

UHV Vacuum Gauges for Accelerator Physics



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

Product Features

Series 937B 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 cold cathode option for system protection
- Computer interface: RS232, RS485 (built in) and Profibus DPV1 (optional)

Series 317 Bakeable Pirani Sensor

- Measures from atmosphere to 1×10^{-3} Torr
- Simple operation removes electronics for bakeout to 250°C
- 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 improved UHV starting times
- UHV construction
- Dual feedthrough design provides accurate, repeatable measurement
- LEMO connectors allow for easy interchange of cables



Applications

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

The Series 937B combination vacuum gauge system is part of the 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, backlit liquid crystal display provides readout for up to six sensors. Intuitive menus and simple push button front panel, allows for ease in setup of the 937B. The 937B allows the use of any sensor card in any card slot.

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

For applications requiring a fast response, for example valve interlocks, the 937B can be configured with a fast response cold cathode card that has an opto-isolated output. This output responds to pressure changes in less than 10 msec. A typical application would be at a synchrotron light source where the fast response option is used in conjunction with a cold cathode sensor installed on a beamline front end. In the event of a sudden pressure rise in a beamline, the fast response output is used to close an isolation valve while protecting the storage ring from possible damage.

317 Bakeable Convection Pirani Sensor

With a measurement range from atmospheric pressure to 1.0×10^{-3} Torr, the 317 can be used to control the ignition of a cold cathode sensor when used in conjunction with the 937B. With the electronic module removed, the sensor is bakeable to 250°C . The electronics slide off the sensor housing after removing two screws and remain attached to the cable. The sensor is radiation resistant making it an ideal choice for high pressure measurements and interlocks on particle accelerators.

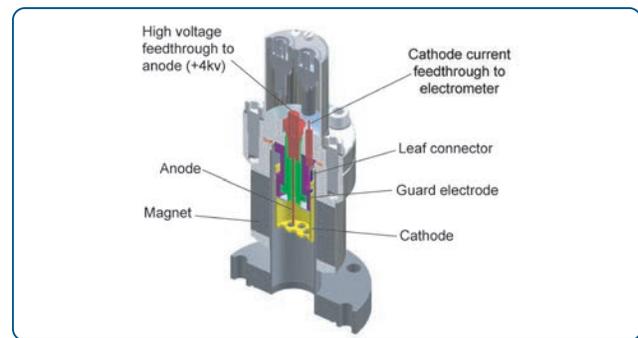
422 Cold Cathode Sensor

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.

The 422 Cold Cathode Sensor incorporates LEMO connectors, these 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).

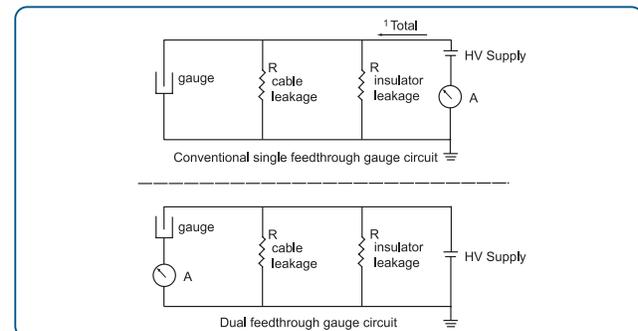
422 Inverted Magnetron Measurement Circuit

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.



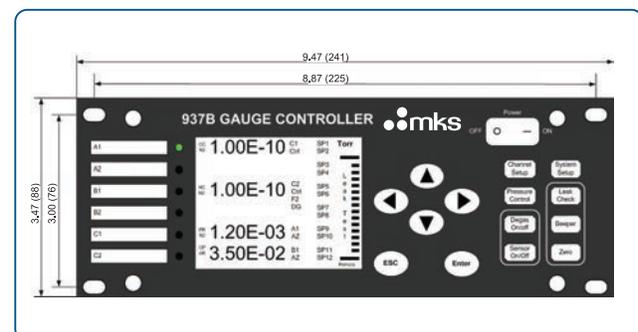
Series 422 Cold Cathode Sensor

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



Cold Cathode Schematics

Circuit comparison between single and dual feedthrough 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 760 Torr (higher with optional cm card) 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, 100-240 VAC, 50/60Hz - universal	
Set Point Relays	Twelve pressure dependent set points; SPST relays, contact rating 2 amps @ 30 VAC, IEC 950 safety rating: 2A @ 50 VAC	
Output	Buffered, log linear & linear output for each channel	
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	
Electrical Connection (Sensors)	Cold Cathode (422) card BNC/SHV	Convection Pirani (317) 9 Pin D sub
Controller Weight	8 lbs (3.6 kg)	
Compliance	CE	
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 ms (<10ms with CL card)	120 ms
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. Connector LEMO with PEEK insulator	Maximum length is 500 ft. 9 pin D-sub connectors, Connector
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 removed
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
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	Country Code	"A" Gauge Slot	"B" Gauge Slot	"C" Gauge Slot	Communication Port
Part Code	Part Code	Part Code	Part Code	Part Code	Part Code
937B	US	CC Cold Cathode	CC Cold Cathode	CC Cold Cathode	PF Profibus
	EU				
	UK	CL Fast Response Cold Cathode	CL Fast Response Cold Cathode	CL Fast Response Cold Cathode	NA * Blank
	JP				
	CA (Canada)	CT Dual Convection Pirani	CT Dual Convection Pirani	CT Dual Convection Pirani	
			NA Blank	NA Blank	

* RS232/485 provided in base configuration

Sample part number: 937B-US-CCCCCT-NA.

Also available with optional Dual Capacitance Manometer Card.

Plug-In Controller Boards	
Part Number	Type
100018446	Cold Cathode (CC)
100015132	Dual Convection Pirani (CT)
100015940	Profibus (PF)
100018448	Fast Cold Cathode (CL)
Use these part numbers when purchasing boards separately for retrofit.	

Sensors	
Part Number	Type
104220006	422 Cold Cathode Sensor, 2 $\frac{3}{4}$ " CF, LEMO Connectors, 250°C, with field emitter
104220008	
103170024SH	Convection-Enhanced Pirani Sensor, 2 $\frac{3}{4}$ " CF, 250°C
103170034SH	Convection-Enhanced Pirani Sensor, 2 $\frac{3}{4}$ " CF, 250°C, with Port Screen
Consult factory for additional configurations.	

Cable Assemblies (Complete)	
Part Number	Type
100014318-10	Cold cathode cable, radiation resistant, LEMO/BNC/SHV, 10 ft. (422 to 937B)
100012372	Cold cathode cable, 250°C, LEMO/BNC/SHV, 10 ft. (422 to 937B)
103170006SH	Pirani cable, shielded, 10 ft. (317 to 937B)
Consult factory for longer cables.	

Cable Stock and Connectors	
Part Number	Type
100006170	Cold cathode cable, radiation resistant, sold per foot up to 1,000 ft.
100003451	Pirani cable, radiation resistant, sold per foot up to 1,000 ft.
100012644	Cold cathode connector set, sensor end LEMO, controller end BNC/SHV, use only with 100006170
100012643	Pirani connector set, comprises two D-type connectors, 1 x male, 1 x female, use only with 100003451
100016757	Cold cathode, fast response, 2 pin LEMO connector for CL card
The above cables and connectors are intended for end-user assembly.	



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