

MKS Baratron®
Type AA02A
Absolute Pressure Transducer
With Process Relay Option

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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 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			
  IEC 417, No.5008	 Off (Supply) IEC 417, No.5008	  IEC 417, No.501E	 Protective earth (ground) IEC 417, No.501E
  IEC 417, No.502	  IEC 417, No.502	  IEC 417, No.502	 Alternating current IEC 417, No.5032
 Both direct and alternating current IEC 417, No.5033-a	  IEC 417, No.5032	 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.

Sicherheitshinweise für den Druckmeßumformer

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 (Energie) IEC 417, No.5007	Aus (Energie) IEC 417, No.5008	Erdanschluß IEC 417, No.5017	Schutzleiteranschluß IEC 417, No.5019
			
Masseanschluß IEC 417, No.5020	Equipotential- anschluß IEC 417, No.5021	Gleichstrom IEC 417, No.5031	Wechselstrom IEC 417, No.5032
			
Gleich- oder Wechselstrom IEC 417, No.5033-a	Durchgängige doppelte oder verstärkte Isolierung IEC 417, No.5172-a	Dreileiter- Wechselstrom (Drehstrom) IEC 617-2, No.020206	
			
Warnung vor einer Gefahrenstelle (Achtung, Dokumen- tation beachten) ISO 3864, No.B.3.1	Warnung vor gefährlicher elektrischer Spannung ISO 3864, No.B.3.6	Höhere Temperatur an leicht zugänglichen Teilen IEC 417, No.5041	

Tabelle 2: Bedeutung der am Gerät angebrachten Symbole

Sicherheitsvorschriften und Vorsichtsmaßnahmen

Folgende allgemeine Sicherheitsvorschriften sind während allen Betriebsphasen dieses Gerätes zu befolgen. Eine Mißachtung der Sicherheitsvorschriften und sonstiger Warnhinweise in dieser Betriebsanleitung verletzt die für dieses Gerät 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 Gerät 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 Gerät, falls erforderlich, vollständig spülen, sowie sicherstellen, daß der Gefahrstoff die am Gerät verwendeten Materialien, insbesondere Dichtungen, nicht angreift.

Spülen des Gerätes mit Gas!

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

Anweisungen zum Spülen des Gerätes

Das Gerät darf nur unter einer Ablufthaube gespült 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 Gerätes 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 Gerät 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 Geräte 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.

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 triphase 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 3: 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 À 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.

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 AA02A Absolute Pressure Transducer is part of the MKS family of general purpose RoHS (Restriction of Hazardous Substances)-compliant pressure transducers designed to provide accurate, reliable, and repeatable pressure measurements in the range from 1K Torr to as low as 0.1 Torr Full Scale (FS). The instrument operates with ± 15 VDC ($\pm 5\%$) input or 24 VDC ($\pm 10\%$) and provides 0 to 10 VDC output linear with pressure. The AA02A transducer exposes only Inconel[®] to the process permitting use with corrosive or dirty gases and eliminating contamination of the process with transducer materials. Measurements are independent of gas composition and the unit has a minimum measuring range of four decades.

Using the latest single-sided, dual-electrode Inconel transducer design, coupled with a precision Capacitance to Digital Converter IC, these instruments are capable of withstanding high overpressure conditions (45 psia) with minimal or no shifts in output over their range. The advanced signal conditioning technology provides high accuracy and operation which is extremely temperature-stable at operating pressure.

Protection from RF interference and noisy electrical environments is increased by the use of a RFI resistant case, by internal design elements, and by the use of surge and ESD suppression networks and RFI filtering on all inputs and outputs. The AA02A unit meets the testing standards required for the European CE Mark when used with an overall metal braided shielded cable, properly grounded at both ends.

The AA02A transducer is designed specifically to meet the needs of vacuum process systems where environmental and process conditions are particularly demanding. The AA02A unit controls its temperature at 45° C (113° F), 80° C (176° F), or 100° C (212° F), thereby minimizing the effects of ambient or process temperature variations typically encountered in process line environments.

The AA02A transducer is available with a variety of fittings and two interface connector lock options. The unit is capable of measuring pressure at ambient temperatures of 15° to 40° C (59° to 104° F) for 45° Model or 15° to 50° C (59° to 122° F) for 80° and 100° C Models.

How This Manual is Organized

This manual is designed to provide instructions on how to set up, install, and operate a Type AA02A unit.

Before installing your Type AA02A 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 and Troubleshooting*, lists any maintenance required to keep the instrument in good working condition, and provides a checklist for reference should the instrument malfunction. A Trouble shooting Guide and a list of Frequently Asked Questions are also included in this section

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

Appendix B, *Model Code Explanation*, describes the model code used to order the instrument.

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 AA02A 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 Materials 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 AA02A Unit

MKS has carefully packed the Type AA02A 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.

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 AA02A Unit

Optional Equipment:

- Electrical Connector Accessories Kit:
AA02A-K1 (includes a mate for the I/O connector)
- Most MKS Power Supply/Readouts
- Most MKS Pressure, Flow, Flow Ratio, and Throttling Valve Controllers
- RM-6 Rack Mount Kit:
19" rack accommodates 1 or 2 readouts and/or controllers
- 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 cable to connect a AA02A unit to a 651 controller, use part number CB259-5-10; for a metal braided shielded cable use part number CB259S-5-10.

You can purchase interface cables to all MKS companion products from MKS (refer to Table 5) or optionally you can make cables that meet the appropriate specifications. For cables connecting to non-MKS products, MKS can provide normal shielding or braided shielded cable assemblies in a nominal 10' (3m) length, terminating in flying leads (pigtail) fashion at both ends.

Overall metal braided shielded cable assemblies, properly grounded at both ends, are recommended if the environment contains high EMI/RFI noise.

Interface Cables		
To Connect the AA02A Unit To...	Use the MKS Cable...	
	Standard	Shielded
PDR-C-1C/2C, PDR-5B Power Supply/Readouts (+/- 15 vdc option)	CB127-1-10	CB127S-1-10
146, 186, 651, 660, Controllers (+/- 15 vdc option)	CB259-5-10	CB259S-5-10
PDR2000AO		CB2000S-1-M1 (Two transducers) CB628S-3-10 (One transducer)
946		100007555

Table 5: Interface Cables

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

Product Location and Requirements

Ambient Operating Temperature

The acceptable ambient operating temperature range for the AA02A transducer is 15° to 40° C (59° to 104° F) for 45° C models, or 15° to 50° C (59° to 122° F) for 80° or 100° C models.

Power Requirements

The AA02A transducer requires an external power source with requirements as given below

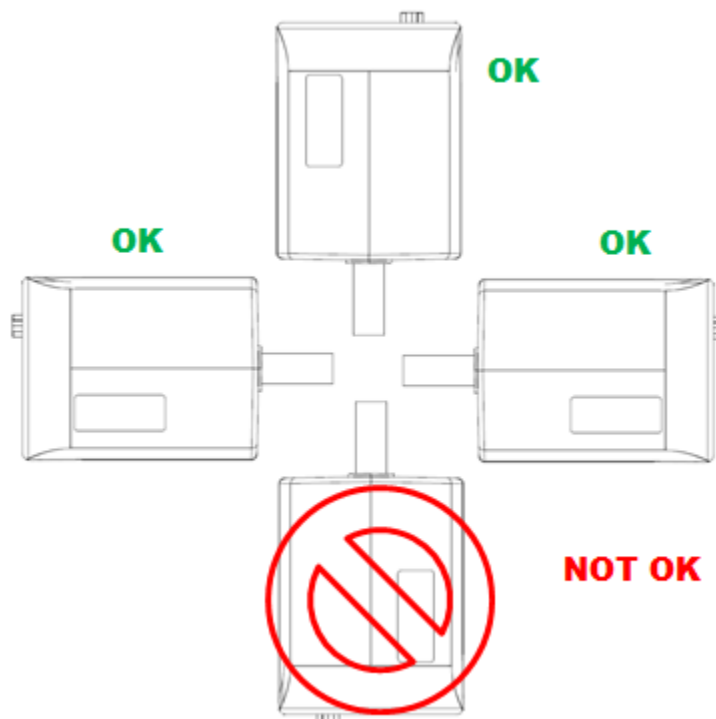
45°C Models ±15 VDC (±5%) at ≤ 400 mA, or +24 VDC (+/- 10%) at ≤ 500 mA.

80°C and 100°C Models ±15 VDC (±5%) at ≤ 600 mA, or +24 VDC (+/- 10%) at ≤ 700 mA.

Noise and ripple should be less than 20 mV peak-to-peak. You may use any readout device which has input capabilities of less than 0 to greater than 10 VDC, and impedance greater than 10K ohms. The power is introduced to the unit through the Interface connector on the top panel of the transducer (refer to Figure 5, page 32).

Mounting Orientation

The transducer and its sensor design can be mounted in any orientation without compromising accuracy or lifetime, but operation with its inlet port facing upwards is not recommended due to the possibility of contaminants falling into the port.



Zero Shift from Downward Orientation

The AA02A transducers with measurement ranges higher than 1 Torr require little or no zero adjustment if they are mounted horizontally on the customer's system. However, transmitters with ranges of 1 Torr and less require zero adjustment to compensate for the effects of gravity on the sensor diaphragm if they are mounted horizontally.

For example, for 0.1 Torr models, this shift represents up to 10% of the full-scale range, and thus is significant. Devices with this range should be mounted vertically as originally calibrated. If this mounting orientation is not possible, a correction factor must be applied to the transmitter's output to obtain the correct pressure.

Explosive Environments

The sensor is kept at a constant temperature of by the heater assembly. Its electrical circuits can draw up to 700 mA of current, which may exceed the self-ignition threshold for some gases and environments. You must always comply with your organization's safety policies and procedures when working in these environments.

Caution



Standard model configurations may not work in all applications. Please contact MKS Applications Engineering Department to provide the proper configurations based upon application need prior to ordering.

Setup

Dimensions

Note



All dimensions are listed in inches with millimeters referenced in parentheses. The tolerances are ± 0.1 inches (x.x) and ± 0.01 inches (X.XX).

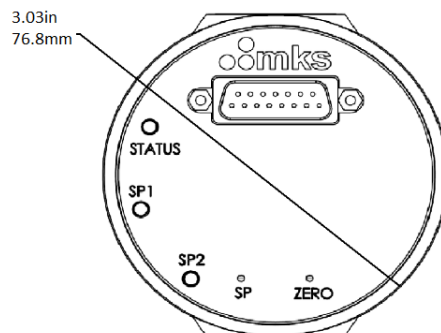
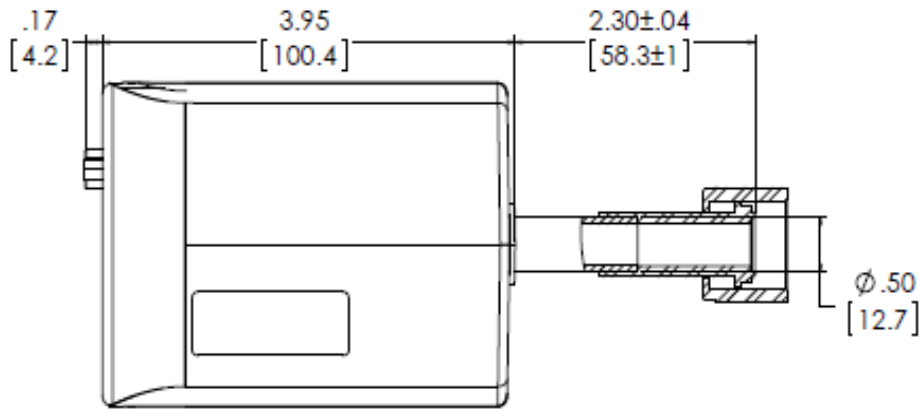
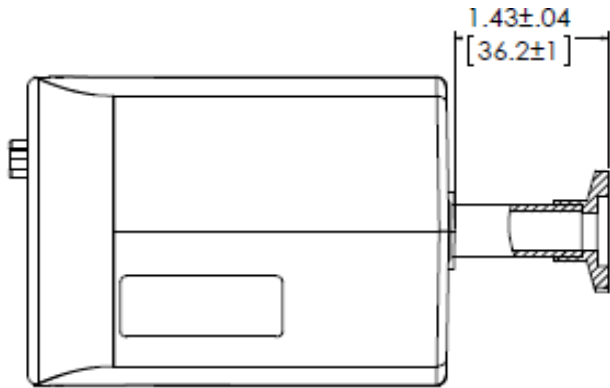


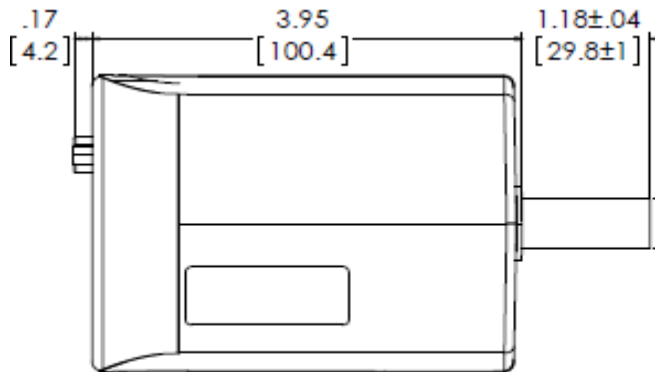
Figure 1: Top View Dimensions



FITTING CODE CE
8 VCR FEMALE.



FITTING CODE GA
NW-16-KF



FITTING CODE BA
STRAIGHT TUBE .50 O.D.

Figure 2: Side View Dimensions

Fittings

The AA02A transducer is available with the following fittings:

- ½" diameter (12.7 mm) tubulation
- Swagelok® 8-VCR® (female)
- Mini-CF (rotatable)
- NW16-KF
- NW25-KF
- Swagelok 8-VCO® (female)

Mounting Instructions

Mount the transducer with the inlet port pointing (vertically) downward. The transducer port will easily carry the weight of the transducer.

Although the unit can be mounted in any orientation, mounting it as suggested allows any foreign matter entering the pressure port to fall away from the diaphragm.

Isolate the unit from vibration as much as possible. When not subject to gas damping at low pressure, the diaphragm may become susceptible to resonance. The low range transducers (≤ 1 Torr) are very sensitive and you should isolate them from any vibration that exists. Remember to isolate the vibration through the cable as well as through the port.

Electrical Information

Interface Connector

The 15-pin male Type “D” Interface connector on the top of the unit (refer to Figure **Error! Bookmark not defined.**, page 32) provides access to the power input and relay connections. The pinouts are listed in Figure 3. The connector is available with either thread locks or slide locks.

Thread Locks

The 15-pin connector with thread locks utilizes threaded posts onto which the mating connector is mechanically fastened using screws. This is the standard MKS style Type “D” connector.

Slide Locks

The 15-pin connector with slide locks utilizes slotted posts onto which the mating connector is mechanically fastened using a slide mechanism which engages the slots in the posts.

Note



Standard MKS interface cables are not available for use with units configured with a slide lock connector.

The “Reserved” pin assignment refers to a pin with an internal connection that may be assigned a function in the future. The “No Connection” pin assignment refers to a pin with no internal connection.

15 Pin D-Sub Connector Pin Assignments

Interface Connector Pin Assignments	
Pin Number	15-pin D-Subminiature Connectors
1	Reserved
2	Pressure Signal Output
3	Reserved
4	SP1- NO
5	Power Return (Power Common)
6	-15 VDC
7	+15 VDC or +24V
8	SP1- RTN
9	SP2- NO
10	Reserved
11	SP2- RTN
12	Pressure Signal Output Return (Signal Common)
13	Reserved
14	Reserved
15	Chassis Ground

Table 6: Connector Pin Assignments

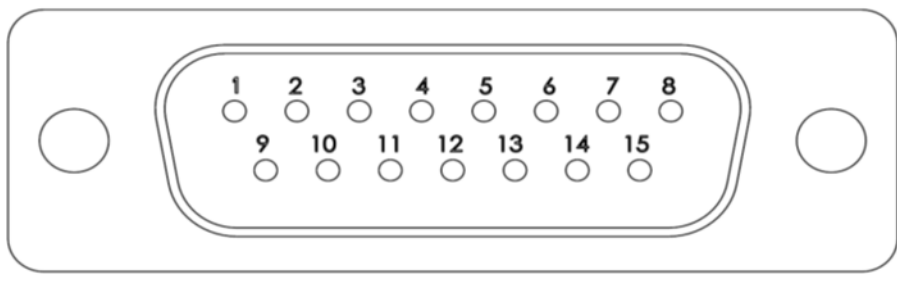


Figure 3: 15 pin D-subminiature connector

AA02A with Trip Points Electrical Connection

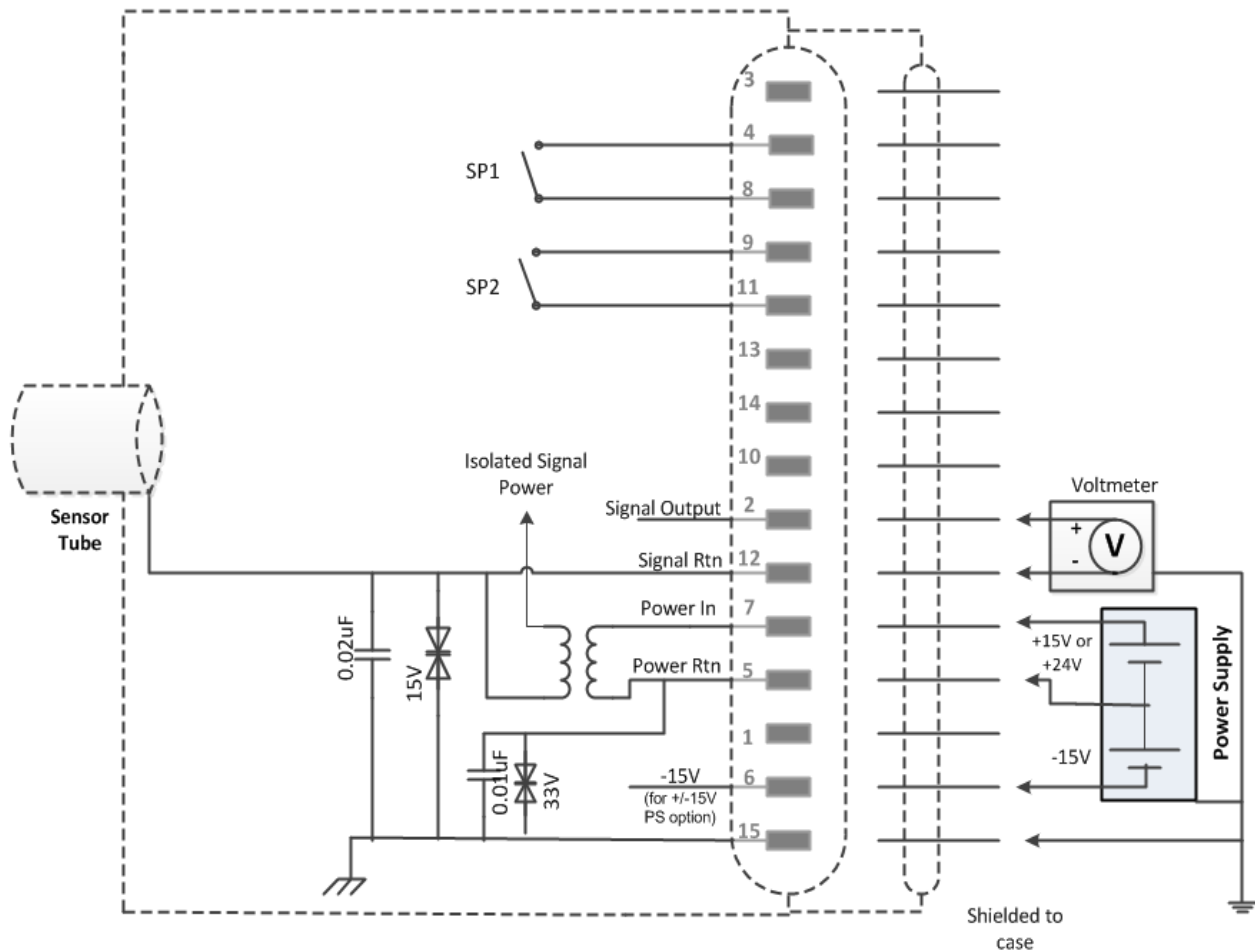


Figure: 4 Analog Electrical Connections with Set Points

Start Up

After installation, allow your transducer to warm up until it is stabilized, then check the transducer zero to verify the proper output. Refer to *How To Adjust the Zero*, page 37, for complete instructions on adjusting the zero controls on the AA02A unit. Warm Up Time

Allow sufficient time for your transducer to warm up. The warm up times for 23° C ambient temperature conditions are:

- 2 hours for ≥ 1 Torr units
- 3 hours for < 1 Torr units

Note

The transducer must be *fully stabilized* before you make any zero adjustments.

Chapter Three: Overview

General Information

A complete pressure transducer system requires three components to convert pressure to a linear DC voltage output: a sensor, signal conditioner, and power supply. The AA02A transducer contains two of the required components: the sensor and signal conditioner.

An MKS or MKS-compatible power supply is required to complete the pressure to DC voltage conversion. For a direct readout of the pressure measurement, a meter (analog or digital) is required.

Sensor

The AA02A transducer is a variable capacitance sensor consisting of a pressure inlet tube (port) connected to a small chamber in the transducer body. One wall of this chamber is an elastic metal diaphragm. The front side of the diaphragm is exposed to the gas whose pressure is to be measured. The back, or *reference*, side of the diaphragm faces a rigidly mounted ceramic disc containing two electrodes. The reference side is permanently evacuated (10^{-7} Torr) and its vacuum is maintained with a chemical getter system.

The diaphragm deflects with changing absolute pressure (force per unit area) independently of the gas type or composition of the measured gas. This deflection causes an imbalance of the sensor electrode capacitances since the distance to the diaphragm is now different for each electrode. The imbalance of capacitances is converted to a DC voltage using a capacitance-to-digital converter (CDC) that is contained inside a microprocessor. The CDC and the sensor capacitances are driven by a precision constant frequency oscillator. The resultant signal is then linearized, zeroed, and amplified via the signal conditioner electronics, to produce a precise 0 to 10 VDC signal scaled to the range of the transducer.

In the heated AA02A transducer, zero and span stability is further increased because the sensor and electronics are temperature controlled. This thermal enclosure reduces the effects of ambient temperature changes by a factor of at least 35 (that is a 35° C change in ambient temperature will produce less than a 1° C change inside the thermal housing).

Signal Conditioner/Electronics

The signal conditioner contains state-of-the-art, capacitance to digital converter integrated circuit that is very stable with ambient temperature changes. The output is a DC voltage which is linear with pressure. The transducer is then calibrated against a traceable reference standard to provide a 0 to 10 Volt DC output over the range of the transducer.

Instrument Components

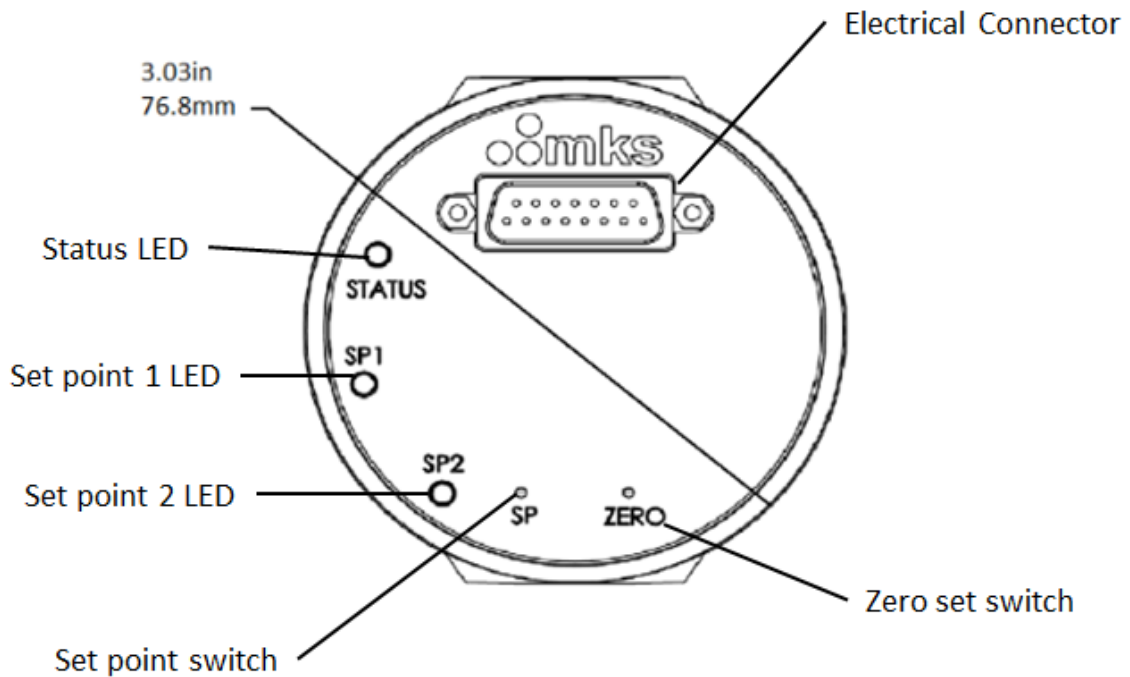


Figure 5: Top Panel Label View of the AA02A Transducer with Set Points

Push Button Zero Switch - ZERO

This push-button zero set switch adjusts the transducer zero. Refer to **Chapter Four: Operation** for more information.

LED Status Indicator

The green LED status indicator has the following stages:

- | | |
|------------------------|--|
| 1. No indication | Mains power not connected |
| 2. Slow blinking green | Pressure in range, warming up. |
| 3. Solid green | Normal operation, measurement mode |
| 4. Fast blinking green | Pressure out of range, pressure zero adjustment in progress. |
| 5. Solid Red | Processor faults |

Relay Set Point Adjustment Switch – SP

This push-button switch adjusts the set point levels. Please refer to **Chapter Four: Operation** for instructions on how to adjust setpoints.


Set point LED Status Indicator

Set point LEDs turn on green the desired set point pressure is reached

Interface Connector

The 15-pin male Type “D” Interface connector provides access to the power input, set point relay contacts and pressure signal pins. Refer to Figure 4 for wiring diagram.

Labels

Note  The figures showing the instrument labels are not drawn to scale.

Top Panel Labels

The label on the top panel of the AA02A unit identifies the ZERO potentiometer, the set point status lights (SP1 & SP2)

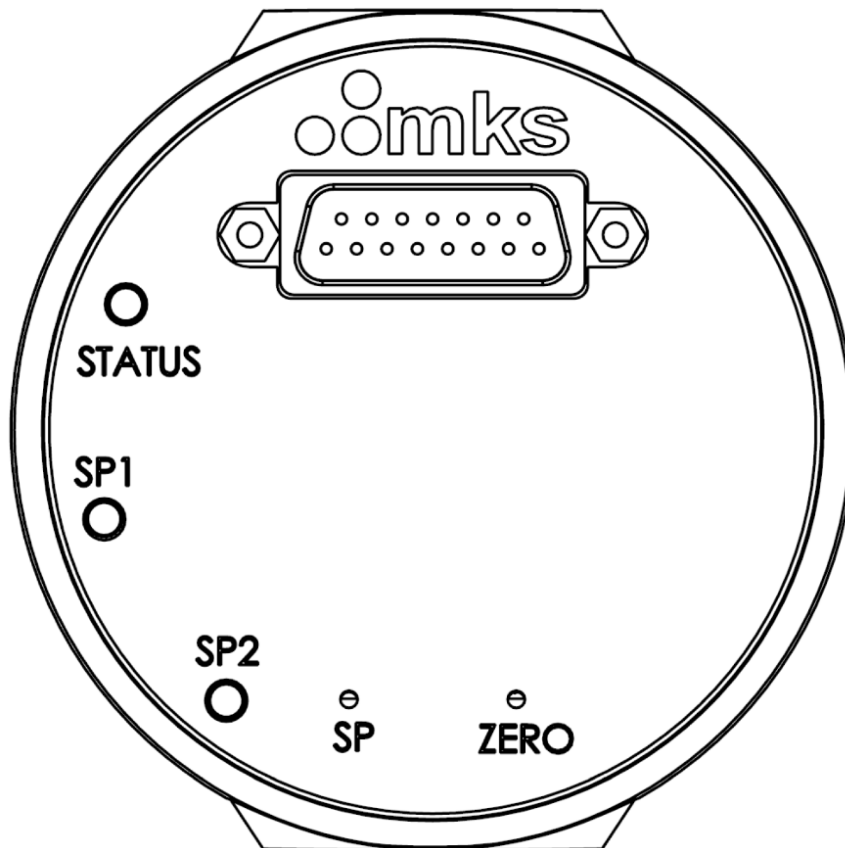


Figure 6: Top Panel Label for Units with the Set Point LEDs, the Status LED and the Zero Pot

Serial Number Label

The serial number label, located on the seam of the band label, lists the unit's serial number, model code, full scale range, input voltage, and output voltage. The label also displays the CE mark signifying compliance with the European CE regulations.



Figure 7: Serial Number Label

The options for your transducer are identified in the model code when you order the unit. Refer to *Appendix B: Model Code Explanation*, page 49, for more information.

Chapter Four: Operation

How To Adjust the Zero

Like all precision electromechanical measuring instruments, AA02A transducer requires periodic zeroing of its output to provide the best possible measurement accuracy. MKS Instruments recommends that the AA02A transducer be zeroed upon initial installation into the user's process system to compensate for any drift that may have occurred during transportation and installation. Subsequent zeroing frequency must be determined by the user according to each application, but in general, more frequent zeroing should be expected if the transmitter is frequently exposed to atmospheric pressure, or if it is used in an application where the best measurement repeatability is needed.

To zero the AA02A transducer, the vacuum system must be pumped down to its lowest achievable vacuum pressure, which ideally should be less than 0.01% of the transmitter's full-scale measurement range. The table below provides the recommended vacuum pressure needed for each available range.

Highest Pressures Suggested for Proper Zero Adjustment	
Full Scale Range (Torr)	Highest Pressure for Proper Zero Adjustment (Torr)
0.1	1×10^{-6}
1.0	1×10^{-5}
2.0	2×10^{-5}
10	1×10^{-4}
20	2×10^{-4}
100	1×10^{-3}
1000	1×10^{-2}

Table 7: Highest Pressures Suggested for Proper Zero Adjustment

Caution



Use care when activating the zero pushbutton. It can be easily damaged or even knocked off its mounting on the electronics by excessive force. If this occurs, the transmitter will not operate correctly.

Once the recommended zeroing pressure has been achieved, the zero pushbutton offers multiple adjustment modes depending on the customer requirements. The first mode is to set the transducer's output to zero. **Briefly** press the ZERO button with a small diameter rod such as the User switch adjustment tool provided. The transducer's output will shift to zero when this is done. The STATUS LED blinks until the adjustment is completed. However, if no action is taken within 8 seconds of entering this mode, the STATUS LED stops blinking and the transducer exits this mode.

To achieve the full dynamic range specified for the transducer, the zero adjustment *must* be made at a pressure less than the transducer's resolution (0.001% of FS). Low range transducers should be pumped for at least one hour after exposure to air to remove any moisture and to allow the pressure to stabilize. Zeroing a transducer above its stated minimum resolution creates a *zero offset* relative to true absolute pressure. All subsequent readings are then linear and accurate *relative to the offset value*.

Note


If available pressures are not sufficiently low to set the transducer zero, you may use a vacuum leak detector with sufficient vacuum pumping (to achieve proper zeroing pressures). In this case, mount the transducer on the leak detector *in the same plane of orientation as it will be during actual use*.

Zero Adjustment with RAMP Function

This function allows the user to adjust the zero to a known reference pressure within the measurement range of the transmitter. It also permits an offset of the calibration curve to either compensate for an offset in the system measurement capability, or to obtain a slightly positive zero for an analog/digital converter that requires 0 – 10 VDC input (i.e. controller does not accept negative input voltages). This offset cannot exceed 20% of the full-scale range, i.e. (+ 2.0 VDC). To use this function:

1. **Press and hold** the ZERO button with a User switch adjustment tool.
2. After 5 seconds, The STATUS LED starts blinking and the zero value (starting at the current output value) will increase continually until the button is released or the maximum permitted offset (maximum of 25% the transducer's full-scale range) is reached. To further increase the zero after releasing the ZERO button, **press and hold** the ZERO button within 3 seconds of the release of the button.
3. To decrease the zero, wait for 3 to 5 seconds after releasing the zero button and then **press and hold** the ZERO button until desired value is reached. To further decrease the zero after releasing the ZERO button, **press and hold** the ZERO button within 3 seconds after the release of the button.
4. To return to measurement mode, **release** the ZERO button for more than 5 seconds.

Set Point Relays

The transmitter includes two (2) set point relays that switch states depending on the actual measured pressure. They can be set at any pressure up to 99% of the transmitter's full-scale measurement range. The current set point settings can be read by a voltmeter after the set point button is pushed. If the pressure is lower than the set point, the corresponding LED (SP1 or SP2) is lit solid and the relay is energized. Note that each set relay has a hysteresis of 1% to avoid "chattering" during actual operation.

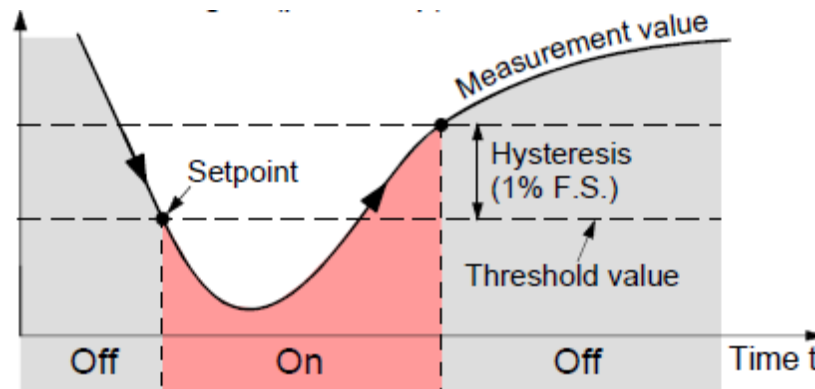


Figure 8: Relay action with changing pressure



If processes are controlled using the set point relays, remember that pushing the SP button will suppress the measurement signal and display the set point setting instead. This may cause a malfunction in the system. Only push the SP button if you are certain that no damages can occur from malfunctions.

Adjusting Setpoint 1 Value

Push the SP button once with a small-diameter tool. The transducer will output the current set point value for ~10 seconds. The SP1 LED will blink. **Push and hold** the ZERO button. The set point value output increases continually until the button is released or the maximum limit (100% of full-scale range) is reached. To further increase setpoint 1 value after releasing the ZERO button, **push and hold** the ZERO button for less than 3 seconds. To decrease set point 1 value, **push and hold** the ZERO button for between 3 and 5 seconds. To further decrease setpoint 1 value after releasing the ZERO button, **press and hold** the ZERO button for less than 3 seconds.

To return to measurement mode, **release** the ZERO button for more than 5 seconds.

Adjusting Setpoint 2 Value

Push the SP button **twice**. The SP2 LED will blink, indicating that this setpoint can now be adjusted.

The adjustment procedure is identical to that of setpoint 1.

Transducer Factory Default Reset

To reset all transducer parameters, remove mains power from the device. Then press and hold the ZERO pushbutton for at least 5 seconds while reconnecting the mains power to the transmitter. This will reset all parameters in the transmitter's memory back to the original default factory settings.

Suggested Pressures for Reading and Control

The lowest suggested pressures for reading and control with the AA02A transducer are listed in Table 7.

Lowest Suggested Pressures for Reading and Control		
Full Scale Range (Torr)	Lowest Suggested Pressure for Reading (Torr)	Lowest Suggested Pressure for Control (Torr)
0.1	5×10^{-5}	5×10^{-4}
1.0	5×10^{-4}	5×10^{-3}
2.0	1×10^{-3}	1×10^{-2}
10	5×10^{-3}	5×10^{-2}
20	1×10^{-2}	1×10^{-1}
100	5×10^{-2}	5×10^{-1}
1000	5×10^{-1}	5×10^0

Table 7: Lowest Suggested Pressures for Reading and Control

Lowest Suggested Pressure Available for Reading

The pressures listed in the middle column of Table 7 reflect reliable and practical pressures for different range transducers. Lower readings may be obtained in environments which have stable temperature and air flow.

Lowest Suggested Pressure to Use for Control

The pressures listed in the last column of Table 7 are for reference, and represent the pressure reading of the transducer at 50 mV signal output. A DC signal of at least 50 mV is the recommended minimum signal level to use when integrating any transducer into complex processing systems.

Chapter Five: Maintenance and Troubleshooting

General Information

If the AA02A transducer fails to operate properly upon receipt, check for shipping damage, and check the cables for correct continuity. Any damage should be reported to the carrier and MKS Instruments immediately.

If there is no obvious damage and the continuity is correct, check your instrument using the troubleshooting chart (refer to Table 8, page 47). If the transducer performance does not improve and it is necessary to return the unit to MKS for service, obtain an ERA Number (Equipment Return Authorization Number) from any MKS Calibration and Service center before shipping. Please refer to the inside back cover of this manual for a list of MKS Calibration and Service Centers.

Maintenance

In general, the AA02A transducer requires no maintenance other than proper installation and operation, and an occasional zero adjustment. Periodically, check for wear on the cables and inspect the enclosure for visible signs of damage.

Zero Adjustment

The transducer zero can be set (or reset) by pressing the ZERO push button the top panel of the unit (refer to Figure 5, page 32). Refer to *How To Adjust the Zero*, page 37, for complete instructions on how to adjust the transducer's zero controls.

Note



1. In production operations such as semiconductor manufacturing, verify the transducer zero (and adjust if necessary) each time the equipment is shut down for routine maintenance.
 2. The zero adjustments are the *only* adjustments that can be made in the field. Return the transducer to MKS Instruments for other adjustments, calibration, or servicing.
-

FAQ (Frequently Asked Questions)

Applications

Q: *Can the transducer be used with corrosive gases?*

A: The transducer uses nickel alloys exclusively in its sensor, and thus can operate in most corrosive environments, but users should expect drift and frequent zeroing in such applications due to chemical reaction byproducts. For the more aggressive Halogen compounds, the lines and gas should be kept as dry as possible.

Q: *When the transducer is pumped down and isolated by closing a valve, the pressure is rising. Is the transducer leaking?*

A: Not likely. When a confined space is evacuated and the pumping is stopped the pressure will rise because of outgassing, mainly from water vapor desorbing from the chamber walls. The pressure can easily rise to a few Torr over time. Keeping the sensor clean and under vacuum will help this issue. If it is critical to the application, MKS provides some product that are bakeable, and can be used at higher temperatures to help this issue.

Q: *When the transducer is leak-checked on a helium leak detector, the leak reading is building up slowly after approximately 30 seconds. Is the transducer leaking?*

A: No. The transducer's sensor is fully welded and has no leak path to atmospheric pressure. However, seals in the vacuum system typically use elastomers such as FKM, and consequently helium molecules can penetrate through the FKM and cause a slow increase of helium leak readout. If a leaking transducer is tested directly on a helium leak detector, the leak will be displayed almost instantly.

Q: *Can the transducer be mounted in any orientation?*

A: Yes. The transducer can be mounted in any orientation without compromising performance or calibration. However, it is recommended not to mount the transducer with the flange port facing upwards to avoid contamination, like particulates or liquids, from entering the device. Note that transducers with ranges of 1 Torr and below will need to be rezeroed if they are mounted horizontally. This is due to the effects of gravity on the sensor diaphragm.

Q: *Can the transducer withstand instant venting?*

A: Yes. The sensor element is extremely robust to mechanical forces and can withstand continuous pressure cycles and instant venting to atmospheric pressure. However, depending on the temperature of the ventilation, a shift in the transducer's output may occur due to either heating or cooling effects from the airflow.

Q: *Can the transducer withstand mechanical vibrations?*

A: Yes, but only for short periods of time. The transducer will not suffer damage from short-term exposure to mechanical vibrations, but depending on the frequency of the vibrations, there may be some variations in the output signal due to resonance of the diaphragm.

Q: *How many atmospheric pressure cycles can the transducer withstand?*

A: The sensor element has been tested to more than 5 million atmosphere-vacuum cycles without damage.

Q: *Can the transducer be used outdoors?*

A: The transducer is designed for a laboratory environment. The transducer's electronics are not sealed against entry of dust, rain, or snow, and therefore can be damaged by use outdoors unless placed inside an environmentally sealed box with controlled temperature conditions.

Analog output

Q: *What is the update rate of the analog output?*

A: For transducers with ranges ≥ 1 Torr (1.33 mbar), the analog output signal is updated approximately 25 times/second. For transducers with ranges < 1 Torr (1.33 mbar), the analog output signal is updated approximately 6 times/second.

Q: *What is the maximum length of analog output cable?*

A: The length of analog cable depends on cable quality and electrical noise environment, but a cable length up to 10 m (39 ft) does normally not require any special precautions other than the cable must be shielded.

Q: *The digital reading is correct, but the analog output reading has some deviation from actual pressure.*

A: Check that the analog out is connected to a floating input and not an input that is connected to ground. If connected analog out return is connected to ground the supply current will flow in the signal line and cause voltage drop and ground looping.

Calibration and adjustment

Q: *How often does the transducer require calibration or zero adjustment?*

A: MKS recommends that the transducer's calibration be checked against a known pressure reference approximately every 12 months. Usually a user will have a Quality system in place that may dictate the accuracy and verification of measurements. Zeroing frequency is highly dependent on the application, and users must determine this empirically. Generally, frequent exposure to atmospheric pressure and to corrosive or condensable gases will require more frequent zeroing. It is always good to log the zero values to develop a history on a given unit.

Q: *The system's vacuum pumps cannot achieve a base pressure below the transducer's resolution. How should the zero adjustment be used?*

A: When the vacuum pumps cannot reach a base pressure within the transducer's resolution, the user must note the actual base pressure achieved prior to zeroing the transducer. Then follow either of the two methods given below:

- Perform zeroing of the transducer via the pushbutton, and then use the ramp function method described under **Zero Adjustment with RAMP Function** on page 39 to reach the base pressure.

- Perform zeroing of the transducer via the pushbutton and then subtract the actual base pressure from all subsequent readings from the transducer.

Q: *How long is the warmup time before obtaining reliable measurements from the transducer?*

A: The transducer output is available within a few seconds of startup, but its published accuracy and performance specifications may not be met until it has been operating for 2 hours. Typically if you monitor the output measurement over time, it will eventually reach a point where it does not change more than a millivolt.

Q: *Will the transducer retain user calibration after power is shut off?*

A: Yes. All transducer parameters are stored internally in the electronics' non-volatile memory.

Service and repair

Q: *Can the sensor element be changed if contaminated?*

A: Yes, but only at authorized MKS Service Centers because a full calibration after replacement is necessary.

Q: *+24 VDC supply voltage has been connected to analog output +. Is the transducer damaged?*

A: Probably yes. The analog output is not protected against applying power to the output pin.

Q: *Reverse voltage has been connected to power supply input. Is the transducer damaged?*

A: Not likely. The transducer power supply circuit has reverse voltage and over voltage protection however, MKS cannot guarantee that the transducer will not be damaged.

Q: *Someone dropped the transducer on the floor. Will it still operate correctly on our system?*

A: Not likely. The transducer is a precision electromechanical measurement sensor, and the impact with the floor probably damaged its sensor permanently.

Troubleshooting

Troubleshooting Chart		
Symptom	Possible Cause	Solution
Overrange positive or negative signal	A shorted transducer or a damaged interconnect cable (transducer to electronics module).	Measure supply voltages at the connector. Inspect cable and transducer. Replace if necessary.
Measurement slowly goes positive over time	Overpressure and/or a build-up of contamination in the measurement cavity.	Return to MKS for servicing or transducer replacement.
Unstable zero output	The ambient temperature may be too high. <i>or</i> The ambient temperature is varying over a wide range.	Ensure the ambient temperature is within product requirements; refer to <i>Appendix A: Product Specifications</i> , page 47.
Zero pushbutton does not work	Pressure higher than 20% of full-scale measurement range. Electronics fault. Damage to zero pushbutton (user induced).	Reduce pressure to within zeroing range Return to MKS Return to MKS

Table 8: Troubleshooting Chart

Appendix A: Product Specifications

Electrical Specifications

CE Compliance Electromagnetic Compatibility ¹ Product Safety Requirements	EMC Directive 2004/108/EC Product Safety Directive 92/59/EC
RoHS (Restriction of Hazardous Substances) Compliance	Fully compliant with Directive 2011/65/EC
Input Power Required 45°C Models 80° and 100°C Models	± 15 VDC (± 5%)@ 0.4 amps (max) or +24 VDC ±10% @ 11 watts (max) ± 15 VDC (± 5%)@ 0.6 amps (max) or +24 VDC ±10% @ 22 watts (max)
Analog Signal Output	0 to 10 VDC into > 10kΩ% load

Environmental Specifications

Ambient Operating Temperature Range 45°C Models 80° and 100°C Models	15° to 40°C 15° to 50°C
Maximum External Case Temperature	50° C (122° F)
Storage Humidity Range	25 to 95% Relative Humidity, non-condensing
Storage Temperature Range	-20° to 80° C (-4° to 176° F)

Performance Specifications

Accuracy (non-linearity, hysteresis, and non-repeatability) 45°C Models 80° and 100°C Models	0.10% Rdg for 1-1000 Torr, 0.12% Rdg for < 1 Torr 0.20% Rdg for 1 – 1000 Torr, 0.40% Rdg for < 1 Torr
Internal Volume	6.3 cc
Leak Integrity	Internal to external <10 ⁻⁹ scc/sec He
Overpressure Limit Without Damage	45 psia (310 kPa)

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

Pressure Ranges (Torr FS)	0.1, 0.25, 1, 2, 10, 20, 100, 200, 500, 1000
Resolution	0.002% FS
Span Temperature Coefficients	0.02% Reading / °C
Time Constant	< 20 msec for ≥ 1 Torr; < 40msec for < 1 Torr
Warm Up Time (for 23° C ambient temperature conditions)	2 hours for 1 – 1000 Torr models; 3 hours for < 1 Torr version
Zero Temperature Coefficients 45° C Models 80° and 100° C Models	0.002% FS/°C for 1-1000Torr; 0.005% FS/°C for < 1 Torr 0.002% FS/°C for 1-1000Torr; 0.001% FS/°C for < 1 Torr

Physical Specifications

Fittings	½” Diameter (12.7 mm) tubulation, Swagelok® 8-VCR® (female), Mini-CF (rotatable), NW-16-KF, NW-25-KF, Swagelok 8-VCO® (female)
Internal Sensor Volume	6.3 cm ³
Weight	1.5 lbs (0.68 Kg)
Wetted Materials	Inconel® and Incoloy®. Some fittings may be built from 300-series stainless steel.

Output Relays

SPST contacts rated at 0.75 AMP @ 60 VDC or 60VAC @ 20°C (room ambient temp)

Electrical Connector

15-pin D-subminiature. All pin assignments are identical to legacy Baratron analog capacitance manometers for direct retrofit into existing systems.

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:

AA02A XX B CC D F G H JJ K L M N

where:

Type Number (AA02A)

This designates the model number of the instrument

AA02A

Full Scale Range (XX)

The full scale range is in torr and is indicated by a two digit/ one letter code

Full Scale Range – Torr

Ordering Code

0.1	.1
0.25	RE
1	01
2	02
10	11
20	21
100	12
200	22
500	52
1000	13

Units of Measure(B)

Torr absolute	T
Mbar absolute	M
kPA absolute	K

Fittings(CC)

Nine types of fittings are available, designated by a two letter code

1/2in OD tube	BA
4 female VCR (ranges > 2 torr only & only with V type sensor)	CD
8 female VCR	CE
8 male VCR	CF
KF16	GA
KF25	GC
8 female VCO	DA
1.33" OD CF	HA
2.75" OD CF	HC

Sensor Type and Inlet Tube Length(D)

Standard Sensor, standard inlet tube length	S
Standard Sensor, reduced inlet tube length	T
Etch Sensor (ranges ≤ 100 Torr), reduced inlet tube length	H
¼" diameter tube (CD fitting only)	V

	<u>Ordering Code</u>
Input Voltage(F)	
± 15 VDC	4
+ 24VDC	3
Sensor Temperature(G)	
100°C	1
80°C	8
45°C	4
Electrical Connector(H)	
15 pin D-subminiature, thread locks	B
15 pin D-subminiature, slide locks	P
Set Points(JJ)	
None	00
Trip A above 50%, Trip B above 50% of FS Range	AA
Trip A above 50%, Trip B below 50% of FS Range	AB
Trip A below 50%, Trip B below 50% of FS Range	BB
Trip A below 50%, Trip B above 50% of FS Range	BA
Trip A above 50%, Trip B below 95% of FS Range	02
Trip A below 50%, Trip B below 95% of FS Range	03
Trip A below 73%, Trip B above 50% of FS Range	04
Trip A below 10%, Trip B above 50% of FS Range	05
Trip A above 65%, Trip B above 76% of FS Range	06
Reserved(K)	0
Calibration(L)	
Standard (all ranges ≥ 1 Torr)	0
Vertical (ranges < 1 Torr only)	V
Horizontal (ranges < 1 Torr only)	H
Accuracy(M)	
Standard Accuracy	0
Reserved(N)	0

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