INSTRUCTION MANUAL

Lesker Model KJL510TC-K
And
Model KJL510TC-H

Digital Vacuum Gauges

KJL510TC-K/H Ranges

1 to 1999 milliTorr
1 to 1999 microBar
1 to 199.9 pascal

The Kurt J. Lesker Company
www.Lesker.com
(412) 387-9200
gauging@lesker.com

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1.0 DESCRIPTION AND PRINCIPLE OF OPERATION.

The LESKER KJL510TC-K/H gauges are compact digital vacuum sensing instruments that use a thermocouple to sense vacuum and display the reading in either milliTorr, microBar or pascal. The KJL510TC-K/H ships with a KJL6000 or Hastings DV6-M vacuum sensor but will work with other sensors which are functionally similar; if in doubt about what gauge sensor you have, consult the packing list that came with your instrument for positive identification.

Major models and variations are as follows:

KJL510TC-K	Plastic case with a D cell battery, shipped with a KJL6000 thermocouple vacuum gauge sensor
KJL510TC-H	Plastic case with a D cell battery, shipped with a Hastings DV6-M or equivalent thermocouple vacuum gauge sensor

Please visit our website (www.Lesker.com) for information about other Lesker vacuum controllers and gauges.

The Lesker Model KJL510TC-K/H operates by measuring the temperature rise of an electrically heated thermocouple exposed to a vacuum. As vacuum increases, or, more correctly, as absolute pressure decreases, fewer and fewer molecules of gas are available to cool the thermocouple. With less molecules the air temperature rises and the thermocouple gauge thus senses vacuum. A precision reference inside the instrument in conjunction with an integrated circuit amplifier controls the electrical excitation of the sensor filament. The voltage response of the thermocouple is piped through a CPU and is translated to the current vacuum reading.

2.0 CONSTRUCTION.

The KJL510TC-K/H consists of the indicating and controlling instrument, the gauge tube (vacuum sensor), and the sensor cable. The KJL510TC-K/H runs on a user-supplied “D” cell battery.

The instrument is housed in a rugged free-standing plastic enclosure. It is normally simply placed on a suitable surface, clean and dry, away from possible sources of electrical noise. The gauge tube houses the various thermocouple sensing, heating and compensating elements and terminates in an octal connector. On most models, the connector wiring terminates at the instrument with a D-subminiature connector. Regulating circuitry in the instrument provides constant current for gauge tube excitation, and thus compensates for resistance in the sensor cable.

3.0 UNPACKING AND INSPECTION.

After the instrument is received, it should be carefully unpacked and inspected for damage during shipment and for completeness. The package should contain, as a minimum, the instrument itself, the thermocouple vacuum sensor, the sensor connecting cable, and an instruction manual or quickstart guide. In the event of a loss during shipment, a claim should immediately be made to the shipping carrier. The Lesker warranty pertains only to the instrument, and does not cover losses in shipping.

4.0 INSTALLATION.

The instrument should be located in a clean, dry environment for best results. A customer supplied Alkaline “D” cell should be installed in the unit. The battery compartment can be opened with a counter clockwise turn of a coin inserted into the slot on the cover. The vacuum sensor cable should be identified by wire tags or markings specific to your environment.

Thermocouple vacuum sensors must be installed in a thread-down orientation in a clean, dry vacuum system. While threading the sensor into the system, the sensor cable should be disconnected to avoid damage. In this way, twisting of the cable and the octal socket on the sensor is avoided. Care should be exercised to install the sensor in a dry part of the system. Since the instrument works on the principle of temperature rise, the sensor will not work if it becomes filled with a liquid such as vacuum pump oil or diffusion pump oil. A good practice is to mount the sensor in the most vertically distant place from oil and other contaminants as applicable, and the sensor should be mounted in the most stable pressure region of the vessel to be measured. For example, it would be better to install the sensor on a tank rather than on the pipe that is directly connected to a vacuum pump.

In the event of contamination, see section 6.0 for gauge tube cleaning instructions.

5.0 OPERATION.

After installation, the KJL510TC-K/H is ready for immediate operation. The unit will normally provide accurate readings immediately, however, occasionally a vacuum sensor will have absorbed material during storage, and may require as much as 24 hours of operation before accurate readings are attained. It is recommended that the KJL510TC-K/H be energized continuously during vacuum system operation. In this way the hot filament will not allow contaminants to condense.

In cases where the system has contaminants, as is often the case with metalizing and coating equipment, it is often effective to isolate the gauge tube with a solenoid or manual valve during periods when contamination is most active.

6.0 **SERVICING –** VACUUM SENSOR CLEANING.

In many cases, a vacuum sensor may become fouled with oil or other foreign matter. It is often possible to restore the functionality of contaminated sensor by cleaning. If the contaminant is known, the sensor should be filled with a fluid that is known to be a solvent to that contaminant. As an example, ether is often effective in removing residues of some oils. Commercial carburetor cleaners are very powerful solvents and are highly effective against some contaminants.

After cleaning with solvents, the vacuum sensor should be completely dried or flushed with a volatile solvent to assure that it is dry prior to installation.

6.1 FACTORY REPAIR AND CALIBRATION.

The vacuum gauge assembly is designed to provide years of trouble-free service, and the liberal internal use of plug-in components make it easily repairable. No field servicing of the unit is recommended, other than replacement of the vacuum sensor, but factory servicing and calibration are available at a nominal cost and turn-around times of 24 hours are typical.

6.2 FIELD CALIBRATION.

Each Lesker vacuum instrument is calibrated to the particular vacuum gauge sensor that is shipped with the unit. While changing the vacuum sensor is possible, it will result in a slightly different reading as all sensors are not created equal. Although it is preferable that all calibration be performed at Kurt J. Lesker Co., field calibration can be accomplished.

Before re-calibrating the instrument, it should be ascertained that the instrument is in fact incorrect. In many cases, the problem will be with a sensor that is oil-fouled, or a system that is operating improperly. It is recommended that a sensor be kept on hand and stored in a clean, dry place. Then in cases of suspect readings, the sensor should be changed before proceeding further.

If adjustments are to be made, proceed as follows:

A) Remove the top cover of the vacuum instrument and locate the two potentiometers. While facing the front of the unit such that you can read the numbers, the zero calibration adjust is to the left, and the span calibration adjust is to the right.
B) Operate the vacuum system at the lowest attainable pressure, and allow the system and the vacuum sensor to stabilize for several minutes. Factory zero setting is done at a pressure of .1 milliTorr (.1 micron) or less.
C) Adjust the zero setting potentiometer so the unit reads zero. Make sure not to under zero. Allow the measurement standard to rise to 1 milliTorr and make sure the gauge reading also reads 1 milliTorr.
D) Check the operation of the gauge at other pressures. Normally, adjustment of the zero will not be interactive with the readings of the instrument at higher pressures. The span adjustment is normally not necessary. If warranted, adjust the span with the potentiometer (on the right). Set the vacuum level to 1000 milliTorr (1 Torr) and slowly turn the potentiometer on the right until the KJL510TC-K/H reads 1000 milliTorr, being careful not to over span.
E) If you adjust the span, recheck the zero. Repeat steps B through D if necessary.

7.0 NOTES ON CALIBRATION.

The KJL510TC-K/H is calibrated in nitrogen, which has thermal properties virtually identical to air. Other gases will affect the readings by an amount proportional to the thermal conductivity of the gas. In most cases, the gases present in a vacuum system will be air, nitrogen, or oxygen, and no appreciable errors will occur.

Certain other gases, however, have thermal conductivity significantly greater than air and will cause the instrument to read higher than the actual amount of pressure. Examples of such gases are water vapor, fluorocarbon refrigerants, and acetone. Conversely, other gases have thermal conductivity significantly lower than air and will cause the instrument to read lower than actual pressure. Examples of such gases include helium, oxygen and to a lesser extent, CO2.

When interpreting readings using gases other than air, it should be borne in mind that the KJL510TC-K/H reads milliTorr, which is a measure of absolute pressure - that is the opposite of vacuum. Thus, a lower numerical reading actually is a higher level of vacuum. For more information, refer to section 8.0.

8.0 UNDERSTANDING milliTorr.

The KJL510TC-K/H and most similar instruments are calibrated in microns of Mercury, or “milliTorr”. It is appropriate to discuss what “milliTorr” is and to relate milliTorr/Torr to other measures of pressure and vacuum.

MilliTorr is not really a measure of vacuum at all, but rather of absolute pressure. It will be recalled that the pressure of the atmosphere is 14.696 or approximately 14.7 pounds per square inch at sea level. This pressure is due to the weight of all of the air in the earth's atmosphere above any particular square inch. This 14.696 psi is equivalent to the pressure produced by a mercury column of approximately 29.92 inches high or .76 meters (about 3/4 of a yard) or 760 millimeters of mercury. Atmospheric pressure varies greatly with altitude. It decreases approximately 1 inch of mercury per thousand feet of altitude. It also varies widely with local weather conditions. (Variations of one half inch in a single day are common.) The word vacuum means pressure lower than atmospheric or "suction," but, in describing negative pressure, the atmosphere is only a satisfactory reference if we are dealing with values of vacuum down to about 27 inches of mercury. Below that, it is much more useful to talk in terms of absolute pressure, starting from absolute zero. The KJL510TCK/HV and all similar instruments do just this.

One TORR, a commonly used unit, is an absolute pressure of one millimeter of Mercury. A milliTorr is equal to one thousandth of a TORR. A MICRON is the same as a milliTorr. The full scale reading of a KJL510TC-K/H is 1999 milliTorr and is equivalent to 1999 Microns, or approximately 2/760 of one Atmosphere.

9.0 ACCESSORIES AND MODIFICATIONS.

The following are offered as accessory equipment or field-installed modifications.

Padded shoulder strap case with Velcro closure: For instruments that will be used in the field, particularly in cryogenic applications, a padded shoulder strap case is available. This case holds the KJL510TC-K/H battery powered gauge in the optimal reading position. The operator can open the Velcro cover, pull out the gauge tube cable, plug it into the tube on the equipment, and observe the reading. It was developed to assist in field service of cryogenic tank farms and vacuum jacketed piping.

10.0 COMPATIBILITY WITH OTHER GAUGE TUBES.

The KJL510TC-K/H works with AC-excited thermocouple sensors equivalent to the KJL6000, including the Hastings DV6-M, DV6-R, and other similar vacuum sensors.