Kurt J. Lesker Company

Series 925C Transducer

Operation and Maintenance Manual

Kurt J. Lesker Company

Series 925C Transducer

Part # 100014437

Part # K____________________________

Please fill in the transducer part and flange type numbers in the space above and have them readily available when calling for service or additional information.

(The part number can be found on your packing slip. Both the part number and serial number are located on the bottom side of the housing.)

For more information or literature, contact:

Kurt J. Lesker Company
1925 Route 51
Clairton, PA 15025-3681 USA

Phone: 1-412-387-9200
1-800-245-1656

Fax: 1-412-384-2745

Table of Contents

Package Contents

Before unpacking the 925C Transducer, check all surfaces of the packing material for shipping damage.

Confirm that the 925C package contains these items:

- 1 925C Transducer unit (integrated sensor and electronics)
- 1 *925C Transducer Operation and Maintenance Manual*

Inspect the components for visible evidence of damage during shipment. If anything has been damaged, notify the carrier immediately. Keep all shipping materials and packaging for claim verification.

☎ If any items are missing from the package, call Kurt J. Lesker Customer Service at 1-412-387-9200 or 1-800-245-1656.

Do not return the product to Kurt J. Lesker unless specified to do so by Kurt J. Lsker Customer Service.

Kurt J. Lesker customer service and support:

Kurt J. Lesker Company	Telephone	1-412-387-9200
1925 Worthington Avenue	Toll-Free	1-800-245-1656 (USA only)
Clairton, PA 15025	Facsimile	1-412-384-2745
USA		

Symbols Used in this Manual

CAUTION: Refer to the manual. Failure to heed the message could result in personal injury, serious damage to the equipment, or both.

Calls attention to important procedures, practices, or conditions.

Safety Precautions

Do not substitute parts or modify instrument. Do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to an Kurt J. Lesker Calibration and Service Center for service and repair to ensure that all of the safety features are maintained.

Do not use the Series 925C Transducer with explosive gas mixtures or gases that are combustible in air. The Transducer uses a thin film Nickel resistive element that is heated to a constant temperature above ambient. This could ignite explosive gas mixtures.

Properly ground the transducer. The transducer should be connected to earth ground both through the vacuum flange and the back shell of the electrical connector.

Allow only qualified technicians to service the 925C Transducer. Users should not remove covers, casing, or plug-in components. Injury may result. A qualified technician must perform any part replacement or internal adjustments.

Keep the unit free of contaminants. Do not allow contamination of any kind to enter the unit before or during use. Contaminants such as dust, dirt, lint, glass chips, and metal chips may permanently damage the unit.

General Specifications

Measuring range	1x10^{-5} Torr to Atm
Set point range	1x10^{-4} Torr to Atm
Analog output (Absolute Pressure)	1 to 9 VDC 1 K maximum output impedance
Accuracy Piezo (± 100 Torr)	10^{-4} to 10^{-3} ±10 % of reading 10^{-3} to 100 ±5 % of reading 100 to Atm ±25% of reading
Repeatability Pirani 1x10^{-4} to 100 Torr	10^{-4} to 10^{-3} ±8 % of reading 10^{-3} to 100 ±2 % of reading 100 to Atm ± 10% of reading
Supply voltage	10 to 30 VDC
Power consumption	<1.5 Watts
Fuse (recoverable)	200mA
Relay	
Relay contact rating	SPDT 1A @ 30 VAC/VDC resistive load
Relay response	50 msec maximum
Materials exposed to vacuum	304 stainless steel, Silicon, SiO_2, Si_3N_4,gold,Utem®1000,Epoxy Resin,Kovar,Aluminum,Viton®
Housing material	304 stainless steel
Internal volume	0.04 in^3 (0.65 cm^3) maximum
Operating temperature	0 to 40 °C
Bakeout temperature (off)	85°C
Installation orientation	Any

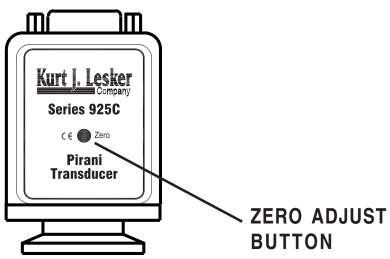
CE Certification	EMC Directive 89/336/EEC
Vacuum connections	NW16 KF, 4 VCR® F, 8VCR®F
Dimensions (with KF 16)	1.6” x 2.32” (40.6 x 59 mm)
Weight (with KF 16)	5.8 oz. (165 g)

Feature and Control Locations

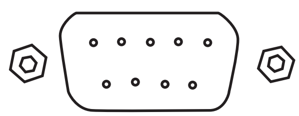
User access is through the 9-pin D-sub connector. The **ZERO** adjust button allows the user to manually perform zero calibration. See **Calibration Commands** in the **RS-485 Command Set** section for more information.

The figures below show the front and top view of the 925C.

FRONT VIEW



MALE, 9-PIN D-SUB CONNECTOR



About the 925C

The Series 925 compac (925C) transducer offers a wide measurement range from 1 x 10^{-5} to atmosphere and is based on measurement of thermal conductivity in a small cavity where gas is passed by diffusion only instead of flow.

While traditional Pirani gauges often have problems with temperature drift, low accuracy, calibration and sensitivity to mounting position, these issues are significantly reduced with the Series 925C Transducer sensor.

The sensor element in the 925C is made of a one millimeter square silicon chip, allowing the measurements to be made in a very small volume. Due to the small size of the sensing portion of the sensor, it has a range from ATM down to 10^{-5} Torr. The design minimizes the effects of convection, so operation is possible in any position without compromising accuracy, for simplified installation.

The digital communication allows for all adjustments and monitoring to be delivered real-time, via a host computer. The 925C includes RS485 or RS232 communication as a standard feature and an analog output of 1-9 VDC with 1 volt/decade.

For Process control, the 925 has one setpoint relay, which can be set, adjusted and monitored through the digital port.

Like all thermal conductivity sensors, the Series 925C is sensitive to gas type. To compensate for gas dependency, the sensor has a number of common gas calibrations that can be selected via digital interface. This makes it a simple solution for locating medium to fine leaks in vacuum systems.

This manual describes the installation and configuration tasks necessary to set up the 925C. After the device is set up, a software engineer at the user's installation would use the communications protocol described in this manual to create a software program (in, for example, Visual Basic, C, or C++) that will automatically control transducer operation.

For additional information on how the 925C works, see the appendix **How the 925C Works**.

Typical Applications for the 925C

- Measure foreline and roughing pressures generated by mechanical vacuum pumps.
- Control valves and pumps to automate pump-down using relay set points.
- Sense abnormal pressure and take appropriate security measures using relay set points.
- Control system pressure using digital communications or an analog output as an input to an automatic pressure controller.
- Start or stop system processes with a relay set point.
- Measure pressures of backfilling gases in the range of 10^{-4} Torr to atmosphere.
- Activate high vacuum gauges in their operating range.
- Analytical Vacuum Applications

Installing the 925C

Transducer Installation

Location

Locate the 925C where it can measure chamber or manifold pressure. Install it away from pumps and gas sources and where vibration is minimal to give the most representative pressure measurement.

Orientation

The 925C can be mounted in any orientation. The sensor was designed to minimize convection so that the operation is possible in any position without compromising accuracy.

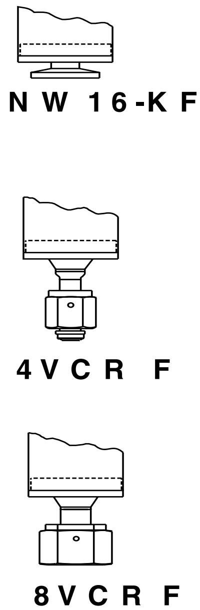
Contamination

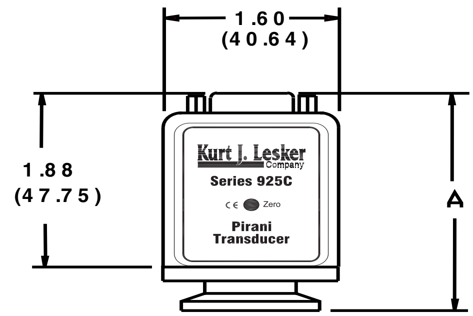
Locate and orient the 925C where contamination is least likely. For example, if the 925C is installed directly above a roughing pump in the system, oil vapor could contaminate the sensor's filament wire and cause the emissivity and calibration to shift. The sensor has a low filament temperature of only 35^{o}C above ambient temperature; therefore, the sensor is less prone to contamination by cracking products from fore-pump oil. The sensor is not intended for use in corrosive environments.

Whenever possible, install the 925C with the vacuum port facing down to keep particulates or liquids from entering the device.

Vacuum Connection

Standard 925C vacuum interfaces are shown on the following page.





FLANGE	A
NW16-KF	2.32" (59
4VCR F	3.06" (75
8VCR F	3.04" (77

Electrical Connection

Use a cable with a female 9-pin D-sub connector with strain reliefs to ensure proper electrical connection and to reduce stress on the connectors.

☞ **Ensure a low impedance electrical connection between the 925C sensor body and the grounded vacuum system to shield the sensor from external electromagnetic sources.**

Input/Output Wiring

The figure and the **925C Electrical Connections Table** on the following page identify the pins of the 925C connector and their functions; make a cable using this information. To comply with EN61326-1 immunity requirements, use a braided, shielded cable. Connect the braid to the metal hoods at both ends of the cable with the end for power supply connected to earth ground.

The power supply input is 10 to 30 VDC. The positive side of the power supply is connected to pin 3 and the negative side to pin 4 of the male D-sub connector. The power supply input is protected by an internal fuse. The fuse is self-recoverable; do not replace it.

⚠ Damage may occur to the circuitry if excessive voltage is applied, polarity reversed, or if a wrong connection is made.

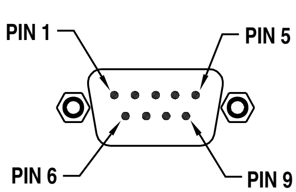
If using analog output (described in the **Analog Output** section), the analog output voltages are pins 5 (+) and 8 (-). Connect them to a differential input voltmeter or an analog-to-digital (A/D) converter with a differential input in a system controller.

☞ **Do not connect the negative side of the analog output (pin 8) to the negative side of the power supply input (pin 4) or to any other ground. Doing so will cause half of the power current to flow through this wire. Measurement errors in the output voltage may be seen due to the voltage drop from this current. The longer the cable, the worse the error will be.**

☞ **Do not connect the set point relay terminals to the analog output.**

925C Electrical Connections Table

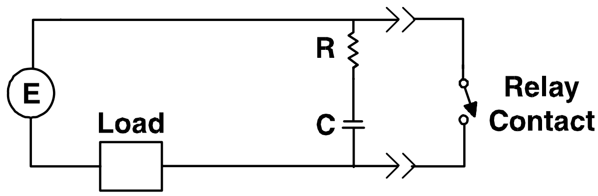
The digital communications connections are pins 7 and 9. RS-485 uses pin 7 for RS485(-) and pin 9 for RS485(+). RS-232 uses pin 7 for RS232 transmit (TXD) and pin 9 for RS232 receive (RXD). For RS232 communications the common part ground must be connected to power ground pin 4.



PIN	DESCRIPTION
1	Relay NO
2	Relay NC
3	Power (+)
4	Power (-)
5	Analog Output (+)
6	Relay Common
7	RS485 (-) / RS232 TXD
8	Analog Output (-)
9	RS485 (+) /rs232 RXD

Relay Inductive Loads and Arc Suppression

If using the set point relay to switch inductive loads (e.g., solenoids, relays, transformers, etc.), the arcing of the relay contacts might interfere with 925C operation and reduce relay contact life. Therefore, an arc suppression network, shown schematically below, is recommended.



The values of the capacitance C and the resistance R can be calculated by the following equations:

$C = I^2/(1 \times 10^7)$

$R = E/ I^a$

where:

C is in farads
R is in ohms
I is DC or Ac_{peak} load current in amperes
E is DC or Ac_{peak} source voltage in volts
a = 1 + (50/ E)
Note that $R_{min} = 0.5\ \Omega$ and $C_{min} = 1.0 \times 10\text{-}9$ F

Pressure Reading

The 925C is based on measurement of thermal conductivity; therefore, the sensor's readout depends on the gas type and concentration.

The 925C is calibrated for Nitrogen gas, and will read a higher pressure when exposed to atmospheric air.

Pressure reading can be obtained by either the PR1 command or the analog output.

Operation

The 925C operation parameters are preset at the factory. The table below shows the factory default settings. Use the user interface and the commands described on the following pages to change parameter settings as necessary. The user interface to the 925C is through either RS-232 or RS-485 serial communications. RS-232 and RS-485 use the same commands to communicate with the 925C; however, RS-485 allows communication with multiple transducers, whereas RS-232 allows communication with only a single transducer. The remainder of this manual refers to RS-485 only.

925C Factory Defaults Table

Setting	Default
Address	253
Baud Rate	9600
Pressure Units	Torr
Set Point 1	1.00E0 Torr
Hysteresis 1	1.10E0 Torr
Set Point Direction	Below
Enable Set Point	Off
Gas Type	Nitrogen

RS-485 Protocol

The 925C supports 2400, 4800, 9600, and 19200 baud rates (factory default: 9600). The data format is 8 data bits, no parity, and one stop bit.

Standard Addresses

Valid addresses are 3 digits, 001 to 253 (factory default: 253).

Universal Addresses

The 925C receives and responds to commands sent to address 254. For example, use 254 to communicate with a device if its address is unknown. The 925C receives and acts upon commands sent to address 255, but does not respond; use 255 to broadcast messages to multiple devices attached to the same system. For example, use 255 to change the baud rate for all devices.

Query and Command Syntax

Queries return current parameter settings; commands change the parameter setting according to the value the user types in the command syntax. Each query or command must begin with the attention character @ and end with the termination string ;FF.

Syntax required for a query is:
@<device address><query>?;FF.

Syntax required for a command is:
@<device address><command>!<parameter>;FF.

Examples:

Query current baud rate:	@253BR?;FF
Change baud rate to 19200:	@253BR!19200;FF

where:

@	<attention character>
253	<device address>
BR?	<query> (for query syntax)
BR!19200	<command>!<parameter> (for command syntax)
;FF	<terminator>

Response Syntax (ACK/NAK)

The ASCII characters 'ACK' or 'NAK' preface the query or command response string. The ACK sequence signifies the message was processed successfully. The NAK sequence indicates there was an error.

The response to a query or a successful command is:
@<device address>ACK<data>;FF

The response to a message with an error is:
@<device address>NAK;FF

Examples:

ACK response:	@253ACK9600;FF (baud rate changed to 9600)
NAK response:	@253NAK;FF

RS-485 Command Set

The query and command formats shown in this section are examples; the values may vary for the user's installation.

Set Up Commands

Address – AD

The AD command returns or sets the 925C address. Note: If multiple devices are installed on the system, an address query using 254 (shown in the query example below) cannot determine the address of only one of the devices.

Values:	001 to 253 (default: 253)
Query:	@254AD?;FF
Query Response:	@001ACK001;FF
Command:	@001AD!002;FF
Command Response:	@002ACK002;FF

Baud Rate – BR

The BR command returns or sets the baud rate of the communications protocol. The 925C responds to this command at the present baud rate; however, the user will need to change the baud rate on the host to ensure future commands are sent at the same rate.

Values:	2400, 4800, 9600, 19.2k, 38.4k,57.6k & 115.2k (default: 9600)
Query:	@001BR?;FF
Query Response:	@001ACK9600;FF
Command:	@001BR!19200;FF
Command Response:	@001ACK19200;FF

Factory Default – FD

The FD command sets all 925C parameter values to the factory default settings shown in the **925C Factory Defaults Table** (page 18). Note: The FD command overrides all parameter values the user sets; use with caution! The address and baud rate reset to 253 and 9600, respectively. The user must change the address and baud rate to these values on the host to communicate with the transducer after using the FD command.

Command:	@001FD!;FF
Command Response:	@001ACKFD;FF

RS Delay – RSD

The RSD command enables or disables a delay of up to 5 milliseconds between recieve and transmit mode. Some RS485 to RS232 converters requires this delay in order to operate.

Values:	OFF, ON (default OFF)
Query:	@001RSD?;FF
Query Response:	@001ACKOFF;FF
Command:	@001RSD!ON;FF
Command Response:	@001ACKON;FF

Test RS485 – TST

The TST command flashes the transducer power LED ON and OFF, in order to visually identify the unit.

Values:	ON, OFF
Query:	@001TST?;FF
Query Response:	@001ACKOFF;FF
Command:	@001TST!ON;FF
Command Response:	@001ACKON;FF

Unit – U

The U command returns or sets the pressure unit to Torr, mBar, or Pascal. The units affect all pressure measurements, including set point values.

Values:	TORR, MBAR, PASCAL (default: TORR)
Query:	@001U?;FF
Query Response:	@001ACKTORR;FF
Command:	@001U!MBAR;FF
Command Response:	@001ACKMBAR;FF

User Tag – UT

The UT command returns or sets the user tag label to assign for 925C identification. The analog will change scale when the pressure unit is changed and will always provide 1V per decade whether Torr, mbar or Pascal is selected.

Values:	Up to 15 ASCII characters
Query:	@001UT?;FF
Query Response:	@001ACKCHAMBER1;FF
Command:	@001UT!CHAMBER2;FF
Command Response:	@001ACKCHAMBER2;FF

Status Commands

Device Type – DT

The DT command returns the transducer device type.

Query: @001DT?;FF
Query Response: @001ACKMICROPIRANI;FF

Firmware Version – FV

The FV command returns the 925C firmware version.

Query: @001FV?;FF
Query Response: @001ACK1.00;FF

Hardware Version – HV

The HV command returns the 925C hardware version.

Query: @001HV?;FF
Query Response: @001ACK1.00;FF

Model – MD

The MD command returns the 925C model number.

Query: @001MD?;FF
Query Response: @001ACK925C;FF

Pressure Reading – PR1

The pressure reading command returns the measured pressure from the 925C (PR1).

Query: @001PR1?;FF
Query Response: @001ACK1.23E-2;FF

Serial Number – SN

The SN command returns the 925C serial number.

Query: @001SN?;FF
Query Response: @001ACK000012345;FF

Time On – TIM

The TIM command returns the number of hours the transducer has been on.

Query:	@001TIM?;FF
Query Response:	@001ACK000000024;FF

Transducer Temperature – TEM

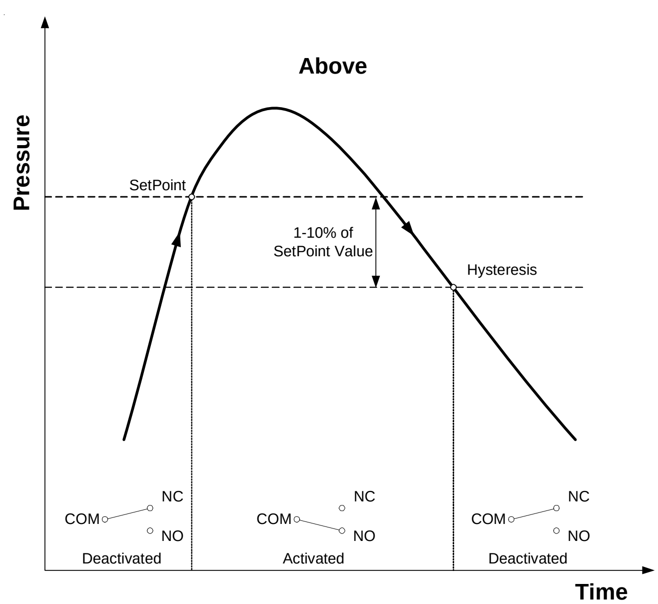
The TEM command returns the 925C on-chip sensor temperature in °C.

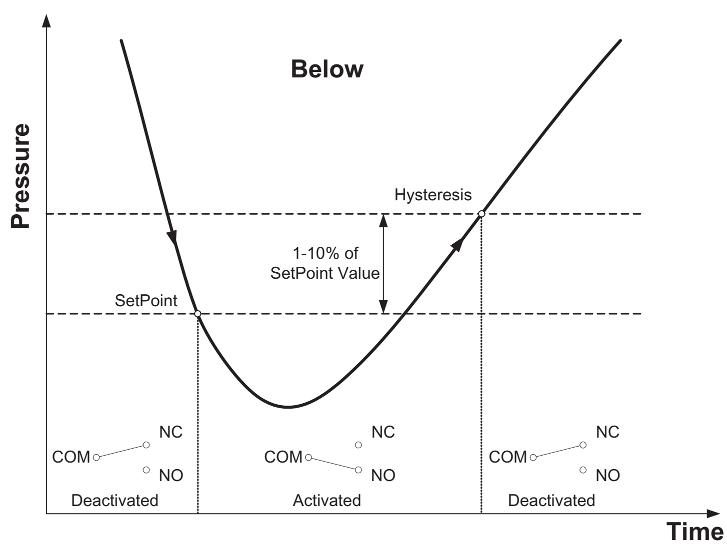
Query:	@001TEM?;FF
Query Response:	@001ACK2.10E+1;FF

Set Point Commands

The 925C has one independent set point mechanical relay for process control or surveillance. The relays can be turned on or off with the Enable set point command. The 925C automatically sets and overwrites any user setting of the hysteresis value when a set point value is entered or the set point direction is changed. The correct procedure for setting up the set point parameters are:

1. Enter set point value: SPx
2. Select set point direction: SDx
3. Enter setpoint hysteresis value, if other than +/- 10% of setpoint value is required: SHx
4. Enable set point: ENx





Set Value – SP1

The set point value command returns or sets the set point value. The set point value is the pressure either below or above which the set point relay will be energized (i.e., N.O. and C contacts will be closed). The direction of the set point (ABOVE or BELOW) is configured using the **Set Point Direction – SD1** command. The set point must be enabled for the set point command to function (see the **Enable Set Point – EN1** command).

The set point hysteresis value is automatically set to +10% of set point value, if set point direction is set to below or -10% of set point value, if set point direction is set to above. The set point hysteresis value always overwrites the current value when a set point value is entered.

Values:	Two- or three-digit scientific notation (default: 1.00E0 Torr)
Query:	@001SP1?;FF
Query Response:	@001ACK1.00E-2;FF
Command:	@001SP1!1.00E-3;FF
Command Response:	@001ACK1.00E-3;FF

Hysteresis Value – SH1

The hysteresis value command returns or sets the pressure value at which the set point relay will be de-energized (i.e., N.C. and O contacts will be closed). The hysteresis value should be higher than the set point value if the set point direction is set to BELOW and lower than set point value if set point direction is set to ABOVE. If abnormal values are entered the command response will be NAK and the current value will not be overwritten. The set point hysteresis values are always overwritten whenever a set point value is entered or the set point direction is changed.

Values:	Two- or three-digit scientific notation (default: 1.00E0 Torr)
Query:	@001SH1?;FF
Query Response:	@001ACK1.10E-2;FF
Command:	@001SH1!1.10E-3;FF
Command Response:	@001ACK1.10E-3;FF

Set Point Direction – SD1

The set point direction command returns or sets the direction of the set point relay. If the value is BELOW, then the relay will be energized below the set point value. (See **Set Point Value – SP1** and **Hysteresis Value – SH1** above.)

Values:	BELOW, ABOVE (default: BELOW)
Query:	@001SD1?;FF
Query Response:	@001ACKBELOW;FF
Command:	@001SD1!ABOVE;FF
Command:	@001ACKABOVE;FF

Enable Set Point – EN1

The enable set point command returns enable status, or disables the set point relay..

Values:	OFF, ON (default: OFF)
Query:	@001EN1?;FF
Query Response:	@001ACKOFF;FF
Command:	@001EN1!ON;FF
Command:	@001ACKON;FF

Set Point Status – SS1

The set point status command command returns the status of the set point relay.

Values:	SET, CLEAR
Query:	@001SS1?;FF
Query Response:	@001ACKCLEAR;FF

Calibration Commands

Atmospheric Calibration – ATM

The ATM command sets full scale readout for the 925C. Vent the transducer to atmospheric pressure before performing atmospheric calibration. Optionally, the user can manually vent to atmosphere, as described in the section **Venting to Atmosphere**.

Values:	Pressure value in scientific notation

Command:	@001ATM!7.60E+2;FF
Command Response:	@001ACK7.60E+2;FF

Gas Type Calibration – GT

The GT command sets gas type for measurement. The 925C measures thermal conductivity; using the gas calibration compensates for gas errors.

Values:	NITROGEN, AIR, ARGON, HYDROGEN, HELIUM, H_20 (default: NITROGEN)

Query:	@001GT?;FF
Query Response:	@001ACKAIR;FF
Command:	@001GT!NITROGEN;FF
Command Response:	@001ACKNITROGEN;FF

Vacuum Calibration – VAC

The VAC command zeroes the 925C readout. Evacuate the transducer to a pressure below $8x10^{-6}$ Torr before performing vacuum calibration. Optionally, the user can calibrate for zero by pressing the **ZERO** button on the side of the 925C, as described in the section **Calibrating for Zero**.

Command:	@001VAC!;FF
Command Response:	@001ACKVAC;FF

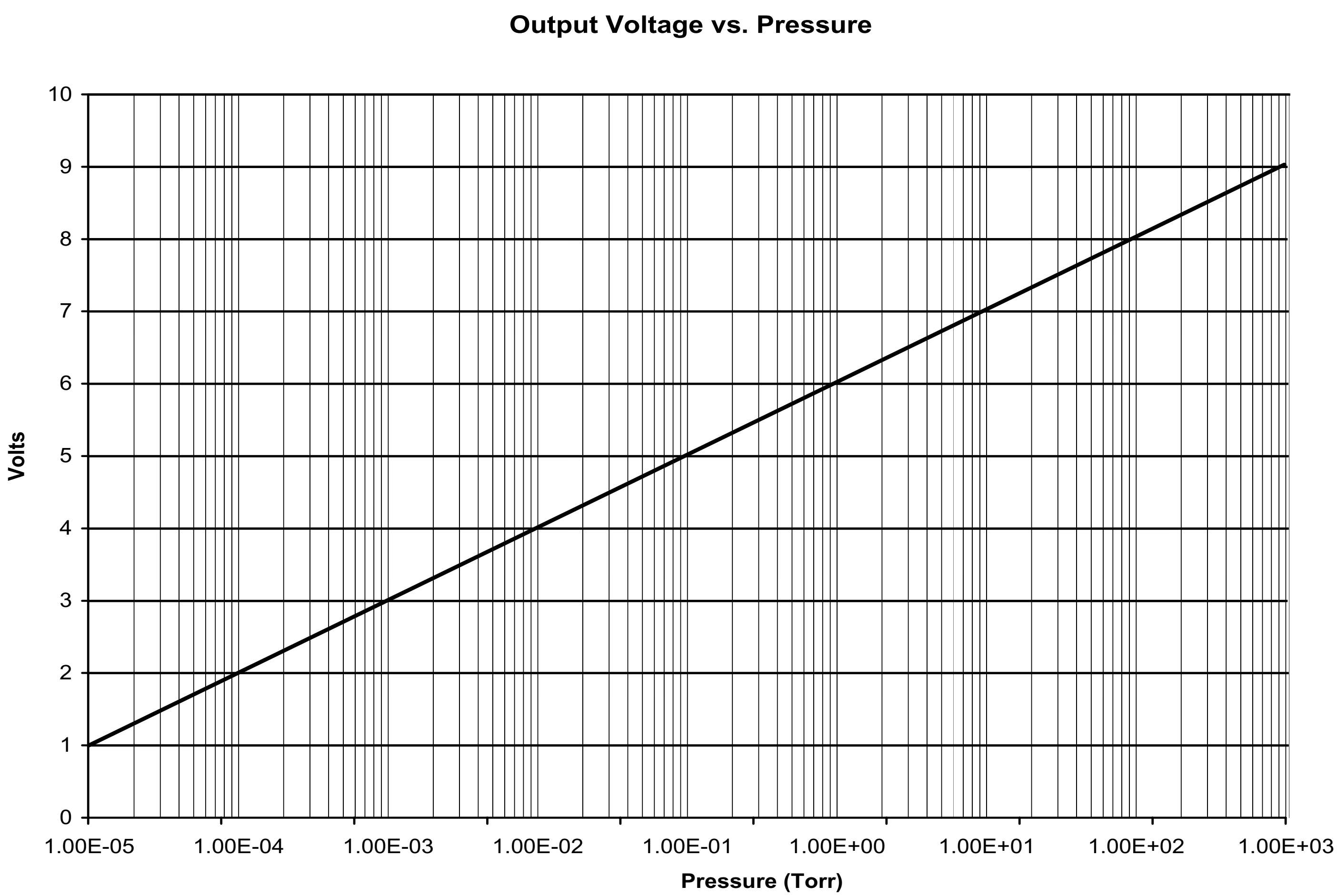
Analog Output

The analog output (12 bit resolution) is based on the pressure reading (PR1) and is available on the signal pins 5 (+) and 8 (-). Connect the signal pins to a differential input. The transducer provides an analog output of 1VDC per decade. The minimum output voltage is 1VDC at 1x-10^{-5} mbar/torr or 1x10^{-3} Pascal.

☞ **Do not connect the negative side of the analog output (pin 8) to the power supply return (pin 4) or to any other ground. The voltage drop from the supply current will produce errors in the analog output voltage. The longer the cable, the worse the error will be.**

The graph below shows the correlation of linear analog output to pressure.

To calculate pressure from voltage: P (Torr) = $10^{(V-6)}$



Pressure to Voltage Table

Pressure (Torr/mbar)	Volts	Pressure (Torr/mbar)	Volts
$1.0x10^{-5}$	1.00	$2.0x10^{-1}$	5.30
$2.0x10^{-5}$	1.30	$4.0x10^{-1}$	5.60
$4.0x10^{-5}$	1.60	$6.0x10^{-1}$	5.77
$6.0x10^{-5}$	1.77	$8.0x10^{-1}$	5.90
$8.0x10^{-5}$	1.90	$1.0x10^{0}$	6.00
$1.0x10^{-4}$	2.00	$2.0x10^{0}$	6.30
$2.0x10^{-4}$	2.30	$4.0x10^{0}$	6.60
$4.0x10^{-4}$	2.60	$6.0x10^{0}$	6.77
$6.0x10^{-4}$	2.77	$8.0x10^{-0}$	6.90
$8.0x10^{-4}$	2.90	$1.0x10^{+1}$	7.00
$1.0x10^{-3}$	3.00	$2.0x10^{+1}$	7.30
$2.0x10^{-3}$	3.30	$4.0x10^{+1}$	7.60
$4.0x10^{-3}$	3.60	$6.0x10^{+1}$	7.77
$6.0x10^{-3}$	3.77	$8.0x10^{+1}$	7.90
$8.0x10^{-3}$	3.90	$1.0x10^{+2}$	8.00
$1.0x10^{-2}$	4.00	$2.0x10^{+2}$	8.30
$2.0x10^{-2}$	4.30	$4.0x10^{+2}$	8.60
$4.0x10^{-2}$	4.60	$6.0x10^{+2}$	8.77
$6.0x10^{-2}$	4.77	$8.0x10^{+2}$	8.90
$8.0x10^{-2}$	4.90	$1.0x10^{+3}$	9.00
$1.0x10^{-1}$	5.00		

Manual Procedures for the 925C

Calibrating for Zero

Though factory calibrated, the 925C calibration may change due to reasons such as filament contamination or aging of the electronic components. If necessary, the user can adjust zero calibration of the 925C. The user can adjust zero calibration by using the **Vacuum Calibration – VAC** command, or by pressing the **ZERO** adjust button, as follows:

☞ **For best results, leave the 925C at the calibration pressure for at least 20 minutes before pressing the ZERO adjust button.**

1. The 925C signal analog output voltages are pins 5 (+) and 8 (-) on the 9-pin D-sub connector. Connect them to a differential input voltmeter or an analog-to-digital (A/D) converter with a differential input in the system controller.

2. Pump the system to a pressure below $1x10^{-5}$ Torr. Then press the **ZERO** adjust button for a voltmeter reading of 1.00 VDC.

3. The LED will blink twice when the zero calibration is executed. THE LED will blink once if the pressure is too high for calibrating zero.

Venting to Atmosphere

The 925C sensor can be vented to atmosphere very rapidly without damage to the sensor element. This is an improvement over the traditional Pirani sensor, which uses a very small diameter filament wire, which can be broken or damaged during sudden venting to atmosphere.

Leak Detection

Its inherent sensitivity to gas type makes the Series 925C useful for detecting leaks, at rates greater than 10^{-4} std cc/sec of helium, in foreline and roughing systems. It is a useful complement to a mass spectrometer leak detector, which locates smaller leaks.

Probe the suspected leak areas with a gas that has a molecular weight different that of the system gas. Helium is suitable for probing a system pumping air or nitrogen.

1. Pump your vacuum system to a base pressure.

2. Slowly and methodically probe with a small amount of the tracer gas (helium).

3. Note the pressure reading.
   The pressure will rise or fall, depending upon the thermal conductivity of the probe gas relative to the system gas. The largest change in the value indicates the probe gas is nearest the leak location.

4. Repeat the test to confirm.

Sensor Failure

If the Micropirani sensor happens to fail, the 925C will provide the following error information:

Pressure Reading:	PR1 = 9.99E+ 3 Torr 9.99E + 3 mbar 9.99 + 5 Pascal
Analog output:	9.5 VDC
Setpoint:	Setpoint will be disabled & cleared
Led:	Quick flash

Maintenance and Troubleshooting

Maintenance and Troubleshooting Table

Symptom	Possible Cause/Remedy
No response to RS-485 commands	- Attention character (@) missing - Address incorrect - Termination characters (;FF) missing - Baud rate incorrect - Electrical connections missing or incorrect Note: If baud rate and electrical connections are correct, then @254;FF should give the response @253NAK;FF (the address may be different from 253).
Vacuum pressure reading too high/too low or zero adjustment was made at the wrong pressure	Adjust zero calibration using the **Vacuum Calibration – VAC** command, or press the **ZERO** adjustment button on the device.
Atmospheric pressure too high/too low	Adjust span calibration using the **Atmosphere Calibration – ATM** command.
Set point does not trip	- Set point not enabled - Set point hysteresis value not set to proper value - Set point direction is different from what the user expects - Connector miswired
No analog output voltage	- Power supply turned off - Electrical connections missing or incorrect

Cleaning the 925C Case and Sensor Tube

The finish of the 925C case is designed to resist many laboratory solvents; clean the case with water or alcohol. Take care to prevent a liquid from entering the electronic enclosure.

Roughing pump oils and other fluids condensing or decomposing on the heated filament can contaminate the sensor elements. This changes the emissivity of the filament, which could in turn cause the calibration to change, especially at low pressure.

☞ **Do not attempt to clean the sensor tube. Trying to clean it may cause permanent damage to the sensor element.**

Replace the sensor if it becomes contaminated.

Accessories and Part Replacement

Description	Part Number
Transducer with NW16 KF flange, RS-232 comm.	K925C11
Transducer with 4VCR® F flange, RS-232 comm.	K925C41
Transducer with 8VCR® F flange, RS-232 comm.	K925C51
Operation and Maintenance Manual	100014437
Kit,Pwr Supply,120V	K12641

Notes:

Notes:

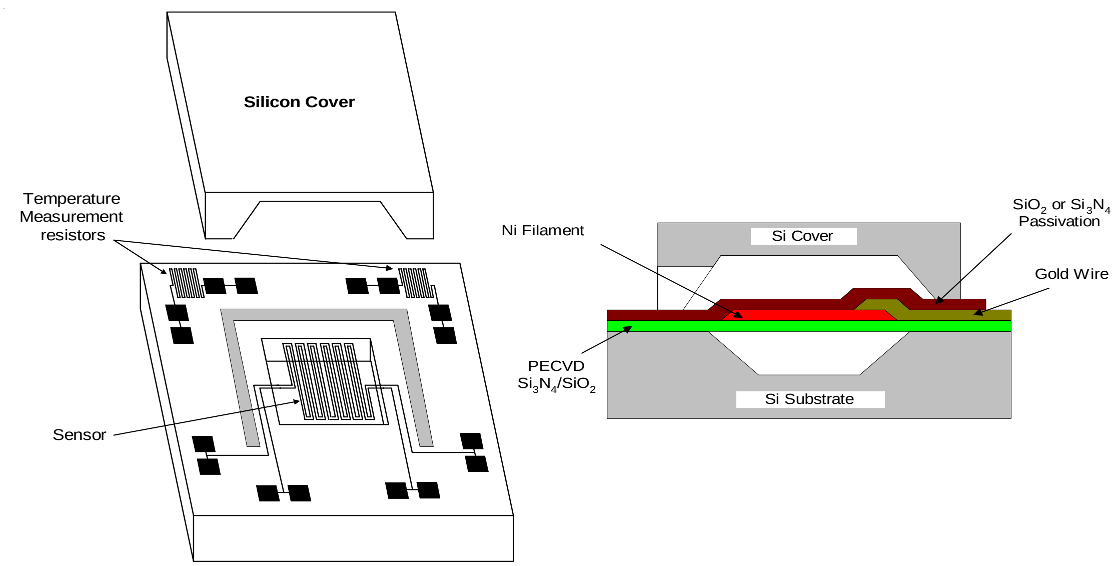
Appendix: How the 925C Works

The 925C sensor measures pressure indirectly as a heat-loss manometer that infers the pressure of a gas by measuring thermal loss from a heated wire.

925C Sensor

The Pirani sensor is type of thermal conductivity sensor. It consists of a hot wire suspended from supports. This wire loses thermal energy in three ways:

- Thermal conduction through the gas, which is pressure dependent
- End loss to the supports
- Radiation to surrounding surfaces



Pirani sensors use pressure-dependent gas transport from a hot wire to measure pressure. End loss and radiation loss act as error signals and determine the low pressure limit of the sensor. Optimizing operational parameters of the wire length and diameter, thermal emissivity, thermal conductivity, and wire temperature can decrease end loss and radiation errors. A standard Pirani sensor usually has a lower reading limit of about 10^{-3} Torr, due to signal lost by end loss and radiation error.

NOTES: