

Ion Pumps

Hositrad offers a completely updated line of Ion Pump products. We have incorporated our extensive experience with a wide variety of ion pumps to provide an improved offering for our customers.

- **Pumping Speeds - 10 to 400 liters per second**
- **Choice of: Diode/Galaxy/Noble Diode Elements**
- **Choice of: Type of High Voltage Feedthrough**



Features

- Improved Element Design, Efficient, Modular Design
- Choice of Element Technology - Standard Diode - Galaxy Diode - Noble Diode
- Choice of High Voltage Feedthrough Standard: HVFT-5125 Fischer-Style Fault-Safe
Optional: HVFT-5143 Varian-Style; HVFT-5120 Varian Starcell Style; FT-PE-133 PE-Style

Benefits

- Higher Pumping Speed/Volume Ratio (Smaller Size, lower profile)
- Low Cost, Long Life for UHV
- Stable Pumping for Air Load/Leaks and Argon Loads

Double-Ended configuration available on 200 and 400 l/s models. Please inquire.

All pumps are shipped processed and under vacuum.

Choice of Pumping Element Technology

1. Diode

In the description of Figure 1 above the most common configuration of sputter-ion pumps, the diode, is described. Both cathodes are made of titanium and the structure is simple and rugged. For most applications, where active and/or residual gases comprise the main load on the pump, this configuration works well. This applies to Nitrogen, Oxygen, Water Vapor, Carbon Dioxide and like chemically active gases. In the case of pumping some specific gases, however, variations of the structure are useful.

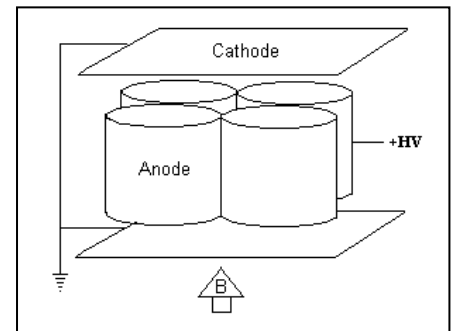


Fig. 1 Diode Ion Pump

For noble gases, such as argon, either as the main gas load or as the result of sustained air leaks (argon comprises approximately 1% of air), the diode pump can develop problems. Since argon is chemically neutral, it is pumped by burial only. After prolonged operation, some of the previously buried argon gets re-emitted due to the sputtering action. The pressure rise causes additional sputtering, which causes additional argon to be re-emitted, etc. and the pressure rises more and more rapidly, up to the point where the pressure reaches about 10-4 mbar. At this point the electrical discharge changes mode into a more diffuse form, the argon gets slowly pumped into other areas of the pump and the pressure slowly falls over a few minutes. At a certain point, the discharge shifts back into the confined Penning mode, and the pressure falls rapidly to the base pressure of the system. This behavior, called "argon instability", continues in a periodic fashion, with a period which increases as the size of argon load decreases. To stabilize this behavior, the balance of sputtering/burial/re-emission must be shifted. This is accomplished by two variations: the Galaxy Diode and the Noble Diode (Differential) pump.

2. Galaxy Diode

The new Galaxy ion pump technology uses two titanium cathodes penetrated with spiral patterns which are axially co-located beneath the anode cells. Noble gas ions, such as argon, strike the spiral elements at grazing incidence, resulting in sputtering and neutralization. The neutralized atoms are permanently buried in inactive areas of the pump. An image of a Galaxy cathode is shown below.

2.1 Pumping speed for active gases:

The Galaxy pumping speed and capacity for air, hydrogen and water is the same as for the standard diode (two flat titanium cathodes).

2.2 Stability for air pumping:

The Galaxy pumping speed for air is stable for all pressures and extended times measured. The **air/argon stability of triode, Starcell™** and differential/noble ion elements.

2.3 Pumping speed for argon:

The Galaxy pumping speed for argon is ~ 10% of its pumping speed. For air. This represents ~ 65-70% of the pumping speed for argon of the same geometry DI (Differential Ion), Noble Diode, Starcell or Triode ion pumps. Galaxy operation for argon is stable for all pressures and times measured, except at argon operating pressures above about 2×10^{-5} mbar.

2.4 Lifetime:

Accelerated and extrapolated lifetime tests with air and argon indicate that the lifetime Of the Galaxy elements is in the same range quoted for other ion pump element technologies, i.e. 40,000 to 50,000 hours at an operating pressure of 1×10^{-6} mbar. Galaxy elements plus new and rebuilt ion pumps are available.



Fig. 2 Galaxy Diode Element

3. Noble Diode/Differential

Another variation for stable pumping of noble gases, is called the noble diode or differential ion pump. In this diode configuration, instead of two cathodes, both made of titanium, one of the cathodes is made of tantalum. Tantalum is a heavier element (atomic weight 181 versus titanium at 48), and thus sputters at a slower rate than titanium. This differential sputtering again shifts the areas of burial and net build-up of sputtered material to an extent which results in stable pumping of noble gases.

Relative Pumping Speeds for Various Gases and Pump Element Technologies

Gas Species	Diode	Galaxy™	Noble Diode
	Speed % of Rated	Speed % of Rated	Speed % of Rated)
<u>Nitrogen</u> N ₂	100	100	83
<u>Oxygen</u> O ₂	70	70	70
<u>Hydrogen</u> H ₂	220	220	160
<u>Argon</u> Ar	~1	5	20
<u>Helium</u> He	10	15	15
<u>Carbon Dioxide</u> CO ₂	100	100	85
<u>Water Vapor</u> H ₂ O	100	100	85

Ion Pumps Lifetime/Performance

- Normal Lifetime is 30,000 – 40,000 Hours at a Pressure of 1×10^{-6} Torr
- Heavy Noble Gases May Cut Life
- Lifetime is Inversely Proportional to Pressure:
 - 1/10 x at 1×10^{-5} mbar
 - 10 x at 1×10^{-7} mbar
 - 100 x at 1×10^{-8} mbar
 - 1000 x at 1×10^{-9} mbar etc.

Ordering Informations

Ion Pump P/N with Magnet	Pumping Speed N ₂	Element P/N	Element Qty	Magnet P/N	Magnet Qty
DSD-010-5125-M	10	PE-10-STD	1	MAG-1010	1
DGD-010-5125-M	10	PE-10-GXY	1	MAG-1010	1
DND-010-5125-M	8	PE-10-ND	1	MAG-1010	1
DSD-020-5125-M	20	PE-20-STD	1	MAG-2020	1
DGD-020-5125-M	20	PE-20-GXY	1	MAG-2020	1
DND-020-5125-M	16	PE-20-ND	1	MAG-2020	1
DSD-030-5125-M	30	PE-38-STD	1	MAG-0114	1
DGD-030-5125-M	30	PE-38-GXY	1	MAG-0114	1
DND-030-5125-M	24	PE-38-ND	1	MAG-0114	1
DSD-050-5125-M	50	PE-38-STD	1	MAG-0114	1
DGD-050-5125-M	50	PE-38-GXY	1	MAG-0114	1
DND-050-5125-M	40	PE-38-ND	1	MAG-0114	1
DSD-100-5125-M	100	PE-38-STD	2	MAG-0114	2
DGD-100-5125-M	100	PE-38-GXY	2	MAG-0114	2
DND-100-5125-M	80	PE-38-ND	2	MAG-0114	2
DSD-200-5125-M	200	PE-38-STD	4	MAG-0114	4
DGD-200-5125-M	200	PE-38-GXY	4	MAG-0114	4
DND-200-5125-M	160	PE-38-ND	4	MAG-0114	4
DSD-400-5125-M	400	PE-38-STD	8	MAG-0400	4
DGD-400-5125-M	400	PE-38-GXY	8	MAG-0400	4
DND-400-5125-M	320	PE-38-ND	8	MAG-0400	4

STD: Diode ; GXY: Galaxy ; ND: Noble Diode

Pump Dimensions and Weights

Pump Speed (L/S)	Flange OD Inches (mm)	Height Inches (mm)	Width Inches (mm)	Depth Inches (mm)	Weight Pounds (kg)
10	2.75 (70)	8.3 (210)	4.0 (100)	4.0 (100)	8.7 (3.9)
20	2.75 (70)	8.3 (210)	4.0 (100)	5.3 (140)	10.8 (4.9)
30	2.75 (70)	7.5 (190)	8.5 (220)	5.3 (140)	23.8 (10.8)
50	4.50 (114)	8.5 (220)	11.0 (280)	5.3 (140)	30.5 (13.9)
100	6.00 (154)	11.5 (290)	14.0 (312)	5.3 (140)	56.0 (25.4)
200	8.00 (203)	11.5 (290)	17.0 (430)	17.0 (430)	105.1 (47.7)
400	8.00 (203)	18.0 (450)	17.0 (430)	17.0 (430)	185.6 (84.3)

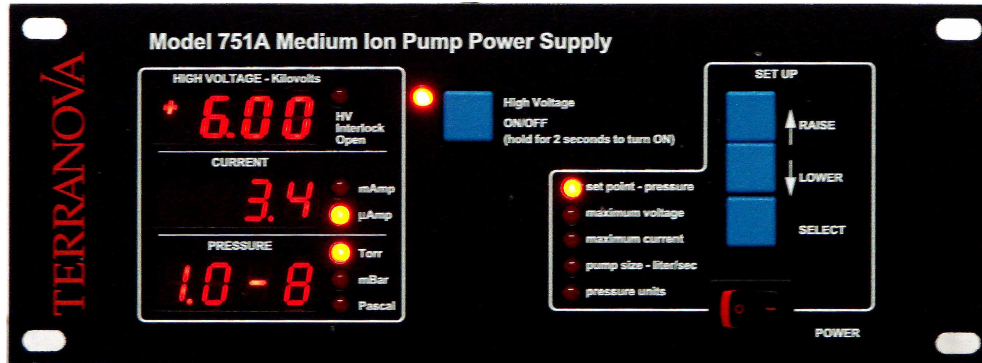
Ion Pump Related Products

In addition to the new ion pumps described above, Hositrاد Vacuum Technology offers a full line of products and services related to ion pumps. Please go to our catalog or web site: www.hositrاد.com

- New Terranova Ion Pump Controls with digital display, process control and computer Interface
- Small Pump Controller (SPC)
- Titan Sublimation Pumps and Supplies
- New Varian-Style and PE style Ion Pumps from appendage pumps to 500 l/s versions
- Customized ion pumps and controls for specialized applications
- Re-building services available for all ion pumps and elements.
- Spare parts: magnets, feedthroughs cathodes, insulators
- High Voltage Cables – bakeable, radiation resistant, custom lengths. choice of connectors

Ion Pump Controllers

Terranova® Ion Pump Controller



The Terranova 751A Ion Pump Controller Unit is designed to supply operating power to sputter-ion pumps while displaying the voltage, current and pressure. The unit is available with either Kings-type or Fischer-type high voltage output connectors; and with either one or two high voltage output connectors for the single high voltage supply.

The Terranova Model 752A Dual Ion Pump Control Unit is designed to supply operating power to two sputter ion pumps and to display the voltage, current and pressure independently for each. The unit is available with either two Kings-type or two Fischer-type high voltage output connectors; one each for the two independent high voltage power supplies.



These units are programmable, microprocessor controlled unit, which gives it great versatility in operation, display, control and data communication. Some major features include:

FEATURES:

- Programmable High Voltage Output from 3.5 KV to 7.5 KV
- Up to 50 Watts Power for High Pressure Operation
- Plus or Minus High Voltage Polarity User Selectable
- Programmable Current Limit
- Programmable Pump Size for Pressure Display
- Choice of Pressure Units; torr, mbar, pascal
- Programmable Process Control Set Point Relay
- Automatic Cool-Down, Shut-Down mode
- Display for Voltage, Pump Current and Pressure
- Serial I/O for Data Collection: RS-232, 422 and 485
- Analog Outputs for Monitoring Voltage and Current
- Ground Sensing Circuit for Operator Safety
- CE, UL and CSA Conformance for Safety, EMC and EMI
- Universal Power Supply 85-250 VAC, 50/60 Hz
- Dimensions: 9.5" (24cm) wide, 3.5" (9cm) high, 16" (41cm) deep

Standard unit is equipped with one Kings 10KV HV output connector. It is also available with dual Kings 10KV HV output connectors or single Fischer HV output connector or dual Fischer HV output connectors. An RS232 Serial Cable is available for the Terranova Ion Pump Control Units, 10 ft.

Small Ion Pump Controller (SPC)



- Provides a cost-effective solution for pumps <40 L/sec., or for operating larger pumps if thoroughly roughed or previously started
- Performs all startup, control, and monitor functions
- Microprocessor-based design provides flexibility and enables user to do several things at the same time
- Contains a programmable process control relay set point, a communications interface, and one high-voltage module
- Design—1/4 rack, 3.5" (2U) high design
- Can be configured to control Varian Ion Pumps
- CE listed

Input Voltage 110, 240 VAC, 24 VDC

Dimensions — in. (mm) (Height x Width x Depth) 3.4"H x 5.6"W x 8.2"D (85.3 x 142.4 x 208mm)

Output Voltage (Open Circuit) ± 3.5 kV-7 kV, Programmable

Output Current (Short Circuit) 15 mA

Power (Maximum) 20 W

High Voltage Connector 1 King Type 1064-I

Front Panel Display LED Digital Pressure (Pascal, mbar, Torr) Current Voltage

Output Analog, 0 to 7 VDC Linear Proportional to Voltage; Analog, 0 to 15 VDC Linear Proportional to Current

Communications RS-232 (Standard), RS-422, RS-485

Weight — lbs. (kg) 3.3 (1.5)

Safety Interlock High Voltage f/t for Ionpumps (only for Terranova Controller)

The safety interlock feature requires two ground connections from the pump to the controller, for the high voltage to operate. The primary ground is made by the braided shielding of the coaxial cable. It connects the controller chassis ground to the pump body through the cable connectors. The second ground is made by an additional wire inside the outer cover of the coaxial bundle. This second ground makes contact to the pump by a ring of fingers inside the Interlock Fischer HV feedthrough, which are connected to the pump through the body of the feedthrough. There are two insulated pins inside the Fischer cable connector, which connect the secondary ground wire to the ring of fingers, when the Fischer connector is plugged into the feedthrough.



Interlock Fischer HV feedthrough



Varian-Style Interlock Connector



HV Cable

On the controller side of the cable the second ground wire is split out of the coax before the Fischer connector. It attaches to a stud on the controllers rear panel that is insulated from the chassis ground. When the second ground makes a complete connection to the controller chassis through the pump feedthrough it latches a relay which allows the high voltage to be turned on. If the high voltage connector is removed from the pump feedthrough, the connection to the relay is broken and the high voltage is turned off for safety.

All HV cables now incorporate a new type of coaxial cable which uses Tefzel™ insulation, is rated at 15KVDC, is bakeable to 200 degrees C, contains a separate ground-sense wire and is radiation resistant.