INSTRUCTION MANUAL

Lesker Model KJL615TC-K
Lesker Model KJL615TC-H

Digital Vacuum Gauge/Controller

KJL615TC K/H Ranges

1 to 1999 milliTorr
1 to 1990 microBar
1 to 199.9 Pascal

Standard Features

Selectable Units
Two Process Setpoints (Relay Contacts)
Analog Output
Bench or Panel Mount

The Kurt J. Lesker Company
1925 Route 51
Jefferson Hills, PA 15025
www.Lesker.com
(412) 387-9200
(412) 384-2745 FAX

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1.0 DESCRIPTION AND PRINCIPLE OF OPERATION.

The LESKER KJL615TC K/H gauges are compact digital vacuum sensing instruments that use a thermocouple gauge tube to sense vacuum and display the reading in milliTorr, microBar or Pascal. The Lesker KJL615TC K/H can either be panel mounted or sit on a bench top, and comes standard with 2 SPDT controls, analog output, and RS232 data.

Major models and variations are as follows:

KJL615TC-K	1/8 DIN enclosure that ships with a KJL6000 thermocouple vacuum gauge sensor.
KJL615TC-H	1/8 DIN enclosure that ships with a Hastings type DV6-M or equivalent thermocouple vacuum gauge sensor.
KJL615TC-NT	1/8 DIN enclosure that ships precalibrated for, but does not include, a KJL6000 or Hastings DV6-M thermocouple vacuum gauge sensor.

Please visit www.Lesker.com for information about other Lesker vacuum controllers and sensors.

The Lesker KJL615TC 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 KJL615TC K/H in conjunction with an integrated circuit amplifier controls the electrical excitation of the sensor filament. The voltage response of the thermocouple is sampled and processed in the digital domain by a microcontroller and translated into the current vacuum reading.
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2.0 CONSTRUCTION.

The KJL615TC K/H consists of the indicating and controlling instrument, the vacuum sensor, the sensor cable, interfaces for the 2 control connections, analog out, RS232 and an AC power adapter.

The instrument is housed in a rugged free-standing plastic enclosure. It can either be placed on a suitable surface, or can be mounted in a 1/8 DIN panel cutout. The vacuum sensor houses the various thermocouple sensing, heating and compensating elements and terminates in an octal connector. On this model, the connector wiring terminates at the instrument with a 6 position RJ12. Regulating circuitry in the KJL615TC K/H provides controlled current for gauge tube excitation, and thus compensates for resistance in the probe leads.

3.0 UNPACKING AND INSPECTION.

After the KJL615TC K/H is received, it should be carefully unpacked and inspected for damage during shipment and for completeness. The package should contain, at a minimum, the instrument, the thermocouple vacuum sensor, the sensor cable, and an instruction manual or quick-start sheet. In the event of a loss during shipment, a claim should immediately be made to the common carrier or the shipping service, as applicable. The Kurt J. 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. The unit can be panel mounted with the hardware provided in a 1/8" DIN panel cutout (3.64" x 1.78" [92mm x 45 mm]). Alternatively, the unit can be placed on a desktop by placing the 4 rubber feet included with your gauge on the underside of the unit. The sensor cable should be identified by wire tags or markings specific to your environment.

Thermocouple vacuum sensors should 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. 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 sensor cleaning instructions.

ADDITIONAL KJL615TC-K/H FEATURES.

The set point connections are on the back of the unit. There are 2 rows of pins; the top row of pins is for set point 1, and the bottom row of pins is for set point 2. The 3 pins are in the order:

1. Common – The common connection of a switch or circuit.

2. N.C. – Normally closed. This means that above the set point value there is a current path between the common and the N.C. terminal. Put another way the switch is "ON" between these 2 terminals. At the set point value and below (higher vacuum, lower pressure) the connection is open. Put another way, the switch is "OFF" between the common and the N.C. connection at higher vacuum (a lower vacuum reading).

3. N.O. – Normally open. This means that above the set point value there is no current path between the common and N.O. connection. Put another way the switch is "OFF" between these 2 terminals. When the vacuum indication goes below the set point value (higher vacuum, lower pressure) the current path closes. Put another way the switch is "ON" between the N.C. and N.O. connections at absolute vacuum readings below the set point value.

Take care in insuring that the wire connections are made fast, and the voltage and current does not exceed 250V or 7A. If you need to control a device that draws more power, consider another relay in between the KJL615TC K/H output and the device to be controlled

The Analog Output is located in the center of the back panel, and should be connected to a high impedance input. The output impedance is 1KΩ and is scaled at 1000mV = 1000 mTorr.

The RS232 connection can be made to a PLC or computer via a male DB9 cable connection to the female DB9 connection on the KJL615TC K/H. The KJL615TC K/H acts as a DCE, so a straight serial connection is appropriate. Serial output is transmit only, whatever reading is on the display is replicated in the serial bitstream at a sample rate of approximately 1 reading a second.

The supplied AC adapter works with an input voltage of 100 to 240 VAC, 50~60 Hz. This adapter provides a regulated and short-protected 5 volt power for proper operation of the KJL615TC K/H.

5.0 OPERATION.

After installation, the KJL615TC 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 KJL615TC 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.

The KJL615TC K/H controller can be easily set to the desired units on the fly:

1. Press the “sel” key three times during normal operation. The currently selected units will blink
2. Press the “⋀” and “⋁” to get to the desired unit.
3. Press “Ent” to complete your selection.

The KJL615TC K/H has 2 set points that can be used to actuate external equipment. These 2 set points can be adjusted from the front of the gauge in your currently selected units.

1. To change SP1:
    a. Press the “sel” key once to enter in set point 1. The SP1 LED should now blink
    b. Press the “⮝” and “⮟” to get to the desired set point value
    c. Press enter to accept the new set point value. Normal run mode will resume.

2. To change SP2:
    a. Press the “sel” key twice to enter in set point 2. The SP1 LED should now blink
    b. Press the “⮝” and “⮟” to get to the desired set point value
    c. Press enter to accept the new set point value. Normal run mode will resume.

3. If you don’t want the set points to actuate or the LEDs to illuminate at all, set the set point for “000”.

One of the units LEDs to the right of the red display will always be lit during normal operation to indicate which pressure range is currently in use.

The Instrument has additional outputs which can be used:

- RS232 – The instrument puts out a standard RS232 serial stream with settings 9600, 8, N, and 1. The unit transmits but does not receive, and displays the current vacuum indication in the current units.
- Analog out – This output reads from 0 to 5 Volts from a pressure of 1 milliTorr up to 1000 milliTorr. There is a graduation of 5 milliVolt per milliTorr.

.005 volts = 1 Millitorr
.5 volts = 100 mTorr
1.25 volts = 250 mTorr
2.5 volts = 500 mTorr
5 volts = 1000 mTorr

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 sensor should be completely dried or flushed with a volatile solvent to assure that it is dry prior to re-installing it. If this is not done, erroneous readings or system contamination result.

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 gauge controller is calibrated to the particular vacuum gauge sensor that is shipped with the unit. While changing the gauge tube is possible, it will result in a slightly different reading as all gauge tubes 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 tube that is fouled, or a system that is operating improperly. It is recommended that a spare tube be kept on hand and stored in a clean, dry place. Then, in cases of suspect readings, the tube should be changed before proceeding further.

If adjustments are to be made, proceed as follows:

A) Operate the vacuum system at the lowest attainable pressure, and allow the system and the gauge tube to stabilize for several minutes. Factory zero setting is done at a pressure of 1 milliTorr (1 micron) or less.
B) Adjust the zero setting potentiometer (adjust hole on top towards front of instrument) 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.
C) 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 necessary, adjust the span potentiometer (rearmost adjust hole when facing front of instrument). Set the system vacuum level to 1000 milliTorr (1 Torr) and slowly turn the potentiometer towards the rear until the 615TC K/H instrument reads 1000 mTorrr, being careful not to over span.
D) If you adjust the span, recheck the zero. The span adjustment influences the overall calibration range while the zero has little effect on upper readings.

7.0 NOTES ON CALIBRATION.

The 615TC 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 KJL615TC 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 KJL615TC K/H and many similar instruments are calibrated in milliTorr. It is appropriate to discuss what milliTorr refers to and to relate milliTorr to other measures of pressure and vacuum.

Torr 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 KJL615TC K/H 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 KJL615TC K/H is .001 Torr (1 milliTorr) to 1 Torr (1000 mTorr).

9.0 ACCESSORIES AND MODIFICATIONS.

The KJL615TC K/H instrument is available with cables of longer lengths to accommodate difficult installations. Consult Kurt J. Lesker Co. for this option.

COMPATIBILITY WITH OTHER SENSORS.

KJL615TCTC K/H instruments are designed to work with Kurt Lesker Co. KJL6000 A/C-excited thermocouple gauge sensors. Other compatible sensors include Hastings DV6-M, DV6-R, etc. Consult Kurt J. Lesker Co. to confirm appropriate use of other vacuum sensors.