Pressure Measurement

7

In This Section

page(s)

Kurt J. Lesker Company

Measuring Pressure

Units of Measure

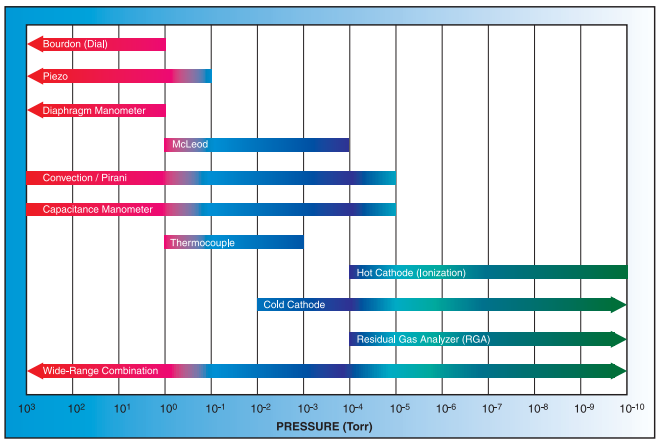
Sub-atmospheric pressures are measured in several units, including: Torr (also called millimeters of mercury, mmHg), milliTorr (mTorr but also called micron, μ), inches of mercury (" Hg), millibar (mbar), and pascal (Pa). In the U.S., three units are in common use: micron as the unit for pressures reached by backing pumps, Torr for high vacuum and UHV pumps, and inches of mercury for coarse vacuum pumps. In Europe, millibar is the common unit for all pressure measurements. Japan uses the pascal unit, but often has Torr as a secondary unit. Most authors of scientific/technical papers are urged to use the SI unit pascal, and some do.

The units are derived from:

- **Pascal—**the force of 1 newton (1 kg accelerating at 1m/sec./sec.) acting on 1 m^2
- **Millibar—**1,000 times the force of 1 dyne (1g accelerating at 1cm/sec./sec.) acting on 1 cm^2
- **Torr—**1/760 times the height of a mercury barometer under "standard" atmospheric pressure
- **MilliTorr or micron—**1,000th of 1 Torr
- **Inches of Hg (vacuum)—**1/29.92 times the height of a mercury barometer under "standard" atmospheric pressure (taking atmospheric pressure as 0" Hg)
- **Inches of Hg (weather forecasts)—**1/29.92 times the height of a mercury barometer under "standard" atmospheric pressure (taking no pressure as 0" Hg)

Pressure Ranges

There is no "universal" gauge that can measure from atmosphere to UHV pressures (a dynamic range of 10^{15}). There are, essentially, three mechanisms used in pressure measurement and the one chosen depends on the pressure range and the residual gases in the vacuum.



Mechanical Gauges have liquid or solid diaphragms that change position under the force of all the gas molecules bouncing off them. These gauges measure absolute pressures unaffected by gas/vapor properties. Unfortunately, this type of gauge is ineffective below 10^{-5} Torr.

Gas Property Gauges measure a bulk property, such as thermal conductivity or viscosity. They are dependent on gas composition and are effective over limited pressure ranges below approximately 100 Torr and above 10^{-4} Torr.

Ionization Gauges For high vacuum and UHV measurements, charge collection is used. The residual gas molecules are ionized by electrons and the resulting ion current measured. Although such gauges will ionize vapors as well as permanent gases, their response depends on parameters other than ionization potential, making accurate total pressure measurement difficult in gas mixtures. Ionization gauges cover the pressure range from 10^{-4} Torr to 10^{-10} Torr.

The typical arrangement of two gauges covering the range of interest between 10 and 1 x 10^{-9} Torr leaves a poorly covered band at pressures widely used in sputtering, etching, CVD, etc. Fortunately, the precise measurements needed between 10^{-1} and 10^{-3} Torr for reproducible processing can be made by adding a third gauge—the capacitance manometer.

When choosing a gauge, in addition to pressure range, other features should be considered: the gauge's pumping speed; how it is affected by radiation, magnetism, temperature, vibration, and corrosive gases; and the damage caused by switching it on at atmospheric pressure. These subjects are discussed in comprehensive vacuum texts such as John F. O'Hanlon's *A User's Guide to Vacuum Technology* (see page 17-20 to order).

Vacuum Gauges

Mechanical Gauges

A gas's pressure is the sum of all the individual forces caused by each atom or molecule colliding with a surface at any instant. Mechanical gauges register this total force by monitoring the surface's movement against the (restoring) force trying to keep the surface in its original place. Because mechanical gauges respond to molecular momentum only, they measure pressures of any gas or vapor. They can be very accurate or inaccurate depending on how the movement is registered.

McLeod

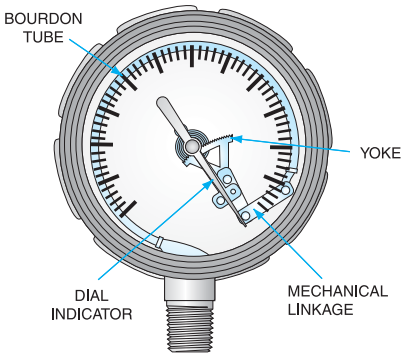
This gauge, though seldom used, is employed mostly as a primary calibration standard for other gauges. In effect, a large known volume of gas at unknown pressure is captured in a glass bulb and compressed by raising the mercury level until the gas is confined in a small, closed capillary of known volume. Because the ratio between the original and final volumes is known and the final pressure can be measured, the original pressure is calculated by Boyle's law (P1 x V1 = P2 x V2). McLeod gauges are particularly useful in the 1 Torr to 10^{-4} Torr range but, because of the compression, cannot be used to measure vapors.

Bourdon

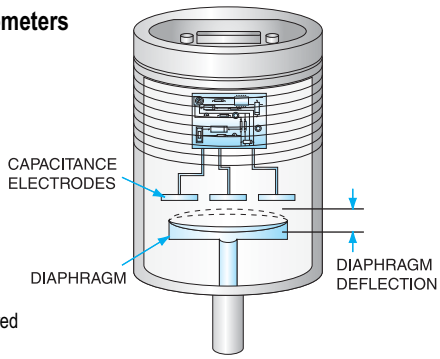
When a closed-end, curved, oval cross-section, copper alloy tube is connected to the vacuum, atmospheric pressure bends it to a greater or lesser degree, depending on the internal pressure. The mechanical force moves an indicator needle through a geared linkage. Bourdon gauges are used primarily in high-pressure measurement (most commonly attached to regulators on gas cylinders), but variations are built to indicate pressures from 0" Hg to 30" Hg and are used for freeze drying, "house" vacuum systems, vacuum impregnation, etc., where the major concern is whether vacuum exists rather than its accurate measurement.

Piezo

Piezo-resistive pressure sensors are typically comprised of a silicon wafer that is machined on a surface that makes the crystal into a suitable deflecting diaphragm when subjected to a normal stress (pressure). The thickness of the silicon crystal at its minimum section is the primary factor that determines the pressure range of the gauge from 1,500 to 0.1 Torr. As the diaphragm deflects under pressure, the resistances of the piezo-resistive elements change in value, causing the Wheatstone bridge network to move out of balance. Applying a voltage to this bridge produces an output voltage that is proportional to the applied pressure. If the elements are of equal resistance, there will be a zero output voltage with no pressure differential across the diaphragm.



Capacitance Manometers



The deflection of a thin metal diaphragm separating a known pressure from an unknown pressure is a measure of the pressure difference between the two volumes. In the capacitance manometer, as the name suggests the deflection is measured using the electrical capacitance between the diaphragm and some fixed electrodes. Capacitance manometers are the most accurate devices for measuring the differential or absolute pressure of all gases (including vapors that do not condense at the gauge's operating temperature).

Gauge heads are specified by their maximum measured pressure (25,000 Torr down to 1 x 10^{-1} Torr), with each head having a dynamic range of approximately 10^4 below that. Accuracies of 0.25% gauge reading are common, with 0.08% available from high-accuracy products.

All types of pressure gauges are affected by ambient temperature changes, but other error sources are so much larger that temperature is ignored. The capacitance manometer, by contrast, is so accurate that gauge-head temperature variation is a critical source of error. We strongly suggest that capacitance manometers be purchased only from reputable manufacturers who understand sources of error and demonstrate effective ways of counteracting them.

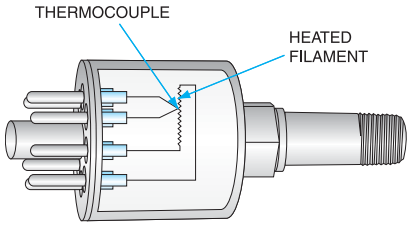
Diaphragm Manometers

Like the capacitance manometer, these gauges use the deflection of a thin metal (or silicon) diaphragm separating a known pressure from an unknown pressure. However, in this type of gauge, the deflection is sensed by a strain gauge attached to the diaphragm. While this limits the minimum measurable pressure to 1 Torr, it does provide a stable, repeatable, device reading pressures up to 1,200 Torr.

Gas Property Gauges

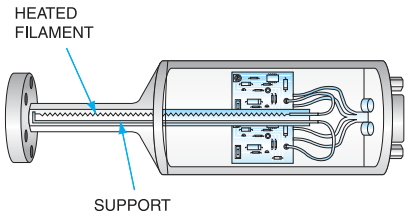
The thermal conductivity or viscosity value for each specific gas is different and varies non-linearly with pressure. Gas property gauges, presented with the typical vacuum chamber gases, are inaccurate. This, and numerous other inherent error sources, suggest the gauge readings are acceptable for noting repeating pressure events but of little use in measuring absolute pressures.

Thermocouple (T/C)



The pressure range between 10 Torr and 10^{-3} Torr is indicated by measuring the voltage of a thermocouple spot-welded to a heated filament exposed to system gas. The filament, fed from a constant current supply, reaches a temperature determined by the amount of energy extracted by the gas. At higher pressures, more molecules hit the filament and extract more energy than at low temperatures. The filament temperatures induce thermocouple voltage changes. These gauges are used extensively in foreline monitoring and to provide the signal to automatically switch the main chamber from backing and high-vacuum pumps at the crossover pressure.

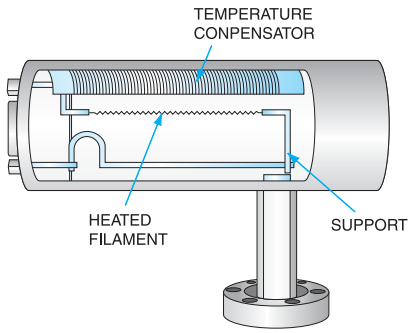
Pirani



In a Pirani gauge, two filaments, often platinum, are used as two arms of a Wheatstone bridge. The reference filament is immersed in a fixed-gas pressure, while the measurement filament is exposed to the system gas. Both filaments are heated by the current through the bridge but, unlike most T/Cs, the Pirani gauge does not use constant voltage or power, but constant filament temperature. Gas molecules hitting the immersed element conduct energy away that is detected and replaced by the feedback circuit to the power supply. This variation of mechanism gives the Pirani gauge perhaps 100 times longer total pressure range (although the same dynamic range for each sensor head) and a faster response. The Pirani gauge is used in the same applications as the T/C gauge. Although the dynamic range for any single gauge matches the T/C, Pirani's cover a pressure range from about 10 Torr to 1 x 10^{-5} Torr.

Convection

This gauge's mechanism differs from that used in the T/C and Pirani gauges only by using a structure that enables the natural convection in (viscous flow) gases to aid in removing heat from the hot filament. Convection gauges measure pressures over the range from about 10 Torr to atmosphere.



Ionization Gauges

With relatively minor differences, all ionization gauges use the same principle. Energetic electrons ionize the residual gases—the positive ions are collected at an electrode and the current is converted to a pressure indication. Hot filament gauges (Bayard-Alpert, Schulz-Phelps) use thermionic emission of electrons from a hot wire, while cold cathode gauges (Penning, Inverted Magnetron) use electrons from a glow discharge or plasma.

All ion-gauge measurements are seriously affected by gas composition. For example, a report in J. Vac. Sci. Tech. indicates an ion gauge's relative sensitivity (relative to N_2 = 1) is 5 for acetone vapor and 0.18 for He. That is, the same absolute pressure of these pure (gaseous) materials will give a gauge indication differing by a factor of almost 28. Ionization gauges do not give accurate absolute pressure measurements unless recently calibrated with the exact gas mixture that is to be measured.

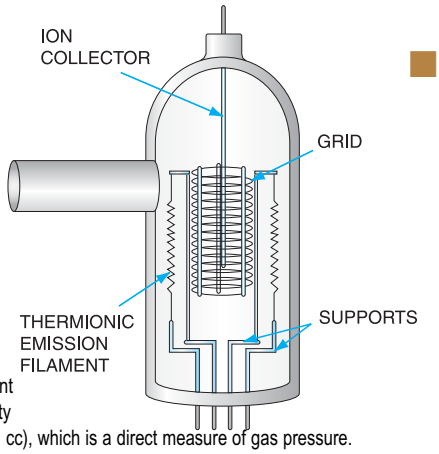
Sensitivity

The term *relative sensitivity* used **above** should not be confused with the parameter called the "gauge sensitivity." The latter comes from the equation relating the gauge's positive ion current (i_p) for a given electron emission (i_e) at given gas pressure (P):

$$i_p = S \times i_e \times P \text{ or } P = 1/S \times i_p/i_e$$

The constant of proportionality (S in units of reciprocal pressure) is the "gauge sensitivity." Practical (hot filament) ion gauges have gauge sensitivities ranging from 0.6 $Torr^{-1}$ to 20 $Torr^{-1}$. This is important when selecting an ion gauge controller because the gauge's sensitivity must be within the controller's available range.

Hot Filament Gauges



The two common hot filament ion gauges, Bayard/Alpert (B-A) and Schulz-Phelps (S-P), differ only in the physical size and spacing of their electrodes. Both have heated filaments biased to give thermionic electrons of 70eV, energetic enough to ionize any residual gas molecules with which they collide. The positive ions formed move to an ion collector held at -150V. The current varies with the gas number density (the number of molecules in each cc), which is a direct measure of gas pressure.

Bayard-Alpert ion gauges have a reasonably linear response from 1 x 10^{-4} Torr to 1 x 10^{-9} Torr, with gauge sensitivities from 5 to 20 $Torr^{-1}$. B-A gauges are available with one or two filaments (the second acting as a spare) and with two filament materials thoria-coated iridium, used in oxygen-rich applications and for "burn-out" protection if accidentally vented and tungsten, used for lower cost and in residual gases containing halogens.

The standard B-A gauge measures down to 1 x 10^{-9} Torr. It does not go lower because primary electrons generate soft X-rays when they hit the grid. An X-ray hitting the ion collector electrode releases a photoelectron, which is indistinguishable from positive ions arriving there. Below 1 x 10^{-9} Torr, photoelectron emission is a large enough fraction of the ion current to distort the pressure reading. Special B-A structures with ultra-thin ion collectors will reach 10^{-10} Torr and perhaps even into the 10^{-11} Torr range.

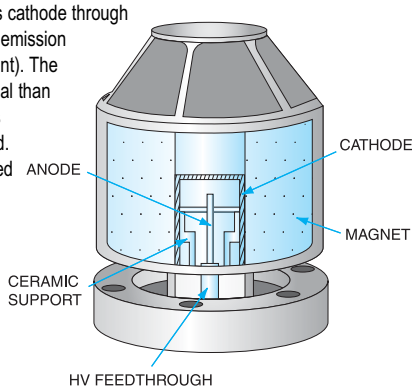
Cold Cathode Gauges

In the CCGs the ionizing electrons are part of a self-sustaining discharge. However, since the CCG has no (thermionic emission) filament, the discharge is initiated by stray field emission or external events (cosmic rays or radioactive decay). At low pressures, this can take minutes and CCGs are usually switched on at high pressure. Once started, the gauge's magnetic field constrain the electrons in helical paths, giving them long path lengths and a high probability of ionizing the residual gas. The ions are collected and measured to determine the gas pressure.

Many electrode geometries have been used—cylinders, plates, rings, rods, in various combinations with the magnetic field direction and strength chosen to maximize the measured current. If the gauge's central or "end" electrodes are negative, the convention is to call this a magnetron. If the same electrodes are positive, the gauge is called an inverted magnetron.

Magnetron: The initial Penning design (cylindrical anode and end plate cathodes) was neither precise nor accurate and it was replaced by other geometries. However, the name Penning is still used even for magnetrons with central wire or ring cathodes. The operating voltage is limited (typically to ~2kV) to avoid field emission effects that cause increases in the ion current unrelated to pressure. While the newer magnetron designs are satisfactory, they are limited to the top of the high vacuum range and attract little commercial attention.

Inverted Magnetron: Largely due to the development efforts of Redhead and his colleagues, this design works into the UHV pressure range. Its axial central anode enters the cylinder/end plates cathode through voltage guard rings (to prevent field emission affecting the ion current measurement). The anode carries a much higher potential than the normal magnetron (~6kV) and is parallel to the gauge's magnetic field. Some commercially available inverted magnetron designs have good linearity and operating characteristics down to 1 x 10^{-11} Torr. However, attempting to start one at such low pressures may take hours or days.



Residual Gas Analyzers

Special mass spectrometers designed to analyze gases remaining in a vacuum chamber are called residual gas analyzers or RGAs. The wealth of information about experimental or process conditions offered by an RGA makes a permanently attached unit a convenient, often necessary, diagnostic device.

Quadrupole RGAs, named for the four rods used in the mass filter section, are powered by mixed RF/DC voltages. Full operating details are beyond this text but are dealt with adequately in many books, such as Dawson's *Quadrupole Mass Spectrometry And Its Applications* and the AVS's monograph by Drinkwine, et al, *Partial Pressure Analyzers and Analysis*. The quadrupole analyzer (or sensor head) bolts to the vacuum system. It consists of an ionizer (ion source) connected to the mass filter, which in turn is attached to an ion detector, all mounted on a UHV flange (often a $2^3/_4$" O.D. CF) carrying the feedthroughs for power and signals. The combined RF/DC voltage is generated close to the sensor head. From here, only main power voltage and returning signal information connect to the control chassis and display or desktop PC. In the ionizer, neutral gas atoms and molecules are bombarded with 70eV electrons from a hot filament. The ionized species are extracted into the quadrupole, where only those ions with the appropriate mass-to-charge (m/e) ratio for the applied RF/DC voltages are transmitted. By varying the RF/DC voltage with time, the m/e ratios are scanned and the ion current at each mass is recorded as a spectrum.

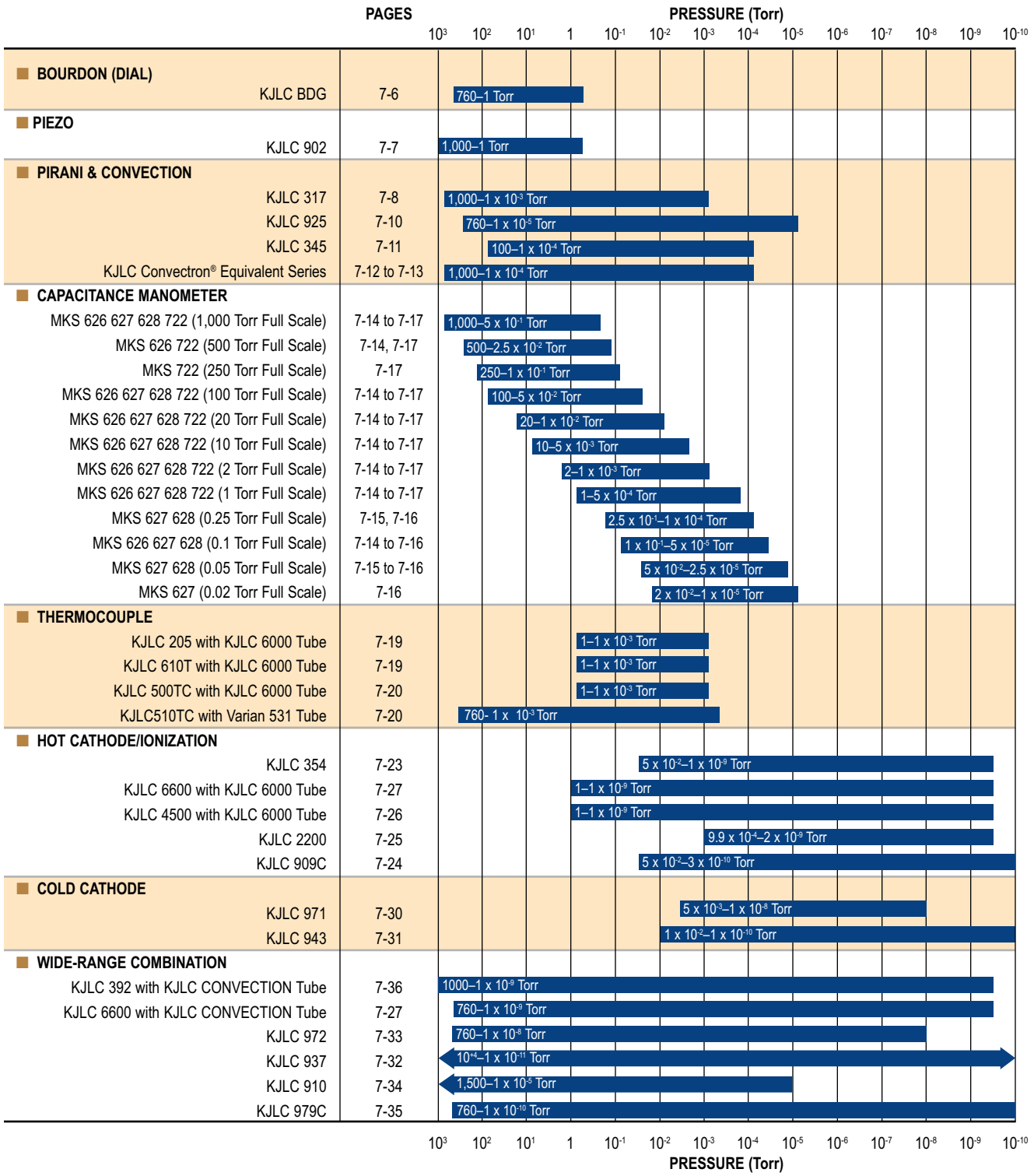
Diagnosing vacuum problems with an RGA requires only a collection of fragmentation patterns from which the following may be quickly determined: the presence of air and water leaks; unacceptable levels of active gases such as O_2, H_2, and H_2O, pump oil backstreaming, the presence of Fl or Cl compounds; the regeneration requirements of a cryopump, and the purity of backfill gases. Because an RGA operates at or below 10^{-4} Torr, high-pressure processes are analyzed with the RGA installed in an auxiliary vacuum system, often a mobile cart moved to various vacuum stations.

Leak Detectors

Leak detectors are mass spectrometers that detect only helium ions at m/e = 4. Because they are specific, they detect extremely small concentrations of helium in the presence of large quantities of other gases. As the name implies, these devices determine the presence of leaks and help locate them. Excellent leak detection instructions are available in Harris' book, Modern Vacuum Practice or available as part of our Lesker University curriculum (see page 16-12 for available training courses).

The chamber under test and the leak detector are connected via a vacuum-tight tube and the chamber is evacuated using the leak detector's own vacuum system. Helium is sprayed from a fine nozzle at the chamber's surface where it displaces the air diffusing through the leak only while the probe is directed at the leak's position. It is a common misconception that the pressure in the chamber must be low before leak testing can start. In fact, chamber pressures lower than 10^{-2} Torr are rarely needed. Once the leak detector inlet valve is fully open, further efforts to reduce pressure in the chamber only waste time. During one operator's 11-year leak-checking experience, for example, most leaks were detected while the leak detector's inlet valve was only partially cracked. Leaks larger than 1 x 10^{-5} atm cc/sec. are the most common—"some" leaks were in the 1 x 10^{-6} atm cc/sec. range, six leaks were in the 1 x 10^{-7} atm cc/sec. range, two in the 1 x 10^{-8} atm cc/sec. range, and only one in the 1 x 10^{-9} atm cc/sec range. Because most leak detectors have a minimum detectable leak rate of 1 x 10^{-10} atm cc/sec., detection sensitivity is rarely a problem for locating real leaks.

Gauge Selection Guide



Kurt J. Lesker Company

➤ 760–1 Torr

KJLC® BDG Series

Our liquid-filled bourdon vacuum gauges are industrial-grade dial gauges suitable for pressures down to 1 Torr (mbar).

Features:

- Bourdon tube constructed of phosphor bronze
- Corrosion- and impact-resistant, industrial-grade Zytel nylon case
- Removable Zytel nylon bezel design for easy calibration
- Large 2 1/2" dial and non-yellowing clear glycerin fill for readability
- Internal "breathing diaphragm" and diaphragm seal:
  - —Virtually eliminates the air bubble in the mid-range of the gauge for improved readability
  - —Prevents freezing, clogging, and corrosion of gauge
  - —Compensates for temperature
- Brass 1/4" NPT male stem-style connection
- 3 major pressure measurement systems available:
  - —Torr, mbar, and in. Hg

Gauges

Description	Termination	Dial Size	Pressure Units	Part No.	Price
Liquid-Filled Bourdon Gauge	1/4" NPT Male	2 1/2"	Torr	KJLDGTORR	Call
Liquid-Filled Bourdon Gauge	1/4" NPT Male	2 1/2"	mbar	KJLDGMBAR	Call
Liquid-Filled Bourdon Gauge	1/4" NPT Male	2 1/2"	in Hg	KJLDGINHG	Call

Gauge Accessories

Description	Part No.	Price
KF16 to 1/4" Female NPT Adapter	QF16XFNPT4	Call
KF25 to 1/4" Female NPT Adapter	QF25XFNPT4	Call
KF40 to 1/4" Female NPT Adapter	QF40XFNPT4	Call
KF50 to 1/4" Female NPT Adapter	QF50XFNPT4	Call
Viton® Centering Ring for KF16 Flange	QF16-075-SRV	Call
Clamp for KF16 Flange	QF16-075-C	Call
Viton Centering Ring for KF25 Flange	QF25-100-SRV	Call
Clamp for KF25 Flange	QF25-100-C	Call
Viton Centering Ring for KF40 Flange	QF40-150-SRV	Call
Clamp for KF40 Flange	QF40-150-C	Call
Viton Centering Ring for KF50 Flange	QF50-200-SRV	Call
Clamp for KF50 Flange	QF50-200-C	Call

➤ 1,000–1 Torr

KJLC® 902 Series

These piezo transducers combine the pressure measurement technology of a piezo transducer with an integrated electronic control circuit.

- Our KJLC 902 is an absolute direct reading transducer, enabling the measurement to be gas independent
- Transducer includes a unique temperature compensation circuit which allows for high accuracy over a wide measurement range <1 to 1,000 Torr (<1 to 1,333 mbar)

902 Gauge with Display Module

An LED readout is available for the 902 which is controlled through the 0–10 VDC linear analog output. The readout is streamlined with the width and depth of the transducer, and adds only 1.4" to the height. The readout attaches to the transducer through the D-sub connector and has a through connector to enable the transducer to connect to the rest of the system for integration.

Additional Features:

- Low-cost transducer alternative
- Compact system design with integrated electronics and sensor in one unit
- Reduced process cycle time due to the tranducer's fast, accurate, and repeatable pressure measurements
- Transducer is suitable for harsh processes due to its clean, robust design and stainless steel construction
- Ease of operation with both digital communication and user- configurable analog output in one unit

  Digital: RS-485 or RS-232

  Digital models also have choice of Analog: 0 to 5 or 0–10 VDC

  —Linear

  —Logarithmic
- Process control from set-point relay with fast response time
- CE marked

Applications:

- Load locks
- Vacuum processes
- Foreline and roughing pressure measurement
- Warning alarm
- Backfill and venting monitoring
- Vacuum system control relay

NOTE: See page 7-9 for our PDR900 controller.

SPECIFICATIONS

Method of Measurement — Piezo
Measuring Range & Accuracy — 1–1,000 Torr (1 to 1,333 mbar): ± <1% of reading
Interface/Connection — Digital RS-485 or RS-232, 9-pin Sub-D
Power Requirements — 12–30 VDC, 30mA, 0.5W max
Repeatability — ± 0.03% of F.S.
Set-Point Range — 1–1,000 Torr (1 to 1,333 mbar)
Set-Point Relay Response — 50ms (1 SPST resistive relay rated at 1A @ 30 VAC/DC)
Temperature: Operating — 0–50° C
Temperature: Bakeout — 85° C
Overpressure Limit — 2,000 Torr (2,666 mbar)
Installation Orientation — Any
Materials Exposed to Vacuum — 304 SS, 316 SS
Output Voltage — 0-10 VDC

Gauges (Transducers)

Description	Termination	Part No.	Price
902 Series Piezo Gauge			
Digital RS-485	KF16	K9021112	Call
	4 VCR® Female	K9021212	Call
	8 VCR Female	K9021312	Call
Digital RS-232	KF16	K9021113	Call
	4 VCR Female	K9021213	Call
	8 VCR Female	K9021313	Call

Gauge Controllers & Accessories

Description	Part No.	Price
KJLC PDR900 Series Controller*		
120 VAC	KPDR90012US	Call
220 VAC	KPDR90012EU	Call
Bolt-on Display Unit (Torr only)	K902001	Call
Power Supply/Cable Combo (RS232)		
120 VAC (U.S.)	K12641	Call
90-230 VAC (U.K./EU)	K12664	Call
Power Supply Only		
120 VAC (U.S.)	K14245	Call
Sub D-Type 9-Pin to 15-Pin Adapter for 902	K14245	Call
Software Package for PC Control	K12604	Call
Cable, 10', 9-Pin to connect PDR900 to 902	K13613	Call
Cable, 25', 9-Pin to connect PDR900 to 902	K13615	Call

*120 VAC version includes US Mains cable.
220 VAC version includes both UK and EU Mains cable.

Kurt J. Lesker Company

➤ 1,000–1 x 10^{-3} Torr

KJLC® 947 Series

Ideal for rough to medium vacuum applications, including measurement of roughing and foreline pressures, activation of high vacuum sensors, or startup of a system process with the standard relay set points.

Features:

- Convection-enhanced Pirani vacuum gauge controller
- Digital LED display for clear, unmistakable readings
- Wide measurement range of 10^{-3} to 10^{+3}
- Rapid responsiveness for critical applications
- Two independent relay set-points for process control
- Gas-type sensitivity ideal for leak detection
- Multiple pressure unit versions available
- CE marked

Controls:

- Zero adjust
- Atmospheric adjust
- Set-point functions

Applications:

- Semiconductor
- Food processing
- Analytical applications
- R&D
- Other industrial vacuum applications

947 SERIES GAUGE CONTROLLER SPECIFICATIONS

Measuring Range & Resolution — 1 x 10^{-3}–1,000 Torr (1.3 x 10^{-3} to 1,333 mbar): 1% of decade
Interface/Connection — 9-pin, Sub-D-socket
Power Supply: Voltage — 90–130 VAC, 50/60 Hz or 210–250 VAC, 50/60 Hz
Power Supply: Max Consumption — 9W
Set-Point Range — 2.0 x 10^{-3} to 990 Torr (2.6 x 10^{-3} to 1,320 mbar)
Set-Point Relays — 2 SPDT @ 1A (resistive)
Set-Point Relay Response — 150ms
Temperature: Operating — 5–40° C
Installation Orientation — Any
Materials Exposed to Vacuum — 304 SS, 316 SS

317 SERIES GAUGE (SENSOR) SPECIFICATIONS

Method of Measurement — Pirani
Measuring Range & Accuracy — 1 x 10^{-3} to 1,000 Torr (1 to 1,333 mbar): ±<1% of Decade
Interface/Connection — Digital RS-485, 9-pin, Sub-D-socket
Repeatability — 5% of indicated pressure
Temperature: Operating — 0–50° C
Temperature: Bakeout — 100° C for Shielded model (gauge tube only)
Gas Calibration — Air/Nitrogen
Installation Orientation — Horizontal
Materials Exposed to Vacuum — Stainless steel, nickel, glass, platinum

Gauge Controllers & Accessories

Description	Part No.	Price
947 Series Controller*		
120 VAC (Torr readout)	K9471206T	**Call**
220 VAC (mbar readout)	K9472205M	**Call**
Interconnect Cable		
10 ft./3m	K31706S	**Call**
25 ft./7.6m	K31707S	**Call**
50 ft./15m	K31708S	**Call**
Controller Panel Mounting Hardware	K5021	**Call**
19" Controller Rack Panel		
3U, 1/4 DIN, blank	K5456	**Call**
3U, 1/4 DIN, 1 cutout	K5457	**Call**
3U, 1/4 DIN, 2 cutouts	K5458	**Call**
3U, 1/4 DIN, 3 cutouts	K5459	**Call**
3U, 1/4 DIN, 4 cutouts	K5460	**Call**

*947 Series Controllers include US Mains Power Cable for Torr versions and both EU and UK Mains Power Cables for mbar versions.

Gauges (Sensors)

Description	Termination	Part No.	Price
317 Series Shielded Pirani Gauge			
	KF16	K31710S	**Call**
	1/8" Male NPT	K31711S	**Call**
	8 VCR® Female	K31712S	**Call**
	1 1/3" CF	K31713S	**Call**
	2 3/4" CF	K31714S	**Call**
	KF25	K31727S	**Call**
	4 VCR Female	K31729S	**Call**

KJLC® PDR900 Series Controller

A standalone single-channel controller for use with our KJLC 900 Series digital transducers.

The PDR900 sets new standards for vacuum gauge controllers. It can be used as a standalone power supply with readout, or as a tool for configuring, calibrating, and diagnosing the integrated gauge sensors used in OEM applications. For use with the 902, 909, 910, 925, 971, 972, and 979.

Features

- Easy-to-read 5-digit LED readout display with LCD menu
- User-selectable pressure units
- Analog and digital communication
- 3 high-power set-point relays for process control
- Leak detection feature with warning alarm
- Data logging tool for process monitoring
- Universal power supply

SPECIFICATIONS

Display Pressure Range — 1 x 10^{-10} to 1,500 Torr (1.3 x 10^{-10} to 2,000 mbar) (sensor dependent)
Display — 5-digit LED
Pressure Units — Torr, mbar, Pascal (user-selectable)
Operating Temperature — 5–40° C
Power Requirements/Consumption — 90–250 VAC, 50/60 Hz (20 W)
Communications — RS-232/RS-485 and analog output
Set Points — 3
Set-Point Relays — SPDT, 4A @ 250 VAC (resistive)

Description	Part No.	Price
KJLC PDR900 Series Controller (120 VAC)*	KPDR90012US	Call
KJLC PDR900 Series Controller (220 VAC)*	KPDR90012EU	Call
Connection Cables for Sensors		
10', 9-PIN for connecting to 902 & 925 sensors	K13613	Call
25', 9-PIN for connecting to 902 & 925 sensors	K13615	Call
10', 15-PIN for connecting to 901, 910, & 979 sensors	K13620	Call
25', 15-PIN for connecting to 901, 910, & 979 sensors	K13622	Call
10', for connecting to 909C	K13703	Call
25', for connecting to 909C	K13705	Call

*120 VAC model includes US Mains Power Cable.
220 VAC model includes both UK and EU Mains Cables.

Kurt J. Lesker Company

➤ 760–1 x 10^{-5} Torr

KJLC® 925 Series

These transducers are thermal conductivity gauges based on a unique, MEMS-based sensor.

- Commonly used for vacuum pressure measurement applications in semiconductor and analytical environments, as well as general vacuum applications
- Wide measurement range from 1 x 10^{-5} Torr (mbar) to atmosphere — based on measurement of thermal conductivity in a small cavity where gas enters by diffusion only, instead of flow

Our transducers experience significantly less problems with temperature drift, low accuracy, calibration, and sensitivity to mounting position compared to traditional Pirani gauges.

Sensor:

- One-millimeter square silicon chip enables measurements to be made in a very small volume
- Small size and repeatable geometry gives it a range from atmosphere down to 10^{-5} Torr (mbar)
- Design minimizes the effects of convection—operation is possible in any position without compromising accuracy, simplifying installation
- Solid-state design is highly resistant to air inrush, vibrations, and mechanical force, resulting in less system downtime due to broken filaments

Additional Features:

- Increased pressure measurement range from 10^{-5} Torr (mbar) to atmosphere, two decades beyond a standard Pirani
- Set-point relay features a fast response time for reliable process control
- Compact dimensional design
- High accuracy and reduced process cycle time
- Ease of operation via analog output and digital communication
- CE marked, compliant with EMC Directive 2004/108/EC

Controls:

- Zero adjust
- Atmospheric adjust
- Gas type selection
- Pressure unit selection
- Baud rate and addressing
- Factory default
- Set-point functions

NOTE: See page 7-9 for our PDR900 controller.

SPECIFICATIONS

Method of Measurement — Pirani
Measuring Range — 1.0 x 10^{-5} Torr (2.7 x 10^{-5} mbar) to Atmosphere
Accuracy — 10^{-4} to 10^{-3} Torr (mbar): 10% of reading
10^{-3} to 100 Torr (10^{-3} to 133 mbar): 5% of reading
100 Torr (133 mbar) to Atmosphere: 25% of reading
Interface — Digital RS-485 or RS-232
Analog Output — 1–9 VDC (1 volt per Decade)
Repeatability — 10^{-4} to 10^{-3} Torr: 8% of reading
10^{-3} to 100 Torr: 2% of reading
100 Torr to Atmosphere: 10% of reading
Temperature: Operating — 0–40° C
Temperature: Bakeout — 85° C for Shielded model (gauge tube only)
Gas Calibration — Air, argon, helium, nitrogen, hydrogen, water vapor
Power Requirements — 10–30 VDC, <1.5 W
Set Point Range — 2.0 x 10^{-3} to 990 Torr (2.67 x 10^{-3} to 1,320 mbar)
Set-Point Relay — 1 SPDT @ 1A (resistive)
Set-Point Relay Response — 50ms (maximum)
Installation Orientation — Any
Materials Exposed to Vacuum — SiO, SiO_2, SiN_4, gold, epoxy resin, 304 stainless steel, Kovar®, Viton®

Gauges (Transducers)

Description	Termination	Part No.	Price
925 Series Gauge			
RS232	KF16	K92511010	Call
	4 VCR® Female	K92541010	Call
	8 VCR Female	K92551010	Call
RS485	KF16	K92512010	Call
	4 VCR Female	K92542010	Call
	8 VCR Female	K92552010	Call

Gauge Controllers & Accessories

Description	Part No.	Price
KJLC PDR900 Series Controller*		
120 VAC	KPDR90012US	Call
220 VAC	KPDR90012EU	Call
Single Transducer Power Supply & Communication Cable		
120 VAC (U.S.)	K12641	Call
90-230 VAC (U.K./EU)	K12664	Call
Sub D-Type Adapter for 925	K12621	Call
Software Package for PC Control	K12604	Call
Cable, 10', 9-Pin to connect PDR900 to 925	K13613	Call
Cable, 25', 9-Pin to connect PDR900 to 925	K13615	Call

*120 VAC version includes US Mains cable.
220 VAC version includes both UK and EU Mains cable.

➤ 100–1 x 10^{-4} Torr

KJLC® 945 Series

A new, economical single-channel controller that is ideal for applications in the rough to high vacuum range of 100 down to 10^{-4} Torr (133 to 10^{-4} mbar) including vacuum pump base pressure measurement and system process startup using the two standard set points.

Features:

- Rugged filament design for reliable operation
- Designed for harsh process environments
- Rapid response to pump down and vent operations
- Repeatable measurements and independent relay set points for optimum process control
- Digital LED display
- CE marked

Applications:

- Semiconductor
- Load locks
- Leak detection
- Vacuum coating
- Freeze dryers

945 SERIES GAUGE CONTROLLER SPECIFICATIONS

Measuring Range & Resolution
1.0 x 10^{-4} to 100 Torr:
1% of indicated decade for > 10^{-3} torr
10% of indicated decade for < 10^{-3} torr

Interface/Connection —
Digital RS-485, 9-pin, Sub-D socket

Power Supply: Voltage —
90–130 VAC, 50/60 Hz
or 210–250 VAC, 50/60 Hz

Power Supply: Max Consumption — 9W

Set-Point Range — 2.0 x 10^{-3} to 100 Torr (2.67 x 10^{-3} to 1,320 mbar)

Set-Point Relays — 2 SPDT @ 1A (resistive)

Set-Point Relay Response — 150ms (maximum)

Temperature: Operating — 5–40° C

Installation Orientation — Any

345 SERIES GAUGE (SENSOR) SPECIFICATIONS

Method of Measurement — Pirani

Measuring Range & Repeatability —
1.0 x 10^{-4} Torr (1.3 x 10^{-4} mbar) to Atmosphere:
5% of reading Tconst

Interface/Connection —
9-pin, Sub-D-socket

Repeatability — 5% of indicated pressure

Temperature: Operating — 0–50° C

Temperature: Bakeout — 50° C

Gas Calibration — Air/Nitrogen

Installation Orientation — Any

Materials Exposed to Vacuum —
Stainless steel, nickel 200, alumina ceramic, platinum, silver brazing alloy

Gauge (Sensors)

Description	Termination	Part No.	Price
345 Series Shielded	KF16	K34510	**Call**
Pirani Gauge	KF25	K34515	**Call**
	1 1/3" CF	K34513	**Call**
	2 3/4" CF	K34514	**Call**
	8 VCR® female	K34512	**Call**
	1/8" NPT male	K34511	**Call**

Gauge Controllers & Accessories

Gauge Controllers & Accessories		
Description	**Part No.**	**Price**
945 Series Controller*		
120 VAC 60Hz (Torr readout)*	K9451206T	**Call**
220 VAC 50Hz (mbar readout)*	K9452205M	**Call**
Output Connector Kit for 945 Series	K8103	**Call**
Interconnect Cable		
10 ft./3m	K31706S	**Call**
25 ft./7.6m	K31707S	**Call**
50 ft./15m	K31708S	**Call**
Controller Panel Mounting Hardware	K5021	**Call**
19" Controller Rack Panel		
3U, 1/4 DIN, blank	K5456	**Call**
3U, 1/4 DIN, 1 cutout	K5457	**Call**
3U, 1/4 DIN, 2 cutouts	K5458	**Call**
3U, 1/4 DIN, 3 cutouts	K5459	**Call**
3U, 1/4 DIN, 4 cutouts	K5460	**Call**

*945 Series Controllers include US Mains Power Cable for Torr versions and both EU and UK Mains Power Cables for mbar versions.

➤ 1,000–1 x 10^{-4} Torr

KJLC® Convectron® Equivalent Series

These gauge tubes and controllers are direct "drop-in," low-cost equivalents to the Convectron® brand of Granville-Phillips gauges.

- New applications or low-cost, direct "drop-in" replacements for Convectron gauges, Mini-Convectron modules, and controllers
- Less prone to damage from mechanical shock or vibration than Convectron tubes
- Less outgassing and faster response to pressure changes than Convectron tubes
- Wide measuring range from 1 x 10^{-4} to 1,000 Torr (1.3 x 10^{-4} to 1,333 mbar)
- Controllers feature universal power and are CE marked

275i Series Gauge with Integrated Controller & Display

- Low-cost, plug-compatible, direct drop-in replacement for the most basic Granville-Phillips Mini-Convectron models
- Built-in digital display
- Wide measurement range: 10^{-4} to 1,000 Torr (10^{-4} to 1,333 mbar)
- Wider measuring range and better accuracy than traditional thermocouple gauges

SPECIFICATIONS

Pressure Range — 1 x 10^{-4} to 1,000 Torr (1.3 x 10^{-4} to 1.333 mbar)
Display — 3-digit LED (Torr & mTorr)
Materials Exposed to Vacuum — gold-plated tungsten, 304 & 316 stainless steel, glass, nickel, Teflon®
Internal Volume — 26 cm^3 (1.589 in^3)
Operating Temperature — 0–40° C
Storage Temperature — -40–70° C
Bakeout Temperature — 70° C
Mounting Position — horizontal recommended
Output — non-linear analog s-curve 0.375–5.659 VDC
Input Power — 11–30 VDC, protected against power reversal, transients, over-voltages
Set Points — One SPDT Relay
Relay Contact Rating — 1A at 30 VDC resistive or AC non-inductive
Connectors — 9-pin sub-D (male)

Description	Part No.	Price
KJLC Gauge with Integrated Controller & Display		
1/8" NPT	KJL275800	**Call**
KF16	KJL275806	**Call**
KF25	KJL275807	**Call**
KF40	KJL275808	**Call**
1 1/3" CF	KJL275803	**Call**
2 3/4" CF	KJL275804	**Call**
4 VCR® Female	KJL275801	**Call**
8 VCR Female	KJL275863	**Call**
24 VDC Power Supply (100–240 VAC), US Plug*	KJLPS401A	**Call**

*Contact us at **pressure@lesker.com** for other plug options.

300 Series Gauge with Integrated Controller & Display

- Wide measurement range: 10^{-4} to 1,000 Torr (10^{-4} to 1,333 mbar)
- New applications or low-cost, direct drop-in, plug-compatible replacement for Granville-Phillips Mini- Convectron® modules
- Built-in digital display, two set points, log-linear, linear, and nonlinear analog outputs, and RS-232/485 interface are all included in our product line
- Monitor your vacuum system from atmosphere to 10^{-4} Torr (mbar) with a single gauge
- Significant savings—no changes to your process; use your existing hardware, cables, and software
- Stock just one module to support all your equipment—replaces dozens of Mini-Convectron configurations

SPECIFICATIONS

Pressure Range — 1x10^{-4} to 1,000 Torr (1.3 x 10^{-4} to 1,333 mbar)
Display — 4-digit LCD (user-selectable Torr, mbar, or Pa)
Materials Exposed to Vacuum — Gold-plated tungsten, 304 & 316 stainless steel, glass, nickel, Teflon®
Internal Volume — 26 cm^3 (1.589 in^3)
Operating Temperature — 0–40° C
Storage Temperature — -40–70° C
Bakeout Temperature — 150° C (gauge only — electronics removed)
Mounting Position — Horizontal recommended
Analog Outputs — 1) non-linear S-curve 0.375–5.659 VDC
2a) linear 0–10 VDC, user scalable (default is 0–10 VDC = 0–1 torr), or 2b) log-linear 1–8 VDC, 1V/decade
Digital Interface — RS-485/RS-232
Input Power — 11–30 VDC, protected against power reversal, transients, and over-voltages
Set Points — Two SPDT Relays
Relay Contact Rating — 1A at 30 VDC resistive, or AC non-inductive
Connectors — 9-pin sub-D (male) and 15-pin high-density sub-D (male)

Description	Part No.	Price
KJLC™ Gauge with Integrated Controller		
1/8" NPT	KJL300800	**Call**
KF16	KJL300806	**Call**
KF25	KJL300807	**Call**
KF40	KJL300808	**Call**
1 1/3" CF	KJL300803	**Call**
2 3/4" CF	KJL300804	**Call**
4 VCR Female	KJL300801	**Call**
8 VCR Female	KJL300863	**Call**
24 VDC Power Supply (100–240 VAC), US Plug*	KJLPS401A	**Call**

*Contact us at **pressure@lesker.com** for other plug options.

➤ 1,000–1 x 10^{-4} Torr

275 Series Gauge Tubes

- Wide measuring range: 10^{-4} Torr to 1,000 Torr (10^{-4} to 1,333 mbar)
- New applications or low-cost, plug-compatible, drop-in replacement gauge for Convectron gauges and Mini-Convectron modules
- Performance identical to existing Convectron gauges
- Rugged design withstands more abuse and harsh environments
- Significant savings—no changes to your system, you use your existing Convectron controllers, cables, and modules
- No changes to your process—a single vacuum gauge can monitor your vacuum system pumpdown and venting; helps keep your process up and running, even if it's not a laboratory environment

SPECIFICATIONS

Pressure Range — 1 x 10^{-4} to 1,000 Torr (1.3 x 10^{-4} to 1,333 mbar)
Resolution — 1 x 10^{-4}
Materials Exposed to Vacuum — gold-plated tungsten, 304 & 316 stainless steel, glass, nickel, Teflon
Internal Volume — 26 cm^3 (1.589 in^3)
Leak Integrity — < 1 x 10^{-9} atm cc/sec. He
Operating Temperature — 0–50° C
Storage Temperature — -40–70° C
Bakeout Temperature — 150° C maximum (gauge only, non-operating, electronics, and cable removed)
Mounting Position — Horizontal recommended

Standard Convection Tube		
Description	**Part No.**	**Price**
KJLC Gauge Tube		
1/8" NPT	KJL275071	**Call**
KF16	KJL275203	**Call**
KF25	KJL275196	**Call**
KF40	KJL275316	**Call**
1 1/3" CF	KJL275256	**Call**
2 3/4" CF	KJL275238	**Call**
4 VCR Female	KJL275185	**Call**
8 VCR Female	KJL275282	**Call**

Mini-Convection Tube		
Description	**Part No.**	**Price**
KJLC Gauge Tube		
1/8" NPT	KJL275810	**Call**
KF16	KJL275816	**Call**
KF25	KJL275817	**Call**
KF40	KJL275818	**Call**
1 1/3" CF	KJL275813	**Call**
2 3/4" CF	KJL275814	**Call**
4 VCR Female	KJL275811	**Call**
8 VCR Female	KJL275864	**Call**

375 Series Panel Mount/Benchtop Gauge Controller

- Wide measuring range lets you monitor your vacuum system from 10^{-4} to 1,000 Torr (10^{-4} to 1,333 mbar) with a single gauge
- Includes two set points, user-selectable analog output, and RS-232/485 interfaces
- Analog output is configurable as a non-linear S-curve, log-linear, or user-scalable linear
- Space-saving 1/8 DIN panel mount housing which can also be used as a benchtop unit
- Powered by universal 100–240 VAC or 12–30 VDC

SPECIFICATIONS

Pressure Range — 1 x 10^{-4} to 1,000 Torr (1.3 X 10^{-4} to 1,333 mbar)
Resolution — 1 x 10^{-4} Torr
Display — 4-digit LCD (Torr, mbar, or Pa—user selectable)
Display Update Rate — 0.5 sec
Operating Temperature — 0–40° C ambient
Storage Temperature — -40–70° C
Analog Output (user-selectable) —
1) non-linear S-curve 0.375–5.659 VDC, or
2) linear 0–10 VDC, user scalable (default is 10 VDC = 1 torr), or
3) log-linear 1–8 VDC, 1V/decade
Digital Interface — RS-232 and RS-485
Housing — 1/8 -DIN panel-mount enclosure
Input Power — 100–240 VAC, 50/60Hz, universal power supply or 12–30 VDC
Set Points — Two SPDT Relays
Relay Contact Rating — 1A at 30 VDC resistive, or AC non-inductive
Set-point Range — 1 x 10^{-3} to 1,000 Torr (1.3 X 10^{-3} to 1,333 mbar)
Connectors — Gauge tube: 9-pin D female
Analog output and digital interface: 9-pin sub-D (female)
Relay outputs: 6-pin pluggable terminal block
Power: universal AC and 2-pin pluggable terminal block DC

Description	Part No.	Price
KJLC Panel Mount Gauge Tube Controller (115 VAC)	KJL375001BA	**Call**
Gauge Tube Interconnect Cable		
10 ft.	KJL37501210	**Call**
25 ft.	KJL37501225	**Call**

➤ 1,000–1 x 10^{-4} Torr

MKS 626B Series

The most economical of the process Baratron® capacitance manometers.

- 626B—Ambient absolute capacitance manometer with 15-pin Type-D connector
- Both use a dual-voltage power supply (±15 VDC)
- Available in full scale ranges from 1–1,000 mm Hg (Torr)
- Inconel® construction for excellent resistance to corrosive gases

626B:

- 15-pin Type "D" connector
- Output signal is 0–10 VDC
- Unit operates at ambient temperature

SPECIFICATIONS

Full-Scale Pressure — 0.1, 0.25, 1, 2, 10, 20,100, 500, 1,000 Torr
Usable Range — 1 to 1 x 10^{-4} (of FS)
Accuracy (% of reading):
Standard — ± 0.25
Temperature Coefficient:
Zero —
0.005% FS/° C (1- to 1,000 Torr FS)
0.010% FS/° C (2 Torr FS)
0.015% FS/° C (0.1, 1 Torr FS)
Span — 0.04% of reading/° C
Operating Range — 0–50° C

Materials Exposed to Vacuum — Inconel® (Iconel® is a registered trademark of Inco Alloys International, Inc., Huntington, WV)
Volume — 6.3 cc
Overpressure Limit — 45 psia
Power Input — ± 15.5 VDC ± 5% @ 35mA
Output (>10K ohm load) — 0–10 VDC

* Not available on 0.1, 1, and 2 Torr FS models.

Cables & Accessories

Description	Part No.	Price
Interconnect Cable (3m) for 622 Manometer		
To 250, 244	CB254-2-10	**Call**
To PR4000, 146, 186, 651, 660	CB112-2-10	**Call**
Connector to Terminal Strip for 622	1727143	**Call**
Interconnect Cable (3m) for 626 Manometer		
To 250, 244	CB258-1-10	**Call**
To PR4000, 146, 186, 651, 660	CB259-5-10	**Call**
Interconnect Cable (3m) for (2) 626 or 622 Manometers to PDR2000	CB2000S-1-M1	**Call**
Interconnect Cable (3m) for 626X to 937B	K7555	**Call**

Choose the base unit, full-scale range, fittings, and accuracy. Next, compose the order code as shown, below.

Example Configuration Part No.: 626B 02T D E

	Part No. Prefix	Base Price
MKS 626A Base Unit	626B	**Call**
	Option Part No.	**Additional Price**
Full Scale Range (Torr)		
0.1 (626 only)	.1T	**Call**
1	01T	**N/C**
2	02T	**N/C**
10	11T	**N/C**
20	21T	**N/C**
100	12T	**N/C**
500	52T	**N/C**
1,000	13T	**N/C**
Fittings		
½" Tube End	A	**N/C**
8 VCR® Female	B	**Call**
1 ⅓" CF (rotatable)	C	**Call**
-KF16	D	**Call**
8 VCO® Female	E	**Call**
2 ¾" CF (rotatable)	L	**Call**
KF25	Q	**Call**
Accuracy		
Standard: 0.25% of Reading*	E	**N/C**
Standard: 0.50% of Reading (0.1 Torr only)	F	**N/C**
Optional: 0.15% of Reading (not available for 0.1, 1, or 2 Torr)	D	**Call**

*Optional: 0.10 Torr model, additional $60.00

*NOTE: mbar models available. Please contact us at **pressure@lesker.com** for product availability and pricing.*

NOTE: The full-scale range is the upper limit of the measurement range. The Baratron can measure approximately 3 decades below this. For example, a 100 Torr Baratron can measure pressures from 100 Torr FS down to 0.2 Torr.

➤ 1,000–1 x 10^{-5} Torr

MKS 627D Series

MKS has improved on the industry standard Type 627A by incorporating new features into the Type 627B process capacitance manometer.

- Temperature controlled to 45° C
- Accurate to 0.12% of reading
- Includes updated temperature control electronics to provide superior long-term stability and repeatability
- Optional heater and temperature status LED/switches indicate that the heater (which maintains the sensor temperature at 45° C) is at temperature
- Available in full-scale ranges down to 20 mTorr to accommodate today's lower process pressures
- Interchangeable with MKS 127 and 627A capacitance manometers
- Can be used with MKS power supplies, display units, and pressure controllers or the user's compatible in-house power supply/readout device
- Inconel® construction for excellent resistance to corrosive gases

Choose the base unit, full-scale range, fittings, accuracy, readout options, and connector. Next, compose the order code as shown, below.

Example Configuration Part No.: 627B 12T C C 2 B

	Part No. Prefix	Base Price
MKS 627B Base Unit	627B	**Call**
	Option Part No.	**Additional Price**
Full Scale Range (Torr)		
0.02	U2T	**Call**
0.05	U5T	**Call**
0.1	.1T	**N/C**
1	01T	**N/C**
2	02T	**N/C**
10	11T	**N/C**
20	21T	**N/C**
100	12T	**N/C**
500	52T	**N/C**
1,000	13T	**N/C**
Fittings		
1/2" Tube End	A	**N/C**
8 VCR® Female	B	**Call**
1 1/3" CF (rotatable)	C	**Call**
KF16	D	**Call**
8 VCO® Female	E	**Call**
2 3/4" CF (rotatable)	L	**Call**
KF25	Q	**Call**
Accuracy		
Standard: 0.12% of Reading (1–1,000 Torr only)	C	**N/C**
Standard: 0.15% of Reading (0.05, 0.1 Torr only)	D	**N/C**
Standard: 0.25% of Reading (0.02 Torr)	E	**N/C**
Readout Options		
Standard Display	1	**N/C**
Optional Heater/Temp. Status Display	2	**Call**
Connector		
15-pin Type D with Thread Lock	B	**N/C**
15-pin Type D with Slide Lock	P	**N/C**

SPECIFICATIONS

Full-scale Ranges — 0.02, 0.05, 0.1, 1, 2, 10, 20, 100 & 1,000 Torr

Resolution —
0.001% of F.S. (0.1 Torr or greater)
0.002% of F.S. (0.02, 0.05 Torr)

Accuracy (% of reading) —
0.12% (1–1,000 Torr FS)
0.15% (0.1, 0.05 Torr FS)
0.25% (0.02 Torr FS)

Temperature Coefficient:
Zero (%FS/° C) —
0.002% (1–1,000 Torr FS)
0.005% (0.1 Torr)
0.015% (0.05 Torr)
0.03% (0.02 Torr)
Span — 0.02% of reading/° C

Ambient Operating Temperature — 15–40° C

Materials Exposed to Vacuum — Inconel®

Volume — 6.3cc

Overpressure Limit — 45psia

Input Power —
±15 VDC
±5% @ 0.25A max.

Output (into 10K ohm load) — 0–10 VDC

Cables & Accessories

Description	Part No.	Price
Interconnect Cable (3m) for 627 Manometer		
To 250, 244	CB258-1-10	**Call**
To PR4000, 146, 186, 651, 660	CB259-5-10	**Call**
To PDR2000	CB2000S-1-10	**Call**
To 937B	K7555	**Call**

*NOTE: mbar models available. Please contact us at **pressure@lesker.com** for product availability and pricing.*

➤ 1,000–5 x 10^{-5} Torr

MKS 628B Series

MKS has improved on the industry standard Type 628A by incorporating new features into the Type 628B Baratron® capacitance manometer.

- Temperature regulated to 100° C
- Accurate to 0.25% of reading
- Includes updated temperature control electronics to provide superior long-term stability and repeatability
- Optional heater and temperature status LED/switches indicate that the heater (which maintains the sensor temperature to 100° C) is at temperature
- Available from 0.05–1,000 mm Hg (Torr)
- Input power is ±15 VDC
- Output signal is 0–10 VDC
- Replaces the Type 628A and Type 128 absolute capacitance manometer
- Inconel® construction for excellent resistance to corrosive gases

Choose the base unit, full-scale range, fittings, accuracy, readout options and connector. Next, compose the order code as shown, below.

Example Configuration Part No.: 628B .1T F 1 B

	Part No. Prefix	Base Price
MKS 628B Base Unit	628B	**Call**
	Option Part No.	**Additional Price**
Full-Scale Range (Torr)		
0.05	U5T	**Call**
0.1	.1T	**N/C**
1	01T	**N/C**
2	02T	**N/C**
10	11T	**N/C**
20	21T	**N/C**
100	12T	**N/C**
1,000	13T	**N/C**
Fittings		
1/2" Tube End	A	**N/C**
8 VCR® Female	B	**Call**
1 1/3" CF (rotatable)	C	**Call**
KF16	D	**Call**
8 VCO® Female	E	**Call**
2 3/4" CF (rotatable)	L	**Call**
KF25	Q	**Call**
Accuracy		
Standard: 0.25% of Reading (1–1,000 Torr FS)	E	**N/C**
Standard: 0.5% of Reading (0.05, 0.1 Torr FS)	F	**N/C**
Readout Options		
Standard Display	1	**N/C**
Optional Heater/Temp. Status Display	2	**Call**
Connector		
15-pin Type D with Thread Lock	B	**N/C**
15-pin Type D with Slide Lock	P	**N/C**

SPECIFICATIONS

Full-Scale Ranges — 0.05, 0.25, 0.1, 1, 2, 10, 20, 100, & 1,000 Torr
Resolution — 0.001% of F.S. (0.1 Torr or greater)
0.002% of F.S. (for <0.10 Torr)
Accuracy (% of reading) — 0.25% (above 1 Torr)
0.5% (below 1 Torr)
Temperature Coefficient:
Zero (%FS/° C) — 0.002%(1–1,000 Torr FS)
0.01% (0.1, 0.25 Torr)
0.02% (0.05 Torr)
Span — 0.02% of reading/° C
Ambient Operating Temperature — 15–50° C
Materials Exposed to Vacuum — Inconel®
Volume — 6.3cc
Overpressure Limit — 45psia
Input Power — ±15 VDC ±5% @ 0.5A max.
Output (into 10K ohm load) — 0–10 VDC

Cables & Accessories

Description	Part No.	Price
Interconnect Cable (3m) for 627 Manometer		
To 250, 244, 260PS-3 (Y-cable)	CB128-2-10	**Call**
To PR4000, 146, 651	CB259-5-10	**Call**
To PDR2000	CB2000S-1-M1	**Call**

*NOTE: mbar models available. Please contact us at **pressure@lesker.com** for product availability and pricing.*

➤ 1,000–1 x 10^{-5} Torr

SPECIFICATIONS

Full-Scale Ranges — 1, 2, 10, 20, 100, 250, 500, 1,000 Torr
Resolution — 0.001%
Accuracy (% of reading) — 0.5%
Temperature Coefficient:
Zero (%FS/° C) — 0.008% (10–25,000 Torr FS)
0.020% (1, 2 Torr)
Span — 0.04% of reading/° C
Ambient Operating Temperature — 0–50° C (10–1,000 Torr)
15–40° C (1, 2 Torr)
Materials Exposed to Vacuum — Inconel®
Volume — 6.3cc
Overpressure Limit — 45psia
Input Power — 13–32 VDC or 10.8–32 VDC @ 10mA max.
Output (into 10K ohm load) — 0–10 VDC or 0–5 VDC

Cables & Accessories

Description	Part No.	Price
Interconnect Cable (3m) for 722 Manometer		
9-pin connector to PR4000, 146, 186, 660	CB700-1-10	**Call**
15-pin connector to PR4000, 146, 186, 651, 660	CB259-5-10	**Call**
Terminal strip connector to PR4000, 146, 186, 651, 660	CB112-2-10	**Call**
To PDR2000	CB2000S-1-M1	**Call**

*NOTE: mbar models available. Please contact us at **pressure@lesker.com** for product availability and pricing.*

MKS 722 Series

This compact, absolute, single-ended, capacitance manometer is an ideal solution for retrofit applications, as well as new equipment designs.

Today's process environments require smaller-sized, lower cost, pressure measurement instruments that provide accurate, repeatable, and reliable measurements. The MKS 722 Series is a perfect fit for today's demands. Its features include:

- Flexible design—1.5" (85.7 mm) diameter
- Unit operates at ambient temperature
- Replaces the 122A and 122B absolute capacitance manometers
- Inconel® construction for excellent resistance to corrosive gases

Choose the base unit, full-scale range, fittings, input/output, accuracy, and connector. Next, compose the order code as shown, below.

Example Configuration Part No.: 722A 02T BD 2 F A

	Part No. Prefix	Base Price
MKS 722A Base Unit	722A	**Call**
	Option Part No.	**Additional Price**
Full Scale Range (Torr)		
1	01T	**Call**
2	02T	**N/C**
10	11T	**N/C**
20	21T	**N/C**
100	12T	**N/C**
250	RDT	**N/C**
500	52T	**N/C**
1000	13T	**N/C**
Fittings		
1/2" Tube End	BA	**N/C**
1/4" weld stub	BB	**N/C**
1/4" weld tee	BD	**Call**
4 VCR Male	CB	**Call**
4 VCR Female	CD	**Call**
1/4" NPT Female*	FA	**Call**
1/4" NPT Male*	FB	**Call**
1/8" NPT Female*	FE	**Call**
1/8" NPT Male*	FF	**Call**
1 1/3" CF	HA	**Call**
KF16	GA	**Call**
8 VCR Female	CE	**Call**
8 VCO Female	DA	**Call**
Input/Output		
13–32 VDC input/0–10 VDC output	2	**N/C**
13–32 VDC input/0–5 VDC output	3	**N/C**
Accuracy		
Standard: 0.5% of Reading	F	**N/C**
Connector		
9-pin Type D	A	**N/C**
Bendix 4-pin	D	**Call**
Terminal strip	J	**N/C**
15-pin Type D (connector on 6" cable)	K	**N/C**
Flying leads (bare wire; red = power, black = return)	L	**Call**

*Not available in 1 and 2 Torr F.S. models

Kurt J. Lesker Company

➤ 1,000–1 x 10^{-5} Torr

MKS PDR2000 Controller

A two-channel power supply/digital readout module for powering and displaying the MKS Baratron® family of transducers.

- Unit can deliver up to 0.75 amps at ±15 VDC to operate up to two heated or unheated units
- User can alternate readings via a select button on screen or view through an RS-232 interface when both units are simultaneously powered
- Two-process relay trip points are available and may be assigned to either manometer
- Upper and lower settings enable full control over the control trip point
- Advanced power supply for 120–240 VAC power input
- Engineering unit selection
- Universal instrument for international applications
- Mounted in a compact 1/8" DIN enclosure, weighing approximately 1 lb.
- Can be used with one or two of these manometers: Type 626, 627, 629, 722, 750, 850, and 852

SPECIFICATIONS

Display Type — Digital, 4-place LED
Number of Channels — 2
Input Power Requirements — 110–240 VAC, 47–63 Hz
Input Signal — 0–10 VDC
Power Supply Output — ±15 VDC @ 750 mA
Signal Output (analog) — Linear, 0-5 VDC for F.S. (0.5 VDC per decade); 0–10 VDC per transducer
Signal Output (digital) — RS-232
Set Points — 2 relays
Set-Point Relays — 2A @ 30 VDC per relay
Operating Temperature — 2–50° C
Mounting — 1/8" DIN
Channel Selection — User selectable via front-panel controls

Gauge Controllers & Accessories

Description	Part No.	Price
MKS PDR2000 Controller	PDR2000	**Call**
Interconnect Cable (3m) from PDR2000 to 622/626/627/628/722 15-pin Manometers for two Baratron Gauges	CB2000S-1-M1	**Call**
Interconnect Cable (3m) from PDR2000 to 622/626/627/628/722 9-pin Manometers for two Baratron Gauges	CB2000S-2-M1	**Call**
Interconnect Cable (3m) from PDR2000 to 626/627/628 Terminal Strip Manometers for one 628 Gauge	CB628S-3-10	**Call**
RS-232 Interface Cable	CBPDR-1-10	**Call**

➤ 1–1 x 10^{-3} Torr

KJLC™ 205 Series

These economical controllers are noted for their fast response and high stability.

KJL-205BM

KJL-205

- Economical analog display
- Offer an easy, accurate calibration procedure with dry air
- Can be operated on any voltage between 90 and 240 VAC without rewiring or switching
- Available in panel-mount and benchtop-mount versions (both are compatible with the KJL-6000 or DV-6 series tubes)
- Models with 3-position switch feature monitors 3 tubes sequentially
- Includes a 10' sensor cable, a 6' line cord, and one KJL-6000 tube (1/8" NPT male)

SPECIFICATIONS

Pressure Range — 1 to 1,000 mTorr
Accuracy — ± 1 m Torr (1–20 mTorr), 5% of Reading (20–1000 mTorr)
Response Time — < 1.0 sec
Power — 90–240 VAC, 50/60 Hz
Display — Analog
Analog Output — 0–5 VDC
Compatible T/C Gauge Tubes — KJL-6000, DV-6R, DV-6M
Mounting — Panel or Benchtop
Set Points — None
Temperature: Operating — 4–60° C
Temperature: Bakeout — 100° C

Description	Part No.	Price
KJLC 205 Panel-Mount Gauge Controller with (1) KJL-6000 Gauge Tube	KJL-205	Call
KJLC 205 Bench-Mount Gauge Controller with (1) KJL-6000 Gauge Tube	KJL-205BM	Call
KJLC 205 Bench-Mount Gauge Controller with 3-Tube Switch & (1) KJL-6000 Gauge Tube	KJL-205BM3X	Call
KJLC 205 Panel-Mount Gauge Controller (only)	KJL-205NT	Call
Replacement KJLC Thermocouple Gauge Tube		
1/8" NPT	KJL-6000	Call
1/8" NPT (rugged enclosure)	KJL-6000R	Call
1 3/4" CF	KJL-6000MC	Call
KF16	KJL-6000QF16	Call
VCR® 4 Female	KJL-6000VCR4	Call
Replacement Thermocouple Interconnect Cable Extension (15 ft.)	KJL-200EC15	Call

KJLC 610TC Series

- Utilizes the KLJC KJL-6000 or Hasting-Raydist DV-6 or DV-4D thermocouple tube
- Pressure Range:
  —1 to 1,000 microns (mTorr) with KJL-600 or the DV-6
  —1 x 10^{-2} to 20 Torr with the DV-4D tube
- Two process control set points are accessible through a connector on the back of the unit
- Set points can be adjusted over the entire range from the front panel
- Relay's contacts are rated at 3A @ 155 VAC
- 0-3 VDC recorder output
- Self-contained in 1/8" DIN metal cabinet to prevent damages
- Rapid response
- Solid-state reliability and stability
- Large four-digit LED display for easier reading
- One-year warranty
- Includes controller, KJL-6000 thermocouple gauge tube, 8' power cord, and 10' thermocouple cable

SPECIFICATIONS

Pressure Range — 1 x x10^{-3} to 20 Torr
Accuracy —5% of Reading
Response Time — < 1.0 sec
Power — 115/230 VAC, 50/60 HZ
Display — Digital LED
Analog Output — 1-3 VDC
Compatible T/C Gauge Tubes — KJL-6000, DV-6, DV-4
Mounting — 1/8 "DIN (1.3"H x 3.55"W x 6.5"D)
Set Points — 2 (3A @ 120 VAC)
Temperature: Operating — 0–50° C
Temperature: Bakeout — 100° C

Description	Part No.	Price
KJLC 610TC Package	KJL610TC	Call
Replacement KJLC Thermocouple Gauge Tube		
1/8" NPT	KJL-6000	Call
1/8" NPT	KJL-6000R	Call
1 1/3" CF	KJL-6000MC	Call
KF16	KJL-6000QF16	Call
VCR 4 Female	KJL-6000VCR4	Call
Thermocouple Interconnect Cable Extension (10 ft.)	KJLTVC10	Call

➤ 20–1 x 10^{-3} Torr

KJLC® 500TC Series

A complete battery-operated gauge package that provides stable, repeatable readings from 1 mTorr to 20 Torr.

- $3\frac{1}{2}$-digit LCD displays the pressure reading
- 1 to 1,000 micron (mTorr) with KJL-6000 or DV-6
- 1 x 10^{-2} to 20 Torr with DV4
- Operates on disposable 9V alkaline battery or AC adapter
- Includes controller, retractable cable, battery, and KJL-6000 thermocouple tube in a rugged plastic case for portability (shipping weight under 2 lbs.)

SPECIFICATIONS

Pressure Range —
1 to 1,000 micron (mTorr) with KJL-6000 or DV-6
1 x 10^{-2} to 20 Torr with DV-4
Accuracy — 5% of reading
Response Time — 1 sec.
Power — 9 Volt/6 mA max
(180-hour life on 9V Alkaline battery)
Display — Digital 3.5 Digit LCD
Analog Output — N/A
Dimensions — 5.75" H x 3.60" W x 1.30" D
Compatible T/C Gauge Tubes — KJL-6000, DV-6, DV-4
Mounting — Portable
Set Points — N/A
Cable — 1 ft. (expandable to 5 ft.) retractable cable w/locking connector
Temperature: Operating — 0–50° C
Temperature: Bakeout — N/A

Description	Part No.	Price
KJLC 500TC Package	KJL500TC	Call
Replacement KJLC Thermocouple Gauge Tube		
$\frac{1}{8}$" NPT	KJL-6000	Call
$\frac{1}{8}$" NPT (rugged enclosure)	KJL-6000R	Call
$1\frac{1}{3}$" CF	KJL-6000MC	Call
KF16	KJL-6000QF16	Call
VCR® 4 Female	KJL-6000VCR4	Call
Replacement Plastic Travel Case	KJL500CASE	Call
Power Adapter (110 VAC to 9V)	KJL500TCA	Call
Replacement Thermocouple Interconnect Cable (6 ft.)	KJL500RC	Call

KJLC® 510TC Series

Battery Operated,Wide Range Digital Vacuum Instrumentation measuring in mTorr, mBar and kPa

Each vacuum gauge includes:

- A vacuum gauge controller
- A thermocouple vacuum gauge tube (vacuum sensor)
- A cable to connect the vacuum gauge controller to the thermocouple vacuum gauge tube
- **Pre-tested under actual vacuum against a NIST standard**

SPECIFICATIONS

Pressure Range —
.001-760 Torr with Varian 531
1-1999 mtorr with KJL-6000 or DV-6
Units — Torr, mBar or kPa
Vac Interface — 1/8 inch MNPT
Sensor — Varian 531, Hastings DV-6M, or KJL6000
Sensor Cable Length — 10 feet
Display — .70 inch high 3.5 Digit LCD display
Dimensions — 2.37" high, 5.12" wide, 5.25" deep
Power — "D" Battery

NOTE: Sensor type must be chosen at time of ordering.

Description	Part No.	Price
KJLC510TC Package Configured for Varian 531 Tubes	KJL510TC-V	Call
KJLC510TC Package Configured for KJLC6000 Tubes	KJL510TC-K	Call
KJLC510TC Package Configured for Hastings DV-6M Tubes	KJL510TC-H	Call

KJLC® Thermocouple Tubes

Our KJL-6000 thermocouple gauge tube is a direct, plug-in replacement (pin-outs, electrical specifications, and operating characteristics) for the commonly used DV-6 gauge.

KJL-6000 Thermocouple Advantages:

- All-metal construction with no fragile plastic headers and breakable plastic keys
- Rugged drop-resistant design withstands an 8' drop to a hard floor
- Integral stainless steel screen prevents particles from damaging gauge elements
- Lifetime guarantee against leaks (leaking tubes are replaced free of charge)

OEM Cross-Reference & Ordering Chart

We identify 7 types of thermocouple tubes that are not interchangeable because of:

- Pin-out differences
- Electrical specifications
- Operating characteristics

Each sensor tube type must be connected to the correct gauge controller or indicator to give sensible pressure readings. Some resellers of gauge tubes have a number of tubes with identical specifications but, to the confusion of the customer, identify them with different part numbers. The cross-reference/replacement chart (at **right**) matches our tubes with those from other manufacturers and resellers.

To ensure successful measurement, always match the controller to the specific gauge tubes that were built for it.

Manufacturer	OEM Part No.	KJLC Part No.	Price
Cooke Vacuum	HTT-O	KJL-1518	Call
CTI	8080015K003	KJL-6000VCR4	Call
CVC Products	GTC-004	KJL-1504	Call
	GTC-036	KJL-0036	Call
D & W Industries	DW880-003	KJL-1504	Call
Frederick's Televac	(No KJLC equivalent — use OEM tubes)		
Teledyne Hastings Raydist	DV-3M	KJL-1000	Call
	DV-6M	KJL-6000	Call
	DV-6R	KJL-6000R	Call
JC Controls	DV-6M	KJL-6000	Call
MKS	TC-1	KJL-5311	Call
Stokes	MB-3M	KJL-1000	Call
Temescal	DV-6M	KJL-6000	Call
Thermionics	6343	KJL-1518	Call
	6343/004	KJL-1504	Call
Varian	0531-F0472-301	KJL-5311	Call
	0531-F0472-303	KJL-531S	Call

Teledyne Hastings Raydist Thermocouple Tubes

Description	Part No.	Price
Thermocouple Gauge Tube		
1/8" NPT	DV-3M	Call
1/8" NPT	DV-4D	Call
1/8" NPT	DV-4R	Call
1/8" NPT	DV-5M	Call
1/8" NPT	DV-6M	Call
1/8" NPT	DV-23	Call
1/8" NPT	DV-24	Call
1/8" NPT	DV-6R	Call

Frederick's Televac Thermocouple Tubes

These tubes are well known in the vacuum industry by their part numbers (we stock and sell these company's tubes under their part numbering schemes).

Description	Part No.	Price
Thermocouple Gauge Tube		
1/8" NPT	TE2100-10	Call
1/8" NPT	TE2100-11	Call
1/8" NPT	TE2100-14	Call
1/8" NPT	TE2100-37	Call

Kurt J. Lesker Company

➤ Convection & Thermocouple

Thermocouple

KJL610TC

KJL6000QF16

Gauge Tube Type	Description	Manufacturer	Part No.	Price
Thermocouple				
	Gauge Tube, 1/8" NPT	Hastings Raydist®	DV-23	**Call**
	Gauge Tube, 1/8" NPT	Hastings Raydist	DV-24	**Call**
	Gauge Tube, 1/8" NPT	Hastings Raydist	DV-3M	**Call**
	Gauge Tube, 1/8" NPT	Hastings Raydist	DV-4D	**Call**
	Gauge Tube, 1/8" NPT	Hastings Raydist	DV-5M	**Call**
	Gauge Tube, 1/8" NPT	Hastings Raydist	DV-6M	**Call**
	Gauge Tube, 1/8" NPT	KJLC	KJL-0036	**Call**
	Gauge Tube, 1/8" NPT	KJLC	KJL-1000	**Call**
	Gauge Tube, 1/8" NPT	KJLC	KJL-1504	**Call**
	Gauge Tube, 1/8" NPT	KJLC	KJL-1518	**Call**
	Gauge Tube, 1/8" NPT	KJLC	KJL-5311	**Call**
	Gauge Tube, 1/8" NPT	KJLC	KJL-531S	**Call**
	Gauge Tube, 1/8" NPT	KJLC	KJL-6000	**Call**
	Gauge Tube, 1.33" CF Flange	KJLC	KJL-6000MC	**Call**
	Gauge Tube, QF 16	KJLC	KJL-6000QF16	**Call**
	Gauge Tube, VCR 4 (Female)	KJLC	KJL-6000VCR4	**Call**
	Gauge Tube, 1/8" NPT	Frederick's Televac®	TE2100-10	**Call**
	Gauge Tube, 1/8" NPT	Frederick's Televac	TE2100-11	**Call**
	Gauge Tube, 1/8" NPT	Frederick's Televac	TE2100-14	**Call**
	Gauge Tube, 1/8" NPT	Frederick's Televac	TE2100-37	**Call**

➤ 5 x 10^{-2}–1 x 10^{-9} Torr

KJLC 354

A miniature dual filament ionization gauge with built in controller and display.

Features:

- Wide measurement range 5 x 10^{-2}–1 x 10^{-9} Torr
- Built-in controller and display eliminates the need for expensive external controllers and cabling
- Pre-programmed, selectable calibration to 16 widely used gases
- Dual hot filament design, rugged and compact metal construction
- A direct drop-in plug-and-play replacement for the Granville Phillips Micro-Ion module
- Field serviceable–the sensor assembly can be easily replaced

SPECIFICATIONS

Pressure Range — 1 x 10^{-9} to 5 x 10^{-2} Torr (1.33 x 10^{-9} to 6.66 x 10^{-2} mbar)

Display — 3 digits plus 2 digit exponent

Materials Exposed to Gases — Dual Filaments: Yttria Coated Iridium, Ion Collector: Tungsten, Grid: Tantalum, Others: 316/304 SS, Glass, Nickel

X Ray Limit — <5 x 10^{-10} Torr

Accuracy (Typical) — ±20% of Reading 1 x 10^{-8} to 5 x 10^{-2} Torr

Emission Current — 100 uA, 4 mA, or automatic switching between 100 uA and 4 mA

Degas — 3 Watts e-beam

Overpressure Protection — Gauge turns off at factory default setting of 5 x 10^{-2} Torr

Bakeout Temperature — 200° C (sensor only - electronics removed)

Mounting Orientation — Any

Digital Interface — RS-485

Output signal (analog output) — Log-linear 0 to 9 VDC, 1V/decade

Input Power — 20 to 28 VDC, 13 W

RF/EMI Protection — CE marked

Set-Point Relays — 1 SPDT Relay

Relay Contact Rating — 1A at 30 Vdc resistive, 0.3 A at 125 Vac non-inductive

Set-Point Range — User configurable from 1 x 10^{-9} to 5 x 10^{-2}

Description	Part No.	Price
NW16KF	KJLC354401YB	Call
NW25KF	KJLC354401YC	Call
NW40KF	KJLC354401YD	Call
1 1/3" / NW16CF Mini- Conflat®	KJLC354401YE	Call
2 3/4" CF / NW35CF Conflat®	KJLC354401YF	Call

Replacement Sensors and Accessories

Description	Flange Type	Part No.	Price
Replacement Sensor	NW16KF	IG4YB	Call
Replacement Sensor	NW25KF	IG4YC	Call
Replacement Sensor	NW40KF	IG4YD	Call
Replacement Sensor	1 1/3" CF	IG4YE	Call
Replacement Sensor	2 3/4" CF	IG4YF	Call
Power supply - 24 VDC, US plug	Any	PS501A	Call

Kurt J. Lesker Company

➤ 5 x 10^{-2}–3 x 10^{-10} Torr

KJLC® 909AR Series

Hot filament transducers with integrated electronics.

Features:

- Wide measurement range of 10^{-10} to 10^{-2} Torr (mbar) for high-vacuum process monitoring
- Pressure-controlled e-beam degas for automated degas without filament shut down, patent pending
- Low-cost transducer alternative
- Compact design with integrated electronics and sensor in one unit
- Two-filament design for extended life
- Ease of operation with both analog and RS-232 digital communication
- Simultaneous pressure measurement during degas cycle
- Sensor portion of transducer can be replaced
- Process control set-point relay
- UHV-compatible materials used in sensor
- Reliable and repeatable pressure measurement for process stability
- CE marked, compliant with EMC Directive 2004/108/EC and Low Voltage Directive 73/23/EEC

These hot filament sensors are Bayard-Alpert style, utilizing a fine wire collector at the center of a grid. Due to its small area, few x-rays hit the collector; therefore, the gauge can measure very low pressures. These transducers include two yttria-coated iridium filaments for reduced downtime. Yttria-coated iridium is resistant to damage caused by high oxygen partial pressures and exposure to atmosphere. The tube operates at lower temperatures, giving a lower chemical reaction rate and minimizing thermal interference. The 909AR includes a screen to shield it from large particles.

Applications:

- Ideal measurement tools for high-vacuum applications, including pressure measurement of high-vacuum chambers and control or start-up of high-vacuum systems
- Measures base pressure and the pressure of back-filled gases
- Use in semiconductor processing and analytical systems

SPECIFICATIONS

Pressure Range — 3 x 10^{-10} to 5 x 10^{-2} Torr (4 x 10^{-10} to 6.5 x 10^{-2} mbar)
Set-Point Range — 5 x 10^{-10} to 9.5 x 10^{-3} Torr (6.5 x 10^{-10} to 1.2 x 10^{-3} mbar)
Calibration Gas — Air/Nitrogen
Operating Temperature Range — 0–40° C
Digital Communication — RS-232
Number of Set Points — 1
Relay Contact Rating — SPDT, 1 A @ 30VAC/VDC (resistive)
Response Time — 100 ms
Analog Output — 0–10 VDC, 1 volt/decade, semilogarithmic
Power Requirements — 24 VDC, 15 W
Accuracy — ±20% of Reading (typical)
Repeatability — Approximately 5% of Reading
Ion Gauge Type — Bayard Alpert
Degas — Electron beam (3 W)
Internal Volume — 23 cm^3
Materials Exposed to Vacuum — 304 stainless steel, glass, tungsten, tantalum, yttria-coated iridium (filament)

Gauge (Transducers)

Description	Part No.	Price
KJLC 909C Series Ion Gauge		
1 1/3" CF	K909AR11	**Call**
2 3/4" CF	K909AR21	**Call**
KF16	K909AR31	**Call**
KF25	K909AR41	**Call**
KF40	K909AR51	**Call**
Replacement Sensors for 909C		
1 1/3" CF	K11600	**Call**
2 3/4" CF	K11508	**Call**
KF16	K11603	**Call**
KF25	K11601	**Call**
KF40	K11602	**Call**

Gauge Controllers & Accessories

Description	Part No.	Price
KJLC PDR900 Series Controller*		
120 VAC	KPDR90012US	**Call**
220 VAC	KPDR90012EU	**Call**
Power Supply		
120 VAC (U.S.)	K12641	**Call**
90-230 VAC (U.K./EU)	K12664	**Call**
Software Package for PC Control	K12604	**Call**
RS-232 Cable		
10', 15-Pin to connect PDR900 to 90AR	K13620	**Call**
25', 15-Pin to connect PDR900 to 909AR	K13622	**Call**
RS-485 Cable		
10', 15-Pin to connect PDR900 to 909AR	K13671	**Call**
25', 15-Pin to connect PDR900 to 909AR	K13673	**Call**

*120 VAC version includes US Mains cable.
220 VAC version includes both UK and EU Mains cable.

NOTE: See page 7-9 for our PDR900 controller.

➤ 9.9 x 10^{-4}–2 x 10^{-9} Torr

KJLC® 2200 Series

A convenient, low-cost gauge controller for single Bayard-Alpert ion gauges, suitable for either tubulated or nude gauge tubes.

- Front panel access to all operating functions, including four set points for system control
- RS-232 interface
- Adjustments for sensitivity and emission
- Ability to measure pressure during the degas cycle
- Includes 6' power cord, accessory connector kit, rackmounting ears, and instruction manual

NOTE: Ion gauge tube and cable must be ordered separately.

WARRANTY: We're so confident in the quality and performance of our 2200 Series controller that it comes with a standard 3-year warranty!

SPECIFICATIONS

Pressure Range — 2.0 x 10^{-9} to 9.9 x 10^{-4} Torr
Ion Gauge Type — Bayard-Alpert
Sensitivity — 1 to 80/Torr (adjustable)
Emission Current — 1 to 20 mA (adjustable)
Set Points
Number — 4 SPST
Range — Full range
Rating — 3A @ 100VAC
Ion Gauge Tubes
Type — Hot filament
Degas — Resistive
Degas Timer — 1–60 min. (adjustable)
Operating Temperature — 0–50° C
Communications — RS-232 9-pin data port
Dimensions — 3.5" x 8" x 10.5"
Input Voltage — 110 or 220 VAC 50/60 Hz, factory set

Gauge Controllers & Accessories

Description	Part No.	Price
KJLC 2200 Series Ion Gauge Controller		
115 VAC	KJL2200	**Call**
220 VAC	KJL2200-220	**Call**
Glass Gauge Tube Interconnect Cable (10 ft.)	KJLIGC10G	**Call**
Nude Gauge Tube Interconnect Cable (10 ft.)	KJLIGC10N	**Call**
Nude Ion Gauge Tube (2.75" CF/ThO-Ir filament)	G8120	**Call**
Tubulated Ion Gauge Tube		
1" O.D. Nonex tube/ThO-Ir filament	G100N	**Call**
1" O.D. Kovar tube/ThO-Ir filament	G100K	**Call**
2.75" CF flange/ThO-Ir filament	G100F	**Call**

ORDERING NOTE: The KJLC 2200 is designed for gauge tubes requiring resistive degas (such as tube part number G8120). Do not use with nude ion gauge tubes requiring e-beam degas.

Kurt J. Lesker Company

➤ 1–1 x 10^{-10} Torr

KJLC® 4500 Series

A reliable, accurate, easy-to-read, and easy-to-operate ion gauge controller that can manage one ion gauge and two thermocouple gauges.

- Compact
- Front panel contains all controls, including set point, sensitivity adjustment, and emission current control
- Digital display registers measurements down to 1 x 10^{-10} Torr
- Panel shows readings from the two thermocouple gauges with a bar graph
- Four set points, adjustable from 1 x 10^{-10} Torr to atmosphere
- AutoStart feature automatically starts the ion gauge when the thermocouple gauge reaches its lower limit
- RS-232 interface
- Analog voltage proportional to pressure
- Includes a 6' power cord, rackmount ears, and instruction manual

SPECIFICATIONS

Pressure Range (ion gauge) — 1 x 10^{-10} to 1 x 10^{-3} Torr
Pressure Range (thermocouple gauge) — 1 x 10^{-3} to 1 Torr
Ion Gauge Type — Bayard-Alpert
Thermocouple Gauge Type — KJL-6000
Sensitivity — 1–64/Torr (adjustable)
Emission Current — 1–20 mA (adjustable)
Set Points
Number — 4 SPDT
Range — 1 x 10^{-10} to 1 Torr
Rating — 3A @ 100VAC
Outputs
Digital — RS-232
Analog — 0–10 VDC
Ion Gauge Tubes
Type — Hot filament
Degas — Resistive (50 W)
Degas Timer — 0–99 min. (adjustable)
Operating Temperature — 0–50° C
Dimensions — 3.5" x 10.5" x 15"
Input Voltage — 110 or 220 VAC, 50/60 Hz, factory set

NOTE: Tubes and cables must be ordered separately.

ORDERING NOTE: The KJLC 4500 is designed for gauge tubes requiring resistive degas (such as tube part number G8120). Do not use with nude ion gauge tubes requiring e-beam degas.

Gauge Controllers & Accessories

Description	Part No.	Price
KJLC 4500 Series Ion Gauge Controller		
115 VAC	KJL4500	**Call**
220 VAC	KJL4500-220	**Call**
Glass Gauge Tube Interconnect Cable (10 ft.)	KJLIGC10G	**Call**
Nude Gauge Tube Interconnect Cable (10 ft.)	KJLIGC10N	**Call**
Thermocouple Gauge Tube Interconnect Cable (10 ft.)	KJLIGCTC10	**Call**
Nude Ion Gauge Tube (2.75" CF/ThO-Ir filament)	G8120	**Call**
Tubulated Ion Gauge Tube		
1" O.D. Nonex® tube/ThO-Ir filament)	G100N	**Call**
1" O.D. Kovar® tube/ThO-Ir filament)	G100K	**Call**
2.75" CF flange/ThO-Ir filament)	G100F	**Call**
KJLC Thermocouple Gauge Tube		
1/8" NPT	KJL-6000	**Call**
KF16	KJL-6000QF16	**Call**
1 1/3" CF	KJL-6000MC	**Call**

WARRANTY: We're so confident in the quality and performance of our 4500 Series controller that it comes with a standard 3-year warranty!

➤ 760–1 x 10^{-9} Torr

KJLC® 6600 Series

Operates 2 Bayard-Alpert ion gauges and 4 convection gauges or 4 thermocouple gauges while providing 8 set points and RS-232 interface.

- Unit will display 2 ion gauges **simultaneously** and the 4 convection or thermocouple gauges sequentially (if the ion gauges are off, the unit will display convection or thermocouple gauges in their place)
- Unit will display 3 convection/thermocouple gauges simultaneously while in rough vacuum, and when pressure reaches 1x10^{-3} Torr, the controller can automatically start and display the ion gauges
- 2 analog recorder outputs
- Adjustable emission
- Auto-calibration of the convection gauges
- Overpressure protection
- Includes a 6' cord, rackmounting ears, and instruction manual

WARRANTY: We're so confident in the quality and performance of our 6600 Series controller that it comes with a standard 3-year warranty!

ORDERING NOTE: The KJLC 6600 is designed for gauge tubes requiring resistive degas (such as tube part number G8120). Do not use with nude ion gauge tubes requiring e-beam degas. Tubes and cables must be ordered separately.

SPECIFICATIONS

Pressure Range (ion gauge) — 1 x 10^{-9} to 1 x 10^{-3} Torr
Pressure Range (convection gauge) — 1 x 10^{-3} to 760 Torr
Pressure Range (thermocouple gauge) — 1 x 10^{-3} to 1 Torr
Ion Gauge Type — Bayard-Alpert
Convection Gauge Type — KJL912161
Thermocouple Gauge Type — KJL-6000
Sensitivity — 1–80/Torr (adjustable)
Emission current — 1–20 mA (adjustable)
Set Points
- **Number —** 8 SPDT
- **Range —** Full range — assignable to any tube
- **Rating —** 3A @ 115 VAC

Outputs
- **Digital —** RS-232
- **Analog —** 0–10 VDC (1V/decade) assignable to any tube

Ion Gauge Tubes
- **Type —** Hot filament
- **Degas —** Resistive (50 W)
- **Degas Timer —** 0–99 min. (adjustable)

Operating Temperature — 0–50° C
Dimensions — 3.5" x 10.5" x 15"
Input Voltage — 110 or 220 VAC, 50/60 Hz, user selectable

Description	Part No.	Price
KJLC 6600 Series Ion Gauge Controller, 95–125/200–250 VAC, 50/60 Hz		
Equipped for convection gauges	KJL6600C	**Call**
Equipped for thermocouple gauges	KJL6600T	**Call**
Glass Gauge Tube Interconnect Cable (10 ft.)	KJLIGC10G	**Call**
Nude Gauge Tube Interconnect Cable (10 ft.)	KJLIGC10N	**Call**
Thermocouple Gauge Tube Interconnect Cable (10 ft.)	KJLIGCTC10	**Call**
Convection Gauge Tube Interconnect Cable (10 ft.)	KJLIGCCV10	**Call**
Nude Ion Gauge Tube (2.75" CF/ThO-Ir filament)	G8120	**Call**
Tubulated Ion Gauge Tube		
1" O.D. Nonex® tube/ThO-Ir filament	G100N	**Call**
1" O.D. Kovar® tube/ThO-Ir filament	G100K	**Call**
2.75" CF flange/ThO-Ir filament	G100F	**Call**
KJLC Thermocouple Gauge Tube		
1/8" NPT	KJL-6000	**Call**
KF16	KJL-6000QF16	**Call**
1 1/3" CF	KJL-6000MC	**Call**
KJLC Convection Gauge Tube		
1/8" NPT	KJL912161	**Call**
KF16	KJL912162	**Call**
1 1/3" CF	KJL912163	**Call**
2 3/4" CF	KJL912164	**Call**

Kurt J. Lesker Company

Hot Filament (Ionization)

Hot Filament (Ionization)

Legend:
G = Grid
F_1, F_2 = Filament
F_C = Filament Common
C = Ion Collector

Figure 1

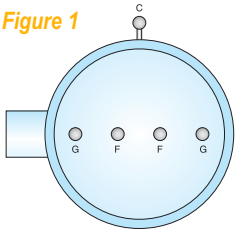


Figure 2

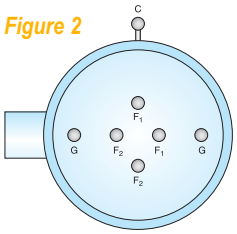


Figure 3

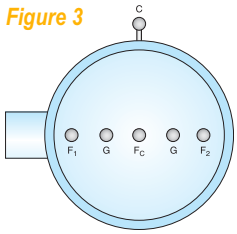


Figure 4

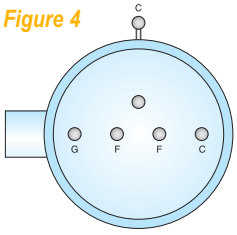


Figure 5

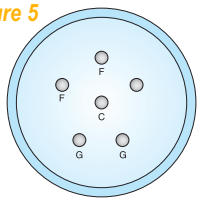
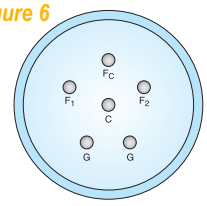


Figure 6




G8120


G8130


G100F


G100K


G075N

Gauge Tube Type	Figure	Description	Manufacturer	Part No.	Price
B-A Ion, Flanged					
	1	Gauge Tube, 2.75" CF, 1 x ThO-Ir filament, 3/4" O.D., 10 Torr-1 sensitivity	KJLC	G075F	Call
	1	Gauge Tube, 2.75" CF, 1 x ThO-Ir filament, 1.0" O.D., 10 Torr-1 sensitivity	KJLC	G100F	Call
	1	Gauge Tube, 2.75" CF, 1 x ThO-Ir filament, 1.0" O.D., 10 Torr-1 sensitivity	KJLC	G100F-PT	Call
	1	Gauge Tube, QF-25, 1 x ThO-Ir filament, 1.0" O.D., 10 Torr-1 sensitivity	KJLC	G100KQF25	Call
	1	Gauge Tube, QF-40, 1 x ThO-Ir filament, 1.0" O.D., 10 Torr-1 sensitivity	KJLC	G100KQF40	Call
	2	Gauge Tube, 2.75" CF, 2 x W filament, 1.0" O.D., 12.5 Torr-1 sensitivity	KJLC	G100TF	Call
	4	Gauge Tube, 2.75" CF, 1 x ThO-Ir filament, 1.0" O.D., 8 Torr-1 sensitivity	KJLC	GX100-564F	Call
B-A Ion, Nude					
	5	Gauge Tube, 1 x ThO-Ir filament, 10 Torr-1 sensitivity	KJLC	G8120	Call
	6	Gauge Tube, 2 x ThO-Irq filament, 25 Torr-1 sensitivity	KJLC	G8130	Call
	6	Gauge Tube, 2 x W filament, 25 Torr-1 sensitivity	KJLC	G8130T	Call
	5	Gauge Tube, 1 x ThO-Ir filament, 10 Torr-1 sensitivity	KJLC	G8140	Call
	6	Gauge Tube, 2 x ThO-Ir filament, 10 Torr-1 sensitivity	KJLC	G8140-DI	Call
	N/A	Gauge Tube, 2 x W filament, 14 Torr-1 sensitivity	VG	VZVIG17	Call
	N/A	Gauge Tube, 2 x ThO-Ir filament, 14 Torr-1 sensitivity	VG	VZVIG18	Call
	N/A	Gauge Tube, 2 x W filament, 12.7 Torr-1 sensitivity	VG	VZVIG22	Call
	N/A	Gauge Tube, 2 x ThO-Ir filament, 12.7 Torr-1 sensitivity	VG	VZVIG24	Call
B-A Ion, Tubulated					
	1	Gauge Tube, Kovar®, 1 x ThO-Ir filament, 3/4" O.D., 10 Torr-1 sensitivity	KJLC	G075K	Call
	1	Gauge Tube, Kovar, 1 x ThO-Ir filament, 3/4" O.D., 10 Torr-1 sensitivity	KJLC	G075K-PT	Call
	1	Gauge Tube, Nonex®, 1 x ThO-Ir filament, 3/4" O.D., 10 Torr-1 sensitivity	KJLC	G075N	Call
	2	Gauge Tube, Kovar, 2 x W filament, 3/4" O.D., 12.5 Torr-1 sensitivity	KJLC	G075TK	Call
	1	Gauge Tube, Kovar, 1 x ThO-Ir filament, 1.0" O.D., 10 Torr-1 sensitivity	KJLC	G100K	Call
	1	Gauge Tube, Kovar, 1 x ThO-Ir filament, 1.0" O.D., 10 Torr-1 sensitivity	KJLC	G100K-PT	Call
	1	Gauge Tube, Nonex, 1 x ThO-Ir filament, 1.0" O.D., 10 Torr-1 sensitivity	KJLC	G100N	Call
	1	Gauge Tube, Nonex, 1 x ThO-Ir filament, 1.0" O.D., 10 Torr-1 sensitivity	KJLC	G100N-PT	Call
	2	Gauge Tube, Kovar, 2 x W filament, 1.0" O.D., 12.5 Torr-1 sensitivity	KJLC	G100TK	Call
	3	Gauge Tube, 7052, 2 x W filament, 1/2" O.D., 12.5 Torr-1 sensitivity	KJLC	GX050-015-2	Call
	3	Gauge Tube, 7052, 2 x W filament, 3/4" O.D., 12.5 Torr-1 sensitivity	KJLC	GX075-016-2	Call
	3	Gauge Tube, Pyrex, 2 x W filament, 3/4" O.D., 12.5 Torr-1 sensitivity	KJLC	GX075-016-P	Call
	3	Gauge Tube, 7052, 2 x W filament, 1.0" O.D., 12.5 Torr-1 sensitivity	KJLC	GX100-017-2	Call
	4	Gauge Tube, Kovar, 1 x ThO-Ir filament, 1.0" O.D., 7.5 Torr-1 sensitivity	KJLC	GX100-564K	Call
	4	Gauge Tube, Nonex, 1 x ThO-Ir filament, 1.0" O.D., 7.5 Torr-1 sensitivity	KJLC	GX100-564N	Call

OEM Cross-Reference


G8120


G8130


G100F


G100K


G075N

Replacement Ion Gauge Tubes

OEM	OEM Part No.	Style	Part No.	Price
CHA	IG-100-K	B-A, Tubulated	G075K	Call
CHA	IG-100-N	B-A, Tubulated	G075N	Call
CHA	IG-100-P	B-A, Tubulated	G075N	Call
CHA	IG-101-K	B-A, Tubulated	G100K	Call
CHA	IG-101-N	B-A, Tubulated	G100N	Call
CHA	IG-101-P	B-A, Tubulated	G075N	Call
CHA	IGT-100K	B-A, Tubulated	G075TK	Call
CHA	IGT-100N	B-A, Tubulated	G075TN	Call
CHA	IGT-100P	B-A, Tubulated	G075TN	Call
Cooke Vac	BA60K	B-A, Tubulated	G075K	Call
Cooke Vac	BA60KF	B-A, Flanged	G100F	Call
Cooke Vac	BA60N	B-A, Tubulated	G075N	Call
Cooke Vac	BA60P	B-A, Tubulated	G075N	Call
Cooke Vac	BA61KF	B-A, Flanged	G100F	Call
Cooke Vac	BA61KT	B-A, Tubulated	G100TK	Call
Cooke Vac	BA61N	B-A, Tubulated	G100N	Call
Cooke Vac	BA61P	B-A, Tubulated	G075N	Call
Cooke Vac	GA61PT	B-A, Tubulated	G100TN	Call
CVC	GIC-015-2	B-A, Tubulated	GX050-015-2	Call
CVC	GIC-016-2	B-A, Tubulated	GX075-016-2	Call
CVC	GIC-017-2	B-A, Tubulated	GX100-017-2	Call
G-Phillips	274002	B-A, Tubulated	G075N	Call
G-Phillips	274003	B-A, Tubulated	G075K	Call
G-Phillips	274005	B-A, Tubulated	G075N	Call
G-Phillips	274006	B-A, Tubulated	G100K	Call
G-Phillips	274007	B-A, Flanged	G075F	Call
G-Phillips	274008	B-A, Flanged	G100F	Call
G-Phillips	274012	B-A, Tubulated	G075TN	Call
G-Phillips	274013	B-A, Tubulated	G075TK	Call
G-Phillips	274015	B-A, Tubulated	G100TN	Call
G-Phillips	274016	B-A, Tubulated	G100TK	Call
G-Phillips	274022	B-A, Nude	G8130T	Call
G-Phillips	274023	B-A, Nude	G8130	Call
G-Phillips	274028	B-A, Nude	G8140	Call
Huntington	IK-100	B-A, Tubulated	G075K	Call
Huntington	IK-100-F	B-A, Flanged	G075F	Call
Huntington	IK-150	B-A, Tubulated	G100K	Call
Huntington	IK-150-F	B-A, Flanged	G100F	Call
Huntington	IN-100	B-A, Tubulated	G075N	Call
Huntington	IN-150	B-A, Tubulated	G100N	Call
Huntington	IP-100	B-A, Tubulated	G075N	Call
Huntington	IP-150	B-A, Tubulated	G075N	Call
Huntington	TK-100	B-A, Tubulated	G075TK	Call
Huntington	TK-150	B-A, Tubulated	G100TK	Call
Huntington	TP-150	B-A, Tubulated	G100TN	Call
Leybold	850-675-G1	B-A, Tubulated	G075K	Call
Leybold	850-675-G3	B-A, Tubulated	G075TK	Call
Leybold	850-675-G4	B-A, Tubulated	G100TK	Call
Leybold	850-675-G5	B-A, Flanged	G100F	Call

OEM	OEM Part No.	Style	Part No.	Price
MKS	IG-1	B-A, Tubulated	G075K	Call
MKS	IG-2	B-A, Tubulated	G100K	Call
MKS	IG-4	B-A, Flanged	G100F	Call
MKS	IG-5	B-A, Nude	G8140	Call
MKS	IG-6	B-A, Tubulated	G100K-PT	Call
MKS	IG-7	B-A, Tubulated	G100F-PT	Call
Perkin-Elmer	605-7000	B-A, Tubulated	G075N	Call
Perkin-Elmer	605-7152	B-A, Flanged	G100F	Call
Perkin-Elmer	605-76726	B-A, Nude	G8130	Call
Perkin-Elmer	605-7673	B-A, Nude	G8130T	Call
Sloan	67035	B-A, Tubulated	G075K	Call
Temescal	924A	B-A, Tubulated	G075K-PT	Call
Temescal	924B	B-A, Tubulated	G100K-PT	Call
Torr	IG4336KI	B-A, Tubulated	G075K	Call
Torr	IG4336NI	B-A, Tubulated	G075N	Call
Torr	IG4336NI	B-A, Tubulated	G075N	Call
Varian	0563-K2466-301	B-A, Tubulated	G100N-PT	Call
Varian	0563-K2466-302	B-A, Tubulated	G100K-PT	Call
Varian	0563-K2466-303	B-A, Tubulated	G100F-PT	Call
Varian	0563-K2466-304	B-A, Tubulated	G100N-PT	Call
Varian	0563-K2466-305	B-A, Tubulated	G075K-PT	Call
Varian	0564-K2500-301	B-A, Tubulated	GX100-564N	Call
Varian	0564-K2500-302	B-A, Tubulated	GX100-564K	Call
Varian	0564-K2500-303	B-A, Tubulated	GX100-564F	Call
Varian	0571-K2471-301	B-A, Tubulated	G100N	Call
Varian	0571-K2471-302	B-A, Tubulated	G100K	Call
Varian	0571-K2471-303	B-A, Flanged	G100F	Call
Varian	0571-K2471-304	B-A, Tubulated	G075N	Call
Varian	0571-K2471-305	B-A, Tubulated	G075K	Call
Varian	0572-K7360-301	B-A, Tubulated	G100TN	Call
Veeco	RG-100K	B-A, Tubulated	G100K	Call
Veeco	RG-100N	B-A, Tubulated	G100N	Call
Veeco	RG-100P	B-A, Tubulated	G075N	Call
Veeco	RG-75K	B-A, Tubulated	G075K	Call
Veeco	RG-75N	B-A, Tubulated	G075N	Call
Veeco	RG-75P	B-A, Tubulated	G075N	Call
Veeco	TG-100K	B-A, Tubulated	G100TK	Call
Veeco	TG-100N	B-A, Tubulated	G100TN	Call
Veeco	TG-100P	B-A, Tubulated	G100TN	Call
Veeco	TG-75K	B-A, Tubulated	G075TK	Call
Veeco	TG-75N	B-A, Tubulated	G075TN	Call
Veeco	TG-75P	B-A, Tubulated	G075TN	Call
VG	VIG17	B-A, Nude	VZVIG17	Call
VG	VIG18	B-A, Nude	VZVIG18	Call
VG	VIG22	B-A, Nude	VZVIG22	Call
VG	VIG24	B-A, Nude	VZVIG24	Call

Kurt J. Lesker Company

➤ 5 x 10^{-3}–1 x 10^{-8} Torr

KJLC 971 Series

Our cost effective cold cathode.

Features:

- The cold cathode anode module design is user serviceable to decrease downtime and save external repair costs
- Includes both analog and digital communication for ease of operation
- Mountable in any orientation for ease of use and flexibility of design
- Alternate analog output and electrical connectors available to match other vendors' vacuum gauges and facilitate an easy upgrade
- Can be used with the PDR900 Vacuum Gauge Controller and Display for easy set up
- RoHS and CE Compliant

SPECIFICATIONS

Pressure Range (ion gauge) — 1 x 10^{-8} to 5 x 10^{-3} Torr
Calibration Gas — Nitrogen
Operating Temperature — 0–40° C (32–104° F)
Maximum Bakeout Temperature — 85° C (185° F), non-operating
Digital Communications — RS-485 or RS-232
Analog Outputs —0.5 VDC/decade
Accuracy (Typical) Combined Absolute — 5 x 10^{-8} Torr to 10^{-3} ±30% of reading
Repeatability (Typical) Combined Absolute — 5 x 10^{-8} Torr to 10^{-3} ±30% of reading
Overpressure Limits — 1500 Torr
Installation Orientation — Any
Material Exposed to Vacuum — 304 and 403 stainless steel, Viton®, epoxy resin, ceramic

Controller/Accessories

Description	Part No.	Price
KJLC PDR900 Series Controller (120 VAC)*	KPDR90012US	Call
KJLC PDR900 Series Controller (220 VAC)*	KPDR90012EU	Call
Connection Cables for Sensors		
10', 15-PIN for connecting to 910, 909AR, 979, 971, and 972 sensors	K13620	Call
25', 15-PIN for connecting to 910, 909AR, 979, 971, and 972 sensors	K13622	Call

*120 VAC model includes US Mains power cable.
220 VAC model includes both UK and EU Mains cables.

Flange	Interface	Connector Relays	Enclosure Seating	Part No.	Price
NW25 KF	RS-232	SUBD 15pinHD male-no relay	Viton Seal (standard)	K97121020	Call
2 ¾" CF	RS-232	SUBD 15pinHD male-no relay	Viton Seal (standard)	K97171020	Call
NW40 KF	RS-232	SUBD 15pinHD male-no relay	Viton Seal (standard)	K97191020	Call
NW25 KF	RS-485	SUBD 15pinHD male-no relay	Viton Seal (standard)	K97122020	Call
2 ¾" CF	RS-485	SUBD 15pinHD male-no relay	Viton Seal (standard)	K97172020	Call
NW40 KF	RS-485	SUBD 15pinHD male-no relay	Viton Seal (standard)	K97192020	Call
NW25 KF	RS-232	SUBD 15pinHD male-3 relay	Viton Seal (standard)	K97121030	Call
2 ¾" CF	RS-232	SUBD 15pinHD male-3 relay	Viton Seal (standard)	K97171030	Call
NW40 KF	RS-232	SUBD 15pinHD male-3 relay	Viton Seal (standard)	K97191030	Call
NW25 KF	RS-485	SUBD 15pinHD male-3 relay	Viton Seal (standard)	K97122030	Call
2 ¾" CF	RS-485	SUBD 15pinHD male-3 relay	Viton Seal (standard)	K97172030	Call
NW40 KF	RS-485	SUBD 15pinHD male-3 relay	Viton Seal (standard)	K97192030	Call

➤ 1 x 10^{-2}–1 x 10^{-10} Torr

KJLC® 943 Series

Controller displays pressure from 10^{-10} to 10^{-2} Torr (mbar) using a high-visibility LED display.

- Two types of analog output are standard, for remote monitoring of pressure
- Internal converter provides output that enables a simple log conversion from voltage to pressure over the entire operating range
- Fast-responding, buffered analog output is provided through the 15-pin accessory connector on the rear panel
- Inverted magnetron design
- Sensor can operate at pressures much lower than traditional Penning cold cathode sensors
- Ideal for UHV use
- No filament to burn out—sensor is not ruined by sudden inrushes of air and is resistant to vibration damage
- No need to adjust emission current or to degas the gauge, reducing response time to pressure changes

SPECIFICATIONS

943 Series Gauge Controller:

Measuring Range — 1.0 x 10^{-10} to 1.0 x 10^{-2} Torr (1.3 x 10^{-10} to 1.3 x 10^{-2} mbar)

Set-Point Range — 2.0 x 10^{-9} to 9.0 x 10^{-3} Torr (2.7 x 10^{-9} to 1.2 x 10^{-2} mbar)

Power Requirements — 100–120 VAC, 50/60 Hz, 9W; 220–240VAC, 50/60Hz, 9W

Set-Point Relays — 2 independently set, SPDT contacts, resistive load; 1 A @ 30VAC or 24VDC

Set-Point Response — 50 msec for pressures >10^{-8} Torr

Analog — 0–9 VDC

Logarithmic Analog — 1 to 9 VDC (1V per decade)

Display — Red LED, 7-segment digits)

423 Series Gauge (Sensor):

Measuring Range — 10^{-11} to 10^{-2} Torr (mbar)

Materials Exposed to Vacuum — Stainless steel, 6061 aluminum, Inconel®, glass, and alumina ceramic

Reproducibility (of reading at constant temperature) — 5%

Cables and Connectors (tube side) — Molded connector with a positive locking bolt

Cables and Connectors (controller side) — Bayonet connector and threaded coaxial connector

Bakeout Temperature — 400° C with CF flanges, and with magnet and cable removed

Operating Temperature — 0–70° C

Calibration Gas — Air/nitrogen

Installation Orientation — Any

Internal Volume —0.9 in^3 (15cm^3) maximum

Gauge Controllers & Accessories

Description	Part No.	Price
KJLC 943 Series Cold Cathode Gauge Controller		
Torr Readout (120 VAC, 60 Hz)*	K9431206T	**Call**
mbar Readout (220–240 VAC, 50 Hz)*	K9432205M	**Call**
KJLC 423 Series Cold Cathode Gauge Tube		
1" tube	K4233	**Call**
KF25	K4234	**Call**
KF40	K4231	**Call**
2¾" CF	K4232	**Call**
Cold Cathode Gauge Tube Interconnect Cable (10 ft.)	K7873	**Call**
Cold Cathode Gauge Tube Interconnect Cable (25 ft.)	K7874	**Call**
Controller Panel Mounting Hardware	K5021	**Call**
Rebuild Kit for 423 Series Gauge Tube	K2353	**Call**
19" Controller Rack Panel		
3U, ¼" DIN, blank	K5456	**Call**
3U, ¼" DIN, 1 cutout	K5457	**Call**
3U, ¼" DIN, 2 cutouts	K5458	**Call**
3U, ¼" DIN, 3 cutouts	K5459	**Call**
3U, ¼" DIN, 4 cutouts	K5460	**Call**

* Controller includes US Mains power cable for Torr versions and both EU and UK Mains power cables for mbar versions.

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➤ 1 x 10^{4}–1 x 10^{-11} Torr

KJLC® 937B Series

These controllers combine the technologies of the cold cathode, standard Pirani, convection Pirani, thermocouple, and capacitance manometer sensors to measure from ultrahigh vacuum to over atmospheric pressure.

Features:

- Control up to five sensors simultaneously
- Configured to the user's specifications regarding sensor, line voltage and frequency, units of measure, and communication choice
- May contain a cold cathode board, and can be configured with two more gauge boards to accommodate up to four additional gauges
- Can also be configured with two additional cold cathode boards, enabling the simultaneous operation of three high vacuum gauges
- Dual or single gauge boards for the standard Pirani, convection Pirani, thermocouple, and capacitance manometer sensors

Along with analog outputs, the 937B can input and output digital data for direct computer communication. The 937B comes standard with 232/485 communications. A slot is available in the controller for an optional board that supports Profibus DPV1 communications. The 937B can communicate with a host computer with either of these ports.

SPECIFICATIONS

Pressure Range — 1 x 10^{-11} to 1 x 10^{4} Torr (1.0 x 10^{-4} to 1.3 x 10^{4} mbar)
Display — Digital LCD (6 separate pressure displays)
Response Time — < 1.0 sec
Power Requirements/Consumption — 100-240 VAC 50/60 Hz
Compatible Gauge Sensors — Cold Cathode, Standard Pirani, Convection Pirani, Hot Cathode, Capacitance Manometers, Piezodiaphragm Gauge
Analog Output —
1. Buffered analog outputs for each gauge
2. Logarithmic outputs for each gauge (0.6V/decade)
3. Combination output combining ion gauge with auxiliary

Communications — RS-232, RS-485, Profibus
Set Points — 12 (pressure dependent)
Set-Point Relays — 12 SPDT Relays, 2A @ 230 VAC
Leak Test — Relative logarithmic bar graph display & variable rate audio signal
Operating Temperature — 5–40° C

Gauge Controllers & Accessories

Description	Part No.	Price
KJLC 937B Series Combination Gauge Controller		
120 VAC, 60 Hz	K937B-US	Call
220 VAC, 50 Hz	K937B-EU	Call
Half Rack Mounting Kit for Controller	K5651	Call

Gauge Sensors, Cards, & Accessories

Description	Part No.	Price
Cards (select up to 3 gauge cards—1 communication card) RS-232/485 included		
Gauge Card for 937B:		
Cold Cathode	K15185	Call
Dual Convection Pirani/STD Pirani	K15132	Call
Dual Capacitance Manometer	K15267	Call
Hot Ionization, Nude Tube	K15641	Call
Hot Ionization, Glass BA Tube	K15989	Call
Communications Card for 937B:		
Profibus	K15940	Call
Cables—Interconnect Cable from Controller		
To 345/317 Pirani Sensor:		
10 ft.	K31706S	Call
25 ft.	K31707S	Call
50 ft.	K31708S	Call
To 423 Cold Cathode Sensor:		
10 ft.	K7873	Call
25 ft.	K7874	Call
50 ft.	K2395	Call
To 626 and 627 Capacitance Manometer:		
10 ft.	K7555	Call
25 ft.	K7556	Call
50 ft.	K7557	Call
To 722 Capacitance Manometer*:		
10 ft. (9-Pin Cable)	K10000	Call
25 ft. (9-Pin Cable)	K10001	Call
50 ft. (9-Pin Cable)	K10002	Call
To Hot Cathode, Low Power Nude:		
10 ft.	K16029	Call
25 ft.	K16030	Call
50 ft.	K16031	Call
To Hot Cathode, Glass BA:		
10 ft.	K10809	Call
25 ft.	K10810	Call
50 ft.	K10811	Call
Sensors		
Series 345 Pirani Sensor, Shielded:		
KF16	K34510	Call
1/8" NPT-M	K34511	Call
8 VCR®-F	K34512	Call
Mini 1 1/3" CF	K34513	Call
2 3/4" CF	K34514	Call
KF25	K34515	Call
Series 317 Convection Pirani Sensor, Shielded:		
2 3/4" CF	K31714S	Call
Mini 1 1/3" CF	K31713S	Call
1/8" NPT-M	K31711S	Call
4 VCR-F	K31729S	Call
8 VCR-F	K31712S	Call
KF16	K31710S	Call
KF25	K31727S	Call
Series 423 Cold Cathode Sensor:		
1" Tube	K4233	Call
KF25	K4234	Call
KF40	K4231	Call
2 3/4" CF	K4232	Call
Rebuild Kit for 423 Sensor	K2353	Call

*9-Pin Sub-D Manometers must be used

➤ 760–1 x 10^{-8} Torr

KJLC 972 Series

Features:

- Single transducer provides a wide measurement range of 10^{-8} Torr to atmosphere, eliminating the need for multiple vacuum gauges
- The MEMS based MicroPirani™ sensors allows low auto cold cathode turn-on pressure (user programmable from 2 x 10^{-4} to 1 x 10^{-3} Torr) for enhanced reliability
- Includes both analog and digital communication for ease of operation
- MicroPirani™ is automatically zeroed during pump down cycle for improved accuracy
- Mountable in any orientation
- Simplified interface via a single smoothed analog output that combines the individual vacuum sensor measurements
- Alternate analog output and electrical connectors available to match other vendors' vacuum gauges and facilitate an easy upgrade
- Can be used with the PDR900 Vacuum Gauge Controller and Display for easy set up
- RoHS and CE Complaint

SPECIFICATIONS

Sensor Type — Cold Cathode/MicroPirani™ (MEMS Thermal Conductivity)
Pressure Range (ion gauge) — 1 x 10^{-8} Torr to Atmosphere
Calibration Gas — Nitrogen
Operating Temperature — 0–40° C (32–104° F)
Maximum Bakeout Temperature — 85° C (185° F), non-operating
Digital Communications — RS-485 or RS-232
Analog Outputs —0.5 VDC/decade
Accuracy (Typical) Combined Absolute — 5 x 10^{-8} Torr to 10^{-3} ± 30% of reading; 10^{-3} to 100 ± 5% of reading
Repeatability (Typical) Combined Absolute — 5 x 10^{-8} Torr to 10^{-3} ± 30% of reading; 10^{-3} to 100 ± 2% of reading
Overpressure Limits — 1500 Torr
Installation Orientation — Any
Material Exposed to Vacuum — 304 and 403 stainless steel, silicon, SiO_2, SiN_4, gold, Viton®, epoxy resin, ceramic

Controller/Accessories

Description	Part No.	Price
KJLC PDR900 Series Controller (120 VAC)*	KPDR90012US	Call
KJLC PDR900 Series Controller (220 VAC)*	KPDR90012EU	Call
Connection Cables for Sensors		
10', 15-PIN for connecting to 909AR, 979, 971, and 972 sensors	K13620	Call
25', 15-PIN for connecting to 909AR, 979, 971, and 972 sensors	K13622	Call

*120 VAC model includes US Mains power cable.
220 VAC model includes both UK and EU Mains cables.

Flange	Interface	Connector Relays	Enclosure Seating	Part No.	Price
NW25 KF	RS232	SUBD 15pinHD male-no relay	Viton Seal (standard)	K97221020	Call
2 3/4" CF	RS232	SUBD 15pinHD male-no relay	Viton Seal (standard)	K97271020	Call
NW40 KF	RS232	SUBD 15pinHD male-no relay	Viton Seal (standard)	K97291020	Call
NW25 KF	RS485	SUBD 15pinHD male-no relay	Viton Seal (standard)	K97222020	Call
2 3/4" CF	RS485	SUBD 15pinHD male-no relay	Viton Seal (standard)	K97272020	Call
NW40 KF	RS485	SUBD 15pinHD male-no relay	Viton Seal (standard)	K97292020	Call
NW25 KF	RS232	SUBD 15pinHD male-3 relay	Viton Seal (standard)	K97221030	Call
2 3/4" CF	RS232	SUBD 15pinHD male-3 relay	Viton Seal (standard)	K97271030	Call
NW40 KF	RS232	SUBD 15pinHD male-3 relay	Viton Seal (standard)	K97291030	Call
NW25 KF	RS485	SUBD 15pinHD male-3 relay	Viton Seal (standard)	K97222030	Call
2 3/4" CF	RS485	SUBD 15pinHD male-3 relay	Viton Seal (standard)	K97272030	Call
NW40 KF	RS485	SUBD 15pinHD male-3 relay	Viton Seal (standard)	K97292030	Call

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➤ 1,500–1 x 10^{-5} Torr

KJLC® 910 Series

These transducers are based on direct-reading absolute Piezo and Pirani sensors.

Features:

- Digital communication enables all adjustments and monitoring to be delivered real-time, via a host computer
- Provides a 1–9 VDC analog output signal at the male 15-pin high-density D-sub connector
- Transducer offers a smooth output between the two sensors and reads from both sensors in the 5 to 15 Torr (6.7 to 20 mbar) range
- Transducer measurement range is from 10^{-5} to 1,500 Torr (10^{-5} to 2,000 mbar)
- Three independent relay set points provide process control
- Set-point features can be set, adjusted, and monitored through the digital port

NOTE: See page 7-9 for our PDR900 controller.

Unlike traditional Pirani gauges, the compact element in the Pirani portion of the 910 Series is made of a one-millimeter-square silicon chip, enabling the measurements to be made in a very small volume. A traditional Pirani sensor has a measuring range from 10^{-3} to about 100 Torr (10^{-3} to 133 mbar), rapidly losing sensitivity above 10 Torr (13 mbar). Because the size of the sensing portion of the Pirani is so small, it has a range from atmosphere down to 10^{-5} Torr (mbar).

Like all thermal conductivity sensors, the Pirani is gas-type sensitive. The Piezo measures independent of gas type. The 910 provides a digital leak detection output that measures differential reading between the Piezo and Pirani. This makes it a simple solution for locating medium to fine leaks in vacuum systems.

SPECIFICATIONS

Pressure Range — 1.0 x 10^{-5} to 1,500 Torr (1.3 x 10^{-5} to 2,000 mbar)
Accuracy — 10^{-4} to 10 Torr (10-4 to 13 mbar): 10% of Reading
10 to 1,000 Torr (13 to 1,333 mbar): 1% of Reading
Repeatability — Atmosphere to 10^{-2} torr: 1% of Reading
10^{-3} torr decade: 5% of Reading
10^{-4} torr decade: 10% of Reading
Calibration Gas — Air, Argon, Helium, Nitrogen, Hydrogen, Water vapor
Operating Temperature — 0–40° C
Bakeout Temperature — 85° C (non-operating)
Set-Point Range — 1.0 x 10^{-4} to 1,500 torr
Set-Point Relays — 1
Relay Contact Rating — SPDT, 1A @ 30 VAC/DC (resistive)
Digital Communications — RS-232 or RS-485
Analog Output — 1–9 VDC (1 volt/Decade)
Power Requirements — 10–30 VDC (<1.5 W max.)
Internal Volume — 0.04 in^3
Installation Orientation — Any
Materials Exposed to Vacuum — Silicon, SiO_2, gold, epoxy resin, 304 SS, Kovar®, Viton®, Ultem 1000, aluminum

Combination Gauges (Transducers)

Description	Part No.	Price
KJLC 910 Series Combination Gauge		
RS-232		
KF16	K91011	**Call**
4 VCR Female	K91041	**Call**
8 VCR Female	K91051	**Call**
RS-485		
KF16	K91012	**Call**
4 VCR Female	K91042	**Call**
8 VCR Female	K91052	**Call**

Gauge Controllers & Accessories

Description	Part No.	Price
KJLC PDR900 Series Controller*		
120 VAC	KPDR90012US	**Call**
220 VAC	KPDR90012EU	**Call**
Power Supply & Communication Cable		
120 VAC (U.S.)	K12641	**Call**
90-230 VAC (U.K./EU)	K12664	**Call**
Software Package for PC Control	K12604	**Call**
Connection Cables for Sensors		
10', 15-Pin for connecting 910 sensors	K13620	**Call**
25', 15-Pin for connecting 910 sensors	K13622	**Call**

*120 VAC version includes US Mains cable.
220 VAC version includes both UK and EU Mains cable.

➤ 760–1 x 10^{-10} Torr

KJLC® 979 Series

Specifically designed for UHV processes and ideal for measuring the wide cyclic pressures of PVD and Ion Implantation systems.

The dual sensor design and digital interface handle high-vacuum coating applications requiring long-term stability and accuracy. The compact package makes it ideal for system integrators and equipment manufacturers in both the semiconductor and analytical markets.

Features:

- Miniature ion gauge combined with our compact Pirani sensor
- MEMS-based digital technology for real-time data access
- Wide measurement range of atmosphere to 10^{-10} Torr (mbar) for high-vacuum processes (13 decades)
- RS-485 communications and control
- 3 sensor independent set-point relays
- Low power—24 VDC, 10W
- Multi-sensor alternative with smoothed analog output (0.5–7 VDC)
- Reduced process cycle time due to the sensor's fast, accurate, and repeatable pressure measurement
- Two yttria-coated iridium filaments, designed for extended life, are controlled via RS-485 interface
- Unique sensor assembly design is easily serviceable

SPECIFICATIONS

Pressure Range —
5 x 10^{-10} Torr (6.7 x 10^{-10} mbar) to atmosphere

Accuracy —
10^{-9} to 10^{-3} Torr (mbar): 20% of Reading
10^{-3} to 100 Torr: 5% of Reading
100 Torr to atmosphere: 25% of Reading

Repeatability —
10^{-9} to 10^{-3} Torr (mbar): 5% of Reading
10^{-3} to 100 Torr (10^{-3} to 133 mbar): 2% of Reading
100 Torr to atmosphere (133 mbar): 10% of Reading

Calibration Gas — Nitrogen

Operating Temperature — 0–40° C

Bakeout Temperature —
100° C (non-operating)

Set-Point Range — 5 x 10^{-10} to 100 Torr (6.7 x 10^{-10} to 133 mbar)

Set-Point Relays — 3

Relay Contact Rating —
SPDT, 1A @ 30 VAC/DC (resistive)

Digital Communications — RS-485

Analog Output —
0.5–7 VDC (0.5 VDC/decade)

Power Requirements —
24 VDC (10W max)

Internal Volume — 1.47 in^3

Installation Orientation — Any

Materials Exposed to Vacuum —
Silicon, SiO_2, SiN_4, gold, glass, tungsten, 304 SS, Viton®, Ultem® 1000, tantalum, yttria-coated iridium, epoxy resin

NOTE: See page 7-9 for our PDR900 controller.

Combination Gauges (Transducers)

Description	Part No.	Price
KJLC 979 Series Combination Gauge (RS-232)		
1 1/3" CF	K97911	Call
2 3/4" CF	K97921	Call
KF16	K97931	Call
KF25	K97941	Call
KF40	K97951	Call
KJLC 979 Series Combination Gauge (RS-485)		
1 1/3" CF	K97912	Call
2 3/4" CF	K97922	Call
KF16	K97932	Call
KF25	K97942	Call
KF40	K97952	Call

Gauge Controllers & Accessories

Description	Part No.	Price
KJLC PDR900 Series Controller*		
120 VAC	KPDR90012US	Call
220 VAC	KPDR90012EU	Call
Power Supply & Communication Cable		
120 VAC (U.S.)	K12641	Call
90-230 VAC (U.K./EU)	K12664	Call
Software Package for PC Control	K12604	Call
Connection Cables for Sensors		
10', 15-Pin for connecting 979 sensors	K13620	Call
25', 15-Pin for connecting 979 sensors	K13622	Call

*120 VAC version includes US Mains cable.
220 VAC version includes both UK and EU Mains cable.

Kurt J. Lesker Company

➤ 1,000–1 x 10^{-9} Torr

KJLC 392

The KJLC 392 is our KJLC 392 Ionization gauge with the ability to control and display two convection gauges.

Features:

- Full measurement range from atmosphere down to 1 x 10^{-9} Torr plus monitoring of your foreline
- Built in controller and display eliminates the need for expensive external controllers and cabling
- Dual Hot Filament design, rugged and compact metal construction
- Field serviceable - the sensor assembly can be easily replaced

SPECIFICATIONS

Pressure Range —
Ionization: 1 x 10^{-9} to 5 x 10^{-2} Torr (1.33 x 10^{-9} to 6.66 x 10^{-2} mbar)
Convection: 1 x 10^{-4} to 1000 Torr (1.33 x 10^{-4} to 1333 mbar)
Used as a full range measurement gauge: 1 x 10^{-9} to 1000 Torr (1.33 x 10^{-9} to 1333 mbar)

Display — OLED graphical display, 3 digits plus 2-digit exponent, bright yellow

Functionality — Ionization gauge can operate up to 2 Convection gauges

Materials Exposed to Gases — Dual Filaments: Yttria Coated Iridium, Ion Collector: Tungsten, Grid: Tantalum, Others: 316/304 SS, Glass, Nickel

Accuracy (Typical) —
Ionization: ±20% of Reading from 1 x 10^{-8} to 5 x 10^{-2} Torr
Convection: ±10% of Reading from 1 x 10^{-3} to 400 Torr; ±2.5% of Reading from 400 Torr to atm

Sensitivity — Factory pre-set. Also user adjustable between 2 to 99.

X Ray Limit — <5 x 10^{-10} Torr

Emission Current — 0.1, 4 mA

Degas — 4 Watts e-beam

Overpressure Protection — Gauge turns off at factory default setting of 5 x 10^{-2} Torr

Bakeout Temperature — 200° C (sensor only - electronics removed)

Mounting Orientation — Any

Digital Interface — RS485

Convection Gauge Compatibility — KJLC275 Tube or Granville Phillips 275 Convectron®

Convection Gauge Cables — One 10 foot cable is included. See order info below for additional gauge cables.

Analog Output —
Ionization Only: One log-linear 0 to 9 Vdc, 1 V/decade, semi-log
Used as a full range gauge: One 0.5 to 7 Vdc, ,0.5 V/decade, semi-log
Convection Gauge 1 & 2: Two 1-8 Vdc, 1 V/decade, semi-log

Set-Point Relays — 3 SPDT Relays

Relay Contact Rating — 1A at 30 Vdc resistive, 0.3 A at 125 Vac non-inductive

Set-Point Range — User configuration from 1 x 10^{-9} Torr to atmosphere when used with a Convection gauge

Description	Part No.	Price
NW16KF	KJLC392402YB	Call
NW25KF	KJLC392402YC	Call
NW40KF	KJLC392402YD	Call
1 ⅓" CF / NW16CF Mini- Conflat®	KJLC392402YE	Call
2 ¾" CF / NW35CF Conflat®	KJLC392402YF	Call

Replacement Sensors and Accessories

Description	Part No.	Price
Replacement Sensor, QF16 flange	IG4TB	Call
Replacement Sensor, QF25 flange	IG4TC	Call
Replacement Sensor, QF40	IG4YD	Call
Replacement Sensor, 1 ⅓" CF	IG4YE	Call
Replacement Sensor, 2 ¾" CF	IG4YF	Call
Convectron Gauge Cable, 10 ft.	HB431-1-10F	Call
Convectron Gauge Cable, 25 ft.	HB431-1-25F	Call
Convectron Gauge Cable, 50 ft.	HB431-1-50F	Call
Power Supply - 24 VDC, US plug	PS501A	Call