INSTRUCTION MANUAL

ION PUMP POWER SUPPLIES
[MODELS PS-1000 and PS-1000N]

Version 2

SERIAL # _____

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Appendices

Current vs pressure curves

- Schematic
- PS-1000
- PS-1000N
- Principles of Ion Pump operation

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 200/208 or 230 VAC single phase power (depending on internal configuration). 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 PS1000 and PS1000N Ion Pump Power Supplies are designed to provide power to diode and triode ion pumps of up to 1,000 l/s, with power requirements up to 5 KV and up to 1 ampere. The PS1000 supplies positive potential for diode pumps while the PS1000N provides negative voltage for triode pumps. These power supplies are built into metal chassis designed to mount into standard 19" electronics racks, provided they are equipped with rack shelves. Front panel controls and indicators allow monitoring of system current, voltage or pressure. An output signal jack permits connection to a chart recorder.

The PS1000 Ion Pump Power Supply is a standard linear power supply providing current up to 1 ampere DC, 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 5000 VDC at 100 ma and 2,500 VDC at 500 ma.

The PS1000 Ion Pump Power Supply is equipped with an adjustable protection circuit. This circuit will shut off the output if the output current exceeds a preset level. This adjustment should be set consistent with the size pump (or pumps) it is powering, and the pressure you wish shutdown to occur (see ion pump calibration curves, page 12). When the protection circuit is turned off, 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

Specifications

INPUT POWER STANDARD CONFIGURATION
200/208 VAC Single Phase 50/60 Hz
30 Amp service

OPTIONAL CONFIGURATION
230 VAC Single Phase 50/60 Hz
30 Amp Service

15' AC cord, attached

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

5 kV @ 100 ma
2.5 kV @ 500 ma
1,000 ma maximum

10' HV power cable with SHV connector included

10' grounding strap (bare braid) included

Dimensions: 8.75" high, 19" wide, 14" deep

Weight: 110lbs

Power Switch: Rocker type, circuit breaker

MeterPressure, 1 x 10^{-4} to 1 x 10^{-9} torr
Voltage, 10 kV
Current, 2 amp
200 ma
20 ma
2 ma
200 microamp
20 microamp

Recorder Output0 to 100 microvolts, adjustable

OUTPUTS
FRONT
Banana Jacks, recorder output
REAR
SHV connector (two outputs), Pump HV
Supplied with one connector cover chained to chassis.
Grounding Stud, to ground pump body.
BNC, recorder output

ADJUSTMENTS
FRONT
Rocker switch, main power
Rocker switch, protection on/off
Rotary Switch, Meter function
Pot, recorder output
REAR
Locking Pot, Low torr scale
Locking Pot, High torr scale
Locking Pot, protection current trip set

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 suspect 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

The PS series power supplies are manufactured in standard 19" relay rack chassis. 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. Failure to do so will void the warranty.

2. Adequate ventilation is necessary to provide cooling for the power supply. Under heavy load, the power supply chassis will dissipate over 2,000 watts of power. The temperature around the supply must be under 40°C (104°F).

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 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. Depending upon the pump type, size, condition, load and application, acceptable starting pressure may be between 1 x 10^{-5} Torr to 10 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.

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 it functional life.

1. Check protection circuit setting. Verify it is set reasonably for your application. This is normally preset for your pump at the factory.

2. Turn off protection circuit, switch meter to voltage or 2-amp current setting.

3. Turn on supply.

4. Observe current or voltage 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 be noted.

   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 to cool. The cycle may then be repeated until the pump starts.

5. Turn on the protection circuit after the pump has started and the pressure has reduced to below the protection pressure/current setting for your system.

   Do not leave the pump unattended without the protection circuit active.

ADJUSTMENTS

PROTECTION TRIP RESET

Once the protection circuit has been tripped due to current draw in excess of the trip point, the power supply will remain off until reset. This reset will occur when one of the following events occur:

- The protection circuit is switched "off" and "on" again.
- The power supply is switched "off" and "on" again.
- The power to the unit is interrupted momentarily.

SETTING PROTECTION TRIP POINT

The trip set point is adjusted via a locking screwdriver adjustment potentiometer mounted on the back panel. The approximate adjustment is from 60 ma to 1,000 ma. The trip point is most easily set as follows:

Install pumping system and power supply on your system taking special care to follow all safety warnings.

Once a vacuum < 1×10^{-6} has been obtained, switch on the protection circuit (front panel switch). The "protection" lamp will light.

Adjust the pressure in your system by whatever appropriate means available to create the pressure where you wish the ion pump power supply to shut down.

Adjust the trip point adjustment potentiometer (back panel) until the power supply shuts down. Lock the trip adjustment.

The trip point may also be set based upon the milliamp scale located around the set point potentiometer (this is an "approximate" setting). Refer to the pressure/current graphs in the manual for the size pump to relate this current to actual trip point pressure.

TORR SCALE CALIBRATION

The torr scale meter function simply displays the ion pump current as corresponding pressure for the size ion pump being used. This is an approximate pressure indication between 1×10^{-4}. to 1×10^{-9} Torr.

This calibration is made at the factory to match your pump application. This adjustment may be made in the field if your application changes, but it is more difficult because of the lack of safe, adjustable dummy loads.

The HIGH TORR and LOW TORR potentiometer adjustments calibrate the Torr scale function. These two adjustments affect each other.

1. Connect the pump and power supply per instructions above. Include in the system, a suitable pressure gauge capable of vacuum indication over most or all of the power supply torr scale range (such as a standard hot cathode ion gauge).

2. Pump your system to approximately 1 x 10^{-9} Torr, as indicated by your pressure gauge. Switch the power supply meter to the Torr scale function and adjust the HIGH TORR pot to indicate the correct pressure.

3. Increase the pressure in the system to > 1 x 10^{-5} Torr. Adjust the LOW TORR pot to indicate the correct pressure as indicated by your pressure gauge.

4. These two adjustments are interdependent. Repeat steps 2 and 3 several times until the desired accuracy is established.

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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