).</li> <li>• <b>OPEN</b> a stored method. Select a stored method using the arrow scroll keys, an asterisk indicates the selected method, and press the OPEN soft key. Go to step 4 to edit method, otherwise go to step 11 to start the run.</li> <li>• <b>DELETE</b> a stored method. An asterisk indicates the selected method. Select a stored method using the arrow scroll keys and press the <b>DELETE</b> Soft key.</li> </ul>
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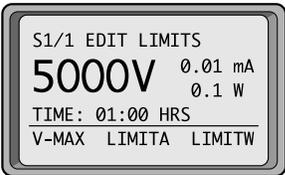
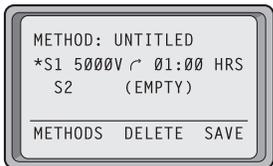
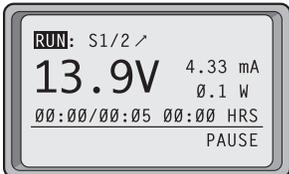
**New method**



**Existing method**



Step	Procedure	Description
4.	<p>Method name</p>  	<p>Name a method.</p> <ul style="list-style-type: none"> <li>Press the up arrow key to select the method name field.</li> <li>Use the <b>CE</b> button to clear the name field and the alphanumeric keypad to enter a method name. Refer to Section 2 for help using the keypad.</li> <li>Press <b>OK</b> to accept the new name and return to the <b>METHOD SCREEN</b> with new or edited run name.</li> </ul> <p>Press <b>CANCEL</b> to abort naming the method and return to the <b>METHOD SCREEN</b>.</p>
5.	<p>Method steps</p> 	<p>Enter the Step Edit sequence.</p> <ul style="list-style-type: none"> <li>Press the up and down arrows to select an existing step or select the (EMPTY) step to add a new step.</li> <li>Press <b>EDIT</b> to enter the edit loop for the selected step.</li> </ul>
6.	<p>Set the Voltage profile</p> 	<ul style="list-style-type: none"> <li>Use the <b>V-MAX</b> soft key to enter the maximum voltage value with the keypad for the current step</li> <li>Use the <b>V-SLOPE</b> soft key to select the voltage ramping (slow, linear or rapid).</li> </ul> <p>Press <b>EDIT</b> to proceed to step 8, Edit Limits.</p> <p>Use the <b>DELAY</b> soft key, available only in the first step of a method, to program a run delay. No voltage is applied during the duration of the step.</p>
7.	<p>Set time delay</p> 	<ul style="list-style-type: none"> <li>Enter the time delay and press <b>OK</b> to accept, and go to the method steps screen (step 5) to edit additional steps.</li> <li><b>CANCEL</b> to return to the Volt profile screen.</li> </ul>

Step	Procedure	Description
8.	Enter parameter limits	<p>Current or power limits must be set according to application instructions to prevent overheating of the IEF device .</p> <p>Use the soft keys to select a limit parameter and the keypad to enter its value. Once the limit mA or W has been entered, the complementary value will be automatically calculated by pressing the LIMIT soft key or EDIT key.</p> <p><b>V-MAX:</b> Change the voltage limit value.  <b>LIMITA:</b> Set the current limit value.  <b>LIMITW:</b> Set the power limit value.</p> <p>Press <b>EDIT</b> to continue.</p>
		
9.	Select the time mode	<p>Use the soft keys to select a time mode and the keypad to enter the run time.</p> <p><b>HRS:</b> Run time is in units of hours.  <b>VHOURS:</b> Run time is in units of volt-hours.</p> <p>Press <b>EDIT</b> to continue.</p>
		
10.	Add a new step or save the method	<p>To program additional steps press the down arrow key to select the empty step and repeat steps 5–9. If the method will not be saved, start the run. Press <b>SAVE</b> and then start the run.</p> <p>Press <b>DELETE</b> to delete a selected step.</p> <p>Press the <b>METHOD</b> softkey to return to the Method List.</p>
		
11.	Start the run	Press  to start a run.
12.	Monitor the run	<p>The run screen is used to monitor run parameters or to pause a run. The current step, voltage ramping, mA and W, elapsed time versus the programmed time, and total elapsed time are displayed on the run screen. The method step is also indicated. This run is executing Step 1 of 2.</p> <p>The run may be paused by pressing the <b>PAUSE</b> soft key or the  key.</p> <p>To edit the run parameters during <b>PAUSE</b>, see Section 4.5. Edits made during the run can be saved by pressing the <b>SAVE</b> soft key at the end of the run.</p> <p>To terminate the run press the  key.</p>
		

Step	Procedure	Description
13.		The Run Completed or Run Terminated screen is displayed at the end of a run. Press <b>RERUN</b> to repeat the run or <b>EXIT</b> to display the method step list.

#### 4.4 Temperature Mode

The Temperature operation mode is used to run an electrophoresis apparatus at constant temperature. Temperature control is very useful to perform DNA sequencing and Single Stranded Conformational Polymorphism (SSCP) analysis in the Sequi-Gen® GT system. The temperature limit may be set from 30 to 90°C; actual temperature will be controlled from room temperature to 90°C.

The PowerPac HV monitors the temperature of the electrophoresis cell through the temperature probe (catalog #165-5058) attached to the wall of the cell. The temperature of the cell is controlled by regulating the power output (in W) once the cell temperature is within 2°C of the set temperature.

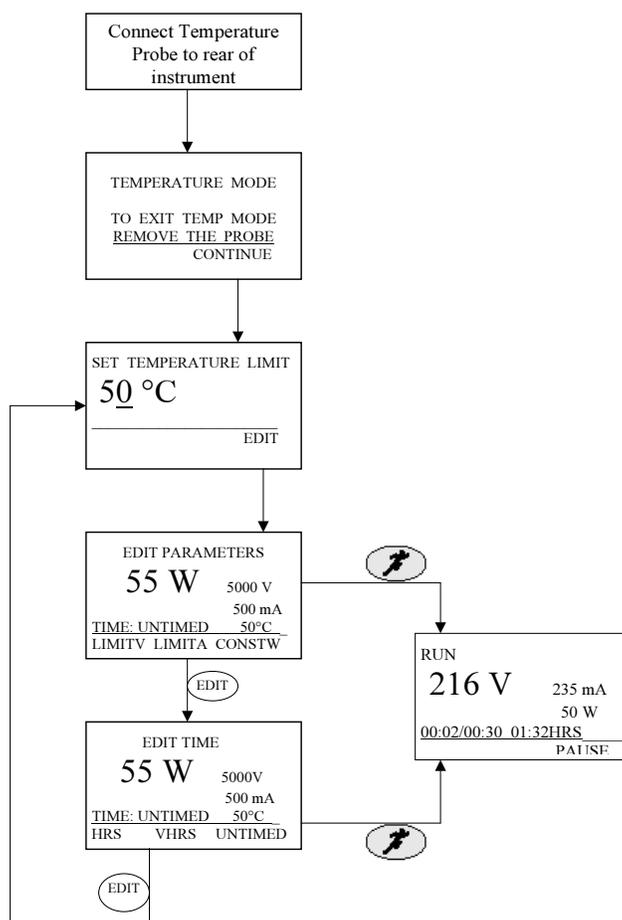
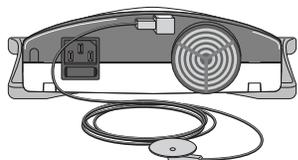


Fig. 10. Menu Overview for Temperature Mode

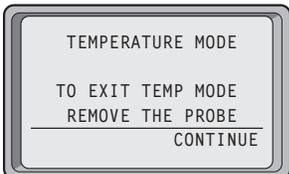
4.4.1 Create, Edit and Run in Temperature Method

Step	Procedure	Description
1.	Set up the power supply	Refer to Section 3 for instrument setup.

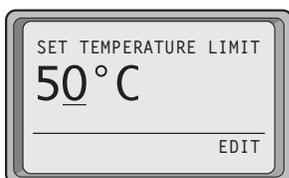
2.	Connect temperature probe to the back of the PowerPac HV	The Temperature mode may be accessed from any screen, except for the run screen, by connecting the probe.
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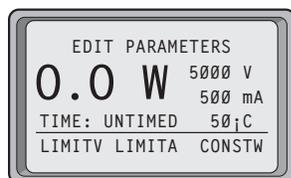
3.	Attach probe to the electrophoresis cell	Use the suction cup to attach the temperature probe to the electrophoresis cell. Make sure the suction cup remains attached during the run.
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4.		<p>The Temperature mode introduction screen appears automatically.</p> <p>Press the <b>CONTINUE</b> soft key.</p> <p><b>Note:</b> See Section 3.3.4 for additional information on TEMP PROBE options.</p>
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5.	Set temperature limit	<p>Use the alphanumeric keypad to enter the desired temperature (30°–90°C).</p> <p>Press the <b>EDIT</b> soft key to continue.</p>
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6.	Enter parameters	<p>Use the soft keys to select a parameter and the keypad to enter its value. To change the constant value, press its soft key and enter a new value.</p>
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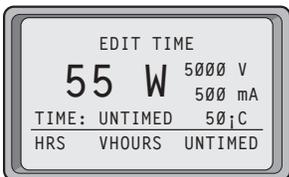
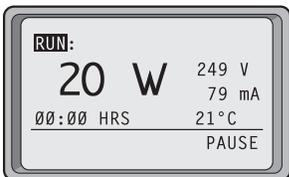
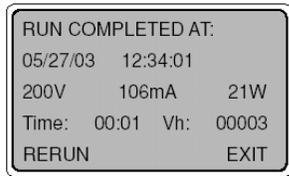
**LIMITV:** Change the voltage limit value.

**LIMITA:** Change the current limit value.

**CONSTW:** Enter the power constant value.

**Note:** The constant power value entered will never be exceeded even if the cell fails to reach the set temperature.

Press **EDIT** to continue.

Step	Procedure	Description
7.	Select the time mode 	Use the soft keys to select a time mode and the alphanumeric keypad to enter the run time. <b>HRS:</b> Run time is in units of hours. <b>VHOURS:</b> Run time is in units of volt-hours. <b>UNTIMED:</b> Run is continuous.
8.	Start the run	Press  to start a run.
9.	Monitor the run 	The <b>RUN</b> screen is used to monitor run parameters or to pause a run. The current step, V, voltage ramping, mA and W, elapsed time versus the programmed time, and total elapsed time are displayed on the run screen. The run may be paused by pressing the <b>PAUSE</b> soft key or the  key. To edit the run parameters during <b>PAUSE</b> see step 6. To Edit preference see Section 3. Edits made during the run may be saved if <b>SAVE</b> soft key is pressed at the end of the run. Otherwise the method will remain as originally created. To terminate the run, press the  key. <b>Note:</b> If the temperature reaches 5° over the set temperature, an alarm will sound intermittently until the situation is resolved. That is, until the power is reduced or the temperature of the gel drops. The alarm sounds similar to the end of run, but repeats.
10.		The Run Completed or Run Terminated screen is displayed at the end of a run. Press <b>RERUN</b> to repeat the run or <b>EXIT</b> to display the method step list.

### 4.5 Edit a Paused Run

The PowerPac HV permits editing the run parameters during a pause in all operation methods modes: Manual, Basic, IEF Methods, and Temperature Mode. The edit capability during Pause is limited to the current and subsequent steps, and follows the same edit sequence used when programming the original run. If the current step started as untimed it cannot be changed to hours or volt-hours.

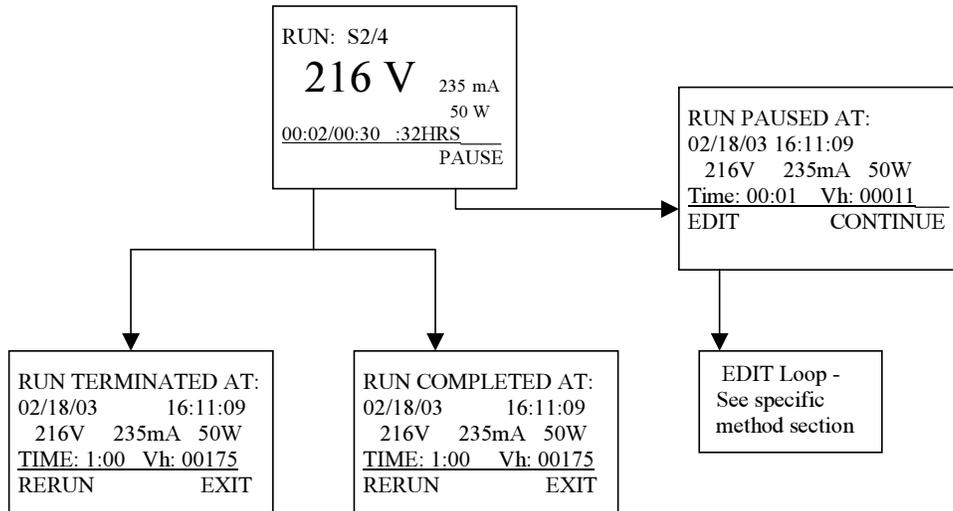
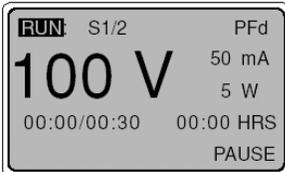
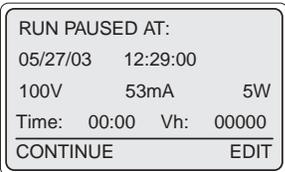
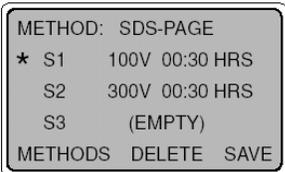


Fig. 11. Menu Overview for Editing a Paused Method.

4.5.1 Editing a Paused Run

Step	Procedure	Description
1.	<p>Pause the run</p> 	<p>Press the <b>PAUSE</b> soft key or  to pause a run that is in progress. The S## indicates this run is performing Step 1 of 2 steps.</p>
2.	<p>Edit the method</p> 	<p>The pause window displays the current run parameters as well as the date and time that the run was paused.</p> <p>Press the <b>EDIT</b> soft key or front panel <b>EDIT</b> button to edit the run parameters. Follow the instructions in the appropriate section.</p> <ul style="list-style-type: none"> <li>• Section 4.1 for Manual run editing</li> <li>• Section 4.2 for Basic Methods editing</li> <li>• Section 4.3 for IEF Methods editing</li> <li>• Section 4.4 for Temperature mode run editing</li> </ul> <p>Use the <b>CONTINUE</b> soft key or  to resume the run.</p>
3.	<p>Exit the Run Completed screen</p> 	<p>After the run is finished, press EXIT to return to the method screen to save the edits (step 4).</p> <p>Press RERUN to restart the run, keeping the run parameters the same as the last edit.</p>
4.	<p>Save the changes</p> 	<p>From the Method screen, press <b>SAVE</b> to save any changes made during the run.</p> <p>Note: Pressing <b>SAVE</b> will overwrite the original method.</p>

## Section 5 Data Transfer Using the Infrared (IR) Port and Data Transfer Software

### 5.1 Overview

The PowerPac HV is capable of transmitting methods and data through an infrared (IR) port located on the front of the power supply (Figure 13). This optional PowerPac Data Transfer Software (DTS)(catalog #164-5067) includes the PowerPac Remote application for a PDA.

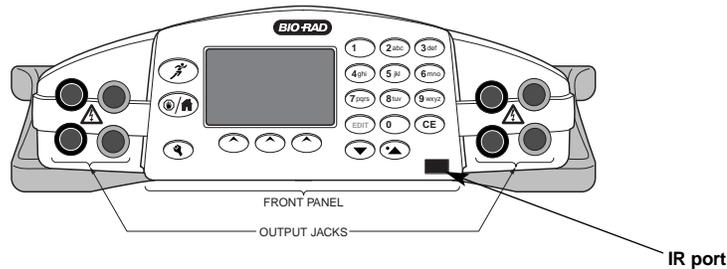


Fig. 12. IR port location

Methods can be transmitted to and from the PDA. Run data can be transmitted to a personal computer (PC), either directly from the power supply or through a PDA.

Using the PDA with PowerPac Remote, methods can be created, stored and beamed to and from the PowerPac HV. The PDA may also be used as the intermediary to store and transfer data from PowerPac to the PC (Figure 14).

The PC data transfer software function will receive, store and process run data. The PC data transfer software will not transfer data back to the PDA or PowerPac HV.

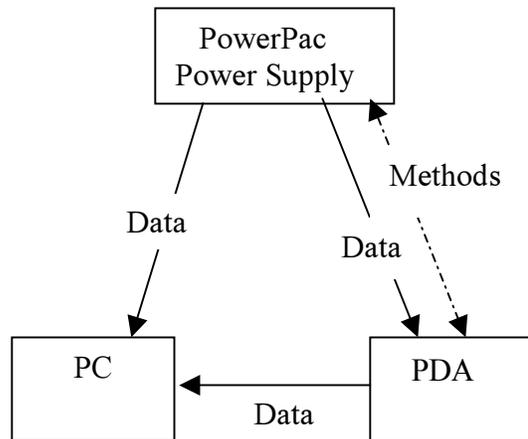


Fig. 13. Overview of Data Transfer

## **5.2 System Requirements**

Minimum PC specifications

- Windows 2000 or Windows XP Operating System
- 400 MHz processor
- 256 MB RAM minimum, 512 MB recommended
- 1,024 x 768 screen resolution, with true-color mode (24 or 32 bits)
- 10 GB hard drive
- CD-ROM drive
- Infrared (IR) port or adaptor

Minimum PDA specifications

- Palm Operating System, Version 4.0
- 8 MB memory

## **Section 6 Maintenance and Troubleshooting**

### **6.1 Maintenance**

The PowerPac HV requires little maintenance to ensure reliable operation. To clean the case, first unplug the power supply. Use a soft, damp cloth to wipe the outer case.

Keep the PowerPac HV away from liquids. Prevent them from entering the case.

Inspect the power cord regularly. Replace it if the cord is damaged or the prongs are bent or corroded (catalog #165-9005).

Replace the temperature probe if the cord is damaged or the connectors are bent or corroded (catalog #165-5058).

#### **6.1.1 Replacing a Fuse**

If the power supply is plugged into a working outlet with the power switch ON, and there is no display, lights nor fan operation, the fuse may need to be replaced.

1. Disconnect the power cord from the electrical outlet.
2. Use a slot head screwdriver to press the tabs on the side of the fuse holder toward each other. This will release the fuse holder and the fuses. (Figure 15) Inspect the fuses visually to determine if one or both of the fuses are blown. If a fuse is blown, it will be discolored or the internal element will be broken.
3. Remove the blown fuse from the holder. Replace it with 8 A, 250 V, 5 x 20 mm, type T, fuse (catalog #900-8933).
4. Reinsert the fuse holder into position. Press the fuse holder gently until it snaps into place on both sides.
5. Reconnect the power cord to the outlet. The unit is now ready for use.

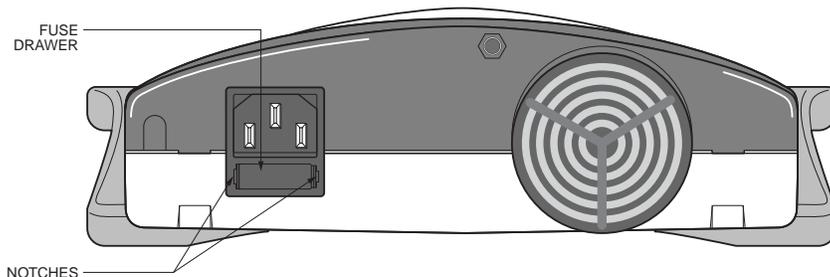


Fig. 14. Location of fuse

**Note:** If the fuses need to be replaced regularly, there may be a hardware failure. Contact Bio-Rad Technical Support.

### 6.1.2 Replacement Parts

Catalog Number	Description
900-8933	Replacement Fuse, 8 A, 250 V, 5 x 20 mm, type T
165-9005	Power Cable
165-5058	Temperature Probe

## 6.2 Troubleshooting

Problem	Possible Cause	Solution
No display/lights/fan	1. No AC power.	1. Check if the PowerPac HV is unplugged, or if there is a problem with the AC power source, or if the power switch is in the “off” position.
	2. Blown fuse	2. Replace the fuse. See Section 6.1.1 for details.
Repeatedly blown fuses	Hardware failure	Contact Bio-Rad Technical Support.
Leads from the cell are not long enough to fit the output jacks	Some leads are not long enough to make electrical connection. The output terminals for the PowerPac HV are recessed 27 mm to meet safety regulations.	The PowerPac HV not compatible with any adaptors or banana plugs. The PowerPac HV can only be operated safely with the included connectors.
Clock settings are lost	Clock battery is low.	Contact Bio-Rad Technical Support.

### 6.3 Error Messages

Error Message	Possible Cause	Solution
ERROR STOP: <b>CODE 01</b> NOLOAD DETECTED CORRECT AND CONTINUE RUN PAUSED	<ol style="list-style-type: none"> <li>1. Electrophoresis cell not connected to the power supply or buffer levels too low.</li> <li>2. The current load is less than 0.02 mA.</li> </ol>	<ol style="list-style-type: none"> <li>1. Make sure all electrical connections are making good contact and the cables and wire electrodes are in good shape.</li> <li>2a. Verify buffer levels are appropriate.</li> <li>2b. Verify the electrophoresis application power requirements match PowerPac HV output range. See Section 3 to disable this safety feature.</li> </ol>
ERROR STOP: <b>CODE 02</b> OVER CURRENT CORRECT AND CONTINUE RUN PAUSED	<ol style="list-style-type: none"> <li>1. Accidental shorting of output leads.</li> <li>2. Shorting due to wrong connections.</li> </ol>	<ol style="list-style-type: none"> <li>1. Make sure all electrical connections are making good contact and the cables and wire electrodes are in good shape.</li> <li>2. Verify buffer levels are appropriate.</li> </ol>
ERROR STOP: <b>CODE 03</b> OVER VOLTAGE CORRECT AND CONTINUE RUN PAUSED	Connection to an external source or control circuitry problem.	<ul style="list-style-type: none"> <li>• Press the <b>CONTINUE</b> soft key to continue the run.</li> <li>• If the problem continues, run, cycle power and restart the run. If the problem persists, contact Bio-Rad Technical Support.</li> </ul>
ERROR STOP: <b>CODE 07</b> RUN POWER FAILURE RUN TERMINATED RESET WHEN READY	AC power interruption during a run and the run is terminated because the Power failure detection is <b>OFF</b>	<ul style="list-style-type: none"> <li>• To continue a run after a power failure, activate the power failure detection mode in the Setup window prior to each run. See Section 3 for detailed explanation.</li> </ul>
ERROR STOP: <b>CODE 08</b> REGULATION ERROR RUN TERMINATED RESET WHEN READY	Control circuitry problems.	<ul style="list-style-type: none"> <li>• Press the <b>RESET</b> soft key to clear the screen, then restart the run.</li> <li>• If the problem continues, turn the instrument off then on. Restart the run. If the problem persists, contact Bio-Rad Technical Support.</li> </ul>

<b>Error Message</b>	<b>Possible Cause</b>	<b>Solution</b>
<p>ERROR STOP: <b>CODE 09</b>                      RAPID CHANGE IN R                      CORRECT AND CONTINUE                      RUN PAUSED</p>	<ol 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> <li>Change in buffer levels</li> </ol>	<ol style="list-style-type: none"> <li>Verify all electrical connections.</li> <li>Pause power supply prior to adding or removing electrophoresis cells</li> <li>Verify buffer levels are appropriate.</li> </ol> <p><b>Note:</b> Certain applications exhibit intrinsic fluctuations in resistance (e.g., use of DCode cell). If this is the case, the load detection feature can be disabled to allow uninterrupted completion of the run. See <b>SETUP</b>, Section 3.</p>
<p>ERROR STOP: <b>CODE 11</b>                      GROUND LEAK                      CORRECT AND CONTINUE                      RUN PAUSED</p>	<p>Insulation failure in the electrical connections outside the power supply.</p>	<ul style="list-style-type: none"> <li>Current flow is not desirable and could be harmful.</li> <li>Check electrical connections, electrophoresis cell, and chiller system for leaks. Verify that the electrophoresis cell rests on an insulated and dry surface.</li> <li>Check power source connections. Additional capacitance from external EM filters or an uninterruptible power supply can cause excessive ground currents.</li> </ul>
<p>ERROR STOP: <b>CODE 12</b>                      REGULATION ERROR                      RUN TERMINATED                      RESET WHEN READY</p>	<p>Improper load or connection to a voltage source</p>	<ul style="list-style-type: none"> <li>Press Reset and restart the run.</li> <li>If the problem continues, cycle power and restart the run. If the problem persists, contact Bio-Rad Technical Service.</li> </ul>
<p>ERROR STOP: <b>CODE 13</b>                      PERM MEM ERROR</p>	<p>Internal circuitry problems</p>	<p>Turn power supply off and on then restart run. If problem persists, contact Bio-Rad Technical Support.</p>
<p>ERROR STOP: <b>CODE 16</b>                      TPROBE PLUG IN                      ERROR                      RUN TERMINATED                      RESET WHEN READY</p>	<p>The run is terminated, either:</p> <ol style="list-style-type: none"> <li>The temperature probe is disconnected from the PowerPac during a temperature run.</li> <li>The temperature probe is connected to the PowerPac during a non-temperature mode run.</li> </ol>	<p>Press the RESET soft key and restart the run or program a new run as needed.</p>

## PowerPac HV – Instruction Manual

Error Message	Possible Cause	Solution
ERROR STOP: <b>CODE 18</b> TEMP REG ERROR CORRECT AND CONTINUE RUN PAUSED	The set temperature cannot be reached because: 1. The temperature probe is no longer connected to the electrophoresis cell or the temperature probe made poor contact with the electrophoresis cell. 2. The programmed power is insufficient to reach the set temperature.	1. Make sure the temperature probe is securely fastened to the electrophoresis cell.  2. Adjust the power so it is sufficient to reach the set temperature.  Press CONTINUE after the appropriate corrections are made.  Press CANCEL to terminate the run
ERROR CODES: <b>14, 15, 17, 19–99</b>	Hardware malfunction	Turn power supply off and on then restart run. If problem persists, contact Bio-Rad Technical Support.

### Contacting Technical Support

For Technical Support Contact your local Bio-Rad office. In the US call 1-800-4BIORAD (1-800-424-6723)

Please have the following information available:

**Model number:** Located on the sticker on the bottom of the unit.

**Serial number:** Located on the sticker on the bottom of the unit.

**Firmware version:** The PowerPac HV displays the software version momentarily after switching the power ON.

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 electrophoresis cell and buffer system.

Calibration and Service agreements are available through Technical Support.

## Appendix A

### Technical Specifications

Output (programmable)	
Voltage	20–5,000 V
Current	0.01–500 mA
Power (maximum)	1–400 W
Output regulation (with automatic crossover)	Constant voltage, constant current, constant power, or constant temperature
Timer control	1 min to 99 hr, 59 min
Volt-hour control	Yes, 99,999 V-hr
Pause/resume function	Yes
Display functions	128 x 64 pixel, yellow-green backlit graphics LCD
Programming	Up to 9 methods, each with up to 9 steps each
Real-time editing	Yes
Real-time clock	Yes
Automatic recovery after power failure	Yes, user-selectable; setup values maintained
Data transfer/archiving	Yes
Temperature control	Yes, via temperature probe; 30–90°C ± 2°C
Microampere readout and control	Yes
Safety features	No-load detection, sudden load change detection, ground leak detection, overload/short circuit protection, overvoltage protection
Operating temperature	0–40°C
Operating humidity	0–95%
Stackability	Yes
Output jacks	4 sets in parallel
Regulatory	EN 61010, CE
IQ/OQ protocols	Yes
Input power (actual)	90–120 or 198–264 VAC, 50 or 60 Hz, autoswitching
Dimensions (W x D x H)	27.5 x 34 x 10 cm
Weight	2.85 kg (6.30 lb)

## Appendix B Warranty and Ordering Information

### Warranty

The PowerPac HV is warranted for 3 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:

- Defects caused by improper operation.
- Repair or modification done by anyone other than Bio-Rad Laboratories or an authorized agent.
- Use with cables or connectors not specified by Bio-Rad Laboratories for this power supply.
- Deliberate or accidental misuse.
- 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

Catalog Number	Description
164-5056	PowerPac HV Power Supply, 100–120/220–240 V, includes power cord
164-5059	PowerPac HV Power Supply with Temperature probe, 100–120/220–240 V, includes power cord
164-5097	PowerPac Data Transfer Software for PC and PDA
165-5098	PowerPac HV IQ/OQ Protocol Binder and Test Box
165-5099	PowerPac HV IQ/OQ Protocol Binder

### Replacement Parts and Accessories

900-8933	Replacement Fuse, 8A, 250 V, 5 x 20 mm, type T
165-9005	Power Cable
165-5058	Temperature Probe

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**Bio-Rad  
Laboratories, Inc.**

*Life Science  
Group*

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**Web site** [www.bio-rad.com](http://www.bio-rad.com) **USA** (800) 4BIORAD **Australia** 02 9914 2800 **Austria** (01)-877 89 01 **Belgium** 09-385 55 11 **Brazil** 55 21 2527 3454  
**Canada** (905) 712-2771 **China** (86 21) 6426 0808 **Czech Republic** + 420 2 41 43 05 32 **Denmark** 44 52 10 00 **Finland** 09 804 22 00  
**France** 01 47 95 69 65 **Germany** 089 318 84-0 **Greece** 30 210 777 4396 **Hong Kong** (852) 2789 3300 **Hungary** 36 1 455 8800  
**India** (91-124)-2398112/3/4, 5018111, 6450092/93 **Israel** 03 951 4127 **Italy** 39 02 216091 **Japan** 03-5811-6270 **Korea** 82-2-3473-4460  
**Latin America** 305-894-5950 **Mexico** 55-52-00-05-20 **The Netherlands** 0318-540666 **New Zealand** 64 9 415 2280 **Norway** 23 38 41 30  
**Poland** + 48 22 331 99 99 **Portugal** 351-21-472-7700 **Russia** 7 095 721 1404 **Singapore** 65-64153188 **South Africa** 00 27 11 4428508  
**Spain** 34 91 590 52 00 **Sweden** 08 555 12700 **Switzerland** 061 717 95 55 **Taiwan** (886 2) 2578 7189/2578 7241 **United Kingdom** 020 8328 2000

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