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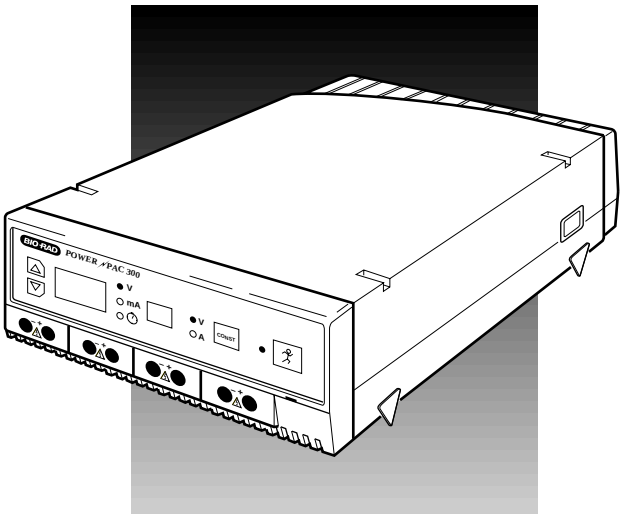
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POWER PAC 200

AND

POWER PAC 300

INSTRUCTION MANUAL

Catalog Numbers
PowerPac 200
165-5052
165-5053
PowerPac 300
165-5050
165-5051

BIO-RAD

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SAFETY



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

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.

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 which are inserted into the power supply's high voltage output jacks. These plugs have been I.E.C. 1010 certified for safety compliance for use with PowerPac power supplies. Use of other plugs or banana jacks, including the PowerPac Adapter, 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.

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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 I.E.C. 1010* 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 which are not I.E.C. 1010 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 I.E.C. 1010 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 for which it is intended or by modifications of the instrument not performed by Bio-Rad or an authorized agent.

*I.E.C. 1010 is an internationally accepted electrical safety standard for laboratory instruments.

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1.0 INTRODUCTION

1.1 OVERVIEW

PowerPac power supplies provide constant voltage or constant current to instruments used in electrophoresis and blotting. The PowerPacs are capable of the following adjustable outputs:

PowerPac 200
Voltage output: Adjustable from 5 to 200 volts in increments of 1 volt.
Current output: Adjustable from 0.01 to 2.00 Amps (2000 mA) in increments of 0.01 A.
Power output: 200 watts (maximum)

PowerPac 300
Voltage output: Adjustable from 10 to 300 volts in increments of 1 volt.
Current output: Adjustable from 4 to 400 milliAmps (mA) in increments of 1 mA.
Power output: 75 watts (maximum)

Up to four electrophoresis cells can be connected in parallel to the power supply.

The PowerPacs are programmed with default limit values for voltage and current. These are the values which are available when the unit first is turned on. These values may be changed for each application.

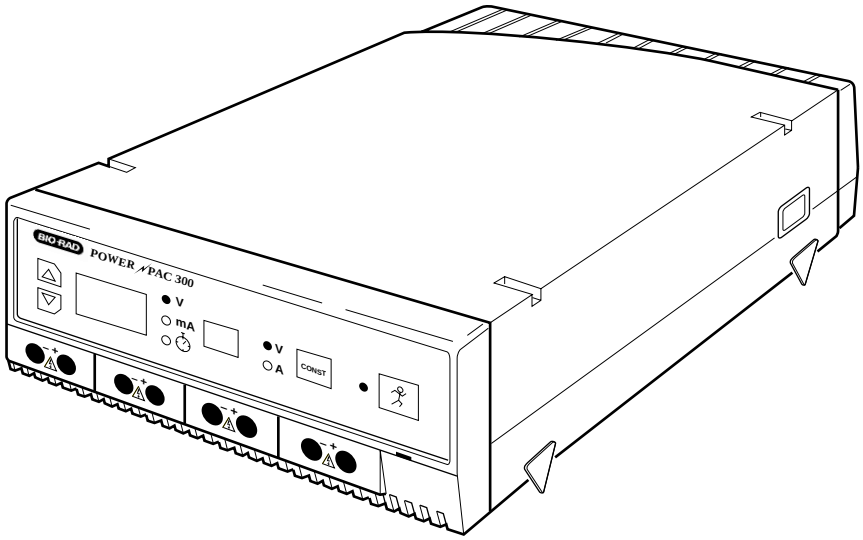


Figure 1. PowerPac 300 Power Supply

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The power supplies operate at the values specified for the constant parameter. However, to prevent damage to your electrophoresis cell, both PowerPacs provide automatic crossover to constant current or constant voltage, depending on which set value is first reached. When the set limit of the non-constant parameter is reached, and the power capability of the unit is not exceeded, the power supply will switch, making the non-constant parameter the new constant parameter.

This manual describes the function and use of the PowerPac 200 and PowerPac 300 power supplies, including all of the necessary information for system setup, operation, and maintenance.

The PowerPac 200 and PowerPac 300 power supplies offer a number of features, including the following:

- Constant voltage or constant current operation with automatic crossover.
- Timer control.
- Viewing angle adjustment.
- 3-digit LED display.
- Stackable case.
- Automatic detection of no-load conditions and rapid changes in resistance.
- Automatic completion of a run interrupted by a power failure, when user enabled.
- Ground leak detection (PowerPac 200 only).

1.2 UNPACKING

When you receive the 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.

Unpack the power supply. The PowerPac power supplies are shipped with the following:

- Power supply unit.
- 3-prong, AC power cord.
- User Manual.

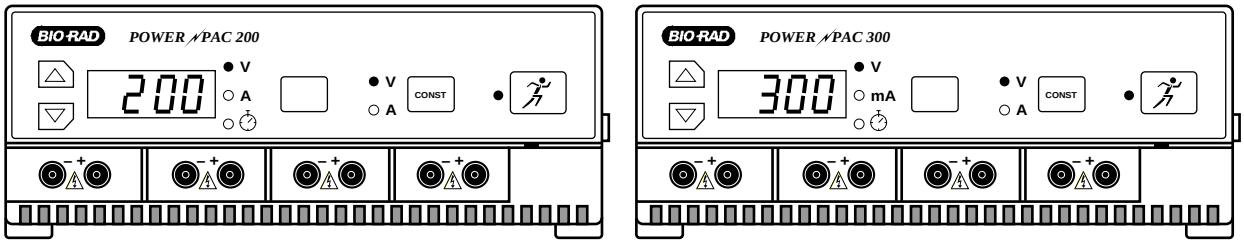
If any part is missing or damaged, contact Bio-Rad Laboratories immediately.

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2.0 CONTROL FEATURES

The front panel keys discussed in Table 1 are used to set up and run the PowerPac 200 and PowerPac 300 power supplies.

Table 1.
Front Panel Controls and Indicators

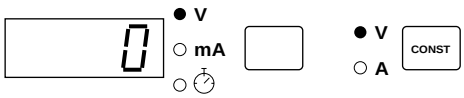
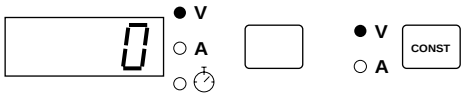
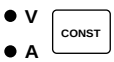
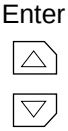


Key	Description
● V ● A CONST	**Constant key:** Selects whether voltage or current is to be constant.
PowerPac 200: ● V, ○ A, ○ ⏱ — PowerPac 300: ● V, ○ mA, ○ ⏱	**Parameter key:** Selects the parameter (volts, milliAmps/Amps, or time) to be displayed.
△ ▽	**Scroll keys:** Changes the displayed value of the selected parameter. • **PowerPac 200**: Voltage and current values change in 1V or 0.01 A steps respectively. Holding either key down more than 1 sec. changes values in 10V or 0.1 A steps. • **PowerPac 300**: Voltage and current values change in 1V or 1 mA steps respectively. Holding either key down more than a few seconds changes values in 10V or 10 mA steps. • Time is specified in minutes, with a maximum of 999 minutes.
● 🏃	**Start/Stop key:** Starts and stops the output of power from the power supply. The indicator is lit when power is being output.
● ⚡ 1 2	1. **Power switch**: Turns the power supply on and off. To turn the unit on, press the side labeled “I” on the switch; to turn the unit off, press the side labeled “O”. 2. **Power-on indicator**: This is lit when the power switch is turned on.

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3.0 SETUP AND OPERATION

Table 2.
Setup Procedure

Step	Procedure	Description
1.	Connect the electrophoresis cell(s) to the power supply. 	The power leads are color coordinated to the output terminals.  indicates high voltages may be present.
2.	Turn on the power.	a. Press the **Power** switch, located on the side of the unit. (Press the side labeled "I" on the switch.) b. The settings displayed are constant voltage and 0V. **PowerPac 300**  **PowerPac 200**  **Note**: The PowerPac 200 and PowerPac 300 return to these settings each time the unit is turned off.
3.	Select the constant parameter. 	Press the **Constant** key to select constant voltage (V) or constant current (mA or A).
4.	Enter the constant value. 	Use the **Scroll** keys to enter a value.

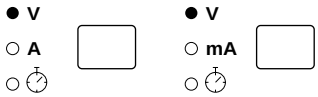
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Table 2. (continued)
Setup Procedure

Step	Procedure	Description
5.	Change the default limit, if desired. **PowerPac 300**  **PowerPac 200** 	a. Press the **Parameter** key to select the limit parameter. b. Use the **Scroll** keys to enter the new limit value. **Note:** Constant voltage: PowerPac 200 default current limit is 2.00 A. PowerPac 300 default current limit is 400 mA. Constant current: PowerPac 200 default voltage limit is 200 V. PowerPac 300 default voltage limit is 300 V.
6.	(Optional) Program a timed run. **PowerPac 300**  **PowerPac 200** 	a. Press the **Parameter** key to select the Time parameter. b. Use the **Scroll** keys to enter the run time in minutes (maximum 999 minutes.) **Note**: During timed runs, the remaining time can be viewed. When time is not set, the elapsed time can be viewed during the run. If the run is stopped, and then restarted, the timer will start over.
7.	(Optional; available only when a timed run is programmed) Select power failure recovery.  **Caution**: Always use the key and *not* the **Power** switch to stop a run in progress. Turning off the **Power** switch during a **PFd** run is treated as a power failure. The run will automatically continue when the unit is turned back on.	A time value must be entered before PFd (Power Fail detect) can be activated. To activate PFd, simultaneously push and momentarily hold both **Scroll** keys. Observe **PFd** is displayed momentarily. To de-activate PFd *before* starting the run, set the timer to 0 minutes or turn the power supply off and back on. In the event of a power failure, all operating parameters including time are retained in memory. When power is restored, the power supply *automatically* completes the run. After the run is completed, the E5 error code is displayed to alert the operator that a power failure occurred. **Reminder**: After each run, PFd is de-activated.

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Table 2. (continued)
Setup Procedure

Step	Procedure	Description
8.	Start the run. ●  Options while running: • View the run conditions. PowerPac 200 PowerPac 300  • Change the run conditions. **PowerPac 300**  **PowerPac 200** 	Press the key. The following options are available during the run: • To view the run conditions, press the **Parameter** key. • To change the value of the constant parameter or the length of a timed run, use the **Parameter** key and the **Scroll** keys. **Note**: During a run, the *value* of the limit parameter cannot be changed. The LED displays the actual run conditions.
9.	End of run. **PowerPac 300**  **PowerPac 200** 	Press the key to stop a run. To clear the display and check operating parameters, press any key other than the key.

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4.0 MAINTENANCE AND TROUBLESHOOTING

4.1 MAINTENANCE

PowerPac power supplies require very 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. Avoid wetting the connectors located below the front panel and on the rear of the unit.

4.2 TROUBLESHOOTING

If there is no LED display, check the power cord connections and the fuse in the back of the unit. (Refer to section 4.3.) If a system or operator error occurs, the appropriate error code will appear flashing on the LED display. The power supply does not output power when an error code is displayed.

Error Code	Explanation	Solution
E 1	**No Load Detected** • The electrophoresis cell(s) are not plugged in. • The cell was unplugged during a run • The current load dropped below the accepted rating, as listed below: PowerPac 300 was less than 4 mA PowerPac 200 was less than 5 mA	Check all electrical connections to the electrophoresis cell and whether the cell contains the appropriate buffer volume. Then, • Press the [run] key to resume the run or, • To clear the error code, press any key (other than the [run] key)
E 2	**Short Circuit** The current load exceeded the following: PowerPac 200: 2.5 A PowerPac 300: 400 mA	Check for and correct any short circuit or excessive load problem. Excessive load due to a high buffer concentration will require the buffer be remade. Then, • Press the [run] key to resume the run or, • To clear the error code, press any key (other than the [run] key).
E 5	**Power Failure During a Timed Run** Power Failure detect (PFd) was activated; the run was completed after the power failure. **Caution:** If a timed run with PFd activation is terminated by turning the main power switch off, the power supply will resume operation under the previous run parameters when the main power switch is turned back on.	To clear the error code, press any key (other than [run] key.) The [run] key is disabled until the error code is cleared. **Reminder:** Time is reset to zero after each timed run. Enter a time value prior to each timed run. PFd is disabled after each run. If PFd is required, activate it prior to starting the run.

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Error Code	Explanation	Solution
E 6	**Power Failure During a Timed Run** Power Failure detect (PFd) was *not* activated; run was terminated either due to power failure or because the previous run was stopped by turning off the power supply or unplugging the unit.	To clear the error code, press any key (other than [run] key.) The [run] key is disabled until the error code is cleared. **Reminder**: Time is reset to zero after each timed run. Enter a time value prior to each timed run. If PFd is required, activate it prior to starting the run.
E 7	**Power Failure During an Untimed Run** Run was terminated either due to power failure, or because the previous run was stopped by turning off the power supply or unplugging the unit.	To clear the error code, press any key (other than [run] key.) The [run] key is disabled until the error code is cleared from the display. **Reminder**: PFd can only be activated prior to a TIMED run.
E 9	**Change in Load Resistance** • Electrophoresis cells were added or removed during a run • Buffer leaking in a connected cell • Loose connection in a connected cell.	Check and correct any potential resistance problems. Then, • Press the [run] key to resume the run or, • To clear the error code, press any key (other than the [run] key).
E 10	**Unacceptable Value(s) Entered** • No value entered • PowerPac 200 voltage below 5 V PowerPac 300 voltage below 10 V • PowerPac 200 current below 0.01 A. PowerPac 300 current below 4 mA.	• To clear the error code, press any key (other than [run]) and enter acceptable values. • When acceptable values are entered, press the [run] key to resume the run.
E 11	**Ground Leak Detected** (PowerPac 200 only)	• Check and correct the cell for an improper connection to earth ground. • Restart the power supply by turning the power switch off and then on.
E3 **E8** **E12** **E13** **E14** **E15** **E21**	**Power Supply Regulation Error** Possible power supply malfunction.	Check for and correct problems, such as dirty contacts, frayed wires, excessive buffer concentration, etc. Then, • Press the [run] key, or • Clear the error code by pressing any key (other than the [run] key). • If error code persists, **note the error code number** and contact your Bio-Rad Representative.
E 98	Internal System Error	Contact your Bio-Rad Representative
E 99	Internal System Error	Contact your Bio-Rad Representative

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4.3 REPLACING A FUSE

To replace the fuse:

1. Disconnect the power cord from the electrical outlet.
2. Remove the fuse holder (labeled “1” in Figure 2 below) by pressing each side (labeled “2” in Figure 2 below) with a small, flat-head screwdriver or similar tool. The fuse holder will pop out.
3. Pull out the fuse from its fuse holder. Replace with the appropriate fuse:
   - 100/120 V units: PowerPac 200: 5 A, 125 V, 5mm x 20mm, Type T fuse.
     PowerPac 300: 2.5 A, 125 V, 5mm x 20mm, Type T fuse.
   - 220/240 V units: PowerPac 200: 2.5 A, 250 V, 5mm x 20mm, Type T fuse.
     PowerPac 300: 2.5 A, 250 V, 5mm x 20mm, Type T fuse.
4. Re-insert the fuse holder into its position below the power plug. Press the fuse holder gently until it snaps into place.

   The unit is now ready for use.

Caution/Warning
Disconnect the power supply before servicing. Failure to follow this procedure may result in personal injury and/or damage to the unit, and it will result in invalidation of the warranty.

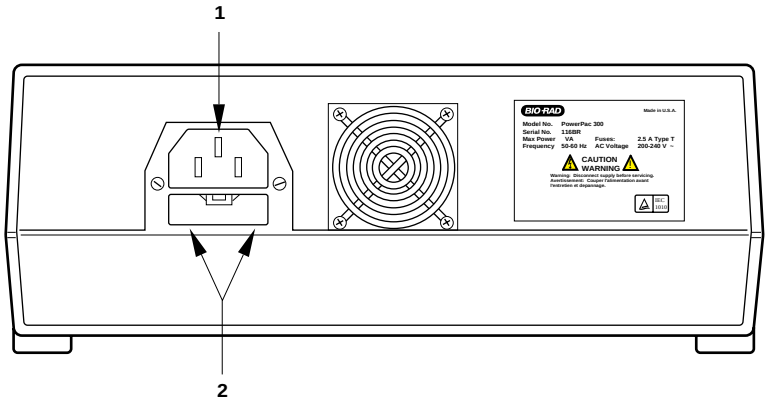


Figure 2. Location of the Fuse

4.4 FIRMWARE VERSION NUMBER

When contacting Bio-Rad during troubleshooting, you may be requested to provide the PowerPac’s software version number. To display the version number, start by turning off the unit. Then,

1. While you hold down the CONST key, turn on the unit.
2. Release the CONST key. The firmware number then is briefly displayed.

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APPENDIX A. SPECIFICATIONS

Note: All specifications subject to change without notice.

Input Power	
100/120 V model:	90 - 132 VAC, 47 Hz - 63 Hz
220/240 V model:	198 - 264 VAC, 47 Hz - 63 Hz
Fuses	
100/120 V units:	PowerPac 200: 5 A, 125 V, 5mm x 20mm, Type T PowerPac 300: 2.5 A, 125 V, 5mm x 20mm, Type T
220/240 V units:	PowerPac 200: 2.5 A, 250 V, 5mm x 20mm, Type T PowerPac 300: 2.5 A, 250 V, 5mm x 20 mm, Type T
Input Power Cord:	3-wire; grounded
Output (Programmable)	Constant voltage, constant current; with automatic crossover
Voltage:	PowerPac 200: 5 V to 200 V, fully adjustable in 1 V steps PowerPac 300: 10 V to 300 V, fully adjustable in 1 V steps
Current:	PowerPac 200: 0.01 A to 2.00 A, fully adjustable in .01 A steps PowerPac 300: 5 mA to 400 mA, fully adjustable in 1 mA steps
Power (max.):	PowerPac 200: 200 W PowerPac 300: 75 W
Terminals:	4-pair recessed female banana jacks, floating in parallel
Timer Control:	001 to 999 minutes, fully adjustable
Resolution	
Ripple:	PowerPac 200: ±1% @ 200 V and 200 W PowerPac 300: ±1% @ 300 V and 75 W
Line Regulation:	PowerPac 200: ±0.5% @ 200 V and 180 W from 90 - 132 V AC or 198 - 264 V AC PowerPac 300: ±1% @ 300 V and 75 W from 90 - 132 V AC or 198 - 264 V AC
Load Regulation:	PowerPac 200: ±1% @ 200 V for a 50% change in output load PowerPac 300: ±1% @ 300 V for a 50% change in output load
Drift:	PowerPac 200: ±0.5% after 30 min. warm up at 200 V and 180 W PowerPac 300: ±1% after 30 min. warm up at 300 V and 75 W
Noise:	PowerPac 200: 30 dBA PowerPac 300: 27 dBA
Readout Stability	
Volts:	PowerPac 200: ±1 V PowerPac 300: ±1V
Current:	PowerPac 200: ±10 mA PowerPac 300: ±1 mA

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Safety Features	
No load detection:	Indicated by error message on LED display
Sudden load change detection:	Indicated by error message on LED display
Overload/short circuit protection:	Indicated by error message on LED display; fuse on both hot and neutral
Ground Leak Detection: (PowerPac 200 only)	Indicated by error message on LED display if the ground current is greater than 500 µA.
Auto power up after power failure:	User-selectable, setup values maintained
Safety Compliance:	I.E.C. 1010
EMI	Conforms to CE standards for Emissions and Immunity; tested only at 220 V. See Declaration of Conformity for details. TUV EMC certification.
Display Functions:	3-digit LED displays voltage, current, time
Function Modes:	Constant voltage, constant current, timer User-selectable automatic power-up after power failure
Environmental	
Operating Temp.:	0 - 40°C
Humidity:	0 - 95%, in the absence of condensation
Dimensions:	29 (L) x 21 (W) x 8 (H) cm. Unit is stackable
Weight:	PowerPac 200: 2.4 kg PowerPac 300: 1.8 kg

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APPENDIX B. WARRANTY AND ORDERING INFORMATION

The PowerPac power supply 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.

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165-5055	PowerPac 1000, 200/240 V
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165-5056	PowerPac 3000, 100/120 V
165-5057	PowerPac 3000, 200/240 V
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