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110660-P1
Rev E, 6/97
Instruction Manual

MKS Baratron®
Type 127A and Type 128A
Absolute Pressure Transducers

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WARRANTY

Type 127A and 128A Equipment

MKS Instruments, Inc. (**MKS**) warrants that the equipment described above (the "equipment") manufactured by **MKS** shall be free from defects in materials and workmanship for a period of one year from date of shipment and will for a period of two years from the date of shipment, correctly perform all date-related operations, including without limitation accepting data entry, sequencing, sorting, comparing, and reporting, regardless of the date the operation is performed or the date involved in the operation, provided that, if the equipment exchanges data or is otherwise used with equipment, software, or other products of others, such products of others themselves correctly perform all date-related operations and store and transmit dates and date-related data in a format compatible with **MKS** equipment. THIS WARRANTY IS **MKS'** SOLE WARRANTY CONCERNING DATE-RELATED OPERATIONS.

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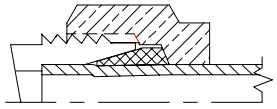
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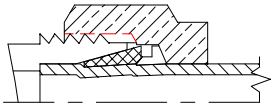
SPECIAL NOTICE

This warranty is void if the product is installed using single or double metal ferrule compression type vacuum fittings, shown below. These fittings are commonly tightened incorrectly, causing damage to the pressure sensor.

Single Ferrule



Double Ferrule



110660-P1
Rev E, 6/97

MKS Baratron®
Type 127A and Type 128A
Absolute Pressure Transducers

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Pressure Transducer Safety Information

Symbols Used in This Instruction Manual

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.

Symbols Found on the Unit

The following table describes symbols that may be found on the unit.

Definition of Symbols Found on the Unit			
On (Supply) IEC 417, No.5007	 Off (Supply) IEC 417, No.5008	 Earth (ground) IEC 417, No.5017	 Protective earth (ground) IEC 417, No.5019
 Frame or chassis IEC 417, No.5020	 Equipotentiality IEC 417, No.5021	 Direct current IEC 417, No.5031	 Alternating current IEC 417, No.5032
 Both direct and alternating current IEC 417, No.5033-a	 Class ll equipment IEC 417, No.5172-a	 Three phase alternating current IEC 617-2 No.020206	
 Caution, refer to accompanying documents ISO 3864, No.B.3.1	 Caution, risk of electric shock ISO 3864, No.B.3.6	 Caution, hot surface IEC 417, No.5041	

Table 1: Definition of Symbols Found on the Unit

Safety Procedures and Precautions

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of intended use of the instrument and may impair the protection provided by the equipment. MKS Instruments, Inc. assumes no liability for the customer's failure to comply with these requirements.

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 the materials in this product, including any 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.

Chapter One: General Information

Introduction

The MKS Type 127A heated Baratron® Absolute Pressure Transducer and the Type 128A High Temperature Absolute Pressure Transducer are capacitance manometers designed to provide accurate, reliable, and repeatable pressure measurements in the range from 1000 Torr (1000 mmHg) to less than 0.1 Torr or micron (10^{-5} mmHg). These transducers utilize the latest balanced bridge signal conditioning technology to provide accuracy and stability previously unavailable in low cost capacitance manometers.

The Type 127 and Type 128 transducers are specifically designed to meet the needs of vacuum process systems, where environmental and process conditions are particularly demanding. Both units expose only Inconel® to the process, which permits use with corrosive or dirty gases, and eliminates contamination of the process with gauge materials. Measurements are independent of gas composition; the 127 and 128 transducers measure true total pressure, regardless of the gas species or whether it is a pure gas or a gas mixture. Temperature control of the sensor minimizes the effects of ambient or process temperature variations typically encountered in process line environments. The 127 transducer has the sensor temperature controlled at 45° C; the 128 transducer has the sensor temperature controlled at 100° C.

RFI shielding is standard to prevent interference from RF or noisy electrical environments. Both units comply with the European EMC Directive 89/336/EEC which governs electromagnetic compatibility. The units are protected against damage due to overpressure such as when the unit is venting to atmosphere between process cycles. The overpressure limit is 35 psia, maximum, for all ranges except 0.1 Torr range which is 20 psia, maximum. (However, MKS recommends that you install an isolation valve to achieve the best zero stability.)

Both the 127 and 128 transducers are compatible with the Type PDR-C power supply/readout units and closed-loop pressure/flow control systems such as the MKS Type 250 Pressure/Flow Ratio Controller or the Type 152/252 Exhaust Valve Controller. In addition, the 127 and 128 transducers work with many commercial ±15 VDC power supplies, and standard digital volt meters (DVMs).

The 127 and 128 transducers utilize the same construction and operation procedures and are discussed interchangeably in this manual. The 127 unit is controlled at 45° C and has a black case. The 128 unit is controlled at 100° C and has a gray case.

How This Manual is Organized

This manual is designed to provide instructions on how to set up, install, and operate a Type 127/128 unit.

Before installing your Type 127/128 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 use the instrument and explains all the functions and features.

Chapter Five, *Maintenance,* lists any maintenance required to keep the instrument in good working condition.

Chapter Six, *Troubleshooting,* provides a checklist for reference should the instrument malfunction.

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

Appendix B, *Model Code Explanation,* describes the model 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 127/128 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.**

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Chapter Two: Installation

How To Unpack the Type 127/128 Unit

MKS has carefully packed the Type 127/128 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 127 or Type 128 Unit
- Type 127/128 Instruction Manual (this book)

Optional Equipment:

- Electrical Connector Accessories Kit - 127A-K1 or 128A-K1 (which includes a mating connector for the 15-pin Type “D” Interface connector)
- Interface cables
- PDR-C-1C/2C Power Supply/Readout
- RM-6 Rack Mount Kit
- Pressure/Flow Controller

Interface Cables

As of January 1, 1996, most products shipped to the European Community must comply with the EMC Directive 89/336/EEC, which covers radio frequency emissions and immunity tests. In addition, as of January 1, 1997, some products shipped to the European Community must also comply with the Product Safety Directive 92/59/EEC and Low Voltage Directive 73/23/EEC, which cover general safety practices for design and workmanship. MKS products that meet these requirements are identified by application of the CE Mark.

To ensure compliance with EMC Directive 89/336/EEC, an overall metal braided shielded cable, properly grounded at both ends, is required during use. No additional installation requirements are necessary to ensure compliance with Directives 92/59/EEC and 73/23/EEC.

MKS offers a full line of cables for all MKS equipment.

Note

1. An overall metal braided shielded cable, properly grounded at both ends, is required during use to meet CE specifications.
2. To order a metal braided shielded cable, add an "S" after the cable type designation. For example, to order a cable to connect a 127 unit to a PDR-C unit, order CB127S-1 for an overall metal braided shielded cable; order CB127-1 for a non-shielded cable.

Interface Cables	
To Connect To A . . .	**Use Cable . . .**
PDR-C-1C/2C, PDR-5B	CB127S-1-XX; CB127-1-XX
244, 250, 252, 152 260 Series	CB258S-1-XX; CB258-1-XX
146, 186, 651, 652, 660	CB259S-5-XX; CB259-5-XX
where XX indicates the cable length	

Generic Shielded Cable Description

Should you choose to manufacture your own cables, follow the guidelines listed below:

1. The cable must have an overall metal *braided* shield, covering all wires. Neither aluminum foil nor spiral shielding will be as effective; using either may nullify regulatory compliance.
2. The connectors must have a metal case which has direct contact to the cable's shield on the whole circumference of the cable. The inductance of a flying lead or wire from the shield to the connector will seriously degrade the shield's effectiveness. The shield should be grounded to the connector before its internal wires exit.
3. With very few exceptions, the connector(s) must make good contact to the device's case (ground). "Good contact" is about 0.01 ohms; and the ground should surround all wires. Contact to ground at just one point may not suffice.
4. For shielded cables with flying leads at one or both ends; it is important at each such end, to ground the shield *before* the wires exit. Make this ground with absolute minimum length. Refer to Figures 1 and 2, page 12. (A ¼ inch piece of #22 wire may be undesirably long since it has approximately 5 nH of inductance, equivalent to 31 ohms at 1000 MHz). After picking up the braid's ground, keep wires and braid flat against the case. With very few exceptions, grounded metal covers are not required over terminal strips. If one is required, it will be stated in the Declaration of Conformity or in the instruction manual.
5. In selecting the appropriate type and wire size for cables, consider:

   A. The voltage ratings;

   B. The cumulative I^2R heating of all the conductors (keep them safely cool);

   C. The IR drop of the conductors, so that adequate power or signal voltage gets to the device;

   D. The capacitance and inductance of cables which are handling fast signals, (such as data lines or stepper motor drive cables); and

   E. That some cables may need internal shielding from specific wires to others; please see the instruction manual for details regarding this matter.

Example 1: Preferred Method To Connect Cable
(shown on a transducer)

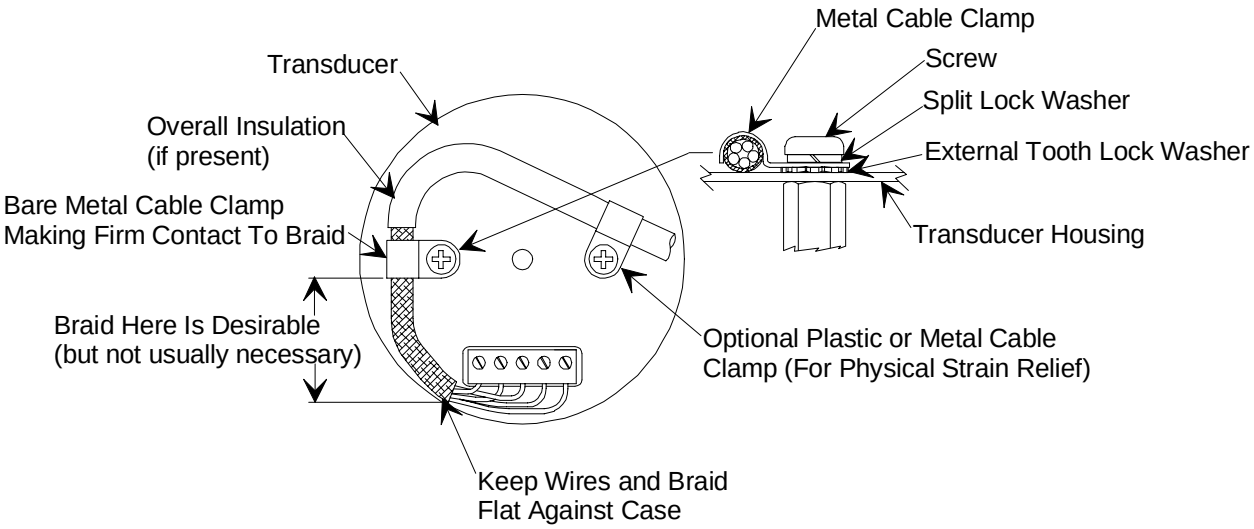


Figure 1: Preferred Method To Connect an Overall Metal Braided Shielded Cable

Example 2: Alternate Method To Connect Cable
(shown on a transducer)

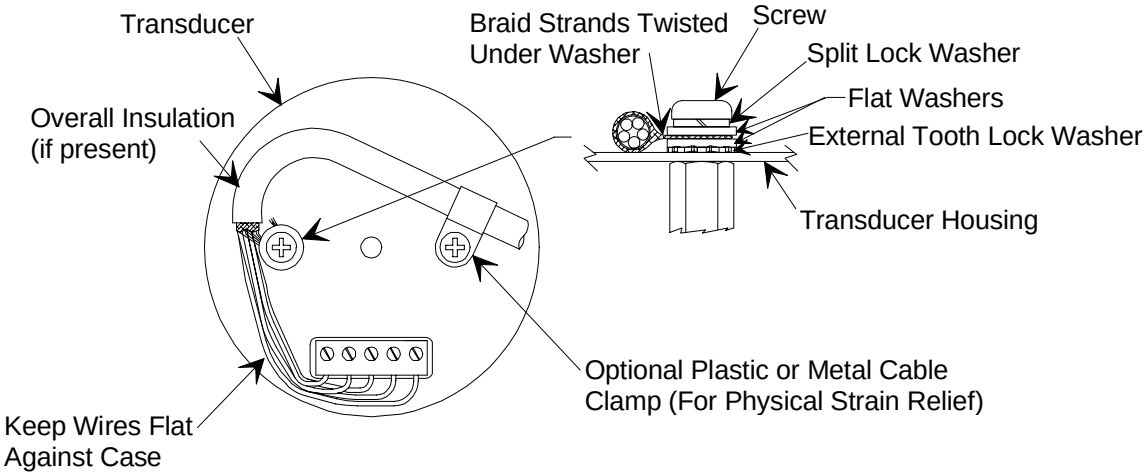


Figure 2: Alternate Method To Connect an Overall Metal Braided Shielded Cable
Use this method when cable clamp is not available

Product Location and Requirements

Operating Environmental Requirements

- Ambient Operating Temperature: 15° C to 40° C (59° F to 104° F)

Setup

The 127/128 transducer is designed to be mounted in any orientation and should be zeroed in that position. It is recommended, however, that the unit be mounted with the inlet port vertically downward as any foreign matter entering the pressure port will fall away from the diaphragm, thereby not affecting the measurement. It is important that the unit be kept free from vibration, as the diaphragm, when not subject to gas damping at low pressure, may become susceptible to resonance. The 0.1 and 1 Torr Full Scale units are the most sensitive and any vibration that exists should be isolated from the unit by the use of sponge rubber pads and a bellows coupling.

Note 

Before using the Type 127/128 unit for pressure measurement, you must zero the transducer. Refer to *How To Zero the Type 127/128 Transducer*, page 19, for instructions on how to zero the unit.

Dimensions

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

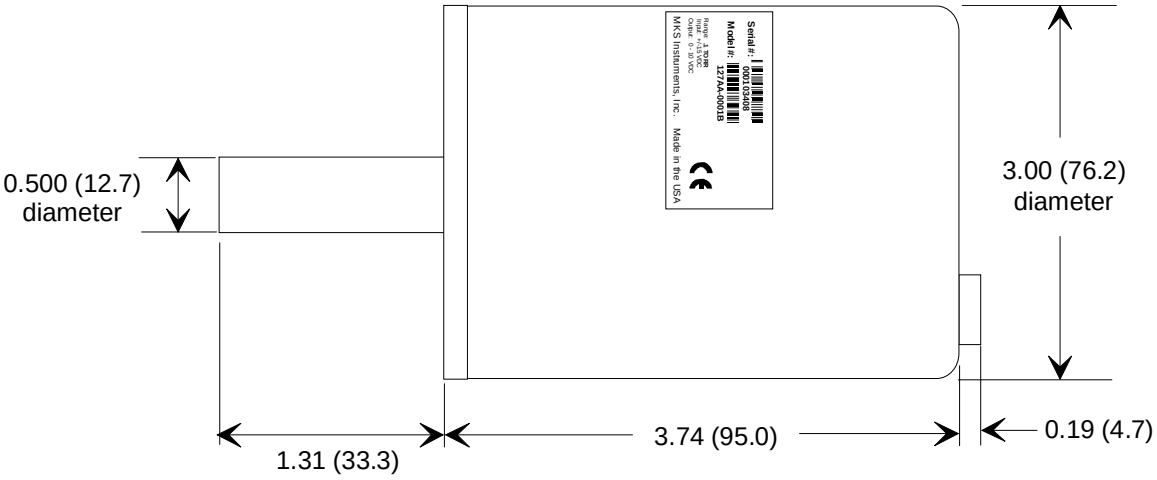


Figure 3: Dimensions of a Low Range Type 127/128 Transducer

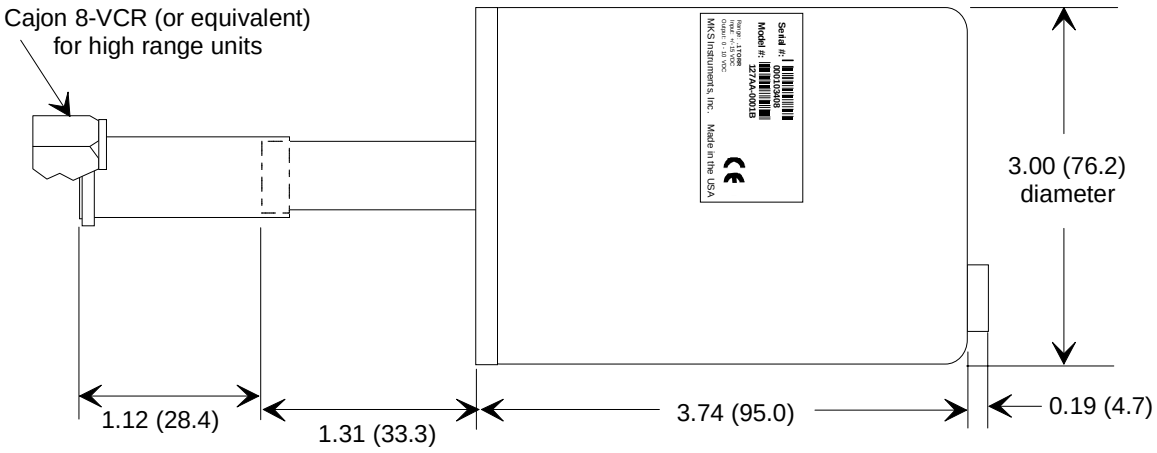


Figure 4: Dimensions of a High Range Type 127/128 Transducer

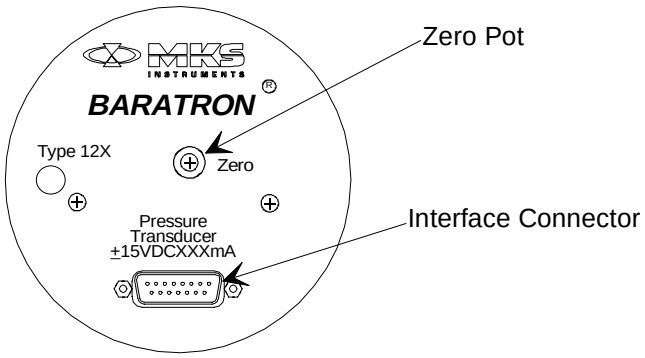


Figure 5: Top View of a Type 127/128 Transducer

Electrical Information

The Type 127 transducer requires an external power source capable of supplying ±15 VDC, ±5%, at 250 mA minimum. The Type 128 transducer requires 500 mA. Noise and ripple should be less than 20 mV peak-to-peak. 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.

Connector

The 127/128 transducer has one 15-pin Type "D" connector located on the top of the unit. Refer to Figure 5, page 15, for the location of the connector.

Pinout of the Interface Connector	
Pin Number	**Assignment**
1	No Connection
2	Pressure Output
3	No Connection
4	No Connection
5	15V Return
6	-15 VDC
7	+15 VDC
8	No Connection
9	No Connection
10	No Connection
11	No Connection
12	Output Return
13	No Connection
14	No Connection
15	Chassis Ground

Table 2: Pinout of the Interface Connector

Note The "No Connection" pin assignment refers to a pin with no internal connection.

Chapter Three: Overview

Circuit Description

The variable capacitance sensor consists of rigidly attached capacitive electrodes located on the back or reference side of a metal diaphragm. The reference side is permanently evacuated and sealed thus making the pressure measurement totally independent of the gas type or composition. When pressure is applied to the diaphragm, its deflection produces a change in the distance between the electrodes and diaphragm and a resultant capacitance change.

The center electrode increases its capacity at a greater rate than does the outer concentric electrode. This imbalance of capacities caused by pressure is converted to a small DC Voltage in the first stage diode bridge. This bridge is excited by a precision constant frequency oscillator. The resultant signal is linearized, zeroed and amplified to produce a precise 0 to 10 VDC signal scaled to the range of the sensor.

To produce the fine zero and span stability that this transducer possesses, the sensor and bridge electronics are temperature controlled. This thermal enclosure will reduce the effects of ambient temperature changes by a factor of at least 35 (that is, 35° C change in ambient will produce 1° C change inside the thermal housing).

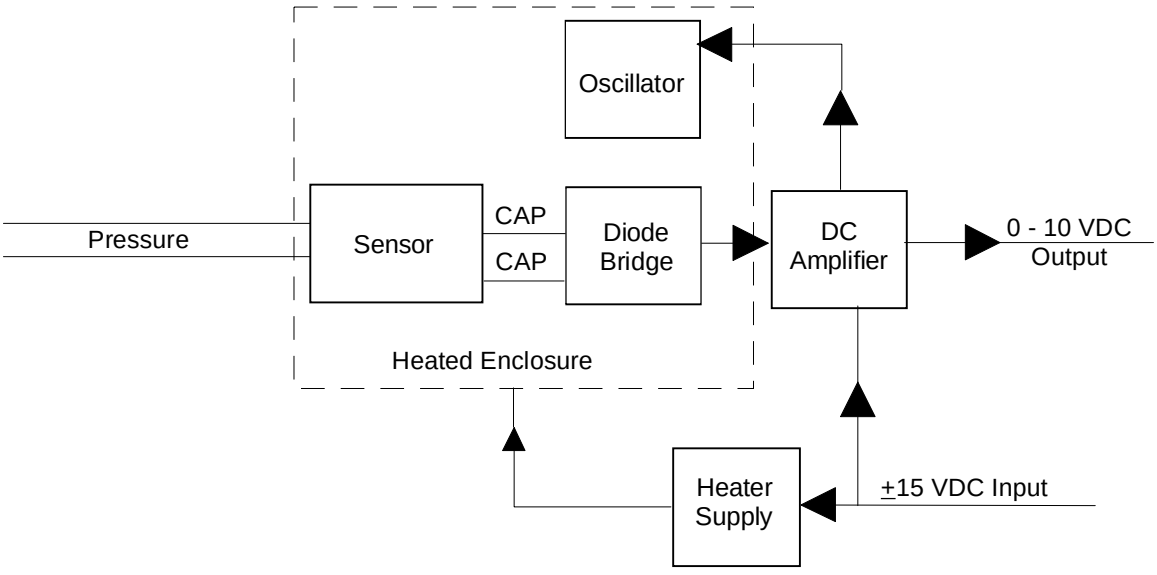


Figure 6: Block Diagram of the Circuitry

Labels

The 127/128 transducer carries a serial number label which identifies the serial number, model code, pressure full scale range, and input and output signal information. The label also displays the CE symbol indicating that the 127/128 transducer meets the requirements of the European Community's EMC Directive 89/336/EEC.



Figure 7: Serial Number Label

Chapter Four: Operation

How To Zero the Type 127/128 Transducer

You must zero the transducer initially when you install it into your system and periodically thereafter. The zero must be set by adjusting the zero potentiometer.

Note Make sure that the unit is fully stabilized before attempting to adjust the zero.

1. Pump down the unit, with power on, to a pressure less than the resolution (0.01% F.S.) for approximately two to four hours (eight hours are required for the 0.1 Torr range).

   Table 3, page 19, lists the maximum pressure for each full scale range.

2. Adjust the zero by turning the Zero potentiometer, located on the top of the unit.

   Refer to Figure 5, page 15, for the location of the Zero pot.

The zero adjustment may also be made at the front panel of an MKS supplied readout/power supply unit, if used.

Maximum Pressure Reading for Zero Adjustment	
Full Scale Range	**Maximum Pressure for Zero Adjustment**
0.1 Torr	5×10^{-6} Torr
1 Torr	5×10^{-5} Torr
2 Torr	1×10^{-4} Torr
10 Torr	5×10^{-4} Torr
100 Torr	5×10^{-3} Torr
1000 Torr	5×10^{-2} Torr
5000 Torr	2.5×10^{-1} Torr
10,000 Torr	5×10^{-1} Torr
15,000 Torr	7.5×10^{-1} Torr
20,000 Torr	1 Torr
25,000 Torr	1.25 Torr

Table 3: Maximum Pressure Reading for Zero Adjustment

Lowest Suggested Pressure Reading	
Full Scale Range	**Lowest Pressure Reading**
0.1 Torr	5×10^{-5} Torr
1 Torr	5×10^{-4} Torr
2 Torr	1×10^{-3} Torr
10 Torr	5×10^{-3} Torr
100 Torr	5×10^{-2} Torr
1000 Torr	5×10^{-1} Torr
5000 Torr	2.5 Torr
10,000 Torr	5 Torr
15,000 Torr	7.5 Torr
20,000 Torr	10 Torr
25,000 Torr	12.5 Torr

Table 4: Lowest Suggested Pressure Reading

Lowest Suggested Pressure for Control	
Full Scale Range	**Lowest Pressure Reading**
0.1 Torr	5×10^{-4} Torr
1 Torr	5×10^{-3} Torr
2 Torr	1×10^{-2} Torr
10 Torr	5×10^{-2} Torr
100 Torr	5×10^{-1} Torr
1000 Torr	5 Torr
5000 Torr	25 Torr
10,000 Torr	50 Torr
15,000 Torr	75 Torr
20,000 Torr	100 Torr
25,000 Torr	125 Torr

Table 5: Lowest Suggested Pressure for Control

Chapter Five: Maintenance

General Information

Periodically check for wear on the cables and inspect the unit for visible signs of damage.

Caution  **Do not attempt to repair the transducer signal conditioner electronics since replacement or movement of PC board components may require complete recalibration of the unit.**

Zero Check

The only maintenance task required is a periodic zero adjustment. Refer to *How To Zero the Type 127/128 Transducer*, page 19, for instructions on zeroing the transducer.

How To Clean the Unit

Periodically wipe down the unit with a damp cloth.

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Appendix A: Product Specifications

Type 127 Performance Specifications

Accuracy	
0.1 Torr	0.25% of Reading ± temperature coefficient
1 to 1000 Torr	0.15% of Reading ± temperature coefficient
>1000 to 25K Torr	0.12% of Reading ± temperature coefficient
CE Compliance	
Electromagnetic Compatibility[1]	EMC Directive 89/336/EEC
Resolution	0.01% of Full Scale
Response Time	<16 milliseconds
Temperature Coefficient	
Zero	
0.1 Torr	0.015% F.S./°C
1 Torr to 25K Torr	0.005% F.S./°C (over 15 to 40 °C)
Span	0.02% Reading/°C (over 15 to 40 °C)

[1] An overall metal braided shielded cable, properly grounded at both ends, is required during use.

Type 127 Physical Specifications

Fittings	½ inch diameter tubulation, Cajon 8-VCR, Cajon 8-VCO, NW-16-KF (not available for 10K through 25K Torr units), Mini-CF, rotatable
Full Scale Pressure Range (in Torr)	0.1, 1, 2, 10, 100, 1000, 5K, 10K, 15K, 20K, 25K
Input Power	
at startup	±15 VDC ±5%, 250 mA
after 1 hour at 30 °C	150 mA
Internal Volume	7.0 cc
Material Exposed to Gas	Inconel (plus pressure fitting materials, if applicable)
Output Signal	0 to 10 VDC into 10K ohm load or greater
Overpressure	
1 Torr to 25K Torr	35 psia
0.1 Torr	20 psia or 120% F.S., whichever is greater
Temperature	
ambient operating	15 to 40 °C
sensor operating	45 °C
Weight	1 kg (2.25 lbs.)

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

Type 128 Performance Specifications

Accuracy	
0.1 Torr	0.5% of Reading ± temperature coefficient
1 to 25K Torr	0.25% of Reading ± temperature coefficient
CE Compliance	
Electromagnetic Compatibility[2]	EMC Directive 89/336/EEC
Resolution	0.01% of Full Scale
Response Time	<16 milliseconds
Temperature Coefficient	
Zero	
0.1 Torr	0.015% F.S./°C
1 Torr to 25K Torr	0.005% F.S./°C (over 20 to 70 °C)
Span	0.02% Reading/°C (over 20 to 70 °C)

[2] An overall metal braided shielded cable, properly grounded at both ends, is required during use.

Type 128 Physical Specifications

Fittings	½ inch diameter tubulation, Cajon 8-VCR, Cajon 8-VCO, NW-16-KF (not available for 10K through 25K Torr units), Mini-CF, rotatable
Full Scale Pressure Range (in Torr)	0.1, 1, 2, 10, 100, 1000
Input Power	
at startup	±15 VDC ±5%, 500 mA
Internal Volume	7.0 cc
Material Exposed to Gas	Inconel (plus pressure fitting materials, if applicable)
Output Signal	0 to 10 VDC into 10K ohm load or greater
Overpressure	
1 Torr to 25K Torr	35 psia
0.1 Torr	20 psia or 120% F.S., whichever is greater
Temperature	
ambient operating	20 to 70 °C
sensor operating	100 °C
Weight	1 kg (2.25 lbs.)

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

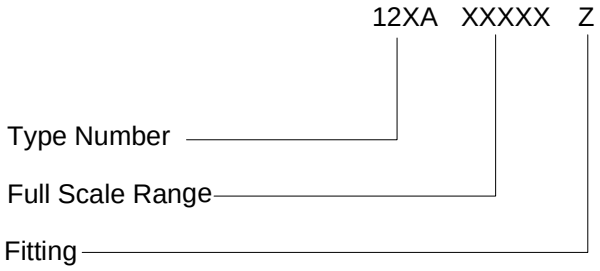
Appendix B: Model Code Explanation

Model Code

The options of your transducer are identified in the model code when you order the unit. The model code is identified as follows:

12XAYYYYYZ

where:



Type Number (12XA)

This designates the model number of the instrument, either 127A or 128A.

Full Scale Range (XXXXX)

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

Full Scale Range	Ordering Code
0.1	000.1
1	00001
2	00002
10	00010
100	00100
1,000	01000
5,000	05000
10,000	10000
15,000	15000
20,000	20000
25,000	25000

Fittings (YY)

The type of fittings is designated by a single letter code.

Fittings	Ordering Code
½" tube	A
Cajon 8-VCR female	B
Mini-CF, rotatable	C
NW-16-KF	D
Cajon 8-VCO female	E

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