

# Ultra High Vacuum Pumps

TiTan™

Ion Pumps

BOOSTIVAC™

Titanium Sublimation Pumping (TSP)

Non-evaporable Getter (NEG)

DIGITEL™

Ion Pump Controllers



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# TiTan™ Ion Pumps



Ion pumps are used in a wide variety of high and ultra-high vacuum (UHV) environments. They can reach the lowest possible vacuum for an economical cost. In addition, ion pumps have some technical advantages over other technologies:

## Advantage for the User

- Vibration free operation
- Low operational cost
- Bakeable
- Low maintenance
- Pressure indication
- Permanent gas capture
- Radiation tolerance
- Long operational life
- Non-contaminating technology

## Characteristics

### Lifetime

All Gamma Vacuum ion pumps are designed to operate for 45,000 – 50,000 hours at  $1 \times 10^{-6}$  mbar. Lifetime increases linearly with decreased pressure. At  $1 \times 10^{-9}$ , for example, an ion pump can last for many years.

### Ultimate Pressure

Ion pumps are capable of reaching pressures below  $1 \times 10^{-10}$  mbar. Ultimate pressure of an ion pump is dictated by overall system conditions and materials.

### Vacuum Processing

Ion pumps are shipped under vacuum at pressures less than  $1 \times 10^{-10}$  mbar. Certificates of conformance are provided and record all leak check points and pump characteristic values. RGA scans can be provided upon request.

### Port Configurations

Each ion pump can be configured with a variety of pumping port options. Additional ports are available in most designs on the top, bottom, or side and can accommodate TSP or non-evaporable getter (NEG) modules.

### Feedthroughs

Gamma Vacuum has standardized on the commercially available 10kV SHV feedthrough since 1996. For legacy purposes, alternate feedthroughs are available.

### Heaters

Integrated heaters can be added to ion pumps for economical and efficient baking.

### Cables

In addition to incorporating the SAFECONN interlock system, high voltage cables are made of flexible silicone materials that are bakeable and have high radiation tolerance.

# Ion Pump Applications

Ion Pump Size Pumping Speed (l/s)	2-3	3-20	20-75	100+
<b>Application</b>				
<b>Industry and Medical Processes</b>				
Radar	■			
Traveling Wave Tubes (TWT)	■			
Klystrons	■			
X-Ray Tube Evacuation	■	■		
X-Ray Sources	■	■		
Treatment & Diagnostics		■	■	
<b>Semiconductor</b>				
Critical Dimension SEM (CD SEM)		■	■	
Lithography			■	■
<b>Instrumentation</b>				
Electron Microscopes (SEM/TEM)		■	■	
Focused Ion Beam (FIB)		■	■	
Scanning Probe Microscope (SPM)		■	■	■
Surface Analysis (AES, XPS, SIMS, EDX)			■	■
Mass Spectrometry (MS)			■	■
Molecular Beam Epitaxy (MBE)			■	■
<b>High Energy Physics</b>				
Accelerators			■	■
Boosters			■	■
Storage Rings			■	■
Front Ends			■	■
Beam Lines			■	■
End Stations			■	■
Free Electron Lasers (FEL)			■	■
Laser Interferometers			■	■

### Small Ion Pumps (MINI – 75S)



Small ion pumps come in a wide variety of sizes and configurations. Gamma Vacuum maintains stock of the most common configurations for same-day shipping. These pumps have the added advantage that they can be mounted in any orientation without additional support.

### Low Profile Ion Pumps (100L – 1200LX)



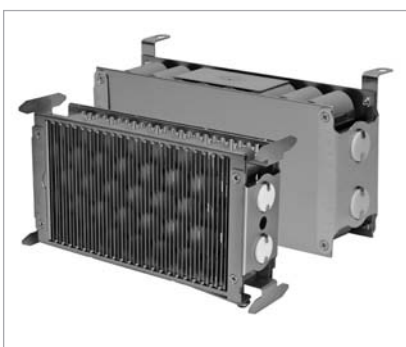
Low Profile ion pumps are under 12 in. (300 mm) high for standard configurations. The closed magnetic loop of these pumps reduces the stray magnetic field created by the pump making these pumps ideal for any type of charged particle application.

### Tall Profile Ion Pumps (150TV – 600TV)



Tall Profile ion pumps are designed for mounting in narrow locations and matching competitive dimensions. These pumps are built to order and designed to fit into locations where a Low Profile ion pump might not fit.

### TiTan Ion Pump Elements



TiTan™ ion pump elements are “tuned” for specific pumping applications. Surfaces are chemically processed to remove potential surface contaminants and provide maximum adhesion for extended lifetime. Ceramics are optimally shielded to reduce exposure to sputtered material.

- TiTan™ CV (Conventional)
  - two titanium cathodes for high pumping speed of reactive gases.
- TiTan™ DI (Differential)
  - a titanium and tantalum cathode for maintained pumping speeds of reactive gases and long term stability of noble gases.
- TiTan™ TR
  - classic triode element for higher pressure operation

## Technical Data and Ordering Information

	Pumping Speed l/s	Inlet Flange	Dimensions L x W x H mm (inch)	Weight kg (lbs)	Part No.
<b>Small Ion Pumps</b>					
MINI	0.2	DN 16 CF	38 x 51 x 38 (1.5 x 2.0 x 1.5)	0.35 (0.8)	on request
3S	2 – 3	DN 16 CF	45 x 108 x 41 (1.8 x 4.3 x 1.6)	0.45 (1.0)	on request
10S	8 – 10	DN 40 CF	113 x 214 x 152 (4.4 x 8.4 x 6.0)	6 (13)	on request
25S	15 – 20	DN 40 CF DN 63 CF	25 x 130 x 202 (4.9 x 5.1 x 8.0)	9 (20)	on request
45S	30 – 40	DN 40 CF DN 63 CF	251 x 130 x 202 (9.9 x 5.1 x 8.0)	16 (34)	on request
75S	40 – 75	DN 40 CF DN 63 CF DN 100 CF	242 x 130 x 277 (9.5 x 5.1 x 10.9)	22 (48)	on request
<b>Low Profile Ion Pumps</b>					
100L	80 – 100	DN 100 CF DN 160 CF	328 x 294 x 294 (12.9 x 11.6 x 11.6)	29 (62)	on request
200L	160 – 200	DN 100 CF DN 160 CF	413 x 233 x 325 (16.3 x 9.2 x 12.8)	50 (112)	on request
300L	240 – 300	DN 160 CF	413 x 337 x 325 (16.3 x 13.3 x 12.8)	66 (145)	on request
400L	320 – 400	DN 160 CF	413 x 413 x 325 (16.3 x 16.3 x 12.8)	67 (148)	on request
400LX	320 – 400	DN 160 CF	490 x 408 x 508 (19.3 x 16.1 x 20.0)	95 (210)	on request
600L	480 – 600	DN 160 CF DN 200 CF	513 x 513 x 325 (20.2 x 20.2 x 12.8)	103 (226)	on request
600LX	480 – 600	DN 160 CF DN 200 CF	413 x 336 x 537 (16.3 x 13.2 x 21.1)	122 (270)	on request
800LX	640 – 800	DN 160 CF DN 200 CF	413 x 413 x 537 (16.3 x 16.3 x 21.1)	127 (280)	on request
1200LX	960 – 1200	DN 160 CF DN 200 CF	513 x 513 x 650 (20.2 x 20.2 x 25.6)	206 (452)	on request
<b>Tall Profile Ion Pumps</b>					
150TV	120 – 150	DN 100 CF	247 x 231 x 338 (9.7 x 9.1 x 13.3)	32 (70)	on request
300TV	240 – 300	DN 160 CF	450 x 231 x 345 (17.7 x 9.1 x 13.6)	65 (143)	on request
600TV	480 – 600	DN 160 CF	450 x 305 x 525 (17.7 x 12.0 x 20.7)	109 (243)	on request

# BOOSTIVAC™ Titanium Sublimation Pumping (TSP) Non-evaporable Getter (NEG)



Titanium Sublimation Pumps (TSPs) are often used in combination with ion pumps or independently to remove reactive gases from the vacuum environment. Combined with an ion pump, the TSP allows for low ultimate pressures in a shorter amount of time. All TSP components are bakeable to 400°C.

## Advantage for the User

### Ease of Use

The TSP and MPC controllers are each fully controlled with an intuitive touch panel LCD.

### Filaments

Each titanium-molybdenum filament contains 1.5 grams of usable titanium and averages 20 hours of operation.

### Connectivity

TSP/NEG cables have MS style connectors that are bakeable and radiation resistant.

### Safety

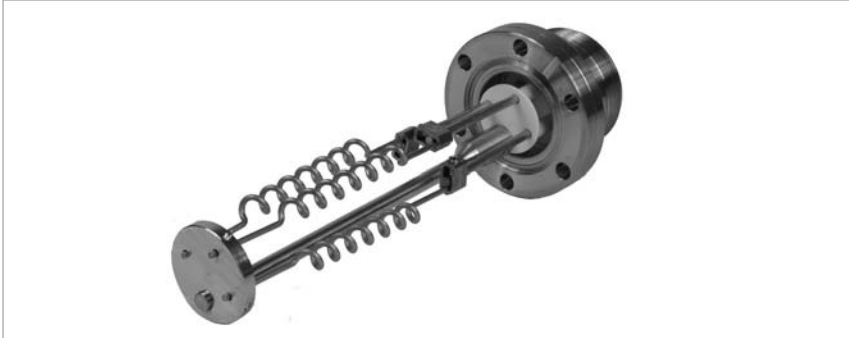
High currents travel over distances up to 15 meters through bakeable and radiation-resistant insulated and strain relief cabling.

### DIGITEL™ Flexibility

The DIGITEL™ line is flexible enough to control a wide variety of ion pump and TSP configurations. The QPCe and MPC can operate up to four ion pumps simultaneously or independent operation of one or two ion pumps respectively. The MPCe and QPCe are capable of controlling one or two TSP or NEG cartridges independently from the remote TSP or NEG controller or the MPCe's optional internal TSP (iTSP) or NEG (iNEG).



### TSP Filament Cartridge



The filament cartridge is mounted on a 2- 3/4" CFF (NW 35). The feedthrough supports three titanium-molybdenum filaments and a return path for ground isolation. Each filament contains 1.5 grams of usable titanium and averages 20 hours of operation.

### Liquid Cryoshroud



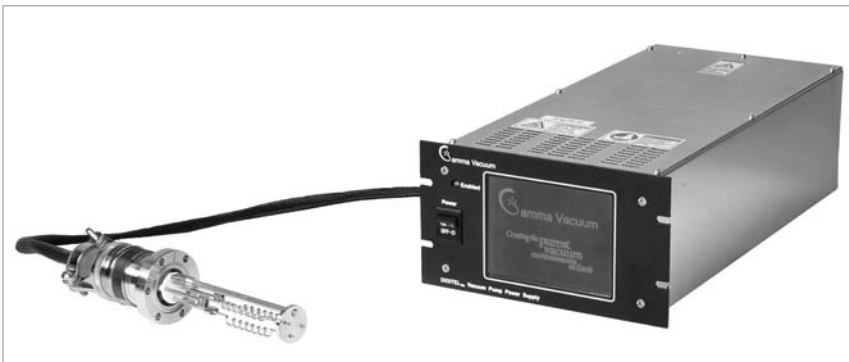
The liquid cryoshroud consists of a double walled, type 304L stainless steel cylinder with two liquid nitrogen feedthroughs with flare type fittings. It provides 1578 cm<sup>2</sup> (245 in.<sup>2</sup>) of liquid nitrogen cooled surface area that provides pumping speeds up to 12,000 l/s for hydrogen (see table). The shroud is mounted on an 8 in. CFF (DN 160) or 10 in. CFF (DN 200)

### Ambient Sputter Shield



The ambient sputter shield economically maximizes surface area when cooling is not practical or possible. It provides 827cm<sup>2</sup> (128 in.<sup>2</sup>) of ambient temperature surface area that provides pumping speeds up to 2,200 l/s for hydrogen (see table). The shield is mounted on an 8 in. CFF (DN 160) or a 6 in. CFF (DN 100).

### Digitel™ TSP / NEG Controller



A TSP or NEG can be fully operated from the LCD touchscreen of the QPC or MPC. They can be fired manually or automatically based on the pressure of either ion pump the controller is monitoring. Timed modes also let the user have full control over exact parameters of operation. A single remote controller can operate up to eight TSP filaments or two NEG pumps.

## Technical Data

## Controller

		DIGITEL TSP/NEG	Remote TSP/NEG
Input power			
Voltage	V	90 – 130 or 200 – 240	
Frequency	Hz	48 – 62	
Output power			
Open circuit voltage	VAC	19 / 32	19 / 32
Current (maximum)	A	55 / –	55 / –
Watts (maximum)	W	850 / 220	850 / 220
Resolution	A	0.1	0.1
High current connections		MS style / XLR style <sup>1)</sup>	MS style / XLR style <sup>1)</sup>
Display			
Type		1/4 VGA touchscreen LCD	touchscreen LCD via MPC/QPC
Readouts		Current, on-time, and programmable options	Current, on-time, and programmable options via MPC/QPC
Analog outputs		linear configurable	
Voltage		linear or logarithmic, configurable	
Current / pressure			
Communications		Local/Remote/Full Ethernet Serial: 232, 422, 485	Local/Remote/Full via MPC/QPC Ethernet via MPC/QPC Serial: 232, 422, 485 via MPC/QPC
Conformity to norms		EN 55011 Class A, IEC 801-2 EN 801-3, IEC 801-4, EN 61010-1	
Weight	kg lbs	16.8 37	13.1 29
Size		3U high. 1/2 rack wide 438 mm (17.2 in.) deep	293 x 219 x 130 mm (min.) (12 x 9 x 5 in.) 293 x 219 x 150 mm (max.) (12 x 9 x 6 in.)
Additional features		TSP Enable	TSP Enable via MPC/QPC

<sup>1)</sup> N410 has MS style

## Typical TSP Pumping Speeds

		Liquid Cryoshroud (8 in.)	Ambient Sputter Shield (8 in.)      (6 in.)	
Area	cm <sup>2</sup> (in. <sup>2</sup> )	709 / 1578 110 / 245*	827 128	621 96
Temperature	°C	20 / -195	20	
H <sub>2</sub>				
Rate	l/s / cm <sup>2</sup>	2.6 / 17	2.6	2.6
Speed	l/s	1,843 / 12,053	2,150	1,614
CO				
Rate	l/s / cm <sup>2</sup>	8.2 / 11	8.2	8.2
Speed	l/s	5,814 / 7,799	6,780	5,092
H <sub>2</sub> O				
Rate	l/s / cm <sup>2</sup>	7.3 / 14.6	7.3	7.3
Speed	l/s	5,176 / 23,039	6,037	4,533

\*Applies to H<sub>2</sub>O speed only

## Ordering Information

<b>Part No.</b>
Regarding ordering information please contact your nearest Leybold representative.



# DIGITEL™ Ion Pump Controllers



The DIGITEL family of Ion Pump Controllers offers the right balance of performance, power and protection.

## Advantage for the User

### Ease of Use

Each DIGITEL™ has a highly visible display. The SPCe has an easy-to-read LCD that displays pressure, current and voltage. The QPC and MPCe are each fully controlled with an intuitive touch panel LCD. Digital resolution down to 1nA is possible depending on pump size and current requirements.

### Communications

Serial communications (RS232, RS422, and RS485) are standard on all DIGITEL™ products. Ethernet protocol for advanced facility and instrumentation communications is available on all units.

### Connectivity

Each DIGITEL™ has programmable analog and interlock capabilities. This allows for optimal flexibility when integrating with standard or legacy setpoint and analog monitoring systems.

### Operator Safety

The integrated SAFECONN high voltage interlock system eliminates electrical shocks and false positive pressure readings. The controller automatically shuts off high voltage when the cable is disconnected from the ion pump or controller end. The system is isolated and guarantees ground, high voltage, and safety connectivity that prevents accidental arcing.

### DIGITEL™ Flexibility

The DIGITEL™ line is flexible enough to control a wide variety of ion pump and TSP/NEG configurations. The QPC and MPCe can operate up to four ion pumps simultaneously or independent operation of one or two ion pumps, respectively. The MPCe is capable of controlling one or two TSP/NEG cartridges independently.

### DIGITAL™ SPCe – Small Pump Controller



The SPCe is a versatile way to fully operate ion pumps 0.2 – 75 l/s with up to 40 mA (50 watts) of power. An LCD pressure/current/voltage display along with standard serial communications makes the SPCe able to accommodate the needs of basic and advanced users. Nano amp resolution provides gauging capabilities using the appropriate ion pump set-up.

### DIGITAL™ QPCe – Quad Pump Controller



Ion pumps 100 l/s and larger required higher currents for starting and higher pressure operation. The QPCe supplies up to four ion pumps with 125 mA (125 watts) each. The easy-to-read color touchscreen display simultaneously displays pressure, current, and voltage. Standard serial and standard Ethernet communications along with legacy set-point and analog outputs allow for easy system integration. The QPCe fits into any rack at just 3U high and 1/2 rack wide.

### DIGITAL™ MPCe – Multiple Pump Controller



#### Ion Pump Control

The MPCe allows for high current control of one or optionally two ion pumps independently or up to four in parallel with 500 mA (1000 watts). At 3U high and a full rack in width, the MPCe is ideal for operating a wide variety of ion pump configurations on any system.

#### TSP/NEG Control

A TSP or NEG can be fully operated from the LCD touchscreen of the QPCe or MPCe. They can be fired manually or automatically based on the pressure of either ion pump the controller is monitoring. Timed modes also let the user have full control over exact parameters of operation. A single remote controller can operate up to eight TSP filaments or two NEG pumps.

# Ion Pump Compatibility

Ion Pump Size	SPCe	QPC	MPCe	TSP
<b>Small Ion Pumps</b>				
MINI	■			
3S	■			
5S		■		
10S	■	■		
25S	■	■		
45S	■	■		
75S	■	■		
<b>Low Profile Ion Pumps</b>				
100L		■	■	■
200L		■	■	■
300L		■	■	■
400L			■	■
400LX			■	■
600L			■	■
600LX			■	■
800LX			■	■
1200LX			■	■
<b>Tall Profile Ion Pumps</b>				
150TV		■	■	■
300TV		■	■	■
600TV			■	■

## Technical Data

## Controller

		SPCe	QPCe	MPCe
<b>Input power</b>				
Voltage	V	90 – 240 or 24 VDC	100 – 240	90 – 230 or 200 – 240
Frequency	Hz	48 – 62	50 – 60	48 – 62
<b>Output power</b>				
Independent outputs	V	1	1 – 4	1 or 2
Open circuit voltage	VDC	±3000 – 7000 programmable	±3000 – 7000 programmable	±5600 or 7000
Current (maximum)	mA	40	125	500
Watts (maximum)	W	50	125	1000
Resolution	nA	1	1	100
<b>High voltage connections</b>		One 10kV SHV or Fischer	1-4, 10kV SHV or Fischer	1-4, 10kV SHV or Fischer
<b>Display</b>				
Type		LCD	Wide VGA Touchscreen Color LCD	1/4 VGA Touchscreen LCD
Readouts		Pressure, current, voltage, and programmable options	Pressure, current, voltage, and programmable options	Pressure, current, voltage, and programmable options
<b>Setpoints</b>		One relay, one TTL	Four relay, four TTL	Four relay, four TTL
<b>Analog outputs</b>		linear configurable		
Voltage		linear or logarithmic, configurable		
Current / pressure				
<b>Communications</b>		Local/Remote/Full Ethernet (optional) Serial: 232, 422, 485	Local/Remote/Full Ethernet (standard) Serial: 232, 422, 485	Local/Remote/Full Ethernet (optional) Serial: 232, 422, 485
<b>Conformity to norms</b>		EN 55011 Class A, IEC 801-2 EN 801-3, IEC 801-4, EN 61010-1		
<b>Weight</b>		1.5 3.3	9.5 21	16.8 / 25.4 (min./max.) 37 / 56 (min./max.)
<b>Size</b>		2U high, 1/4 rack wide 313 mm (12.3 in.) deep	3U high, 1/2 rack wide 438 mm (17.2 in.) deep	3U high, full rack wide 438 mm (17.2 in.) deep
<b>Additional features</b>		SAFECONN AUTOSTART/AUTORUN High Voltage Enable Fowler-Nordheim Calibration High-Pot Capability	SAFECONN AUTOSTART/AUTORUN High Voltage Enable Remote TSP/NEG Control	SAFECONN AUTOSTART/AUTORUN High Voltage Enable Remote TSP/NEG Control

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