



UHV Gauging for High Energy Physics

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

Features and Benefits

Series 937 Controller

- Wide measurement range of 10^{-11} to 760 Torr
- Easily operates up to five sensors via three gauge slots
- Displays up to five pressure readings simultaneously
- Repeatable measurements and five independent relay set points for improved process control
- Field upgradeable, modular design
- Easy to operate
- Fast response versions available
- RS232 or RS485 digital communication
- Fully CE compliant with EMC directive 89/336/EEC and Low Voltage Directive 72/23/EEC

Series 317 Bakeable Pirani Sensor

- Series 317 Bakeable Pirani measures from atmosphere to 1×10^{-3}
- Aluminum housing bakeable to 250°C
- Simple operation to remove 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
- 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 937A combination vacuum gauge system is part of the HPS® family of vacuum gauges, and will operate as many as five sensors simultaneously. Every controller is configured to the user's exact requirements by selecting sensor type, line voltage and frequency, units of measurement, communication type and set point values.



Series 937 Controller

The 937A controller is designed for versatility, reliability and economy. The large, easy to read, liquid crystal display provides readout for up to five sensors. The switches are color coded for ease of use and space is available for the user to add identification to the sensor read outs.

The controller uses a single cold cathode board in slot A, and can be configured with two additional gauge boards in slots A and B. These slots will accommodate either the convection Pirani or cold cathode gauges. When used with the available dual convection card, the controller can display up to a maximum of five 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, an option is available for a cold cathode board with a response time less than 15 milliseconds. See part number configurator for ordering information.



317 Pirani Sensor

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.

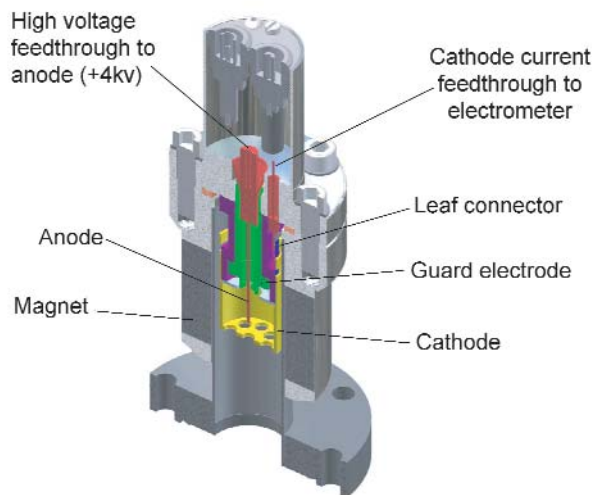
422 Cold Cathode Sensor

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.

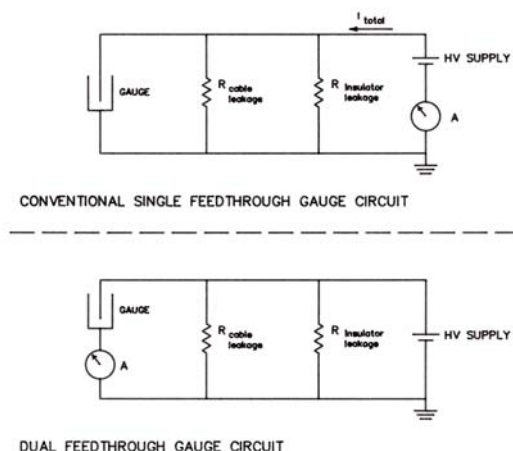


422 Cold Cathode Sensor



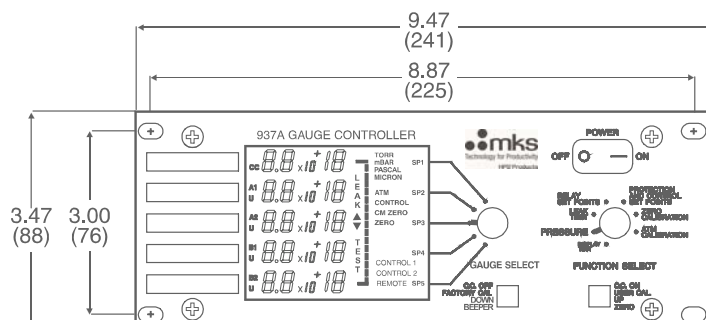
422 Inverted Magnetron Measurement Circuit

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 937A Controller

in./(mm)



Dimensions & Specifications

Series 937A 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	100, 120, 220 or 240 Vac, 50 or 60 Hz, 35 watts
Set Point Relays	Five pressure dependent set points; SPDT relays, contact rating 2 amps @ 30 VAC, IEC 950 safety rating: 2A @ 50 VAC
Output	Buffered analog outputs for each gauge; Logarithmic outputs for each gauge (0.6V/decade output); Combination output, combining cold cathode and auxiliary gauge (0.6V/decade output)
Front Panel Controls	Power on/off, seven position rotary switch to select operating functions, two push buttons to adjust the operating functions and five position rotary switch for tube selection
Display	Liquid crystal; 5 pressure displays with 2 digit mantissas and 1 digit exponents; 0.36" digit height, ±60° viewing angle; Updated 20 times per second; 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	89/336/EEC EMC Directive 73/23/EEC 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 ⁻⁶ Pascal
Resolution	1% of indicated decade, except 10% below 10 ⁻¹⁰ Torr and above 10 ⁻³ Torr	1% of indicated decade
Set Point Response	50 milliseconds	15 to 150 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 ⁻⁶ 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	2.8 lbs. (1.3 Kg) w/ CF	0.5 lb (0.2 kg)
Volume	1.8 in.3 (30 cm3) max	0.5 in.3 (8.0 cm3) 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

in./(mm)

Size 2 3/4" CF LEMO Connectors	
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317 Convection Pirani

in./(mm)

Size 2 3/4" CF	
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Ordering Information

Series 937A Controller

Base Controller		Line Voltage	Line Frequency	Units of Measure	Base Gauge Slot		Gauge Choice Slot "A"	Gauge Choice Slot "B"	Communication Port		
Part Code	Price	Part Code	Part Code	Part Code	Part Code	Price	Part Code	Part Code	Price Each	Part Code	Price
937A		100V 100 Vac	50 50 Hz	TR Torr	CB Cold Cathode		CB Cold Cathode	CB Cold Cathode		232 RS232	
		120V 120 Vac	60 60 Hz	MB mbar	CF Cold Cathode (fast response)		CF Cold Cathode (fast response)	CF Cold Cathode (fast response)		485 RS485	
		220V 220 Vac		PA Pascal	NA Blank		CT Dual Convection Pirani	CT Dual Convection Pirani		PF Profibus	
		240V 240 Vac		MC micron			C1 Single Convection Pirani	C1 Single Convection Pirani		NA Blank	
							NA Blank	NA Blank			

To obtain the total controller price, add the prices of the 937A base controller and each of the options. Sample part number: 937A-120V60TR-CBCBCT232.

Note: CB denotes a cold cathode card for use with the 422 sensor. This card also uses BNC (ion current) and SHV (high voltage) connectors. This card has a typical response time of 100 msec. The fast response version of this card has the part code CF, this has a response time of < 15 msec.

Plug-In Controller Boards

Part Number	Type	Price
100011591	Cold Cathode	
100009428F	Cold Cathode (Fast Response)	
100007943	Dual Convection Pirani	
100007035	Single Convection Pirani	
100009183	RS232 / RS485	
100012702	Profibus Card	

Use these part numbers when purchasing boards separately for retrofit.

Sensors

Part Number	Type	Price
104220006	422 Cold Cathode Sensor, 2 3/4" CF, Lemo Connectors, 250°C	
103170024SH	Convection-Enhanced Pirani Sensor, 2 3/4" CF, 250°C	

Cables

Part Number	Type	Price
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	Price
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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