

# MKS Product Guide



MKS Instruments enables technologies that transform our world. We deliver foundational technology solutions to leading edge semiconductor manufacturing, advanced electronics and specialty industrial applications. We apply our broad science and engineering capabilities to create instruments, subsystems, systems, and process control solutions that improve process performance, optimize productivity and enable unique innovations for many of the world's leading technology and

industrial companies. Our solutions are critical to addressing the challenges of miniaturization and complexity in advanced device manufacturing by enabling increased power, speed and feature enhancement for optimized connectivity. Our solutions are also critical to addressing ever-increasing performance requirements across a wide array of specialty industrial applications.

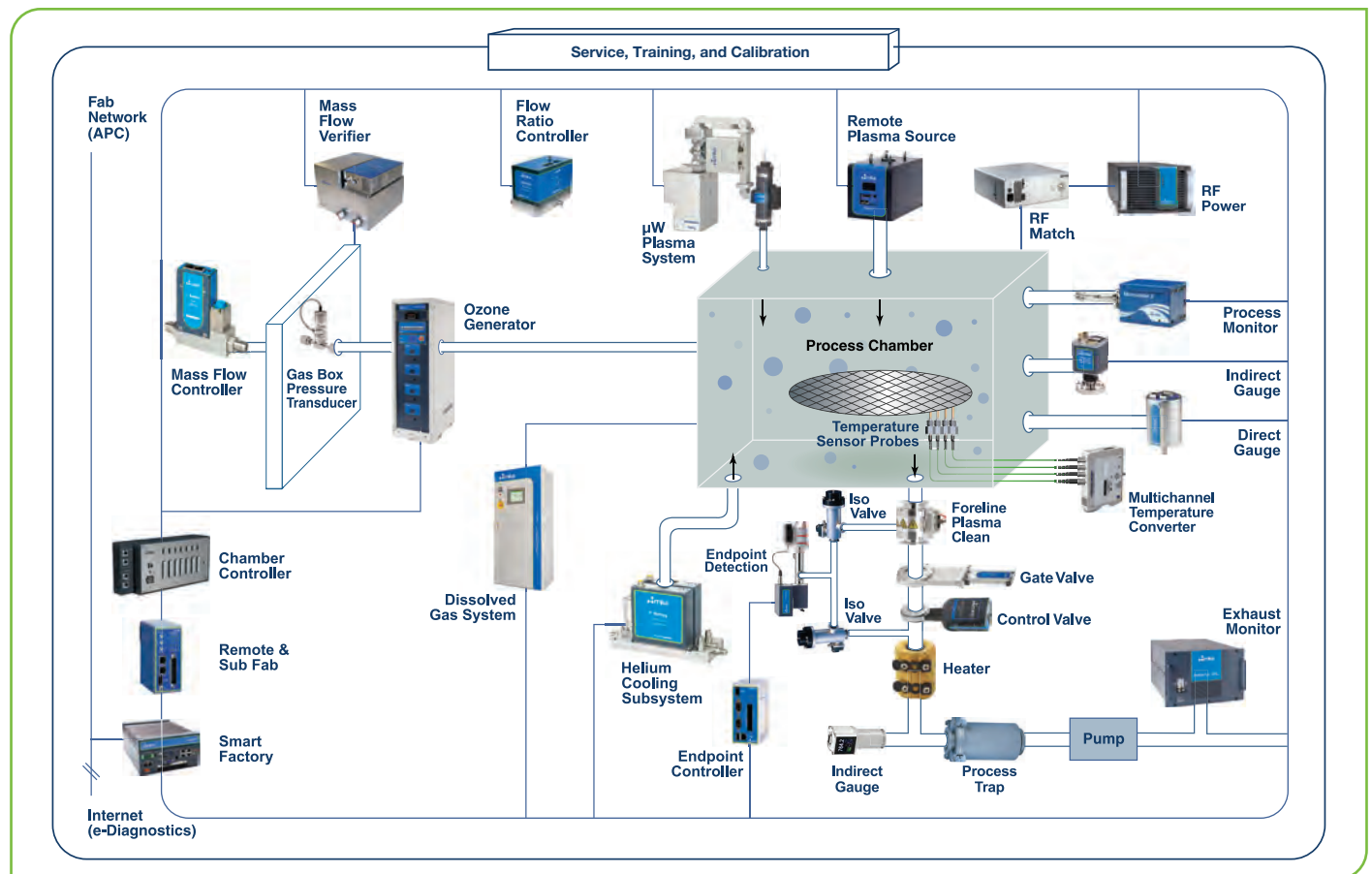
## Products

- Automation, Control & Sensing
- Capacitance Manometers
- Gas Analyzers
- Heater Jackets
- Mass Flow Controllers & Meters
- Plasma & Reactive Gas Solutions
- Pressure Controllers & Valves
- RF & Microwave Generators
- Vacuum Flanges & Fittings
- Vacuum Gauges

## Surround the Wafer®

MKS Instruments' Surround the Wafer® offering provides Semiconductor customers with a wide range of products, design and development services, system level integration, training programs, calibration, service, and repair. This

unique combination of products and services enables our customers to solve the challenges of ultra-thin layers, new materials and complex 3D structures while maintaining quality and productivity levels.



## Automation, Control & Sensing Solutions

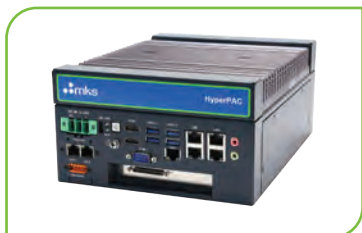
MKS has the critical building blocks and experience to deliver the latest technologies for distributed automation control and process monitoring. We offer a complete Automation Platform Solution along with a suite of automation control hardware and software configurable modules that better automates processes via computer-controlled automation, while seamlessly integrating with existing MKS products to provide a complete solution for semiconductor and industrial manufacturing.

Our Sensing Solution combines a fiber optic probe with a single or multichannel temperature converter providing increased flexibility and ease of use. MKS' Fiber Optic Temperature Sensor, designed specifically to perform under conditions where traditional electrical sensors fail, achieves the highest measurement accuracy and repeatability over a wide temperature range for plasma-assisted semiconductor process such as deposition and etch.



### MKS Automation Platform

- Multi-language compatibility
- Equipped with standard library
- Real-time control
- Easy to replace by module



### HyperPAC Programmable Industrial PC

- Expandable IO
- Compact form factor
- EtherCAT®/DeviceNet™ master capability
- DDR4 ECC memory (Error Correcting Code)



### Fiber Optic Temperature Sensors

- 1 - 5 channels
- Supports Modbus, Analog, or EtherCAT communication
- Analog output 4 - 20mA (16-bit DAC)
- Systems do not require recalibration

## Capacitance Manometers

MKS Baratron® capacitance manometers are highly accurate and repeatable, insensitive to gas composition, compact, and easily interfaced with most process tools. We manufacture our diaphragm gauges almost exclusively using nickel-based alloys such as Inconel®, Incoloy® and others. This makes them highly resistant to corrosion when the materials are matched

to the process. Our sensors are fully welded and 100% leak-checked prior to assembly. In the event of an extremely rare failure of the diaphragm, the process gases are completely contained within the sensor, preventing escape to the outside environment. No other pressure or vacuum gauge offers that level of safety.



### 226B All-purpose Differential Pressure Transducer

- 20 Pa to  $1 \times 10^5$  Pa Full Scale range
- 0.3% or 0.5% of Full Scale accuracy or 0.3% of reading option for unidirectional calibration
- Unidirectional or bidirectional calibration
- 140 kPa overpressure limit



### 626D Unheated Absolute Pressure Transducer

- $1.33 \times 10^2$  to  $1.33 \times 10^5$  Pa Full Scale range
- 0.25% to 0.50% accuracy of Reading
- 310 kPa overpressure limit
- Input Voltage:  $\pm 15$  VDC



### 627H Heated Absolute Pressure Transducer

- $2.67$  to  $3.33 \times 10^6$  Pa Full Scale range
- 0.12% or 0.15% accuracy of Reading
- 310 kPa or 120% of Full Scale overpressure limit, whichever is greater
- 45°C temperature control



### 631F Heated Absolute Pressure Transducer

- $1.33 \times 10^2$  to  $1.33 \times 10^5$  Pa Full Scale range
- 0.50% accuracy of Reading
- 150°C, 200°C internally heated temperature
- Uses: LPVCD, freeze drying etc.

## Capacitance Manometers



### 722C Compact All-purpose Absolute Pressure Transducer

- $1.33 \times 10^2$  to  $3.33 \times 10^6$  Pa Full Scale range
- 0.50% accuracy of Reading
- 310 kPa overpressure limit
- Signal output: 0 - 10 VDC or 0 - 5 VDC



### AA07B Gas Supply Pressure Transducer

- $1.33 \times 10^5$  to  $2 \times 10^7$  Pa Full Scale range
- 1% accuracy of Reading
- 13 - 32 VDC @ 10 mA max input power



### DA05A and DA07A Absolute Baratron® Digital Capacitance Manometers

- DA05A: Full Scale pressure <1 Torr/mbar and heated to 45°C, 80°C, and 100°C
- DA07A: Full Scale pressure from 1 - 1000 Torr/mbar and unheated or heated to 45°C, 80°C, and 100°C
- Includes both analog output and EtherCAT communications
- Standard or etch/fluorine/deposition friendly sensor options available



### PR4000B Digital Power Supply / Readout

- Power Supply:  $\pm 15$  VDC @ 1.5 Amps; 24 Volts @ 1 Amp
- RS232 standard, RS485 optional for dual-channel

## Gas Analyzers (Mass Spectrometers)

Our wide range of powerful, versatile, and proven mass spectrometry-based solutions deliver a new level of understanding and control in vacuum and gas-related applications.



### **Cirrus™ 3-XD Atmospheric Gas Analyzer**

- Benchtop or rack-mount gas analysis system
- Detection at ppb to % level
- 250 data points per second
- Ethernet communication



### **HPQ3 High-Pressure Residual Gas Analyzer**

- 0.13 Pa maximum operating pressure
- 1-100 amu mass range
- Ethernet communication
- Fully-automated in-situ process monitoring possible



### **Microvision 2 Smart Head Quadrupole Mass Spectrometer**

- <3 ms per point analog scanning speed
- Complete range of additional digital and analog connections
- Pollution-resistant double filter

## Gas Analyzers (Mass Spectrometers)



### **Vision 2000-A Residual Gas Analyzer for ALD & CVD Processes**

- $<2.7\text{e-}10$  Pa minimum detectable partial pressure
- Modular UniBloc inlet with all metal seals and field serviceable parts
- Temperature inlet up to  $200^{\circ}\text{C}$  (consult the factory for models up to  $300^{\circ}\text{C}$ )
- Direct coupling for a sample transfer tube



### **Vision 2000-C™ & Vision 2000-E™ Residual Gas Analyzers for Multi-pressure, CVD & ALD Processes**

- $<2.7\text{e-}9$  Pa minimum detectable partial pressure
- Continuous in situ monitoring
- Baseline monitoring for air leaks and background contamination
- Remote Vacuum Controller (RVC) for failsafe vacuum operation



### **Vision 2000-P™ Residual Gas Analyzers for Select Pressure & PVD Processes**

- $<100$  ppb for most common gases
- Track process gas mixture composition when two gases are utilized
- Vacuum troubleshooting for fast PM recovery

## Gas Analyzers (FTIR/TFS™)

FTIR Spectroscopy gas analyzer instruments from MKS are capable of ppb to ppm sensitivity for multiple gas species in a variety of gas analysis applications, such as toxic gas detection, automotive emissions measurement, and monitoring stack emissions, processes, ambient air, purity, and selective catalytic reduction performance.

MKS Instruments' platform of innovative optical analyzers based on Tunable Filter Spectroscopy (TFS™) provides real-time gas analysis, while delivering customers a substantially lower total cost of ownership. TFS can be utilized from UV (Ultra-Violet) through IR (Infra-Red) spectral regions.



### **AIRGARD® Ambient Air Analyzer**

- FTIR (infrared spectroscopy) has compact design with wide measurement wavelength range
- Single digit parts per billion detection
- Less than 20 seconds response time
- Library of 375 harmful substance/gases



### **MultiGas™ 2030 FTIR Gas Analyzer**

- Fully-automated gas analyzer that can directly read concentration levels
- Able to detect multiple gas 1-10 ppm level even among exhaust gas flows
- 5 Hz sampling
- Capable of transient phenomena monitoring



### **Precisive® Hydrocarbon Gas Analyzer**

- No carrier gas or fuel gas requirements
- Hazardous area certified
- Drift doesn't exceed 0.2% per month



## Heater Jackets

Our heater jackets are designed for use on stainless steel tubing and components. These cleanroom-compatible, CE compliant jackets are made with a unique molded design for proper fit and easy installation. Materials

ensure consistent and uniform heating where the heater jacket comes in contact with the piping, while maintaining a safe, "warm to touch" temperature on the outside of the jacket.



### Series 48 Single-Use Filter

- Molding specification heater for vacuum pipes
- 40°C to 100°C temperature set point range
- CE, UL, Semi S2, and Nema 4x compliant
- Equipped with temperature controller



### Series 49UL Thermal Management System

- Polyimide or Teflon® heater jacket
- Local LED status display
- Low particulate generation and low VOC
- 25°C to 200°C temperature range

## Mass Flow Controllers & Meters

Mass flow controllers and meters are available in thermal and pressure based sensor technologies, analog and digital communication, and metal or elastomer seals. Enabling our customers to bring their products and

processes to market faster, more reliably, and more cost effectively is at the heart of our flow measurement and control product design philosophy.



### C-Series Compact Mass Flow Controllers

- Full Scale flow 15 sccm to 50,000 sccm (N<sub>2</sub> equivalent)
- Ultrafast response time of <100 msec
- $\pm 0.8\%$  set point accuracy
- Minimal zero and span drift assure long term reproducibility



### G-Series Mass Flow Controllers

- Full Scale flow 5 sccm to 300 slm (N<sub>2</sub> equivalent)
- EtherCAT, DeviceNet, Profibus®, Profinet®, RS485, or analog communication available
- Elastomer and metal-sealed
- 4-20 mA communication



### High Flow Mass Flow Controllers

- Full Scale flow 500 slm to 1000 slm (N<sub>2</sub> equivalent)
- Valve plug options of Viton®, Buna, Neoprene® or EPDM
- Analog, RS485, Profibus, Profinet or DeviceNet I/O communication available
- Standard closed conductance leak rate of less than 1.0% of Full Scale



### P-Series High Performance Mass Flow Controllers

- Full Scale flow 5 sccm to 50,000 sccm (N<sub>2</sub> equivalent)
- Metal seal
- Analog, DeviceNet or EtherCAT communication available
- Multi-gas/Multi-range with 1% set point accuracy

## Flow Ratio Controllers and Flow Verifiers



### Delta™ Flow Ratio Controller

- Full Scale flow 500 sccm to 10000 sccm
- Separates mixed gas at the desired ratio
- Available with 2, 3 or 4-zone flow ratio control
- Analog, EtherCAT or DeviceNet communications



### High Precision Mass Flow Verifier

- Verifies MFC flow in situ
- Measurement range 5 to 3000 sccm
- Process matching between wafers, chambers or seals with a measurement precision of 1.0% or more

## Plasma & Reactive Gas Solutions

IC architectures and new materials require innovation in materials processing. MKS delivers leading edge technology to improve productivity and process

repeatability for deposition, etch and wet clean processes with Remote Plasma Sources, Ozone Generation and Dissolved Gases.



### CM12P1 Remote Plasma Source for ALD, CVD, and PVD Chambers

- Compact design enables easy integration to OEM process chambers
- 12 kW output power
- $\pm 1\%$  to power set point accuracy
- EtherCAT or Analog DB25 communication



### CH24P1 Remote Plasma Source For High Flow Applications

- Compact split applicator power design provides easy integration to OEM process chambers
- 24 kW output power
- $\pm 1\%$  to power set point accuracy
- EtherCAT or Analog DB25 communication



### Paragon® Remote Plasma Source

- 8 slm  $\text{NF}_3$  flows
- $> 95\%$   $\text{NF}_3$  dissociation
- Compatible with  $\text{O}_2$  and  $\text{NF}_3$  mixed gases



### Revolution® Remote Plasma Source

- Up to 10 slm oxygen radicals
- Plasma power up to 6kW
- EtherCAT or analog communication

## Plasma & Reactive Gas Solutions



### LIQUOZON® Dissolved Gas System

- 30 - 90 ppm ozone concentration
- 2 - 140 lpm flow rate
- Analog and digital bidirectional communication with remote control



### Ozone Gas Delivery System

- 350g/Nm<sup>3</sup> minimum ozone output
- Models available with up to 4 channels
- Oxygen or nitrogen feed gas
- System options include safety monitoring, status indicators and ozone destruction capability

## Pressure Controllers & Valves

Our innovative solutions for vacuum pressure control are backed by our relentless focus on operational excellence to ensure your success by improving the productivity of vacuum processes.



### 148JA All Metal-sealed Control Valve

- 10 sccm to 30 slm Full Scale range
- 316 S.S., Nickel, Teflon, KM45 and Elgiloy® wetted materials
- 150°C bake out temperature
- 4 VCR® male fittings



### 248D Elastomer-sealed Control Valve

- 10 sccm to 50,000 sccm Full Scale range
- 316 S.S., Nickel, Viton standard wetted materials
- 60°C bake out temperature
- ¼" Swagelok® standard fitting; 4 VCR or 4 VCO® optional



### PPCA High Performance Pressure Control Valve with Integrated Controller

- 1.33 to 133.33 Pa Full Scale range
- Full Scale flow 50 sccm to 50,000 sccm
- Teflon, Viton, Buna-N, Neoprene, EPDM valve seat
- 4 VCR fittings



### PPCMA High Performance Downstream Pressure Controller with Mass Flow Meter

- 0.66 to 133.33 Pa Full Scale range
- Full Scale flow 5 sccm to 5000 sccm (N<sub>2</sub> equivalent)
- Teflon, Viton, Buna-N, Neoprene, EPDM valve seat
- 4 VCR male fittings, 1.5" surface mount (C-seal)

## Pressure Controllers & Valves



### T2BA Exhaust Throttle Valve

- 0.25% of set point accuracy or 5 mV (whichever is greater)
- KF25, KF40, KF50, NW63, NW80, NW100 and NW160 valve bore and flange size. Additional sizes available.
- Heatable valve body (105°C standard, 150°C and 200°C optional)
- EtherCAT, RS232, RS485, DeviceNet, and Analog TTL communication



### Vacuum Valves

- Various vacuum valves according to the usage, including compact bellows valve, self-heating valve, and a 2-stage valve for which soft start is possible

## RF & Microwave Generators

MKS offers high reliability, compact, solid state, RF power generators and microwave generators and systems. Our generators, combined with our Impedance Matching Network and our V/I Probe form a complete RF Delivery System.



### elite™ RF Plasma Power

- 13.56 MHz frequency
- >85% power efficiency DC to RF
- $\pm 2\%$  power reproducibility accuracy
- Half-rack enclosure enables direct tool mounting



### Keinos RF Generator

- 2 MHz frequency
- 5 kW, 11 kW, 13 kW output power
- Up to 50 KHz pulse frequency for advanced process requirements
- Forward power accuracy of  $< \pm 1.0\%$  of set point



### SmartPower® Microwave Power/Plasma Source Generator

- 1.8 kW and 3 kW output power
- 1% output power ripple
- Supports 200mm and 300mm applications



## Vacuum Flanges & Fittings

We offer ISO-KF, ISO-MF, ISO-BF, CF (ConFlat®), and welded style vacuum fittings, vacuum flanges and vacuum components including elbows, reducers, tees, crosses, viewports, seals, adapters, clamps, hoses, flanges, tubes and tubing, and gaskets.



### Series 23 Buttweld Vacuum Components

- Designed to be used in conjunction with our full line of ISO-MF, ISO-KF and CF UHV flanges
- Easily welded to the flanges or each other during on-site installation
- Made of 304 stainless steel
- Specifically prepared for use in high vacuum process or UHV applications.



### Series 31 ISO-KF Vacuum Flange Components

- Made with quality stainless steel materials
- Available in sizes NW ISO 10 to NW ISO 50
- Custom manifolds and flanges available
- High temperature O-rings available



### Series 76 ISO-MF and ISO-BF Vacuum Flange Components

- Quick operating modular system for vacuum construction with flanging ranging from 2.5 to 24 inches (NW63 to NW630)
- More compact than ASA flanges
- Sexless flange



### Series 88 CF UHV Flange Components and Fittings

- Standard for ultrahigh vacuum (UHV) applications
- Made with very high purity stainless steel
- Available sizes from mini 1-1/3 to 4-5/8 inches

## Vacuum Gauges: Cold Cathode Transducers and System Controller

MKS Instruments offers a wide range of cold cathode products. The 970B Series is a family of compact, low cost, general-purpose transducers that utilize from one to three sensors — cold cathode, MicroPirani™ and Piezo technologies. Combining these sensing technologies enables a wide measurement range from  $10^{-6}$  Pa to atmosphere. In addition to its small size, broad range and lower cost, the 970B Series can

be operated via digital communication or as an autonomous analog unit. The family comprises of three transducer models, the 971B UniMag™ (cold cathode), 972B DualMag™ MicroPirani/cold cathode) and the 974B QuadMag™ (Piezo/MicroPirani/cold cathode). Options include a local display and set point relays.



### Series 970B Cold Cathode Transducer Family

- Wide measurement range  $10^{-6}$  to 13 kPa
- Low CCG turn on pressure ( $6.66 \times 10^{-2}$  Pa) for longer lifetime
- All transducers include both analog and digital communication for ease of operation



### Series PDR900 Controller

- Single channel controller for use with 900 Series transducers
- LCD menu display for easy user interface
- Easy to read 5 digit LED display
- Three high power set point relays for process control

## Vacuum Gauges: Combination Gauge/System Controllers

MKS offers highly flexible vacuum gauge controllers that enable a wide range of gauging technologies, tailoring the system to each individual application. These versatile vacuum controllers provide power and simultaneous

readouts for up to six different vacuum gauges and/or mass flow controllers, with options for controlling pressure, calibration, and system diagnostics.



### Series 937B Digital Combination Vacuum Gauge System

- $1 \times 10^{-9}$  to  $2.7 \times 10^6$  Pa measurement range
- Simultaneous control and readout of up to six sensors and gauges
- User-configurable for units of pressure in Torr, millibar, Pascal, or microns
- RS232, RS485, and Profibus (optional) communication



### Series 946 Vacuum System Controller

- Simultaneous control and readout for up to six vacuum gauges and/or six mass flow controllers
- Provides pressure measurement, flow, valve, and pressure control
- Closed-loop pressure control option for use with MKS valves eliminates the need for separate pressure control electronics
- RS232 and RS485 communication

## Vacuum Gauges: Micro-Ion® Gauges and Spinning Rotor Gauge

The Micro-Ion® gauge is the world's smallest B-A style gauge in an all-metal, rugged enclosure. Micro-Ion gauges are compact, reliable, cost-effective, and measure a wide range of vacuum pressure. Micro-Ion modules are available with dozens of different options and capabilities to meet any need for accurate pressure measurement from  $10^{-7}$  Pa to atmosphere.

The Spinning Rotor Gauge (SRG) line is a high-vacuum gauge that operates by measuring the amount of viscous drag on a magnetically-levitated spinning ball, which is directly related to the number of molecules in the chamber. The SRG is an industry calibration standard, often used in a metrology department.



### Series 355, 392, 390 Micro-Ion® Modules and Transducers

- Series 355: Micro-Ion transducer provides vacuum pressure measurement from  $1 \times 10^{-7}$  to 7 Pa
- Series 392: Combines Micro-Ion and Conductron sensors to provide measurement from  $1.33 \times 10^{-7}$  Pa to atmosphere
- Series 390: Combines Micro-Ion, Conductron and Piezo resistive sensors to provide measurement from  $1.33 \times 10^{-7}$  Pa to atmosphere, along with gas independent atmospheric pressure indication



### Spinning Rotor Gauge System (SRG3-EL)

- $5 \times 10^{-5}$  to 100 Pa measurement range
- Transfer standard for vacuum measurement
- Insensitive to ionization effects from other vacuum gauges
- Up to 1 Pa: 1% of measuring value + U 1 to 100 Pa: increasing up to 10% of measured value (typical)

## Vacuum Gauges: Mini-Convectron®, Convectron® Gauges, Controllers and Transducers

Convectron® gauges have been the world-standard convection-enhanced pirani gauge for over three decades and are used in thousands of vacuum processes to accurately measure pressure from  $10^{-2}$  Pa to atmosphere. Every Convectron gauge is individually calibrated before shipping from the factory. The Series 475 Convectron gauge controller incorporates the latest technological

advances in electronics and design. Mini-Convectron® modules combine the Convectron gauge with electronics in a compact modular design and are available with dozens of different options and capabilities to meet any need for accurate pressure measurement from  $10^{-1}$  Pa to atmosphere.



### Series 275 Mini-Convectron® Transducers

- $1 \times 10^{-2}$  Pa to atmosphere pressure measurement
- Compact, rugged, RF and noise-immune module
- 150°C maximum bake out temperature
- RS485 and DeviceNet communication



### Series 275 Convectron® Vacuum Gauge

- $1 \times 10^{-2}$  Pa to atmosphere pressure measurement
- Easy installation in space-restricted locations
- Millisecond response time



### Series 475 Convectron® Gauge Controller

- $1 \times 10^{-2}$  Pa to atmosphere measurement range
- 0.1 Pa resolution at atmosphere
- $N_2$ , Ar, He,  $CO_2$  and  $O_2$  selectable gas curves
- RS232 and optional RS485 communication

## Vacuum Gauges: MicroPirani™ and Piezo Transducers

The Series 900 vacuum transducers are microprocessor-based, stand-alone gauges that offer ultra compact design and a wide pressure measurement range. Designed for system integration, the Series 900 transducers offer both analog and digital communication and incorporate

MEMS-based (Micro Electro-Mechanical Systems) technologies including MicroPirani™ and Piezo sensors. These transducers are mountable in any orientation without loss of accuracy for ease of installation.



### Series 901P MicroPirani™/Piezo Loadlock Transducer

- Accurate absolute measurement from  $1.33 \times 10^{-3}$  to  $1.99 \times 10^5$  Pa, gas independent (8 kPa to 13 kPa)
- 100 msec maximum relay response
- EtherCAT, RS232 or RS485 and analog communication



### Series 902B Absolute Piezo Transducer

- $1.33 \times 10^{-3}$  to  $1.33 \times 10^5$  Pa Full Scale measurement range
- 100 msec maximum relay response
- Suitable for harsh processes
- RS232, RS485, EtherCAT and Analog communication



### Series 910 DualTrans™ MicroPirani™/Absolute Piezo Transducer

- $1.33 \times 10^{-3}$  to  $1.99 \times 10^5$  Pa absolute pressure measurement range
- 85°C maximum, non operating bake out temperature
- Calibration gases include Air, Argon, Helium, Nitrogen,  $H_2$ ,  $H_2O$  vapor,  $CO_2$ , Xenon, Neon



### Series 925 MicroPirani™ Transducer

- $1.33 \times 10^{-3}$  to atmosphere pressure measurement range
- High accuracy for improved process control
- Pre-programmed gas curves for  $N_2$ , Ar, He,  $H_2$ ,  $H_2O$ , Xe and  $CO_2$
- EtherCAT, RS232 or RS485 and analog user interfaces

## Support and Service

### Application Team & Technical Support

Our application labs, staffed with a team of technical experts and MKS-certified test equipment, provide expertise and support in our served applications. With extensive Semiconductor process knowledge in deposition and removal of thin films, patterning of complex architectures, inspection and clean, we provide application support to ensure our customers achieve optimal processing for complex and demanding applications. Our application team also provides critical guidance to our internal product development groups.

Our technical support team provides comprehensive technical support for our products. With experts around the globe, we are staffed to support your installation, set-up, trouble shooting and production inquiries 24 hours, 7 days per week.

### Engineering Development

MKS works closely with our customers to develop specific products and solutions to solve their complex problems. We will develop custom solutions based on the customer's specification. We also collaborate with our customers by providing engineering and development.

### Training Programs

Leveraging our extensive in-house product knowledge and semiconductor processing expertise, we can provide intensive in-house and on-site training for critical subcomponents. Using detailed technical information and demonstration equipment, we tailor training to ensure it's interesting and relevant for your needs. Custom training may also be available.

### Calibration

We offer calibration on our valves, pressure sensors, mass flow controllers, Spectra-Physics® lasers, and Newport™ and Ophir® power meters. Calibration is done on MKS-certified test equipment at our Service Centers around the world.

### Repair

Our Service Centers are staffed by highly-skilled engineers and technicians expert at diagnosing and repairing MKS products. We offer comprehensive repair and service programs that maximize the installed base of critical subcomponents to ensure extended life of your equipment, increased uptime and tool availability, improved predictability and productivity.

## WHY MKS?

### CRITICAL TECHNOLOGIES

World-class technology and development capabilities for leading-edge processes



### PROVEN PARTNER

Recognized leader delivering innovative, reliable solutions for our customers' most complex problems



### OPERATIONAL EXCELLENCE

Consistent execution across all aspects of our business



### COMPREHENSIVE PORTFOLIO

Extensive offering of products and services for the markets we serve



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**MKS INSTRUMENTS** enables technologies that transform our world. We deliver foundational technology solutions to leading edge semiconductor manufacturing, electronics and packaging, and specialty industrial applications.

We apply our broad science and engineering capabilities to create instruments, subsystems, systems, process control solutions and specialty chemicals technology that improve process performance, optimize productivity and enable unique innovations for many of the world's leading technology and industrial companies.

Our solutions are critical to addressing the challenges of miniaturization and complexity in advanced device manufacturing by enabling increased power, speed, feature enhancement, and optimized connectivity. Our solutions are also critical to addressing ever-increasing performance requirements across a wide array of specialty industrial applications.

Additional information can be found at [www.MKS.com](http://www.MKS.com).

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