



## INSTRUCTION MANUAL

LPS-1500-2 SERIES SAMPLE POWER SUPPLIES  
(FOR RESISTIVE HEATERS)

Version 1.2

SERIAL # \_\_\_\_\_

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231 B Otto Street - Port Townsend, WA 98368 - (360)385-7707

## WARNING

POWER SUPPLIES FOR SAMPLE HEATING MAY EMPLOY LETHAL VOLTAGES.

PLEASE READ THE MANUAL AND UNDERSTAND IT. DO NOT HESITATE TO CALL US AND ASK QUESTIONS ABOUT THE DEVICE AND PROCEDURES IF REQUIRED.

THIS DEVICE SHOULD BE INSTALLED AND OPERATED ONLY BY PROPERLY QUALIFIED PERSONNEL.

We at Thermionics want you alive and well, using our equipment to achieve your goals. With appropriate care this unit will operate safely and effectively. There is no risk that is worth your life.

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## WARNING

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THIS POWER SUPPLY MAY GENERATE AMPLE VOLTAGE AND CURRENT TO KILL.

ALL PERSONNEL INVOLVED IN ITS INSTALLATION AND OPERATION MUST BE QUALIFIED TO WORK ON AND WITH SUCH EQUIPMENT. ANY USER MUST FIRST BE FAMILIAR WITH THIS MANUAL, IT'S SAFETY WARNINGS, AND HIGH VOLTAGE PROCEDURES IN GENERAL.

DO NOT TAKE SHORT CUTS. PLEASE DO NOT BE IN A HURRY.

EACH and EVERY item in the following list must be strictly followed.

1a. Unplug this supply from the wall and wait at least 1 minute prior to working on the sample area of the manipulator. This will allow the filter capacitor (if any) to bleed down inside the power supply. Check for zero potential with a voltmeter before working on the sample holder.

At that point, attach a safety grounding strap to the exposed electrical lines at the base of the heater assembly. Do not remove the strap until all work has been completed.

2. Attach a grounding cable to the rear of the power supply chassis. This should be hard wired to the chamber which will house the heater. This connection must be made prior to connecting the electrical connector to the vacuum feedthrough. Verify the ground connection with a VOM.

3. The power supply is intended to operate on either 220 - 240 VAC only, using a 3-prong plug (grounding type). Refer to the specification plate on the unit to verify this requirement. This must be connected to a correctly wired receptacle. IF one is not available, one must be installed.

4. Protect the electrical output cable and connector from moisture. Bag and tape the connector when not in use. Care is especially important around liquid nitrogen. Condensation due to LN2 boil-off can cause corrosion. Thoroughly insulate LN2 lines when they are near the cable or at the connector at the base of the manipulator or at the chamber wall. Do not run the cable on the floor. Mechanical damage or freezing by LN2 may cause failure of the insulation and thus produce a severe safety hazard. Replace any equipment showing damage or misuse.

5. The heater power lines may be exposed in the vacuum chamber. BE CERTAIN to constrain all conductors in the chamber in such a manner as to not allow them to reach the high voltage power lines under any condition. It is common to break or melt thermocouples off of samples. IF the broken TC lines contact the power, significant electrical damage would result to equipment as well as create a PERSONNEL SAFETY HAZARD.

6. Understand the limits of travel of your device and calibrate the range of operation. Do not do this by "feel". Visually watch the operation through a viewport. Forcing the system beyond its capabilities will cause mechanical & electrical damage and may endanger the operator's life. Do not change position of the heater assembly while the power is on.

7. The sample plate must be at ground potential. This must be a secure connection. Do not operate the system in any other manner. If there is any doubt, verify electrical path to ground with a VOM.

8. Replace any items that may be damaged or worn.

## Preface

The LPS series substrate power supplies are a line of power control units especially designed to give the researcher exceptional operational control of the sample temperature while maximizing the life of the heater filament. Depending on the options selected, this is accomplished by providing:

- PID microprocessor-based controller
- True proportional output
- Setable peak power output control
- Setable minimum power output

The LPS-1500-2 series is available only in the following output.  
0 to 140 VDC@ 0 to 12.5 amps DC, with a total of 1500 watts, depending on load impedance. Custom outputs are available.

All automatic LPS series models include output current readout and setable power limit. The units are equipped with Digital temperature readout, PID temperature control, Computer interface via RS 232, and HV and current readout.

## Unpacking

All LPS models are shipped with custom foam-in-place packing. We have found this the only system to provide adequate protection for shipment. The foam is separated approximately halfway inside the box with thin blue plastic. We recommend the packing box with packing be saved for possible future shipment or equipment storage.

## Mounting

The LPS series power supplies are manufactured in standard 19" relay rack chassis. We require shelf supports be utilized to handle the chassis weight....and thus not cantilever the weight off the front panel.

## Controls, Fuses, Meters and Adjustments

### CONTROLS:

The following is a list of controls found on some or all the LPS-1500 series power supplies.

### AC POWER:

Rocker type, circuit breaker front panel mounted. Controls all power to the chassis.

### OUTPUT SWITCH:

Disconnects all power to the output transformer.

Temperature controller and fan remain on.

Refer to controller manual (attached).

### MINIMUM OUTPUT:

The output setting establishes a minimum power setting. This will keep some current passing through the heater whenever the output switch is on, and the maximum output is set above 0 %. This is done to minimize the temperature swings in the heater and thus prolong element life. If the user prefers, this can be left at 0 %.

### MAXIMUM LIMIT OR OUTPUT ADJUSTMENT:

Adjusts maximum power output or simply the output in manual mode. This must be set correctly so as not to burn out heater assembly.

### FUSES:

Output: back panel, 15 amp

### OUTPUT METER:

Output: 0-15 Amp

## Connections

The following connections are made on the back panel and must be attached to the appropriate circuits prior to operation. Be sure the main AC power switch is off before connecting the power cord to the supply outlet.

AC INPUT: Power cord supplied

OUTPUT: 15 ft Output cable included

If the power supply has been purchased with a vacuum feedthrough, the mating connector will be attached. If not, please heed the following warning:

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## Warning:

IT IS THE CUSTOMER'S RESPONSIBILITY TO CORRECTLY TERMINATE THE OUTPUT CABLE, SUPPLYING APPROPRIATE PERSONNEL PROTECTION. THIS MUST INCLUDE A SAFETY GROUND CONNECTION TO THE CHAMBER AND THE ELECTRICAL CHASSIS.

FAILURE TO TERMINATE THE OUTPUT CABLE CORRECTLY MAY CAUSE DAMAGE TO THE EQUIPMENT AND HUMAN INJURY OR DEATH.

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THERMOCOUPLE: 15 ft Type K thermocouple cable included

INTERLOCK: The rear panel of the power supply has a two conductor with ground, twist lock connector. This interlock enables the heater power to be turned on. This should be connected to an SPST set of contacts that open when the chamber containing the heater is under vacuum. Depending on application, this may be a diaphragm switch, a filament relay on a controller for a hot cathode ion gauge, or other suitable contacts. The contacts must stay closed unless vacuum is established in the chamber, and thus preclude human entry and/or burning out the heater.

## Operation

Before turning on the AC switch, high vacuum should be established in the chamber and the controls should be set as follows:

OUTPUT: off  
MAXIMUM OUTPUT:  
MINIMUM: (0)  
MINIMUM OUTPUT:  
MINIMUM: (0)

Turn on AC switch. The controller display should light and indicate the sample temperature and set point. Read the controller manual for its proper operation. The controller is a true proportional type and depending on operating temperature, a number of tuning values should be set for best operation.

### NOTE:

We supply different types of temperature controllers depending upon the parameters requested by the user. Most are supplied with an "auto-tune" self-tuning capacity. Refer to the controller manual (supplied) for proper "auto-tune" operation.

If you are manually tuning the temperature controller, we suggest the following PID settings for initial operation:

P: Proportional Band "Pb"=20

I: Integral Time "ti"=10

D: Derivative Time "td"=5

Set the controller to request heat to the power module (set the requested temperature above the current temperature). The output indicator "OPT" should come on.

Switch on the output, and slowly increase the maximum output control to the desired current

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**\*\*\*WARNING\*\*\***

The filament will be burned out if the limit control is adjusted too high. Each optional filament type has a different maximum setting. Verify this current from the heater manual or consult the factory. This setting should be made only after the filament has been warmed up.

Increase the limit until current is indicated on the output meter.

Set the minimum output above 0 if desired.

Proceed to operate.

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We at Thermionics have a large stake in your new equipment operating up to your expectations. If you experience difficulty with this unit, or any other aspect of your endeavor where our experience might be of value, we want to hear from you. We want to be part of your success.