MKS Baratron®
Type 221B
Differential Pressure Transducer

Instruction Manual

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Revision F, 3/13
Instruction Manual

WARRANTY

Type 221B 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.

For the period commencing with the date of shipment of this equipment and ending one year later in the case of defects in materials and workmanship, but two years later in the case of failure to comply with the date-related operations warranty, **MKS** will, at its option, either repair or replace any part which is defective in materials or workmanship or with respect to the date-related operations warranty without charge to the purchaser. The foregoing shall constitute the exclusive and sole remedy of the purchaser for any breach by **MKS** of this warranty.

The purchaser, before returning any equipment covered by this warranty, which is asserted to be defective by the purchaser, shall make specific written arrangements with respect to the responsibility for shipping the equipment and handling any other incidental charges with the **MKS** sales representative or distributor from which the equipment was purchased or, in the case of a direct purchase from **MKS**, with the **MKS** home office in Andover, Massachusetts, USA.

This warranty does not apply to any equipment which has not been installed and used in accordance with the specifications recommended by **MKS** for the proper and normal use of the equipment. **MKS** shall not be liable under any circumstances for indirect, special, consequential, or incidental damages in connection with, or arising out of, the sale, performance, or use of the equipment covered by this warranty.

MKS recommends that all **MKS** pressure and flow products be calibrated periodically (typically every 6 to 12 months) to ensure accurate readings. When a product is returned to **MKS** for this periodic re-calibration it is considered normal preventative maintenance not covered by any warranty.

THIS WARRANTY IS IN LIEU OF ALL OTHER RELEVANT WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING THE IMPLIED WARRANTY OF MERCHANTABILITY AND THE IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, AND ANY WARRANTY AGAINST INFRINGEMENT OF ANY PATENT.

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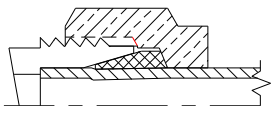
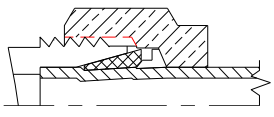
SPECIAL NOTICE

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



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Type 221B
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Printed in the United States of America

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Symbols Used in This Instruction Manual

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

Warning 

The WARNING sign denotes a hazard to personnel. 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 to equipment. 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 II 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

Observe the following general safety precautions 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 attempt component replacement and internal adjustments. Any service 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 removing it from a system, 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 for protection.

DO NOT OPERATE IN AN EXPLOSIVE ENVIRONMENT

To avoid explosion, do not operate this product in an explosive environment 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

Carefully check all vacuum component connections to ensure leak-tight installation.

OPERATE AT SAFE INLET PRESSURES

Never operate 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, install a suitable burst disc in the vacuum system to prevent system explosion should the system pressure rise.

KEEP THE UNIT FREE OF CONTAMINANTS

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

ALLOW PROPER WARM UP TIME FOR TEMPERATURE-CONTROLLED UNITS

Temperature-controlled units will only meet specifications when sufficient time is allowed for the unit to meet, and stabilize at, the designed operating temperature. Do not zero or calibrate the unit until the warm up is complete.

Informations relatives à la sécurité pour le transducteur de pression

Symboles utilisés dans ce manuel d'utilisation

Définitions des indications AVERTISSEMENT, ATTENTION, et REMARQUE utilisées dans ce manuel.

Avertissement 

L'indication AVERTISSEMENT signale un danger pour le personnel. Elle attire l'attention sur une procédure, une pratique, une condition, ou toute autre situation présentant un risque d'accident pour le personnel, en cas d'exécution incorrecte ou de non respect des consignes.

Attention 

L'indication ATTENTION signale un danger pour l'appareil. Elle attire l'attention sur une procédure d'exploitation, une pratique, ou toute autre situation, présentant un risque d'endommagement ou de destruction d'une partie ou de la totalité de l'appareil, en cas d'exécution incorrecte ou de non respect des consignes.

Remarque 

L'indication REMARQUE signale une information importante. Elle attire l'attention sur une procédure, une pratique, une condition, ou toute autre situation, présentant un intérêt particulier.

Symboles apparaissant sur l'unité

Le tableau suivant décrit les symboles pouvant apparaître sur l'unité.

Définition des symboles apparaissant sur l'unité			
Marche (sous tension) IEC 417, No.5007	 Arrêt (hors tension) IEC 417, No.5008	 Terre (masse) IEC 417, No.5017	 Terre de protection (masse) IEC 417, No.5019
 Masse IEC 417, No.5020	 Equipotentialité IEC 417, No.5021	 Courant continu IEC 417, No.5031	 Courant alternatif IEC 417, No.5032
 Courant continu et alternatif IEC 417, No.5033-a	 Matériel de classe II IEC 417, No.5172-a	 Courant alternatif triphasé IEC 617-2, No.020206	
 Attention : se reporter à la documentation ISO 3864, No.B.3.1	 Attention : risque de choc électrique ISO 3864, No.B.3.6	 Attention : surface brûlante IEC 417, No.5041	

Tableau 2: Définition des symboles apparaissant sur l'unité

Mesures de sécurité et précautions

Prendre les précautions générales de sécurité suivantes pendant toutes les phases d'exploitation de cet appareil. Le non respect des ces précautions ou des avertissements contenus dans ce manuel constitue une violation des normes de sécurité relatives à l'utilisation de l'appareil et peut diminuer la protection fournie par l'appareil. MKS Instruments, Inc. n'assume aucune responsabilité concernant le non respect des consignes par les clients.

PAS DE SUBSTITUTION DE PIÈCES OU DE MODIFICATION DE L'APPAREIL

Ne pas installer des pièces de substitution ou effectuer des modifications non autorisées sur l'appareil. Renvoyer l'appareil à un centre de service et de calibrage MKS pour tout dépannage ou réparation afin de garantir le l'intégrité des dispositifs de sécurité.

DÉPANNAGE UNIQUEMENT PAR DU PERSONNEL QUALIFIÉ

Le personnel d'exploitation ne doit pas essayer de remplacer des composants ou de faire des réglages internes. Tout dépannage doit être uniquement effectué par du personnel qualifié.

PRÉCAUTION EN CAS D'UTILISATION AVEC DES PRODUITS DANGEREUX

Si des produits dangereux sont utilisés, l'utilisateur est responsable de la prise des mesures de précaution appropriées, de la purge complète de l'appareil quand cela est nécessaire, et de la garantie que les produits utilisés sont compatibles avec les composants de cet appareil, y compris les matériaux d'étanchéité.

PURGE DE L'APPAREIL

Après l'installation de l'unité, ou avant son enlèvement d'un système, purger l'unité complètement avec un gaz propre et sec afin d'éliminer toute trace du produit de flux utilisé précédemment.

UTILISATION DES PROCÉDURES APPROPRIÉES POUR LA PURGE

Cet appareil doit être purgé sous une hotte de ventilation, et il faut porter des gants de protection.

PAS D'EXPLOITATION DANS UN ENVIRONNEMENT EXPLOSIF

Pour éviter toute explosion, ne pas utiliser cet appareil dans un environnement explosif, sauf en cas d'homologation spécifique pour une telle exploitation.

UTILISATION D'ÉQUIPEMENTS APPROPRIÉS ET PROCÉDURES DE SERRAGE

Tous les équipements de l'appareil doivent être cohérents avec ses spécifications, et compatibles avec l'utilisation prévue de l'appareil. Assembler et serrer les équipements conformément aux directives du fabricant.

VÉRIFICATION DE L'ÉTANCHÉITÉ DES CONNEXIONS

Vérifier attentivement toutes les connexions des composants pour le vide afin de garantir l'étanchéité de l'installation.

EXPLOITATION AVEC DES PRESSIONS D'ENTRÉE NON DANGEREUSES

Ne jamais utiliser des pressions supérieures à la pression nominale maximum (se reporter aux spécifications de l'unité pour la pression maximum admissible).

INSTALLATION D'UN DISQUE D'ÉCHAPPEMENT ADAPTÉ

En cas d'exploitation avec une source de gaz pressurisé, installer un disque d'échappement adapté dans le système à vide, afin d'éviter une explosion du système en cas d'augmentation de la pression.

MAINTIEN DE L'UNITÉ À L'ABRI DES CONTAMINATIONS

Ne pas laisser des produits contaminants pénétrer dans l'unité avant ou pendant l'utilisation. Des produits contaminants tels que des poussières et des fragments de tissu, de glace et de métal peuvent endommager l'unité d'une manière permanente ou contaminer le processus.

RESPECT DU TEMPS D'ÉCHAUFFEMENT APPROPRIÉ POUR LES UNITÉS Á TEMPÉRATURE CONTRÔLÉE

Les unités à température contrôlée atteignent leurs spécifications uniquement quand on leur laisse un temps suffisant pour atteindre d'une manière stable la température d'exploitation. Ne pas remettre à zéro ou calibrer l'unité tant que l'échauffement n'est pas terminé.

Sicherheitshinweise für den Druckmeßwertwandler

In dieser Betriebsanleitung vorkommende Symbole

Bedeutung der mit WARNUNG!, VORSICHT! und HINWEIS gekennzeichneten Absätze in dieser Betriebsanleitung.

Warnung! 

Das Symbol WARNUNG! weist auf eine Gefahr für das Bedienpersonal hin. Es macht auf einen Arbeitsablauf, eine Arbeitsweise, einen Zustand oder eine sonstige Gegebenheit aufmerksam, deren unsachgemäße Ausführung bzw. ungenügende Berücksichtigung zu Verletzungen führen kann.

Vorsicht! 

Das Symbol VORSICHT! weist auf eine Gefahr für das Gerät hin. Es macht auf einen Bedienungsablauf, eine Arbeitsweise oder eine sonstige Gegebenheit aufmerksam, deren unsachgemäße Ausführung bzw. ungenügende Berücksichtigung zu einer Beschädigung oder Zerstörung des Gerätes oder von Teilen des Gerätes führen kann.

Hinweis 

Das Symbol HINWEIS macht auf wichtige Informationen bezüglich eines Arbeitsablaufs, einer Arbeitsweise, eines Zustands oder einer sonstige Gegebenheit aufmerksam.

Erklärung der am Gerät angebrachten Symbole

Nachstehender Tabelle sind die Bedeutungen der Symbole zu entnehmen, die am Gerät angebracht sein können.

Bedeutung der am Gerät angebrachten Symbole			
Ein (Netz) IEC 417, No.5007	 Aus (Netz) IEC 417, No.5008	 Erde IEC 417, No.5017	 Schutzerdung IEC 417, No.5019
 Rahmen, Chassis IEC 417, No.5020	 Aquipotential-anschluß IEC 417, No.5021	 Gleichstrom IEC 417, No.5031	 Wechselstrom IEC 417, No.5032
 Gleichstrom und Wechselstrom IEC 417, No.5033-a	 Geräteklasse II IEC 417, No.5172-a	 Drehstrom IEC 617-2, No.020206	
 Vorsicht! Bitte Begleitdokumente lesen! ISO 3864, No.B.3.1	 Vorsicht! Stromschlaggefahr! ISO 3864, No.B.3.6	 Vorsicht! Heiße Oberfläche! IEC 417, No.5041	

Tabelle 3: Bedeutung der am Gerät angebrachten Symbole

Sicherheitsvorschriften und Vorsichtsmaßnahmen

Folgende allgemeine Sicherheitsvorschriften sind während allen Betriebsphasen dieses Instruments zu befolgen. Eine Mißachtung der Sicherheitsvorschriften und sonstiger Warnhinweise in dieser Betriebsanleitung verletzt die für dieses Instrument und seine Bedienung geltenden Sicherheitsstandards, und kann die Schutzvorrichtungen an diesem Gerät wirkungslos machen. MKS Instruments, Inc. haftet nicht für Mißachtung dieser Sicherheitsvorschriften seitens des Kunden.

Niemals Teile austauschen oder Änderungen am Gerät vornehmen!

Ersetzen Sie keine Teile mit baugleichen oder ähnlichen Teilen, und nehmen Sie keine eigenmächtigen Änderungen am Gerät vor. Schicken Sie das Instrument zwecks Wartung und Reparatur an den MKS-Kalibrierungs- und -Kundendienst ein. Nur so wird sichergestellt, daß alle Schutzvorrichtungen voll funktionsfähig bleiben.

Wartung nur durch qualifizierte Fachleute!

Das Auswechseln von Komponenten und das Vornehmen von internen Einstellungen darf nur von qualifizierten Fachleuten durchgeführt werden, niemals vom Bedienpersonal.

Vorsicht beim Arbeiten mit gefährlichen Stoffen!

Wenn gefährliche Stoffe verwendet werden, muß der Bediener die entsprechenden Sicherheitsvorschriften genauestens einhalten, das Instrument, falls erforderlich, vollständig ausblasen, sowie sicherstellen, daß der Gefahrstoff die am Gerät verwendeten Materialien, insbesondere Dichtungen, nicht angreift.

Ausblasen des Instrumentes

Nach dem Installieren oder vor dem Ausbau aus einem System muß das Instrument unter Einsatz eines reinen Trockengases vollständig ausgeblasen werden, um alle Rückstände des Vorgängermediums zu entfernen.

Anweisungen zum Ausblasen des Instrumentes

Das Instrument darf nur unter einer Ablufthaube ausgeblasen werden. Schutzhandschuhe sind zu tragen.

Gerät nicht zusammen mit explosiven Stoffen, Gasen oder Dämpfen benutzen!

Um der Gefahr einer Explosion vorzubeugen, darf dieses Gerät niemals zusammen mit (oder in der Nähe von) explosiven Stoffen aller Art eingesetzt werden, sofern es nicht ausdrücklich für diesen Zweck zugelassen ist.

Anweisungen zum Installieren der Armaturen

Alle Anschlußstücke und Armaturenteile müssen mit der Gerätespezifikation übereinstimmen, und mit dem geplanten Einsatz des Instrumentes kompatibel sein. Der Einbau, insbesondere das Anziehen und Abdichten, muß gemäß den Anweisungen des Herstellers vorgenommen werden.

Verbindungen auf Undichtigkeiten prüfen!

Überprüfen Sie sorgfältig alle Verbindungen der Vakuumkomponenten auf undichte Stellen.

Gerät nur unter zulässigen Anschlußdrücken betreiben!

Betreiben Sie das Instrument niemals unter Drücken, die den maximal zulässigen Druck (siehe Produktspezifikationen) übersteigen.

Geeignete Berstscheibe installieren!

Wenn mit einer unter Druck stehenden Gasquelle gearbeitet wird, sollte eine geeignete Berstscheibe in das Vakuumsystem installiert werden, um eine Explosionsgefahr aufgrund von steigendem Systemdruck zu vermeiden.

Verunreinigungen im Gerät vermeiden!

Stellen Sie sicher, daß Verunreinigungen jeglicher Art weder vor dem Einsatz noch während des Betriebs in das Instrumenteninnere gelangen können. Staub- und Schmutzpartikel, Glassplitter oder Metallspäne können das Gerät dauerhaft beschädigen oder Prozeß und Meßwerte verfälschen.

Bei Geräten mit Temperaturkontrolle korrekte Anwärmzeit einhalten!

Temperaturkontrollierte Instrumente arbeiten nur dann gemäß ihrer Spezifikation, wenn genügend Zeit zum Erreichen und Stabilisieren der Betriebstemperatur eingeräumt wird. Kalibrierungen und Nulleinstellungen sollten daher nur nach Abschluß des Anwärmvorgangs durchgeführt werden.

Medidas de seguridad del transductor de presión

Símbolos usados en este manual de instrucciones

Definiciones de los mensajes de advertencia, precaución y de las notas usados en el manual.

Advertencia 

El símbolo de advertencia indica la posibilidad de que se produzcan daños personales. Pone de relieve un procedimiento, práctica, estado, etc. que en caso de no realizarse u observarse correctamente puede causar daños personales.

Precaución 

El símbolo de precaución indica la posibilidad de producir daños al equipo. Pone de relieve un procedimiento operativo, práctica, estado, etc. que en caso de no realizarse u observarse correctamente puede causar daños o la destrucción total o parcial del equipo.

Nota 

El símbolo de notas indica información de importancia. Este símbolo pone de relieve un procedimiento, práctica o condición cuyo conocimiento es esencial destacar.

Símbolos hallados en la unidad

La tabla siguiente contiene los símbolos que puede hallar en la unidad.

Definición de los símbolos hallados en la unidad			
Encendido (alimentación eléctrica) IEC 417, N° 5007	 Apagado (alimentación eléctrica) IEC 417, N° 5008	 Puesta a tierra IEC 417, N° 5017	 Protección a tierra IEC 417, N° 5019
 Caja o chasis IEC 417, N° 5020	 Equipotencialidad IEC 417, N° 5021	 Corriente continua IEC 417, N° 5031	 Corriente alterna IEC 417, N° 5032
 Corriente continua y alterna IEC 417, N° 5033-a	 Equipo de clase II IEC 417, N° 5172-a	 Corriente alterna trifásica IEC 617-2, N° 020206	
 Precaución. Consulte los documentos adjuntos ISO 3864, N° B.3.1	 Precaución. Riesgo de descarga eléctrica ISO 3864, N° B.3.6	 Precaución. Superficie caliente IEC 417, N° 5041	

Tabla 4: Definición de los símbolos hallados en la unidad

Procedimientos y precauciones de seguridad

Las precauciones generales de seguridad descritas a continuación deben observarse durante todas las etapas de funcionamiento del instrumento. La falta de cumplimiento de dichas precauciones o de las advertencias específicas a las que se hace referencia en el manual, constituye una violación de las normas de seguridad establecidas para el uso previsto del instrumento y podría anular la protección proporcionada por el equipo. Si el cliente no cumple dichas precauciones y advertencias, MKS Instruments, Inc. no asume responsabilidad legal alguna.

NO UTILICE PIEZAS NO ORIGINALES O MODIFIQUE EL INSTRUMENTO

No instale piezas que no sean originales ni modifique el instrumento sin autorización. Para asegurar el correcto funcionamiento de todos los dispositivos de seguridad, envíe el instrumento al Centro de servicio y calibración de MKS toda vez que sea necesario repararlo o efectuar tareas de mantenimiento.

LAS REPARACIONES DEBEN SER EFECTUADAS ÚNICAMENTE POR TÉCNICOS AUTORIZADOS

Los operarios no deben intentar reemplazar los componentes o realizar tareas de ajuste en el interior del instrumento. Las tareas de mantenimiento o reparación deben ser realizadas únicamente por personal autorizado.

TENGA CUIDADO CUANDO TRABAJE CON MATERIALES TÓXICOS

Cuando se utilicen materiales tóxicos, es responsabilidad de los operarios tomar las medidas de seguridad correspondientes, purgar totalmente el instrumento cuando sea necesario y comprobar que el material utilizado sea compatible con los materiales del instrumento e inclusive, con todos los materiales de sellado.

PURGUE EL INSTRUMENTO

Una vez instalada la unidad o antes de retirarla del sistema, purgue completamente la unidad con gas limpio y seco para eliminar todo resto de la sustancia líquida empleada anteriormente.

USE PROCEDIMIENTOS ADECUADOS PARA REALIZAR LA PURGA

El instrumento debe purgarse debajo de una campana de ventilación y deben utilizarse guantes protectores.

NO HAGA FUNCIONAR EL INSTRUMENTO EN AMBIENTES CON RIESGO DE EXPLOSIÓN

Para evitar que se produzcan explosiones, no haga funcionar este instrumento en un ambiente con riesgo de explosiones, excepto cuando el mismo haya sido certificado específicamente para tal uso.

USE ACCESORIOS ADECUADOS Y REALICE CORRECTAMENTE LOS PROCEDIMIENTOS DE AJUSTE

Todos los accesorios del instrumento deben cumplir las especificaciones del mismo y ser compatibles con el uso que se debe dar al instrumento. Arme y ajuste los accesorios de acuerdo con las instrucciones del fabricante.

COMPRUEBE QUE LAS CONEXIONES SEAN A PRUEBA DE FUGAS

Inspeccione cuidadosamente las conexiones de los componentes de vacío para comprobar que hayan sido instalados a prueba de fugas.

HAGA FUNCIONAR EL INSTRUMENTO CON PRESIONES DE ENTRADA SEGURAS

No haga funcionar nunca el instrumento con presiones superiores a la máxima presión nominal (en las especificaciones del instrumento hallará la presión máxima permitida).

INSTALE UNA CÁPSULA DE SEGURIDAD ADECUADA

Cuando el instrumento funcione con una fuente de gas presurizado, instale una cápsula de seguridad adecuada en el sistema de vacío para evitar que se produzcan explosiones cuando suba la presión del sistema.

MANTENGA LA UNIDAD LIBRE DE CONTAMINANTES

No permita el ingreso de contaminantes en la unidad antes o durante su uso. Los productos contaminantes tales como polvo, suciedad, pelusa, lascas de vidrio o virutas de metal pueden dañar irreparablemente la unidad o contaminar el proceso.

CALIENTE ADECUADAMENTE LAS UNIDADES CONTROLADAS POR MEDIO DE TEMPERATURA

Las unidades controladas por medio de temperatura funcionarán de acuerdo con las especificaciones sólo cuando se las caliente durante el tiempo suficiente para permitir que lleguen y se estabilicen a la temperatura de operación indicada. No calibre la unidad y no la ponga en cero hasta que finalice el procedimiento de calentamiento.

Chapter One: General Information

Introduction

Note Some Baratron® products may not be exported to many end user countries without both US and local government export licenses under ECCN 2B230.

The MKS Baratron® Type 221B Differential Pressure Transducer consists of three elements: the signal conditioner, cable, and sensor. The system is shipped fully connected and requires only the addition of an external power supply and the appropriate readout device.

The transducer consists of a tensioned Inconel® diaphragm on one side of which is placed a dual electrode; that is, a single-sided system usable when process contamination is possible.

The electronics (signal conditioning measuring circuits, and so forth) is contained in a flange-mounted aluminum box on the opposite end of the transducer cable. An electrical connector with a mate is provided to make all input power and output signal connections.

The Type 221B transducer meets the electromagnetic testing required for the European CE directive when used with an overall metal braided shielded cable, properly grounded at both ends.

How This Manual is Organized

This manual is designed to provide instructions on how to set up, install, and operate a Type 221 unit.

Before installing your Type 221 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*, states how to mount the instrument in your system.

Chapter Three, *Overview*, describes the instrument and its functionality.

Chapter Four, *Operation,* explains how to use the instrument and describes the functions and features.

Chapter Five, *Maintenance*, describes repair and return policies for the 221 transducer.

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

Appendix B, *Model Code Explanation*, describes the instrument's ordering 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 221 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 RMA (Return Material Authorization) number from the MKS Calibration and Service Center before shipping. The RMA 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 221 Unit

MKS has carefully packed the Type 221 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 RMA (Return Material 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 221 Sensor Unit
- Type 221 Signal Conditioner Unit
- Type 221 Instruction Manual (this book)
- Cable to connect sensor to pre-amp

Optional Equipment:

- Electrical Connector Accessories Kit, 221B-K1 (includes a mating connector for the 14-pin Amp connector)
- External power supply and readout unit
- Interface Cables (refer to Table 5, page 20)

Interface Cables

As of July 20, 2009, most products shipped to the European Community must comply with the EMC Directive 2004/108/EC, 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/EC and Low Voltage Directive 73/23/EC, 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 2004/108/EC, 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/EC and 73/23/EC.

Note

1. An overall metal braided, shielded cable, properly grounded at both ends, is required during use to meet CE specifications.
2. To order an overall metal braided shielded cable, add an "S" after the cable type designation. For example, to order a standard connection cable for the Type 221 transducer, use part number CB-112-14-10; for a braided shielded cable, use part number CB-112S-14-10.

Interface Cables		
To Connect the 221B Unit to ...	**Use the MKS Cable ...**	
	Standard	**Shielded**
PDR-C-1C/2C	CB-472-1-XX	CB-472S-1-XX
651, 652, 660	CB-112-14-XX	CB-112S-14-XX
PAR	CB221	CB221S
XX indicates the cable length, in feet; standard length is 10 ft		

Table 5: Interface Cables

Figure 1, page 21, lists the cables to use to connect the 221 unit to an external power supply and readout unit.

Replacement Cables	
Description	**Part Number**
8 ft. length sensor to pre-amp	105434-G1
9 ft to 20 ft. length sensor to pre-amp	CA-105434-SPCB
Consult factory for lengths longer than 20 ft.	

Table 6: Replacement Cables

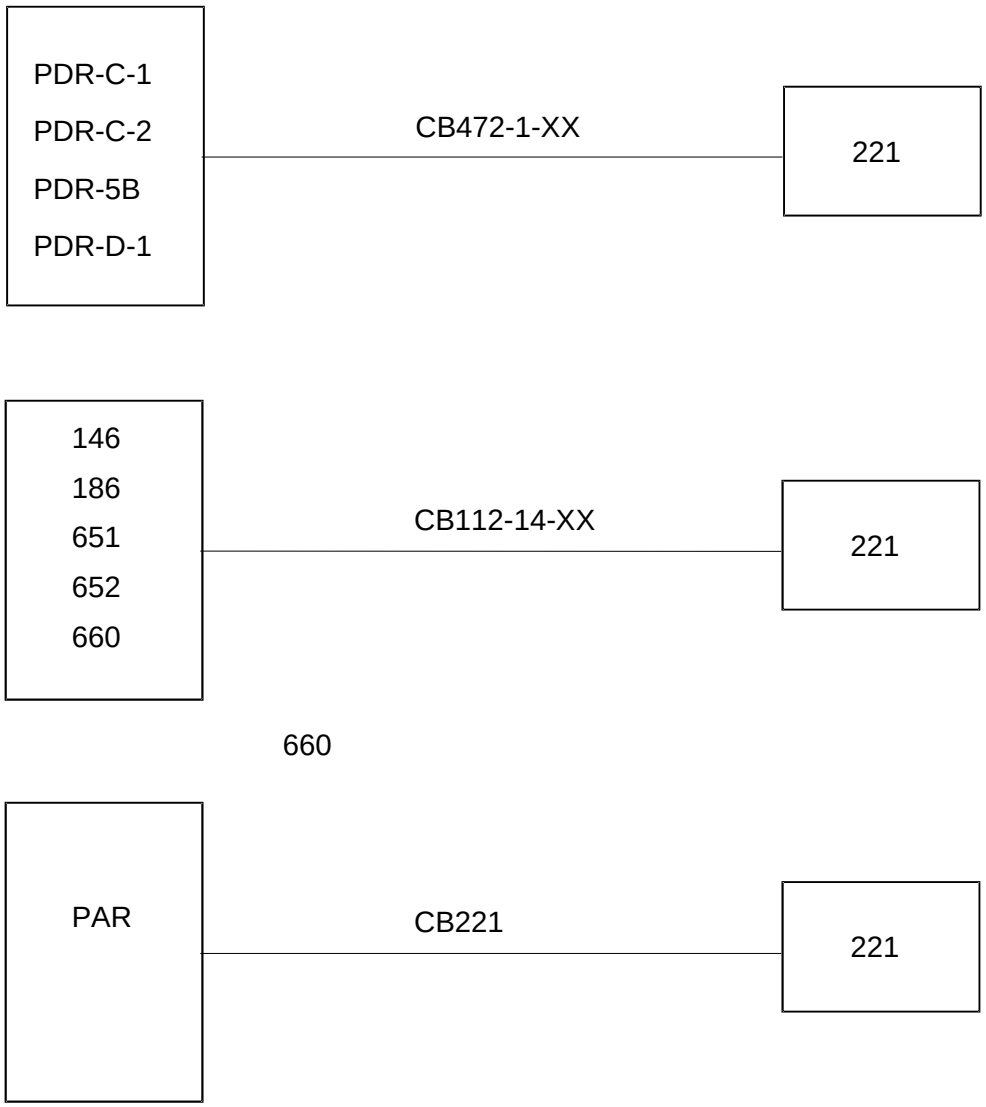

Figure 1: Interface Cables for the Type 221 Transducer

Generic Shielded Cable Guidelines

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 2 and 3 on page 23. (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).
   E. That some cables 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)

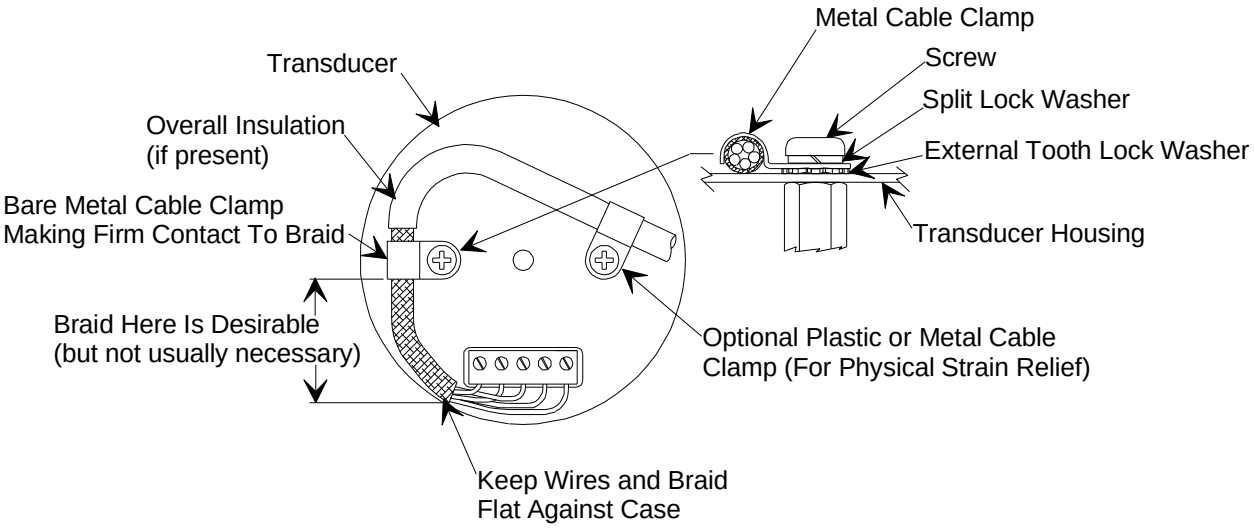

Figure 2: Preferred Method to Connect an Overall Metal Braided Shielded Cable

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

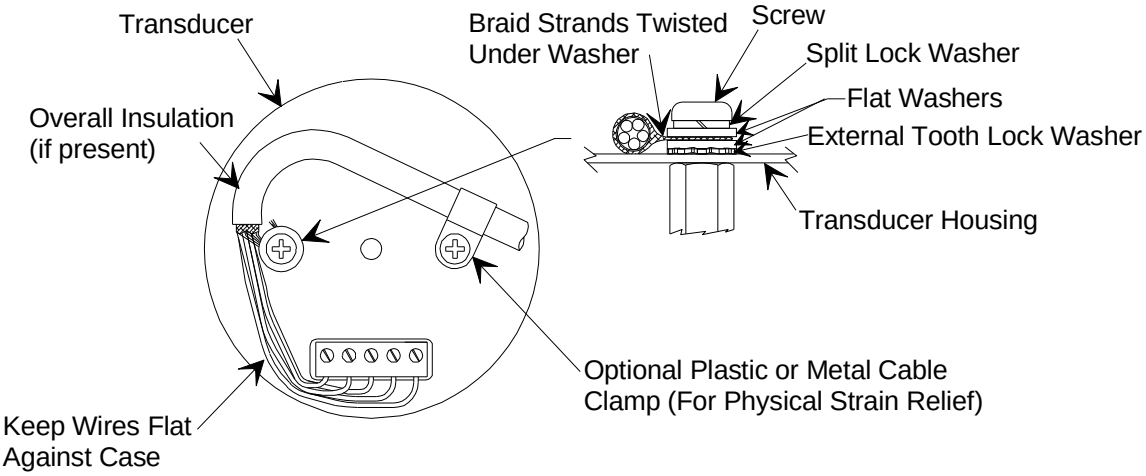

Figure 3: Alternate Method to Connect an Overall Metal Braided Shielded Cable
Use this method when cable clamp is not available

Product Location and Requirements

Operating Requirements

- Ambient Operating Temperature:

  Sensor and cable: 0° C to 150° C (32° F to 302° F)

  Pre-amplifier: 0° C to 50° C (32° F to 122° F)
- Input Power: ±15 VDC @ 35 mA, regulated ±2%

Setup

Dimensions

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

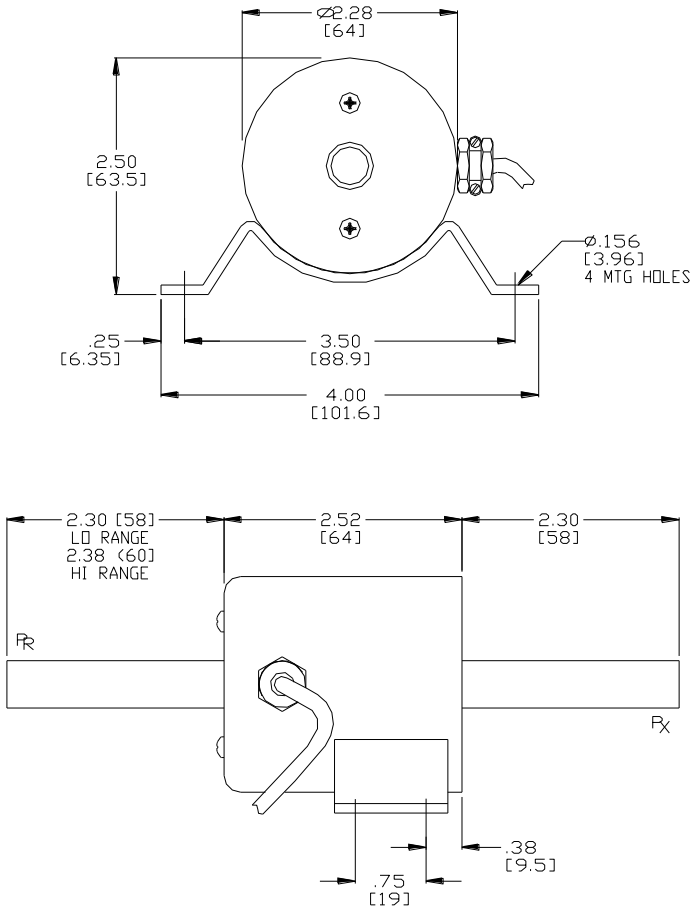

Figure 4: Type 221 Outline Drawing

Mounting

The transducer should be mounted with the pressure port in the horizontal position, as shown in Figure 5.

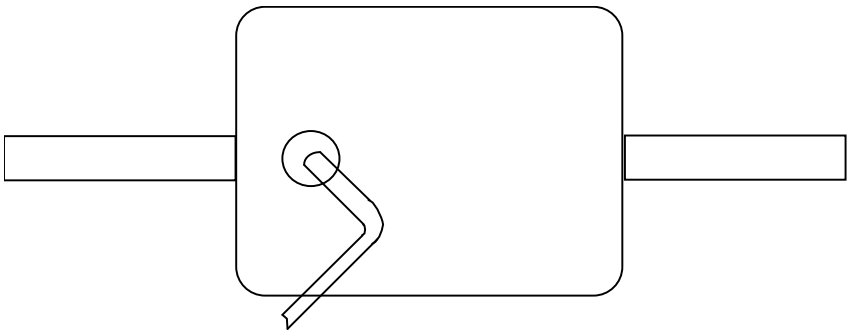

Figure 5: Mounting The Type 221 Transducer

Electrical Information

The external power supply must be capable of supplying ±15 Volts, ±2%, at 30 mA minimum. Noise and ripple should be less than 20 mV peak-to-peak. The external readout may be any device capable of reading the full scale output of the 221B, which is ±10 Volts into a load of 10K ohms or greater.

Connector

The operation consists of connecting the external power supply and readout to the sensor through the connector supplied in the Electrical Connector Accessories Kit, 221B-K1 or an equivalent a mating connector for the 14-pin Amp connector and applying electrical power. The connections are as follows:

Connector Pinout	
Pin Number	**Description**
1	Chassis Ground
2	DC Common
3	No Connection
4	No Connection
5	+15 Volt Input
6	-15 Volt Input
7	DC Output Signal
8	Chassis Ground
9	DC Common
10 through 14	No Connection

Table 7: Connector Pinout

Note 

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

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Chapter Three: Overview

General Information

In the single-sided sensor, the dual electrode is excited by secondary of the transformer Tl. With zero differential pressure across the diaphragm, the signal at the center tap is at AC ground. As deflection takes place, the center tap potential goes positive as the capacity of the center electrode increases more than that of the outside electrode. This output is amplified by the signal amplifiers which correct for linearity and provide a zero adjustment.

Excitation Oscillator

The 10 kHz oscillator is of the Wein Bridge type. The frequency of operation is determined by C3, C4 and R10, R11. The Wein Bridge is used as a feedback element around amplifier U3 and produces the excitation which is coupled through C5 and R12 to drive the bridge transformer and the demodulation input.

The oscillator produces a high purity sine wave which is amplitude stabilized by Q2. This FET amplifier controls the gain of the amplifier U3. Q2 in turn is controlled by amplifier Q1 which monitors the oscillator output via a peak detector. The output from the peak detector is balanced against a temperature stabilized reference created by VRI and associated resistors. This combination produces an input to Q1 which controls the amplitude by varying the “resistance” of Q2. Adjustment of the amplitude over a limited range is provided by R3.

Signal Amplifiers

The first stage is a preamplifier which provides a high impedance input to the transducer and a lower impedance driving signal to the second stage amplifiers to reduce the possibilities of unwanted pick-up. The second stage amplifiers receive the signal from the first stage, provide linearity adjustment and zero control and then feed the output into the demodulator transformer T1.

Demodulator

The demodulator is a synchronous type which is referenced to the excitation oscillator. This blocks out all frequencies except the desired one.

U2 is a high-speed comparator which provides a fast rising amplitude square wave that is synchronized to the zero crossing of the oscillator waveform.

The output from this comparator is fed, via C12 and C13, to the gates of Q3 and Q4. These switches alternately ground the ends of T2 providing a rectified signal to the DC amplifier.

Output DC Amplifier

The final low impedance DC output signal is derived from U1 which operates as a DC filter to smooth the ripple from the demodulator. The gain of this stage is set in final calibration by selection of R32 while a smaller adjustment is provided by R34.

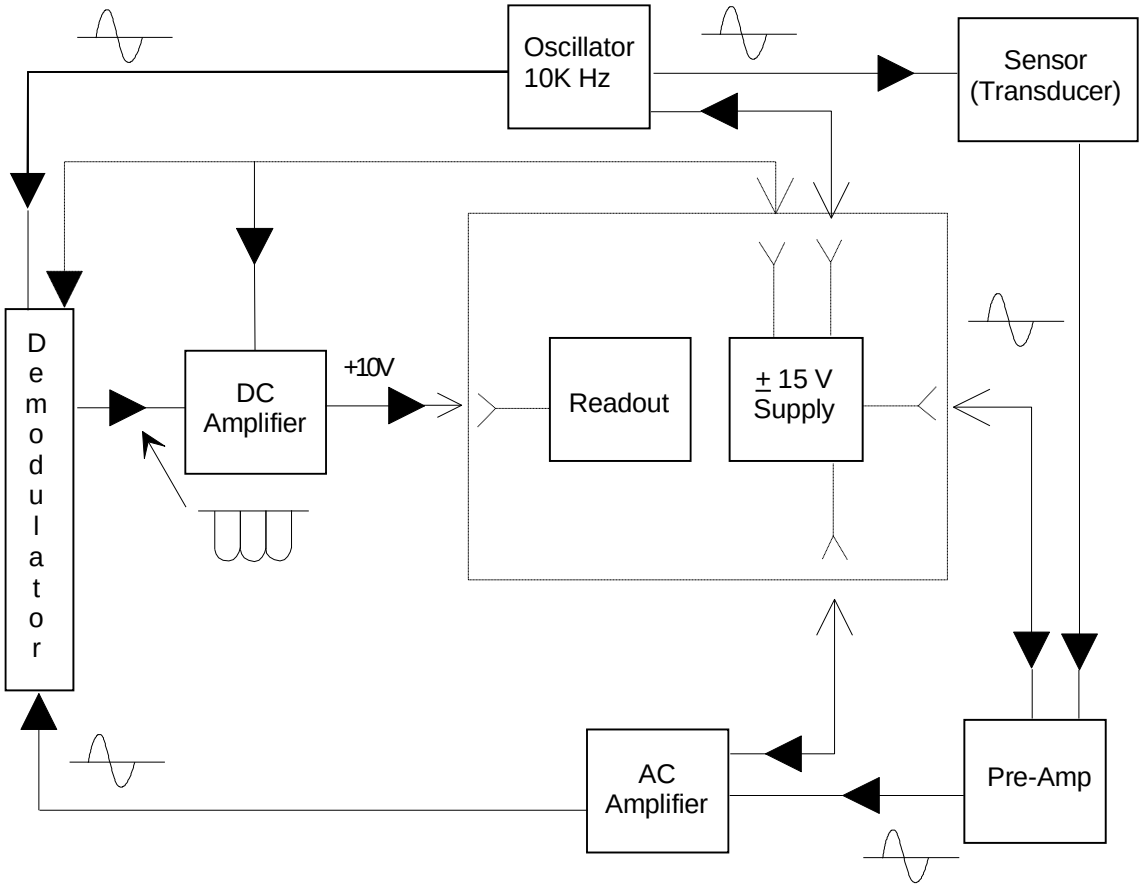

Figure 6: Type 221 Block Diagram

Labels

Serial Number Label

The serial number label lists the serial number and the model number of the unit. The CE symbol designates compliance with the European CE directive.

Figure 7: Serial Number Label

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Chapter Four: Operation

How to Adjust the Zero

All capacitance manometers require initial and periodic zero adjustments be made at a pressure lower than their minimum resolution in order to ensure 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.

Note 

Adjust the zero setting initially after installing the 221 transducer and periodically thereafter.

1. Pump the system to a pressure below the resolution of the 221 transducer.

   Refer to Table 8 for the recommended pressure values.

Suggested Pressure For Zero Adjustment	
Full Scale Range (Torr)	**Highest Base Pressure for Proper Zero Adjust (Torr)**
10	1.0×10^{-3}
100	1.0×10^{-2}
1000	1.0×10^{-1}
5000	5.0×10^{-1}
10000	1.0×10^{0}
15000	1.5×10^{0}
20000	2.0×10^{0}
25000	2.5×10^{0}

Table 8: Suggested Pressure For Zero Adjustment

Note 

A transducer with a full scale values below atmospheric pressure will produce an overranged output unless they are connected to a vacuum system and pumped down.

2. Set the ZERO potentiometer for an output of 0 Volts (display reads "0000").

   Refer to Figure 4, page 25, for the location of the ZERO potentiometer.

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.

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.

Lowest Suggested Pressures for Reading and Control		
Full Scale Range (Torr)	**Lowest Suggested Pressure Reading (Torr)**	**Lowest Suggested Pressure Control (Torr)**
10	3.0×10^{-3}	5×10^{-2}
100	3.0×10^{-2}	5.0×10^{-1}
1000	3.0×10^{-1}	5.0×10^{0}
5000	1.5×10^{0}	2.5×10^{1}
10000	3.0×10^{0}	5.0×10^{1}
15000	4.5×10^{0}	7.5×10^{1}
20000	6.0×10^{0}	1.0×10^{2}
25000	7.5×10^{0}	1.25×10^{2}

Table 9: Lowest Suggested Pressures for Reading and Control

Chapter Five: Maintenance

General Information

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

How To Clean the Unit

Periodically wipe down the unit with a damp cloth.

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

Caution 

Only qualified individuals should perform maintenance. They must comply with all the necessary ESD and handling precautions while installing and adjusting the instrument. Proper handling is essential when working with all highly sensitive precision electronic instruments.

MKS recommends that you do ***not*** attempt to clean the sensor.

Appendix A: Product Specifications

Electrical Specifications

CE Compliance Electromagnetic Compatibility[1]	 EMC Directive 2004/108/EC
Input Power Required	±15 VDC @ 35 mA, regulated ±2%
Output Signal	0 to 10 VDC into ≥ 10K ohm

Performance Specifications

Accuracy [2]	± 0.5% of Reading ± temperature coefficients
Full Scale Ranges	10, 100, 1000, 5000, 10000, 15000, 20000, 25000 Torr
Materials Exposed to Gases Px Pr	 Inconel® Inconel, stainless steel, ceramic, palladium, glass
Overpressure Limit[3]	120% of F.S. or 20 psi (140 kPa), whichever is greater
Resolution	0.01% F.S.
Temperature Coefficients Zero Span	 ± 0.02 % F.S./° C ± 0.04% Reading/° C
Volume P_X Pr	 7.9 cc 19.0 cc

Physical Specifications

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

[2] Includes non-linearity, hysteresis, and non-repeatability.

[3] For full scale ranges < 1000 Torr, the following restriction apply: if high pressure is on the Px side of the sensor, the maximum overpressure allowable is 120% F.S. or 20 psi, whichever is greater; if high pressure is on the Pr side of the sensor, the maximum overpressure allowable is 120% F.S. (Consult factory for higher Pr overpressure protection.)

Fittings	
Standard	½" (12.7 mm) tubulation ≤ 1000T Swagelok® 8-VCR® only on 5K and higher ranges
Optional	NW-16-KF, Swagelok 8-VCR, 1.33 inch (33.7 mm) O.D. Conflat®

Environmental Specifications

Ambient Operating Temperature Range	
Sensor and cable	0° to 150° C (32° to 302° F)
Pre-amplifier	0° to 50° C (32° to 122° F)

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

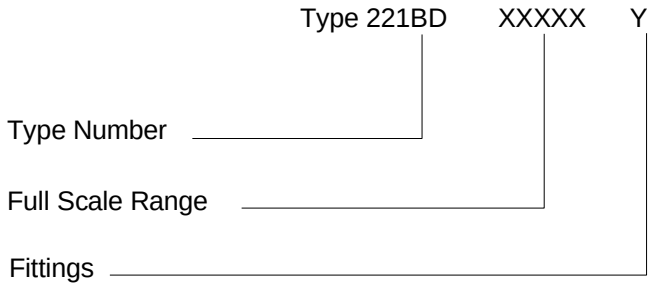
Appendix B: Model Code Explanation

Model Code

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

221BD-XXXXXY

where:



Type Number (221BD)

This designates the model number of the instrument; a 221 differential transducer.

Full Scale Range (XXXXX)

The full scale range is indicated by a two digit / one letter code.

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

Fittings (YY)

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

Fittings	Ordering Code
½" Diameter Tubulation (10, 100 and 1000 Torr units only)	A
Swagelok® 8-VCR® Female	B
1.33 inch (33.7 mm) O.D. Conflat®, rotatable	C
NW16-KF (ranges < 5000 Torr only)	D

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