INSTRUCTION MANUAL

ION PUMP POWER SUPPLIES
[MODELS PS-100 and PS-100N/s]
[230 v 50/60 Hx model]

Version 2

SERIAL # _____

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Appendices

- Current vs pressure curves
- Principles of Ion Pump operation
- Schematic

WARNING

THIS POWER SUPPLY USES AND GENERATES VOLTAGE AND CURRENT CAPABLE OF SERIOUS PERSONAL INJURY AND DEATH.

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, ITS SAFETY WARNINGS, AND HIGH VOLTAGE PROCEDURES IN GENERAL.

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

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

There is no risk that is worth your life. 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.

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

1. Unplug this supply from the wall and wait at least 1 minute before working on the pump or supply, including attaching or removing HV cables. This will allow the High Voltage capacitor to bleed down inside the power supply. Disconnect the HV lead and check for zero potential with a voltmeter before working on the Ion Pump. Attach a safety grounding strap to the exposed high voltage lines.

   Do not remove the strap until all work has been completed.

2. There is a grounding stud on the rear panel which must be hard wired to the pump. A tinned copper braid grounding cable is included with the supply. Make this connection before connecting the HV connector to the HV vacuum feedthrough. Verify this connection with a VOM.

3. The power supply operates on 230 VAC, 50/60 Hz single phase power A 3 prong plug (grounding type) is used. This **must** be connected to a

correctly wired receptacle. IF one is not available, one **must** be installed.

4. DO NOT SWITCH ON the high voltage with the HV connector disconnected from the vacuum feedthrough or power supply.

5. Protect the high voltage cable and connector from moisture. Bag and tape the connector when not in use. Dirt or moisture can cause a HV leakage path.

   Care is especially important around liquid nitrogen. Condensation due to LN2 boil-off can cause leakage paths. Thoroughly insulate LN2 lines when they are near the cable. **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.

   Take care to hold the body of the cable connector to stop its' rotation when attaching or removing the cable. This is true for both the SHV and the ion pump connectors. Internal damage will occur to the cable connector if it is rotated with respect to the cable. This will cause malfunction and may create a safety hazard.

   Replace any equipment showing damage or misuse.

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

Preface

Congratulations! You have purchased a precision vacuum positioning device from Thermionics. This unit is capable of many years of use with minimal care and maintenance. This manual is a tool to aid you in obtaining this service.

Please read the manual thoroughly before attempting unpacking and installation of the unit.

We at Thermionics encourage your comments and suggestions on this manual.

Product Description

The PS100 and PS100N Ion Pump Power Supplies are designed to provide power to diode and triode ion pumps of up to 20 l/s, with power requirements up to 5 KV and up to 100 milliamperes intermittently, 60 milliamperes continuously. The supply can be used successfully on pumps up to 200 l/sec when pump starting at higher pressures (> 1 x 10-5 torr) is not required. The PS100 supplies positive potential for diode pumps while the PS100N provides negative voltage for triode pumps. These power supplies are built into a ½ rack metal chassis. Two of these supplies may be mounted side-by-side in a standard relay rack with an optional mounting shelf (Part Number PS-05HRA). Front panel controls and indicators allow monitoring of system current. An output signal jack permits connection to a chart recorder.

The PS100 Ion Pump Power Supply is a standard linear power supply providing current up to 100 milliamperes DC intermittently, 60 milliamperes continuously, or voltage up to 5,000 VDC. This supply is NOT intended to produce these specifications simultaneously. Consistent with good pump operation, the voltage will sag at higher current levels. This supply will provide 5,000 VDC at low currents.

The PS100 Supplies include a protection circuit which may be disabled for pump starting via a front panel switch.

Specifications

INPUT POWER STANDARD CONFIGURATION

230 VAC Single Phase 50/60 Hz
3 Amp service

Verify the input voltage listed on the nameplate on the supply is the same as is being supplied. DO NOT connect to incorrect voltage.

15' AC cord, attached.

OUTPUT POWER

Model PS1000Positive voltage output (diode pumps)
Model PS1000NNegative voltage output (triode pumps)

5 kV @ 100 ma
130 ma maximum (short circuit)

Duty Cycle Short Circuit 30 minutes maximum
Full load (100 ma) 2 hours maximum
60 ma continuous operation

10' HV power cable with SHV connector included.

10' grounding strap (bare braid) included.

Dimensions: 5.5" high, 8" wide, 14" deep

Weight: 14lbs

Power Switch: Toggle type, circuit breaker

Meter Current, Digital
two ranges
milliamperes, 0.1 to 199.9
microamperes, 1 to 1,999

Recorder Output fixed; 1 volt equals 10 ma.

OUTPUTS
FRONT
Banana Jacks, recorder output
REAR
SHV connector, Pump HV
Grounding Stud, to ground pump body Adjustments
FRONT
Toggle switch, main power
Rocker switch, protection on/off
Rotary Switch, Meter scale

Unpacking

All shipment containers should be visually inspected upon arrival for physical damage. Visual inspection of the product should also be done immediately. Shipping companies often require claims for damage be established upon arrival of goods.

This power supply is heavy, but it is still a delicate electronic instrument. Any suspected damage must be investigated by a properly qualified HV technician. Care must be used when handling to properly support this unit at all times. Do not to allow its' weight to cause injury.

All PS models are shipped with custom foam-in-place packing. 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.

Installation

These power supplies are built into ½ rack metal chassis. Two of these supplies may be mounted side-by-side in a standard relay rack with an optional mounting shelf. The following points should be considered when choosing a suitable rack position.

1. Shelf supports MUST be utilized to support the chassis weight….and thus not cantilever the weight off the front panel.

2. Adequate ventilation is necessary to provide cooling for the power supply. Space must be left above and alongside the supply to allow the free flow of air for cooling. Under heavy load, the power supply chassis will dissipate over 500 watts of power. The temperature around the supply must be under 40oC (104oF).

3. The unit should be mounted so that the operator can observe the front panel information and conveniently reach the front panel controls.

4. The rear panel must be accessible so cables can be connected.

5. The power supply must have the correct power service and MUST BE properly grounded.

6. The power supply is supplied with a 10-foot HV cable and 10-foot grounding strap. The supply should be mounted within this distance of the HV connector on the pump, however custom length cables can be supplied on special order if needed.

7. The cable path between the power supply and the pump is important. Care is especially important around liquid nitrogen. Condensation due to LN2 boil-off can cause leakage paths. Mechanical damage or freezing by LN2 may cause failure of the insulation and thus produce a severe safety hazard. Thoroughly insulate LN2 lines when they are near the cable. **Do not run the cable on the floor.**

CONNECTIONS

The following connections are made on the back panel and must be attached to the appropriate circuits prior to operation.

THESE ARE CRITICAL SAFETY ITEMS

Perform these connections in the following order:

1. **GROUNDING CABLE:** Terminated with eyelet; hard wire to pump body. It is **IMPERATIVE that** a safety ground strap or cable be attached **DIRECTLY** between the power supply and the ion pump being powered. A 1/4" grounding stud is provided on the back of the power supply for this purpose. A grounding strap with eyelets is also included with the supply.

   This safety ground is important because if the return circuit (ground braid) in the high voltage cable were to be inadvertently interrupted, the power supply will attempt to raise the pump body to the output potential of the power supply.

*** WARNING ***
This would be an EXTREMELY DANGEROUS SITUATION. NEVER operate any ion pump or other HV device without such a redundant safety ground cable in place.

Verify this ground with a VOM meter.

2. OUTPUT: 10 ft Output cable, included. Two SHV outputs are supplied. The cap (attached to the chassis by bead chain) MUST be covering the second output if it is not in use.

   Protect the high voltage cable and connector from moisture. Bag and tape the connector when not in use. Either dirt or moisture can cause a HV leakage path.

   Care is especially important around liquid nitrogen. Condensation due to LN2 boil-off can cause leakage paths. 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 a severe safety hazard.

   Take care to hold the body of the cable connector to stop its' rotation when attaching or removing the cable. This is true for both the SHV and the ion pump connectors. Internal damage will occur to the cable connector if it is rotated with respect to the cable. This will cause malfunction and may create a safety hazard.

   Replace any equipment showing damage or misuse.

3. *** CAUTION *** Be sure the main AC power switch is off before connecting the power cord to the AC supply outlet. ***

   Connect the AC power cable to the proper grounded AC supply.

Operation

STARTING

Before turning on the AC switch, vacuum should be established in the pump. Minimize the volume open to the pump when starting. Isolate the pump if possible. Depending upon the pump type, size, condition, load and application, acceptable starting pressure may be between 1 x 10-5 Torr to 1 millitorr. For long pump life, we recommend starting pressures of less than 1 x 10-5 Torr for diode pumps and less than 1 x -4 Torr for triode pumps.

It will be necessary to start larger pumps (50 to 200 l/sec) at lower starting pressures with the PS-100. This supply is adequate for operating the larger pumps, but its 130-mA capacity may limit ease of starting at high pressures in these applications.

If higher starting pressures are chosen, significant pump heating may occur. This alone will add to the gas load, delaying or inhibiting system start. Cycling the pump on and off may be required to start the system. When starting at higher pressures, it is best to minimize the volume (ideally, only that of the pump itself). Do not operate the pump at high pressures (and thus high currents) for long periods of time. Plasmas may form in the pump, evaporating material in and around the system, significantly reducing its functional life.

Depending upon conditions, cooling time may be needed so as to not allow the power supply to overheat. See the duty cycle specifications.

1. Turn off protection circuit, switch meter to "ma." scale

2. Turn on supply

3. Observe current on meter. At low starting pressures the current will have a slow spike, reducing after a few seconds. A corresponding increase in voltage to 5,000 VDC will occur.

At higher starting pressures, the pump current will not reduce quickly, if at all. Continued use under these conditions may produce internal pump heating and outgassing. The power supply should be turned off to allow the pump and the power supply to cool. The cycle may then be repeated until the pump starts.

CAUTION
Do not operate the power supply longer than 30 minutes in the "start" or full current mode, regardless of the ion pump heating. This is indicated by the meter reading over 100 ma on the "ma" range.

CAUTION
Do not operate the power supply longer than 2 hours at currents greater than 60 ma., regardless of the ion pump heating. Power supply overheating may occur. Allow the power supply to cool if these duty cycles are exceeded in operation.

4. Turn on the protection circuit after the pump has started and the current has reduced to below 20 ma.
Do not leave the pump unattended without the protection circuit active.

WARNING
The power supply circuitry includes an automatically resetting thermal circuit breaker attached to the transformer. This device may disconnect the power from the transformer in overheating conditions. It will reset when allowed to cool, restarting the power supply. THIS WOULD HAPPEN WITHOUT WARNING. If the power supply shuts down with the front panel circuit breaker in the on position, immediately turn off the front panel breaker and disconnect the power supply cord from the wall outlet. Allow the unit to cool before attempting a restart.
FAILURE TO SHUT OFF THE SUPPLY MAY ALLOW THE HIGH VOLTAGE TO COME ON WITHOUT WARNING. THIS MAY BE A PERSONNEL SAFETY HAZARD.

PROTECTION CIRCUIT

The PS100 Ion Pump Power Supply is equipped with over current protection circuitry. This circuit shuts down the power supply if more than 20 to 25 ma is drawn.

When the protection circuits are turned off, continuous full power is available to the pump. This is normally used for limited supervised time periods during pump starting. DO NOT USE THE UNPROTECTED MODE UNSUPERVISED. In the unprotected mode the front panel circuit breaker protects only against electronic component failure in the power supply.

NOTE:
Operation of ion pumps at high current levels for long periods of time may/will cause:
a) Excessive pump body heating and outgassing
This may include magnet damage and/or system contamination.

b) Sputtering of pump materials inside vacuum system

c) Erosion of internal pump components to failure

d) Loss of vacuum integrity of pump body

e) Significant reduction of useful pump life

f) Power supply overheating and/or failure

ADJUSTMENTS

This supply has no user adjustments. If difficulty occurs in any part of the operation, please contact the factory.

Warranty

This unit is covered under the Thermionics standard warranty. Please refer to the beginning of our current catalog for the exact terms of the warranty, and how to implement warranty service if needed.

Maintenance

There are no user serviceable components inside the power supply. The chassis circuit breaker is integral with the power on/off rocker switch and is thus reset whenever the unit is turned off.

We recommend the user utilize the factory for service of this supply if such is ever needed. We maintain a supply of components and the testing and calibration facilities. We offer fast and efficient service.

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.

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