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Model 1000/500 Constant Voltage Power Supply

Instruction Manual

**Catalog Numbers
165-4710,
165-4711**

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Section 1

Introduction

1.1 Preface

Bio-Rad's Model 1000/500 microprocessor-controlled power supply provides constant voltage to dual-output jacks under a variety of operating conditions. Voltage is continuously adjustable from 5-1,000 volts, producing up to 250 watts of power. Current limits can be set from 0-500 milliamperes. The Model 1000/500 is a truly versatile power supply, being capable of providing the voltage for IEF, the current for multiple PAGE gels, and the control required for experimental reproducibility.

Features of the Model 1000/500 Power Supply:

- Programmable step functions which automatically alter the power conditions with no need to touch the supply
- Current measurement to 10 microamperes for monitoring focusing experiments to completion
- Volt-hour integration and/or volt-hour control for experimental reproducibility
- No-load detection systems to insure safe operation
- Dual LED readouts for monitoring current and voltage simultaneously
- Continuous monitoring of load resistance, power output, time, and volt-hours during the run

1.2 Safety

Caution: The Model 1000/500 Power Supply runs at high voltages and should be operated only by qualified personnel. **Do not assume that once the power supply is turned off, the voltage output will instantly drop to zero.** Depending upon the resistive load, the output to an electrophoretic apparatus may take a number of minutes to completely dissipate after the run is terminated. Additionally, if the power supply is run at a high voltage, then turned off and disconnected from the electrophoretic apparatus, the internal dissipation of the output may take up to 15 minutes. Read this instruction manual thoroughly before using the power supply.

1. Always connect the power supply to a separate 3-prong, grounded AC outlet. Handle only one lead wire at a time when connecting a load to the power supply.
2. For the internal cooling fan to function properly, the sides of the power supply require 6 cm or more of clearance. **DO NOT BLOCK THE FAN.**
3. Do not operate the Model 1000/500 Power Supply in extreme humidity, or where condensation can short the electrical elements.
4. Before operating the power supply in a cold-room, wrap it in a plastic bag and let it equilibrate to temperature for 2 or more hours. After thermal equilibration remove the supply from the bag and begin operation. Follow the same procedure for re-equilibration to room temperature.

Note: The Model 1000/500 Power Supply will perform at temperatures between 0° and 35° C. It has also passed tests for operation with humidity between 0 and 95% under conditions where condensation is absent. Operating the power supply outside of these conditions is not recommended, and will void the warranty.

5. Do not store any item on top of the power supply.

1.3 Specifications

Output

Voltage:	5-1,000 VDC
Current:	0-500 mA
Power:	0-250 watts

Output terminals

Dual output jacks in parallel

Limits

Voltage:	5-1,000 volts, 1 V step
Current:	0.01-500 milliamps, 0.01 mA step
Power:	1-250 watts, 1 W step

Automatic crossover upon reaching limit

Set point accuracy (output and limit)

Voltage:	± 1% 0-1,000 VDC
Current:	± 1% 0.0000 10-500 mA
Power:	± 1% 0-250 W

Display format

Dual LED readouts

Programmability

Three steps in continuous sequence, either time or volt-hour limited

Timer control

0.01-1,000 hours, 0.01 hour steps, continuously adjustable

Volt-hour control

0-1,000,000 volt-hours, 10.0 volt-hour steps, continuously adjustable

Overload and short protection

Fuse, and internal limits

No-load detection

LED display and alarm

Line regulation

± 0.5% at 1,000 VDC

Load regulation

± 2% with 50% change in load

RMS ripple and noise

Less than 2% at 1,000 VDC and 250 W

Drift

± 0.5% after 30 minutes

Operating temperature

0-35° C

Line voltage frequency

100/120 V Model 90-132 VAC (47-63 Hz)
220/240 V Model 198-264 VAC (47-53 Hz)

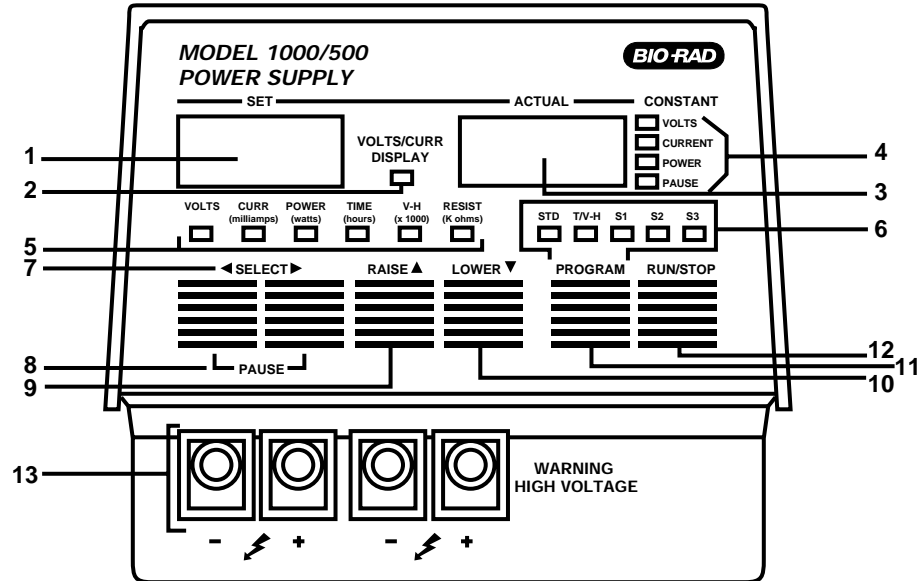
Dimensions (W x L x H)

16.5 x 31 x 13.5 cm

Weight

2.8 kg

1.4 Diagram and Description of Membrane Control Pad



- | | | |
|-----|--------------------------|---|
| 1. | LED display #1 | Displays voltage, current, power, time, and volt-hour parameters for setting prior to a run. During the run it displays set values for any of the parameters. When the display indicator light is lit, the actual voltage is displayed. |
| 2. | Display indicator light | When lit, LED displays show actual voltage (volts) and current (milliamperes). |
| 3. | LED display #2 | Displays current during run when the display indicator light is lit. Displays actual values during a run for all other parameters including resistance. Warning information is also displayed here. |
| 4. | Control indicator lights | Indicate which running parameter is in constant operation (voltage, current, power). Show when the pause mode is in effect. |
| 5. | Parameter indicator | Indicate which parameter (volts, current, power, resistance, lights time, volt-hours) the LED displays are currently showing. |
| 6. | Program indicator | Indicate under which program mode the power supply is lights currently operating, (standard, timer control, or step mode). |
| 7. | SELECT | Press either select button once to step parameter indicator lights in desired direction. Press and hold either button for quick step movements. |
| 8. | PAUSE | Pressing both select buttons simultaneously activates the pause mode. |
| 9. | RAISE | Press this button to adjust parameters upwards. |
| 10. | LOWER | Press this button to adjust parameters downward. |
| 11. | PROGRAM | Rotates through program modes. Press and hold for quick step movements. |

12. RUN/STOP Will start or stop power supply when pressed. Resumes supply when in pause mode.
13. Output Terminals Connect leads from electrophoresis apparatus here.

1.5 Description of LED Displays

1. **1.0t** - Signifies a display value of 1,000.
2. **nLd** - No load warning. See Section 4, Troubleshooting.
3. **OL/OV** - Overload warning. See Section 4, Troubleshooting.
4. **End** - Signifies that a time parameter has elapsed and the run has ended.
5. **OFF** - Identifies parameters which are off.
6. **PSE** - Indicates that the PAUSE mode is in effect.

Section 2 Operation

2.1 Standard Mode Operation

General Application: The Standard Mode Operation is used in basic electrophoretic experiments where the length of the run is not important. In this mode the supply is programmed to run in either constant voltage, current, or power within set limits. To set the power supply for Standard Mode Operation, follow the steps indicated below.

Power On

1. Turn on the power supply using the switch located on the right side of the unit. The power supply will default to the DISPLAY setting, showing that both the voltage and current are off, and to the STD (standard) program mode.

Setting Limits

Note: While setting the running conditions for any of the four Operation Modes, all set values will be displayed in the left LED. The right LED will continue to read **OFF**. After START has been pressed, the set values for running parameters will still be displayed in the left LED, while the actual value will be displayed in the right LED.

2. Press, or press and hold, either of the select buttons until the parameter indicator light is at VOLTS. Press RAISE until the desired voltage limit is reached. If the desired voltage is overrun, press LOWER to adjust the limit.
3. Press the right select button once to set the current limit. The current limit default is 500 milliamperes. Press LOWER until the desired current limit is reached.
4. Press the right select button once again to set the power limit. The power default is 250 watts. Press LOWER until the desired power value is reached.
5. To change any individual parameter, press, or press and hold, the appropriate select button until the Parameter Indicator Light is on the desired parameter. Press and hold RAISE or LOWER to set the correct value.

Note: The power supply will run at constant voltage unless the resistive load exceeds the current or power limits set at step 3 and step 4. To run the power supply under constant current, set the voltage and power limits at their maximum or at a value high enough to

insure constant current operation. To run under constant power, set the voltage and current limits in the same way to insure constant power operation.

Starting the Run

6. Press the right select button until the parameter indicator light is on DISPLAY. This allows the monitoring of the actual voltage (volts) and current (milliamperes) during a run. Alternatively, any individually set parameter value can be viewed with its actual value during the run.
7. Attach the leads of the electrophoresis cell to the power supply. Press RUN. The power supply will run indefinitely until either PAUSE or STOP is pushed. Once the output of the power supply has reached the set limits, the control indicator lights will monitor which running parameter is held constant. Depending upon electrophoretic conditions, more than one control indicator light may be lit at once.

Interrupting the Run

Any manipulation of the electrophoretic cell, or change of running parameters can be done in the PAUSE mode, where all run parameters are frozen, and the output drops to zero. The right LED will display **PSE** in every parameter except VOLTS, which will show the actual voltage decreasing to zero. With the parameter indicator light on DISPLAY, the right LED will show **PSE** while the left LED will show the actual voltage decreasing. Press RUN and the experiment proceeds from the point of interruption.

Stopping the Run

There are two ways to turn off the power supply.

1. The power supply can be turned off using the STOP button. When the STOP button is pushed, the Display Indicator Light will come on, and the left LED will show the output voltage dissipating while the right LED shows **OFF**. Using this method preserves the running parameters which have been set. To start another experiment using the same running parameters, press RUN.
2. Alternatively, the power supply can be turned off by turning the power switch off. This automatically resets all parameters to their default values.

Note: When the stop button is used to terminate a run in the Standard Operation Mode, the total elapsed time and volt-hours of the experiment are retained in the power supply's memory. This information can be accessed by pressing either select button until either the TIME or V-HR indicator light is lit. If RUN or PROGRAM is pushed, or the power switch is turned off, this information is lost.

2.2 Time Mode Operation

General Application: The Model 1000/500 Power Supply can operate at constant voltage, current, or power for a set time period. The power supply automatically shuts off and the alarm sounds after a set period has elapsed. To set the supply for timer-controlled operation, follow the steps outlined below.

Power On

1. Turn on the power supply using the switch located on the right side of the unit. The power supply will default to the DISPLAY setting, showing that both the voltage and current are off, and to the STD (Standard) program mode.

Setting Time Program Mode

2. Press, or press and hold, the program button until T/VH is lit. In this mode, the time control parameters (time or volt-hour) are functional.

Set limits as described in Section 2.1.

Set the Timer

3. Press, or press and hold, either select button until the Parameter Indicator Light is on TIME. Press RAISE until the desired time value is reached.

Starting the Run

4. Press the right select button until the parameter indicator light is on DISPLAY. This allows the monitoring of the actual voltage (volts) and current during a run. Alternatively, any individual set parameter value can be viewed with its actual value during the run.
5. Attach the leads of the electrophoresis cell to the power supply. Press RUN. Once the output of the power supply has reached the set limit(s), the Control Indicator Lights will monitor which running parameter is held constant. Depending upon electrophoretic conditions, more than one control indicator light may be lit at once.

The power supply will run until the set time elapses, at which point the alarm will sound and the display indicator light will come on showing the output voltage dissipating in the left LED while the word **End** will appear in the right LED display.

Interrupting the Run

Any manipulation of the electrophoretic cell, or change of running parameters can be done in the PAUSE mode, where all run parameters are frozen, and the output drops to zero. The right LED will display **PSE** in every parameter except VOLTS, which will show the actual voltage decreasing to zero. With the parameter indicator light on DISPLAY, the right LED will show **PSE** while the left LED will show the actual voltage decreasing. Press RUN and the experiment proceeds from the point of interruption. If premature termination of a time program run is desired, STOP can be pressed.

Terminating the Alarm

The end-of-run alarm can be terminated by pressing any key once. Do not, however, press PROGRAM or RUN/STOP. Pressing any one of these two buttons will cause an unwanted restart and/or loss of stored experiment values.

2.3 Volt-hour Mode Operation

General Application: The Model 1000/500 power supply can operate at constant voltage, current, or power for a set number of volt-hours. Using this mode, the power supply continuously integrates the voltage as a function of time and reports this value in volt-hours. Reproducibility in electrophoresis experiments can be obtained by running experiments for an identical number of volt-hours. To set the Model 1000/500 Power Supply for volt-hour operation, follow the steps below.

Power On

1. Turn on the power supply using the switch located on the right side of the unit. The power supply will default to the DISPLAY setting, showing that both the voltage and current are off, and to the STD (Standard) program mode.

Setting Volt-hour Program Mode

2. Press, or press and hold, the program button until T/VH is lit. In this mode, the time-control parameters (time or volt-hour) are functional.

Set limits as described in Section 2.1.

Setting Volt-hour Limit

3. Press, or press and hold, either of the select buttons until the parameter indicator light is on V-H. Press RAISE until the desired volt-hour value is reached. Displayed volt-hours are expressed in thousandths of the actual elapsed number of volt-hours. The volt-hour value can be changed at any point during the run without pausing or stopping the power supply.

Starting the Run

4. Press the right select button until the parameter indicator light is on DISPLAY. This allows the monitoring of the actual voltage (volts) and current (milliamperes) during a run. Alternatively, any individual set parameter value can be viewed with its actual value during the run.
5. Attach the leads of the electrophoresis cell to the power supply. Press RUN. Once the output of the power supply has reached the set limit(s), the Control Indicator Lights will monitor whichever running parameter is being held constant. Depending upon electrophoretic conditions, more than one control indicator light may be lit at once.

The power supply will run until the set volt-hour recording is reached. At this point, the alarm will sound and the word **End** will appear in the right LED display.

Interrupting the Run

Any manipulation of the electrophoretic cell, or change of running parameters can be performed in the PAUSE mode. In the PAUSE mode, all run parameters including volt-hour integration are frozen, and the output drops to zero. The right LED will display **PSE** in every parameter except VOLTS, which will show the actual voltage decreasing to zero. With the parameter indicator light on DISPLAY, the right LED will show **PSE** while the left LED will show the actual voltage decreasing. Press RUN and the experiment proceeds from the point of interruption. If premature termination of a volt-hour program run is desired, the stop button can be pressed.

Terminating the Alarm

The end-of-run alarm can be terminated by pressing any key once. Do not, however, press PROGRAM or RUN/STOP. Pressing any one of these two buttons will cause an unwanted restart and/or loss of stored experiment values.

2.4 Programmable Step Mode Operation

General Application: The step mode allows up to three different sets of running conditions to be programmed and run in sequence. The power supply will automatically switch to the next program, and turn itself off at the end of the last sequence, or at any step where no time, or volt-hour control set value has been entered. Either a time or volt-hour control can be used in each sequence of the step function. To set the Programmable Step Function Mode, follow the steps outlined below.

Power On

1. Turn on the power supply using the switch located on the right side of the unit. The power supply will default to the DISPLAY setting (showing that both the voltage and current are off) and to the STD (Standard) program mode.

Setting the Step Mode

2. In the programmable step mode a programmed sequence can be started in any of the steps S1, S2, or S3. In this mode, the time parameters (time or volt-hour) are functional and the power supply will step to the next program. For instance, if a two-step program sequence is desired, time-controlled parameters (time or volt-hours) can be set for program steps S1 and S2, while the time and volt-hour control parameters for step S3 remain off. With this sequence, the power supply is started in step S1 and will automatically switch to step S2, and then to step S3. At step S3, the power supply immediately shuts off because a time parameter was not entered. Alternatively, a two-step sequence could be started in step S2, automatically switch to step S3, and turn off at the completion of step S3. For a three-step program, parameters for all three steps are entered. At the end of step S3 the supply will shut off and the right LED display will show **End**.

Programming a Two-step Sequence

3. To operate the power supply in a two-step sequence, follow steps a through f outlined below.
 - (a) To set the first step of a two-step programming sequence, press or press and hold PROGRAM until S1 is lit.
 - (b) Set limits as described in Section 2.1.
 - (c) Set Time Control.

Press or press and hold either select button until the parameter indicator light is on the desired time-control parameter, TIME or VH. Press RAISE until the desired value is reached. (**Note:** Setting one time-control parameter automatically turns off the other time parameter to insure that the run is not terminated prematurely.)
 - (d) Press PROGRAM button so S2 will be lit.
 - (e) Repeat steps (b) and (c) above, setting the desired running parameters for step two of the sequence.
 - (f) The default value for the time-control parameters is zero. Unless the power supply was switched on immediately before programming, it is recommended that the time and volt-hour control for step S3 be checked to insure that they are off. Press PROGRAM once so S3 will be lit. Press or press and hold either select button until the Parameter Indicator Light is on TIME or VH. Both time parameters should read **OFF**, or 0.00, so that when the power supply switches to S3 it will shut off.

Programming a Three-step Sequence

4. To program the power supply to operate in a three-step sequence, follow steps a through c.
 - (a) Follow steps (a) through (e) above.
 - (b) Press PROGRAM once so S3 will be lit.
 - (c) Follow steps (b) and (c) above.

Starting the Run

5. After programming either the two- or three-step program sequence, press PROGRAM until the Program Indicator Light is on S1.
6. Press the right select button until the Parameter Indicator Light is on DISPLAY. This allows the monitoring of the actual voltage (volts) and current (milliamperes) during a run. Alternatively, any individual set parameter value can be viewed with its actual value during the run.
7. Attach the leads of the electrophoresis cell to the power supply. Press RUN. The Program Indicator Lights will identify which step of your programmed sequence the power supply is running at any moment. The Control Indicator Lights will monitor which running parameter is held constant during each step. Depending upon electrophoretic conditions, more than one control indicator light may be lit at once. The power supply steps from S1-S2-S3 at which point the alarm will sound and the word **End** will appear in the right LED display.

Interrupting the Run

Any manipulation of the electrophoretic cell, or any change of running parameters can be done in the PAUSE mode. In the PAUSE mode, all run parameters, including volt-hour integration, are frozen and the output drops to zero. The right LED will display **PSE** in every parameter except VOLTS, which will show the actual voltage decreasing to zero. With the parameter indicator light on DISPLAY, the right LED will show PAUSE while the left LED will show the actual voltage decreasing. Press RUN and the experiment proceeds from the point of interruption. If premature termination of a step program run is desired, STOP can be pressed.

Terminating the Alarm

The end-of-run alarm can be terminated by pressing any key once. Do not, however, press PROGRAM or RUN/STOP. Pressing any one of these two buttons will cause an unwanted restart and/or loss of stored experiment values.

Note: The programmed step function values are only maintained in the power supplies as long as the power supply remains plugged in and switched on. When the power supply is switched on and showing **OFF** in both LED displays, it only draws current equivalent to a night lamp. Any interruption of AC current will cause the power supply to default to original start-up values.

Section 3 Special Features

3.1 Monitoring Ultra-low Currents for IEF Experiments

Near the completion of an isoelectric focusing run, it is difficult to identify whether the experiment is finished unless the power supply can monitor current down to the microampere level. The Model 1000/500 Power Supply is uniquely capable of providing this valuable information. During a typical isoelectric focusing run, the current initially increases until the macromolecules approach their steady-state pH positions. At this point, the current drops and eventually levels off at the microampere level. Monitoring when this low plateau of current is reached is the best means of identifying completion of an isoelectric focusing experiment. Accurately monitoring current to completion in an IEF experiment also prevents potential loss of resolution due to overfocusing.

The current can be monitored to ultra-low levels when the DISPLAY Indicator Light is lit. Alternatively, SELECT can be pushed until the CURR parameter indicator light is lit.

3.2 Monitoring Time Parameters

In any of the program modes, the elapsed time and elapsed number of volt-hours can be monitored during a run by simply pressing either of the select buttons until the parameter indicator light is on TIME or V-H. The LED display #1 will show the set time (or volt-hours) while LED display #2 will show the elapsed time (or volt-hours). In the standard, time, volt-hour, or last step of a programmed sequence mode, these parameters can also be viewed in the same manner at the completion of a run. These values will remain available as long as the PROGRAM or RUN/STOP buttons are not pushed. If the time control was used during a run, only the actual elapsed number of volt-hours will be displayed when viewing V-H at the completion of the run. If volt-hour control was used during the run, TIME will then show **OFF** on LED display #1 and the actual elapsed time of the run on LED display #2.

3.3 Checking Buffer Conductivity

General Application: During an electrophoretic run, the conductivity of the buffer system can be measured to insure that properly made buffer was used, and that proper running conditions are achieved. This is possible in any of the four operating modes of the Model 1000/500 Power Supply. The ionic strength and concentration of the electrolytes is critical to achieving high resolution. If the electrolyte concentration is too low, the macromolecules that are being separated will conduct a large portion of the current which can lead to poor resolution. If the electrolyte concentration is too high, the amount of current conducted will increase while the voltage decreases. This can lead to the generation of heat which can decrease resolution, and may cause damage to the electrophoresis apparatus. To check the buffer conductivity, follow the procedure outlined below.

Checking Buffer Conductivity

The resistance of an electrophoretic load can be measured any time after the electrophoresis run is started. To monitor the resistance during an electrophoretic run, follow the steps below.

1. Press either select button until the parameter indicator light is on RES.
2. Monitor the resistance for one minute or longer. If the resistance value does not fall within the range expected, discard the buffer solution, prepare fresh electrolyte, and retest conductivity.

Section 4 Troubleshooting

Condition	Cause	Remedy
1. With the power supply on, the LED displays fail to illuminate.	1a. Power cord is not properly connected.	1a. Check connections.
	1b. The fuse has blown.	1b. Replace fuse.
2. After pressing RUN, the LED flashes n Ld and the alarm sounds.	2a. The electrophoresis cell (load) is not connected.	2a. Check the electrophoresis cell for circuit continuity.
	2b. Check to see that electrophoresis cell leads are plugged in.	
	2c. Check electrophoresis buffers for conductivity.	
3. During run, the LED flashes n Ld and the alarm sounds.	3a. The supply has detected a sudden interruption of the circuit and turned off.	3a. Turn the power supply off. Check electrophoresis cell for circuit interruption.
4. With the power supply on, the LED flashes OL and the alarm sounds.	4a. Power supply has detected a direct short at the output.	4a. Turn power supply off. Disconnect load and check both load and cable for continuity.
5. Actual output of a parameter is not the same as set value.	5a. Limit setting on one of the other parameters is too low as shown by control indicator light.	5a. With the power supply in pause, reset the limits to achieve the desired constant running parameter.
6. Fuse blows frequently.	6a. Abnormality inside unit.	6a. Contact Bio-Rad or technical representative.
7. Right LED displays End , and alarm sounds.	7a. Program has reached its preset time limit or number of volt-hours.	7a. Any button can be pushed to terminate alarm.

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