



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

- 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 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 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



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.

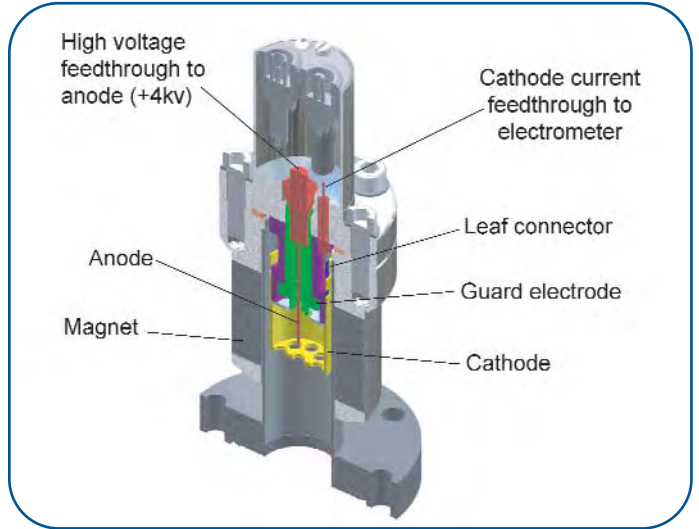
422 Cold Cathode Sensor

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.

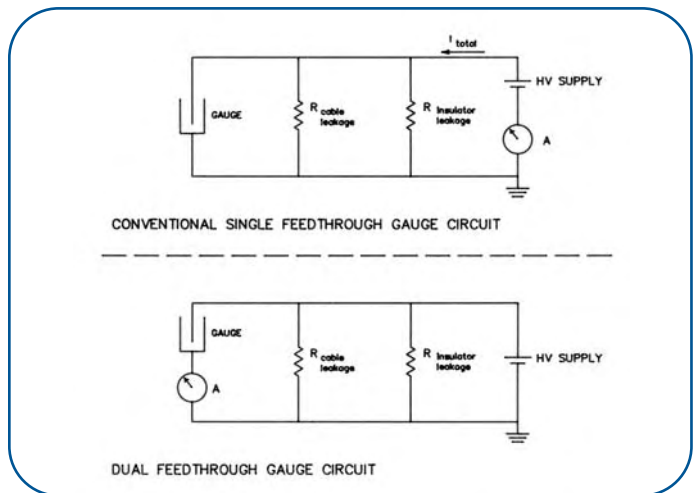


422 Cold Cathode Sensor



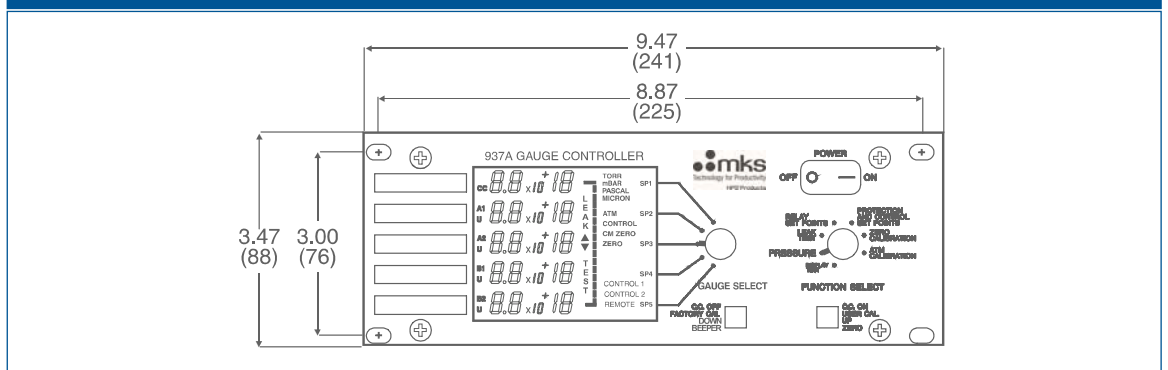
422 Inverted Magnetron Measurement Circuit

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

| | 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 | |
|---|--|

317 Convection Pirani

in./ (mm)

| | |
|--------------------------|--|
| Size 2 3/4" CF | |
|--------------------------|--|



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 | |
| 104220008 | 422 Cold Cathode Sensor, 2 3/4" CF, Lemo Connectors, 250°C, field emitter | |
| 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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