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MKS Baratron®
Type 122A
Absolute Pressure Gauge

Table of Contents

List of Figures

List of Tables

Safety Procedures and 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 MKS Calibration and Service Center for service and repair to ensure that all safety features are maintained.

SERVICE BY QUALIFIED PERSONNEL ONLY

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified service personnel only.

USE CAUTION WHEN OPERATING WITH HAZARDOUS MATERIALS

If hazardous materials are used, users must take responsibility to observe the proper safety precautions, completely purge the instrument when necessary, and ensure that the material used is compatible with sealing materials.

PURGE THE INSTRUMENT

After installing the unit, or before its removal from a system, be sure to purge the unit completely with a clean dry gas to eliminate all traces of the previously used flow material.

USE PROPER PROCEDURES WHEN PURGING

This instrument must be purged under a ventilation hood, and gloves must be worn to protect personnel.

DO NOT OPERATE IN EXPLOSIVE ATMOSPHERES

To avoid explosion, do not operate this product in an explosive atmosphere unless it has been specifically certified for such operation.

USE PROPER FITTINGS AND TIGHTENING PROCEDURES

All instrument fittings must be consistent with instrument specifications, and compatible with the intended use of the instrument. Assemble and tighten fittings according to manufacturer's directions.

CHECK FOR LEAK-TIGHT FITTINGS

Before proceeding to instrument setup, carefully check all plumbing connections to the instrument to ensure leak-tight installation.

OPERATE AT SAFE INLET PRESSURES

This unit should never be operated at pressures higher than the rated maximum pressure (refer to the product specifications for the maximum allowable pressure).

INSTALL A SUITABLE BURST DISC

When operating from a pressurized gas source, a suitable burst disc should be installed in the vacuum system to prevent system explosion should the system pressure rise.

KEEP THE UNIT FREE OF CONTAMINANTS

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

Definitions of WARNING, CAUTION, and NOTE messages used throughout the manual.

Warning 

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, condition, or the like, which, if not correctly performed or adhered to, could result in injury to personnel.

Caution 

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of all or part of the product.

Note 

The NOTE sign denotes important information. It calls attention to a procedure, practice, condition, or the like, which is essential to highlight.

Chapter One: General Information

Introduction

The MKS Baratron® Type 122A Absolute Pressure Transducer marks the beginning of a new era in low cost pressure measurement. Using a latest-generation single-sided dual-electrode Inconel® sensor coupled with a new fixed-frequency bridge signal conditioner, the 122 provides operation which is inherently temperature stable at zero pressure, capable of withstanding high overpressure conditions with minimal or no shifts in output over its range, and high resistance to corrosive environments.

The variable-capacitance sensor is the result of over 25 years of research, development and customer experience in total pressure measurement. The design incorporates a tensioned metal diaphragm (Inconel), one side of which is exposed to the gas whose pressure is to be measured. The other (reference) side of the diaphragm contains a dual electrode assembly (previously found in premium transducers only) sealed in a high vacuum reference cavity which is maintained by a chemical getter system.

The signal conditioning electronics board contains a fixed-frequency oscillator, balance-sensing circuit, linearization circuitry and amplifiers which provide a 0 to 10 Volt DC full scale output. The signal conditioner is inherently temperature stable at balance (pressure = 0 Torr) and is self-compensating with temperature changes at other pressures.

A drawn aluminum can forms the protective cover for the transducer and a PC board mounted removable terminal block allows connections to be easily made for ± 15 VDC power inputs and the 0 to 10 VDC pressure signal output. In addition, the aluminum cover works in conjunction with an inner PC shield board with RF bypass capacitors to virtually eliminate RFI and EMI. Refer to Figure 5, page 12, for a cross sectional view of the 122 transducer.

How This Manual is Organized

This manual is designed to provide instructions on how to set up, install, and operate a Type 122 unit.

Before installing your Type 122 unit in a system and/or operating it, carefully read and familiarize yourself with all precautionary notes in the *Safety Messages and Procedures* section at the front of this manual. In addition, observe and obey all WARNING and CAUTION notes provided throughout the manual.

Chapter One: General Information, (this chapter) introduces the product and describes the organization of the manual.

Chapter Two: Installation, explains the environmental requirements and describes how to mount the instrument in your system.

Chapter Three: Overview, gives a brief description of the instrument and its functionality.

Chapter Four: Operation, describes how to operate the instrument.

Chapter Five: Maintenance, describes repair and return policies for the 122 transducer.

Appendix A: Product Specifications, lists the specifications of the instrument.

Appendix B: Product Code, describes the instrument's product code.

Customer Support

Standard maintenance and repair services are available at all of our regional MKS Calibration and Service Centers, listed on the back cover. In addition, MKS accepts the instruments of other manufacturers for recalibration using the Primary and Transfer Standard calibration equipment located at all of our regional service centers. Should any difficulties arise in the use of your Type 122 instrument, or to obtain information about companion products MKS offers, contact any authorized MKS Calibration and Service Center. If it is necessary to return the instrument to MKS, please obtain an ERA Number (Equipment Return Authorization Number) from the MKS Calibration and Service Center before shipping. The ERA Number expedites handling and ensures proper servicing of your instrument.

Please refer to the inside of the back cover of this manual for a list of MKS Calibration and Service Centers.

Warning  **All returns to MKS Instruments must be free of harmful, corrosive, radioactive, or toxic materials.**

Chapter Two: Installation

How To Unpack the Type 122 Unit

MKS has carefully packed the Type 122 unit so that it will reach you in perfect operating order. Upon receiving the unit, however, you should check for defects, cracks, broken connectors, etc., to be certain that damage has not occurred during shipment.

Note  Do *not* discard any packing materials until you have completed your inspection and are sure the unit arrived safely.

If you find any damage, notify your carrier and MKS immediately. If it is necessary to return the unit to MKS, obtain an ERA Number (Equipment Return Authorization Number) from the MKS Service Center before shipping. Please refer to the inside of the back cover of this manual for a list of MKS Calibration and Service Centers.

Unpacking Checklist

Standard Equipment:

- Type 122 Unit
- Type 122 Instruction Manual (this book)

Optional Equipment:

- Electrical Connector Accessories Kit - 122A-K1

Dimensions

Note All dimensions are listed in inches with millimeters referenced in parentheses.

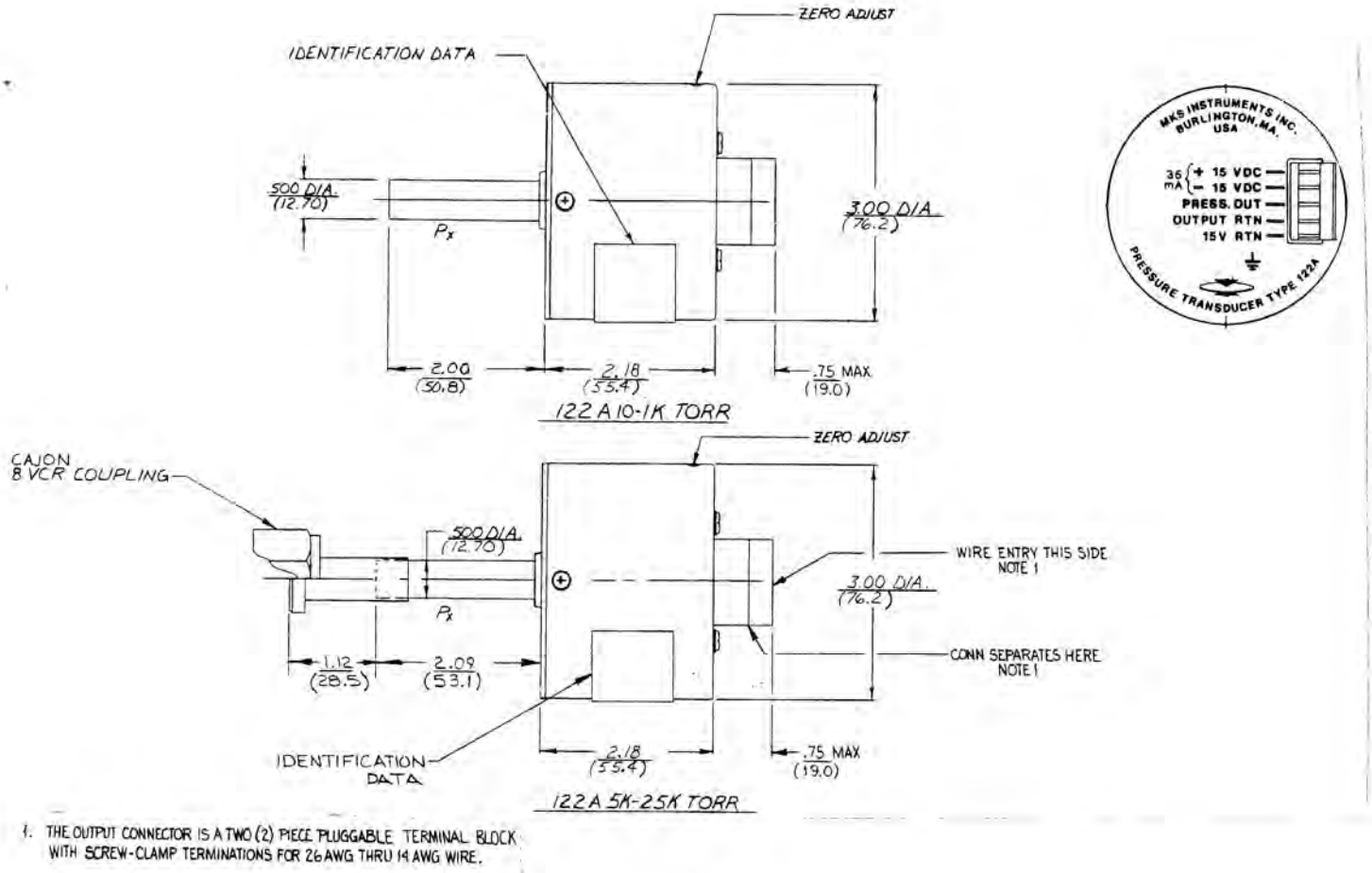

Figure 1: Dimensions of a 122 Transducer

Setup

Mounting Instructions

Although the 122 unit may be mounted in any attitude, it is recommended that it be placed in a system with the P_X port facing down, as this allows contamination, if present, to fall away from the pressure sensing diaphragm. Any standard vacuum fitting installed by MKS may be used (Cajon®, VCR®, Ultra-Torr®, KF flange, etc.). The sensor port will easily carry the weight of the transducer.

Electrical Installation

The 122 transducer requires an external power source capable of supplying ±15 VDC, ±2%, at 35 mA minimum. Noise and ripple should be less than 20 mV p-p. Any readout device may be used which has input capabilities of 0 to 10 VDC and impedance greater than 10k ohms.

Note The ground of any external power supply and readout should be the same as the sensor ground (chassis ground), to minimize any possible ground loops which can affect the performance and stability of the system.

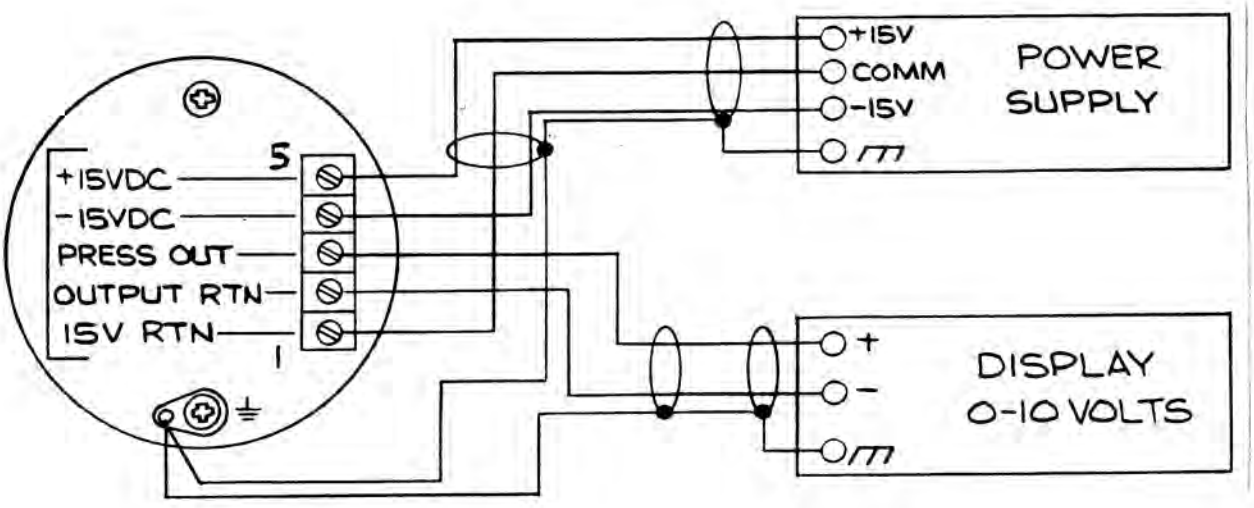

Figure 2: Electrical Connections

Cables

Certain interface cables can be supplied by MKS, or you may choose to make your own, provided the appropriate specifications contained herein are maintained. Refer to Figure 3, page 9, for the part numbers for the cables used with various MKS Readout/Controller Systems.

Note

1. Metal, braided, shielded cables are required to meet CE Mark certification.
2. To order metal, braided, shielded cables, add an "S" after the cable type designation. For example to order a standard cable to connect the 122 transducer to a 152 controller, use part number CB254-2; for a shielded cable, use part number CB254S-2.

Complete MKS Pressure Measurement System (Pressure Transducer/Power Supply/Readout)

For convenience, when you purchase a complete pressure measurement system with all MKS components, MKS will supply (at no additional charge) the appropriate shielded cable with connector(s), in standard nominal lengths.

Interface Cables for Non-MKS Power Supplies/Readouts

Shielded cable assemblies, in a nominal 10' (3M) length, with one end terminated in "flying leads" (pigtail) fashion are available at nominal cost. Shielded cable assemblies are recommended, especially if the transducer's environment contains high EMI/RFI noise.

Cable Color Code

Table 1, page 8, shows the standard color codes used with MKS cables for the 122 transducer.

Cable Color Codes	
MKS Cable	**Color**
+15 Volt Power Input	Green
-15 Volt Power Input	White
Pressure Output Signal	Red
Output Signal Return	Black (paired with Red)*
Power Supply Return	Black (paired with Green)
Chassis (Case) Ground	Black (shields)
* *The Output Signal Return is internally connected to the Power Supply Return.*	

Table 1: Cable Color Codes

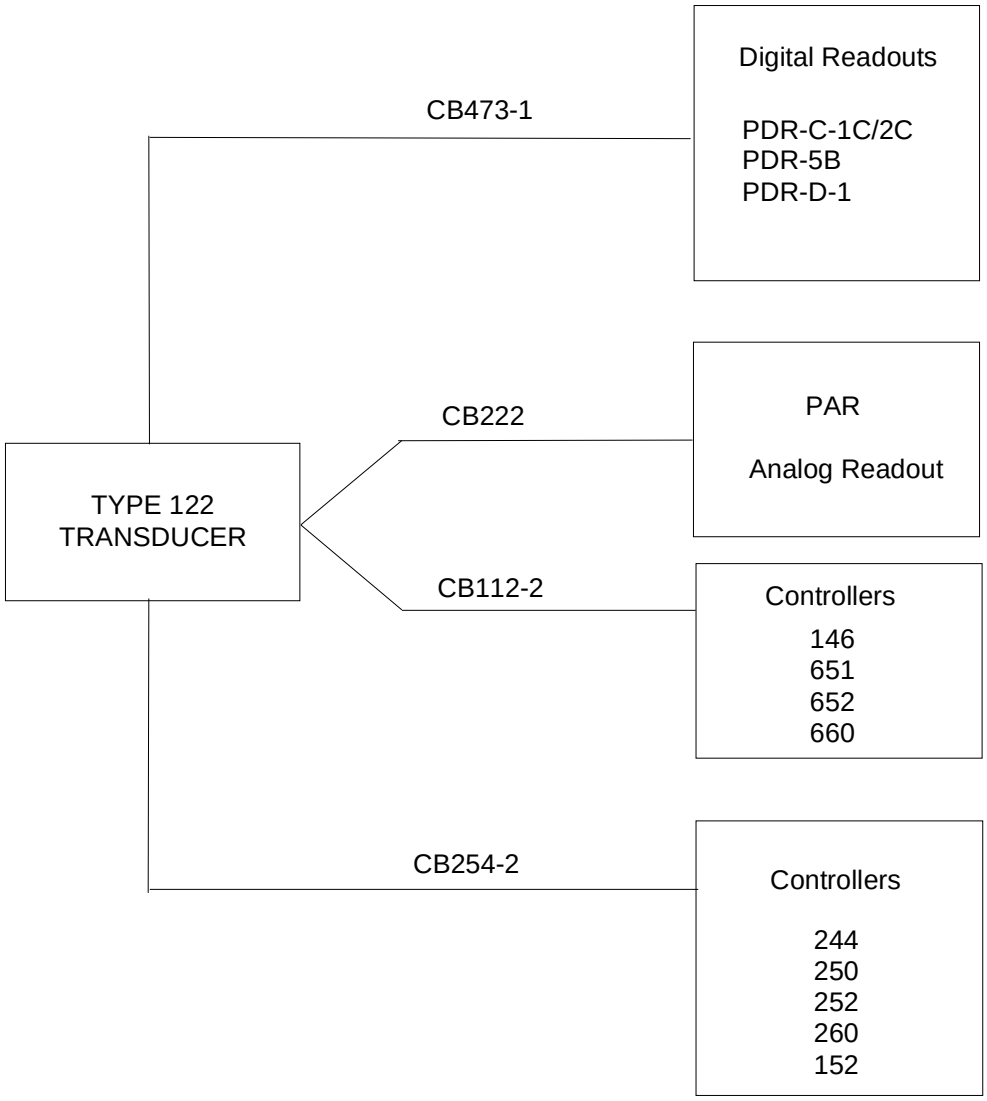

Figure 3: Interface Cables for the 122 Transducer

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Chapter Three: Overview

Sensor

The variable capacitance sensor, shown in Figure 4, consists of a pressure inlet tube (port) connected to a small chamber in the sensor body. One wall of this chamber is an elastic metal diaphragm. The back, or "reference" side of the diaphragm faces a rigidly mounted ceramic disc containing two electrodes in a volume which is permanently evacuated and sealed. When pressure is applied to the diaphragm, its deflection produces a change in distance between the electrodes and diaphragm which produces corresponding changes in capacitances. The change in capacitance of the electrode near the center of the diaphragm is always more than the capacitance change of the outer electrode.

Figure 4: Type 122 Transducer

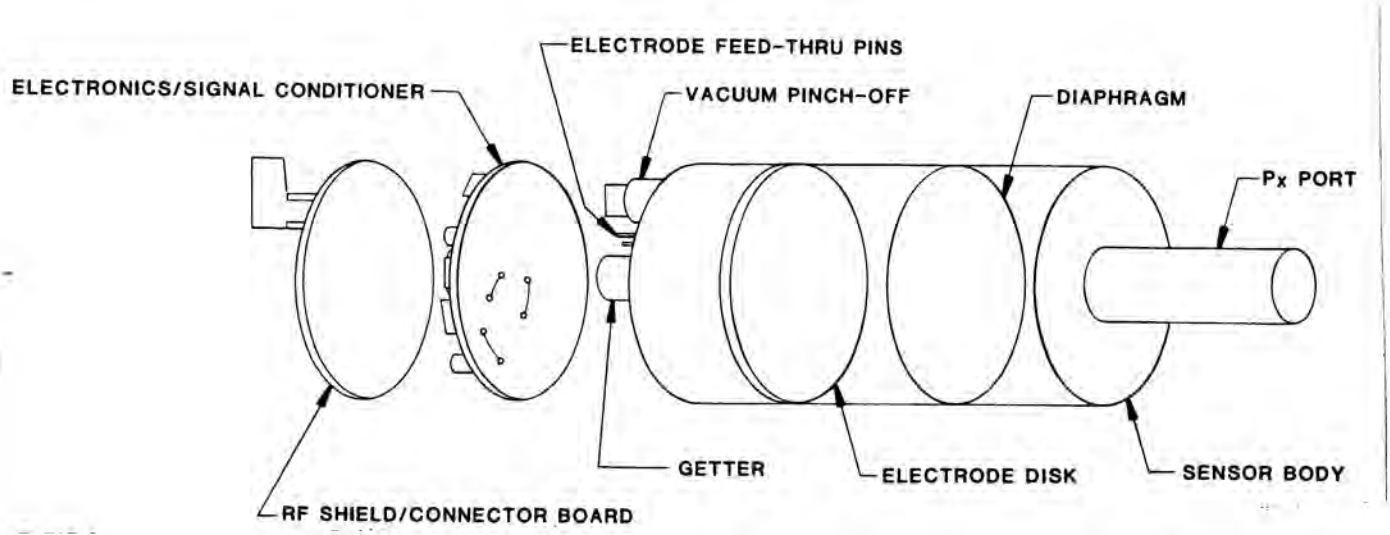

Figure 5: Cross Sectional View of the Type 122 Transducer

Signal Conditioner / Electronics

The block diagram (refer to Figure 6) shows the output from a sine wave oscillator which is at a fixed frequency and amplitude and is used to drive the bridge circuit. An imbalance of the sensor electrode capacitances (caused by an input pressure) causes a differential charge through the bridge and to the following buffer amplifier. The output from the buffer amplifier is fed to the output amplifier whose gain is set by the SPAN control potentiometer. This pot is normally set at the time of calibration; its access hole through the transducer cover is plugged to prevent inadvertent decalibration. The ZERO potentiometer adds in a small amount of correction voltage which is derived from the internal ±1.2 VDC references.

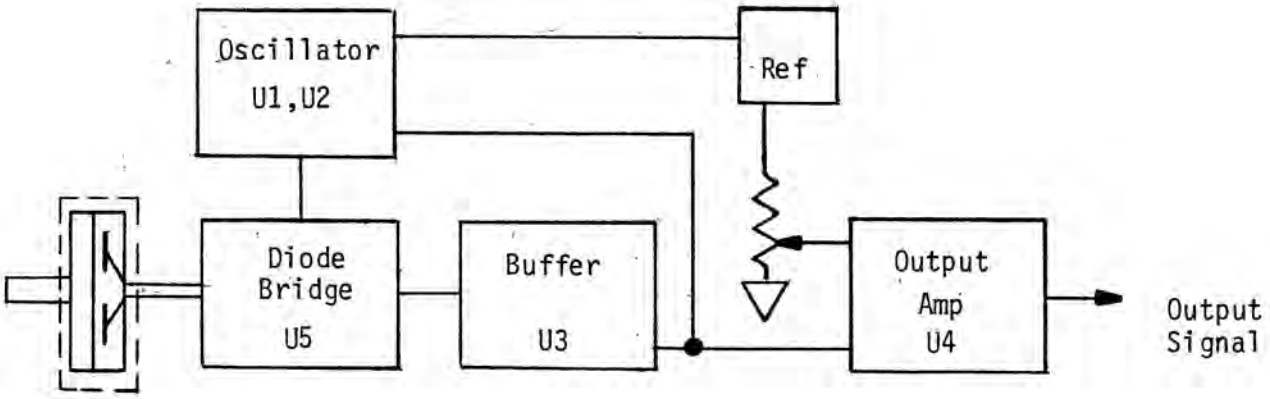

Figure 6: Block Diagram of the 122 Transducer

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Chapter Four: Operation

How To Adjust the Zero

The 122 transducer zero should be adjusted by first pumping to a pressure below the gauge resolution, and then setting the ZERO potentiometer for an output of zero volts (display reads "0000").

Note The gauge should be in place and allowed to warm-up for at least 15 minutes before making this adjustment. Refer to Table 2, page 16, for recommended zero pressure levels to use with various ranges of transducers.

If available pressures are not sufficiently low to set the transducer zero, a vacuum leak detector may be used. In this case, mount the transducer on the leak detector ***in the same plane of orientation as where it will be used.***

In production operations such as semiconductor manufacturing, it is recommended that the transducer zero be verified and adjusted, if necessary, each time the equipment is shut down for routine maintenance.

Note Type 122 transducers are calibrated to specifications (refer to *Appendix A: Product Specifications*, page 19) at the factory and every effort is made to ensure that shipments arrive at your location free of defects or need for further calibration other than zero adjustment. ***It is advised that users do not attempt adjustments other than zero.***

Suggested Pressures for Zero Adjustment					
Model Number	**Full Scale Range (Torr)**	**Lowest Suggested Pressure Reading (Torr)**	**Lowest Suggested Pressure Control (Torr)**	**Highest Base Pressure for Proper Zero Adjust (Torr)**	**Warm-Up Time Before Adjusting Zero (Minutes)**
122AA-00010-	10	3×10^{-3}	5×10^{-2}	1×10^{-3}	30
122AA-00100-	100	3×10^{-2}	5×10^{-1}	1×10^{-2}	30
122AA-01000-	1000	3×10^{-1}	5×10^{0}	1×10^{-1}	30

Table 2: Suggested Pressures for Zero Adjustment

Lowest Suggested Pressure Reading

Lower readings are often possible, but not always practical; a stable operating environment (temperature and air flow) permits lower readings. Optimum repeatability of low pressure (<100 millitorr) measurement is achieved with temperature-controlled transducers.

Lowest Suggested Pressure Control

The pressures noted in this column are for reference, and represent the pressure reading of the transducer at 50 millivolts signal output. A 50 millivolt DC signal is usually the preferred minimum signal level, when integrating any electronic component into complex processing systems.

Highest Base Pressure For Proper Zero Adjust

All capacitance manometers require initial and periodic zero adjustments be made at a pressure lower than their minimum resolution in order to assure that the full dynamic range specified can be achieved. Zeroing a transducer at some pressure above its stated minimum resolution will create a “zero offset” relative (or unique) to the system on which the transducer is located. All readings made subsequent to the offset will be linear and accurate relative to the offset zero value.

Chapter Five: Maintenance

General Information

If the 122 transducer fails to operate properly upon receipt, check for shipping damage, and check the cables for proper continuity. Any damage should be reported to the carrier and MKS Instruments immediately. If it is necessary to return the unit to MKS, obtain an ERA number (Equipment Return Authorization Number) from a MKS Service Center before shipping. Please refer to the inside back cover of this manual for a list of MKS Calibration and Service Centers.

Warning  **All returns to MKS Instruments must be free of harmful, corrosive, radioactive, or toxic materials.**

Signal Conditioner Electronics

MKS recommends that you do ***not*** attempt to repair the transducer signal conditioner electronics, since replacement or movement of many PC board components may require complete recalibration of the unit.

Sensor

MKS recommends that you do ***not*** attempt to clean the sensor except in the case of water soluble deposited material, such as ammonium chloride from the exhaust line of a low pressure CVD Nitride reactor. In this case, the following procedure may be used:

1. Remove the cover from the 122 transducer.
2. Unscrew the metal standoffs which hold the lower PC board.
3. Remove the two boards being careful not to change the orientation of ***any*** parts.
4. Place the sensor ***only*** in an ultrasonic cleaner with hot water and attempt to remove the deposited material.
5. Reassemble the transducer, being careful not to change the orientation of any PC component.
6. Vacuum pump the unit the remove water vapor.
7. Reset the ZERO.

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Appendix A: Product Specifications

Accuracy (non-linearity, hysteresis, and non-repeatability)	± 0.5% of Reading (optional ± 0.15%) ± temperature coefficients
CE Mark Compliance[1]	EMC Directive 89/336/EEC
Fittings	
Standard	½" (12.7 mm) tubulation; Cajon® 8-VCR® only on 5K and higher ranges
Optional	KF-16, Cajon 8-VCR, Cajon 8-VCO®
Full Scale Ranges	10, 100, 1K, 5K, 10K, 15K, 20K, 25K mmHg
Input Power Required	±15 VDC @ 35 mA, regulated ±2%
Materials Exposed to Gases	Inconel and stainless steel
Operating Temperature Range	0° to 50° C (32° to 122° F)
Output Signal	0 to 10 VDC into 10K ohm or greater
Overpressure Limit	120% of F.S. or 35 psia (240 kPa), whichever is greater
Temperature Coefficients	
Zero	0.008 % F.S./° C
Span	0.04% Reading/° C
Volume (P_X side)	7.00 cc for 10, 100, 1K mmHg 8.5 cc for all other ranges

Due to continuing research and development activities, these product specifications are subject to change without notice.

[1] When used with optional metal, braided, shielded cables.

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Appendix B: Product Code

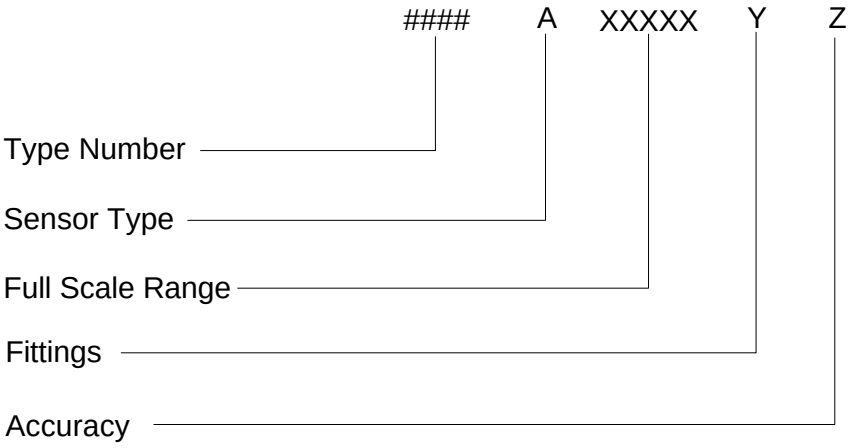
Product Code

The desired instrument options are identified in the product code when you order the unit.

The product code is identified as follows:

A-XXXXX Y Z

where:



Type Number (####)

This designates the model number of the instrument.

The pressure gauge is identified as the Type 122A.

Sensor Type (A)

This designates that the 122 unit is an absolute pressure gauge.

Full Scale Range - mmHg (XXXXX)

The full scale range is indicated by a five digit code.

	Ordering Code
10	00010
100	00100
1000	01000
5000	05000
10000	10000
15000	15000
20000	20000
25000	25000

Fittings (Y)

Four types of fittings are available, designated by a single letter code.

	Ordering Code
½" Diameter Tubulation	A
Cajon 8-VCR Female	B
KF-16	D
Cajon 8-VCO Female	E

Accuracy (Z)

Three specifications for accuracy are available, designated by a single letter code.

		Ordering Code
Standard:	0.5% of Reading	B
Optional:	0.3% of Reading	C
	0.15% of Reading	D

How To Order a Type 122 Unit

To order the Type 122 absolute pressure transducer with a 10 mmHg full scale range, ½" diameter tubulation fittings, and standard accuracy of 0.5% of Reading, the product code is:

122A A-00010 A B

To order the Type 122 absolute pressure transducer with a 1000 mmHg full scale range, Cajon 8-VCR fittings, and the optional accuracy of 0.15% of Reading, the product code is:

122A A-01000 B D

Index