



UHV Gauging for High Energy Physics

Ideally suited for High Energy Physics (HEP) applications, the HPS® Series 937B ultra high vacuum system incorporates the technologies of the cold cathode and convection Pirani sensors. The system operates as many as six sensors simultaneously and measures pressures from 10^{-11} to 760 Torr.

Features & Benefits

Series 937 Controller

- Wide measurement range of 10^{-11} to 760 Torr
- Easily operates up to 6 sensors via 3 gauge slots
- Displays up to 6 pressure readings simultaneously
- Repeatable measurements and 12 independent relay set points for improved process control
- Field upgradeable, modular design
- Easy to operate
- Fast response versions available
- Computer interface: RS232, RS485 (built in) and Profibus DPVI (optional)
- Fully CE compliant with EMC Directive 2004/108/EC and Low Voltage Directive 2006/95/EC

Series 317 Bakeable Pirani Sensor

- Measures from atmosphere to 1×10^{-3} Torr
- Aluminum housing bakeable to 250°C
- Simple operation removes electronics for bakeout
- Radiation resistant

Series 422 Cold Cathode Sensor

- Inverted Magnetron design provides pressure measurement of 10^{-2} to 10^{-11} Torr
- Bakeable to 250°C while operating
- Radiation resistant
- Optional field emitter for shorter UHV starting times
- UHV construction
- Dual feedthrough design provides accurate, repeatable measurement
- Lemo connectors allow for easy interchange of cables

Applications

The HPS UHV gauging system can be used for applications requiring any of the following: high temperature bakeout, radiation-resistance; or 10^{-11} Torr measurements.

The vacuum measurement and analysis sensors can be installed on linear accelerators, booster rings, storage rings, beamlines and vacuum pumping systems.

Description

The Series 937B combination vacuum gauge system is part of the HPS family of vacuum gauges, and will operate as many as six sensors simultaneously. Every controller is configured to the user's exact requirements by selecting sensor type. Units of pressure are user configurable, in Torr, millibar, Pascal or microns. RS232 and RS485 are standard on the 937B, with Profibus as an option.

Series 937 Controller

The 937B controller is designed for versatility, reliability and economy. The large, easy to read, liquid crystal display provides readout for up to six sensors. The backlit LCD display intuitive menus and simple push button front panel, allows for ease in setup of the 937B. The 937B enables the use of any sensor card in each of the sensor card slots.

When used with the available dual convection card, the controller can display up to a maximum of six pressure inputs. Typical HEP configurations include two cold cathode cards with a dual convection card to provide simultaneous display and control of four pressure inputs.

Fast Response Option

The standard cold cathode card has a response time of around 100 milliseconds. For applications requiring a fast response, for example valve interlocks, the 937B can be configured with a response time of less than 15 milliseconds.

317 Bakeable Pirani Sensor

The 317 Pirani Sensor is CE compliant and bakeable to 250°C with the bridge electronics removed. Two screws are removed to detach the electronics. Electronics slide off after removing two screws and remain attached to the cable.

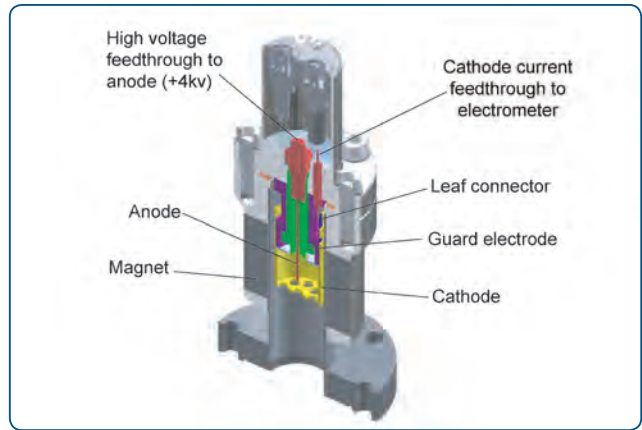
422 Cold Cathode Sensor

The 422 Cold Cathode Sensor is identical to the 421 sensor except it incorporates LEMO connectors. LEMO connectors use PEEK for the insulators which allows a sensor to be both bakeable and radiation resistant. Maximum bakeout temperature is 250°C while operating. In addition, MKS offers cables that are bakeable and radiation resistant (no Teflon).

The internal design of the 422 has been carefully constructed using only materials suitable for UHV conditions. Combined with Inverted Magnetron technology, this sensor has the capability of measuring down to 1×10^{-11} Torr.

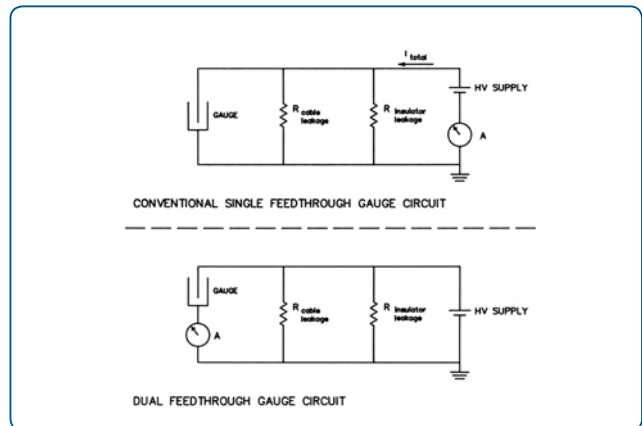
422 Inverted Magnetron Measurement Circuit

The IMG Measurement Circuits offer a dual feedthrough design instead of single feedthrough. The disadvantage of a single feedthrough design is that it measures all currents including unwanted currents, such as cable leakage. MKS's dual feedthrough design measures only the gauge current. This is especially important when measuring extremely small ion currents. This ensures the best accuracy and repeatability under UHV conditions and permits reliable measurement into the 10^{-11} Torr decade.



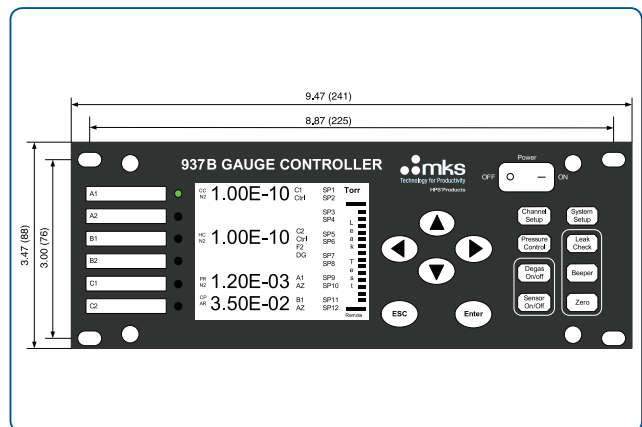
Series 422 Cold Cathode Sensor —

Cross-section of a modern inverted magnetron Cold Cathode showing the MKS Dual feedthru design



Cold Cathode Schematics —

Circuit comparison between single and dual feedthru designs used on Cold Cathode Sensors



937B Dimensional Drawing —

Note: Dimensions are nominal values in inches (mm referenced).



Specifications

Series 937B Controller Specifications		
Measurement Range	1.0 x 10 ⁻¹¹ to 1.0 x 10 ⁺⁴ Torr 1.0 x 10 ⁻¹¹ to 1.3 x 10 ⁺⁴ mbar 1.0 x 10 ⁻⁹ to 1.3 x 10 ⁺⁶ Pascal	
Operating Temperature	5° to 40° C (41° to 104°F)	
Storage Temperature	-10° to 55°C (14° to 131°F)	
Relative Humidity	80% max for temperatures less than 31°C, decreasing linearly to 50% maximum at 40°C	
Power Requirement and Consumption	150 watts maximum	
Set Point Relays	Twelve pressure dependent set points; SPDT relays, contact rating 2 amps @ 30 VAC, IEC 950 safety rating: 2A @ 50 VAC	
Output	Buffered, log linear & linear output for each channel & channel combinations	
Front Panel Controls	Power on-off switch, setup and operational commands can be accessed via the keypad	
Display	320x240 color QVGA TFT LCD with back lighting. Up to 6 pressure displays. Display indicators for unit of measure, calibration functions, user calibration, set points, gauge position indicators	
Leak Test	Relative logarithmic bar graph display and variable rate audio signal	
CE Certification w/appropriate sensors	2004/108/EC EMC Directive; 2006/95/EC Low Voltage Directive	
Controller Weight	8 lbs (3.6 kg)	
Sensor Specifications	422 Cold Cathode	317 Convection Pirani
Measurement Range	1.0 x 10 ⁻¹¹ to 1.0 x 10 ⁻² Torr 1.3 x 10 ⁻¹¹ to 1.3 x 10 ⁻² mbar 1.3 x 10 ⁻⁹ to 1.3 Pascal	1.0 x 10 ⁻³ to 1.0 x 10 ⁺³ Torr 1.3 x 10 ⁻³ to 1.3 x 10 ⁺³ mbar 1.3 x 10 ⁻¹ to 1.3 x 10 ⁺⁵ Pascal
Resolution	1% of indicated decade, except 10% below 10 ⁻¹⁰ Torr and above 10 ⁻³ Torr	1% of indicated decade
Set Point Response	120 milliseconds	120 milliseconds
Set Point Range	2.0 x 10 ⁻¹⁰ to 9.5 x 10 ⁻³ Torr 2.7 x 10 ⁻¹⁰ to 1.2 x 10 ⁻² mbar 2.7 x 10 ⁻⁸ to 1.2 Pascal	2.0 x 10 ⁻³ to 9.5 x 10 ⁺² Torr 2.7 x 10 ⁻³ to 1.2 x 10 ⁺³ mbar 2.7 x 10 ⁻¹ to 1.2 x 10 ⁺⁵ Pascal
Reproducibility	5% of indicated pressure	5% of indicated pressure
Cables & Connectors*	Maximum length is 300 ft.	Maximum length is 500 ft. 9 pin D-sub connectors, multiconductor shielded cable
Operating Temperature	0° to 250°C (32° to 482°F)	0° to 50°C (32° to 122°F)
Bakeout Temperature	0° to 250°C (32° to 482°F)	250°C (482°F) with cable and electronics attached
Sensor Construction (materials exposed to vacuum)	Stainless steel, silver-copper brazing alloy, alumina ceramics, aluminum AL 6061, Elgiloy®, OFHC® copper	304 stainless steel, nickel 200, glass, platinum
Weight	2.9 lbs. (1.3 Kg) w/ 2¾" CF	1.34 lbs (0.52 kg) w/ 2¾" CF
Volume	1.8 in. ³ (30 cm ³) max	0.5 in. ³ (8.0 cm ³) maximum

*Note: Cables connected with LEMO connectors on sensor end and bayonet connectors on controller end. High temperature and radiation resistant materials available.

422 Cold Cathode	317 Convection Pirani
<p>Size 2¾" CF LEMO Connectors</p>	<p>Size 2¾" CF</p>



Ordering Information

Series 937B Controller				
Base Controller	"A" Gauge Slot	"B" Gauge Slot	"C" Gauge Slot	Communication Port
Part Code	Part Code	Part Code	Part Code	Part Code
937B	CC Cold Cathode	CC Cold Cathode	CC Cold Cathode	PF Profibus
	NA Blank	CT Dual Convection Pirani	CT Dual Convection Pirani	NA * Blank
		NA Blank	NA Blank	

* RS232/485 provided in base configuration

To obtain the total controller price, add the prices of the 937B base controller and each of the options.
Sample part number: 937B-CCCCCT232.

Plug-In Controller Boards	
Part Number	Type
100015185	Cold Cathode
100015132	Dual Convection Pirani
100015940	Profibus Card

Use these part numbers when purchasing boards separately for retrofit.

Sensors	
Part Number	Type
104220006	422 Cold Cathode Sensor, 2¼" CF, Lemo Connectors, 250°C
103170024SH	Convection-Enhanced Pirani Sensor, 2¼" CF, 250°C

Cables	
Part Number	Type
100014318-10	Cold cathode cable, radiation resistant, w/ LEMO connectors, 10 ft.
100012372	Cold cathode cable, high temperature, w/ LEMO connectors, 10 ft.
103170006SH	Pirani cable, shielded, 10 ft.

Cables and Connectors	
Part Number	Type
100006170	Cold cathode cable, radiation resistant, 1,000 ft. length
100003451	Pirani cable, radiation resistant, 1,000 ft. length
100012644	Cold cathode connector set, sensor end LEMO, controller end BNC/SHV
100012643	Pirani connector set, comprises two D-type connectors, 1 x male, 1 x female

The above cables and connectors are intended for end-user assembly. Alternate cable lengths and bakeable cold cathode cables are available upon request.



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