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REV 00K, 11/16

MKS Type 120A Baratron®
High Accuracy
Pressure Transducer

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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.

Table 1: 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	3~ 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	

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.

Tabelle 2: 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	Aquipotential-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	3~ Dreileiter-Wechselstrom (Drehstrom) IEC 617-2, No.020206	

Warnung vor einer Gefahrenstelle (Achtung, Dokumentation 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

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.

Tableau 3: 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	3~ 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	

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.

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.

Tabla 4: 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	3 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	

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 Type 120A MKS Baratron® Vacuum Gauge is a capacitance manometer designed to provide accurate, reliable, and repeatable pressure measurements in the range from 25000 Torr (25000 mmHg) to less than 10^{-5} Torr. The 120A transducer is the result of over fifty years experience with capacitance manometers and is the most accurate stand-alone Baratron transducer available. Designed for the increasing demands of process technology, the 120A transducer provides improved accuracy, lower temperature coefficients, and an additional decade of usable measurement range over previously available process transducers. The 120A transducer combines the proven MKS high-accuracy sensor combined with power and signal conditioning electronics (oscillator, demodulator, amplifier, and remote zero circuitry), within a single, chemically inert, injection molded, high impact, RFI shielded enclosure.

The 120A transducer yields a linear, high level DC output signal of 0 to 10 Volts which can be read directly by a DVM, data acquisition system, MKS readout/power supply instruments, or used with MKS controllers for accurate pressure control. Standard features include a remotely-activated range turndown capability (to provide full scale output of 0 to 10 Volts for 100% or 10% of sensor range), remotely-activated zeroing capability, and a DC output signal which is isolated from input power and chassis ground.

The 120A transducer controls the sensor temperature at 45° C which minimizes effects of ambient or process temperature variations typically encountered in process environments. RFI shielding is standard, to prevent interference from RF or noisy electrical environments. Power requirements are industry standard ±15 VDC (with power supply common not connected) or 24 to 30 VDC. Full scale ranges of 1 to 25000 mmHg absolute and differential are available using a rugged all-welded sensor. Its single-sided, dual electrode design results in superior corrosion resistance with only Inconel® and stainless steel exposed to the process gas.

How This Manual is Organized

This manual is designed to provide instructions on how to set up, install, and operate a Type 120A unit.

Before installing your Type 120A unit in a system and/or operating it, carefully read and familiarize yourself with all precautionary notes in the *Safety Messages and Procedures* section at the front of this manual. In addition, observe and obey all WARNING and CAUTION notes provided throughout the manual.

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

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

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

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

Chapter Five: Maintenance and Troubleshooting, describes how to troubleshoot a problem should the 120A transducer malfunction.

Appendix A: Product Specifications, lists the specifications of 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 120A 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 120A Unit

MKS has carefully packed the Type 120A unit so that it will reach you in perfect operating order. Upon receiving the unit, however, you should check for defects, cracks, broken connectors, etc., to be certain that damage has not occurred during shipment.

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

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

Unpacking Checklist

Standard Equipment:

- Type 120A Unit
- Type 120A Instruction Manual (this book)

Optional Equipment:

- Electrical Connector Accessories Kit - 120AA-K1

Dimensions

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

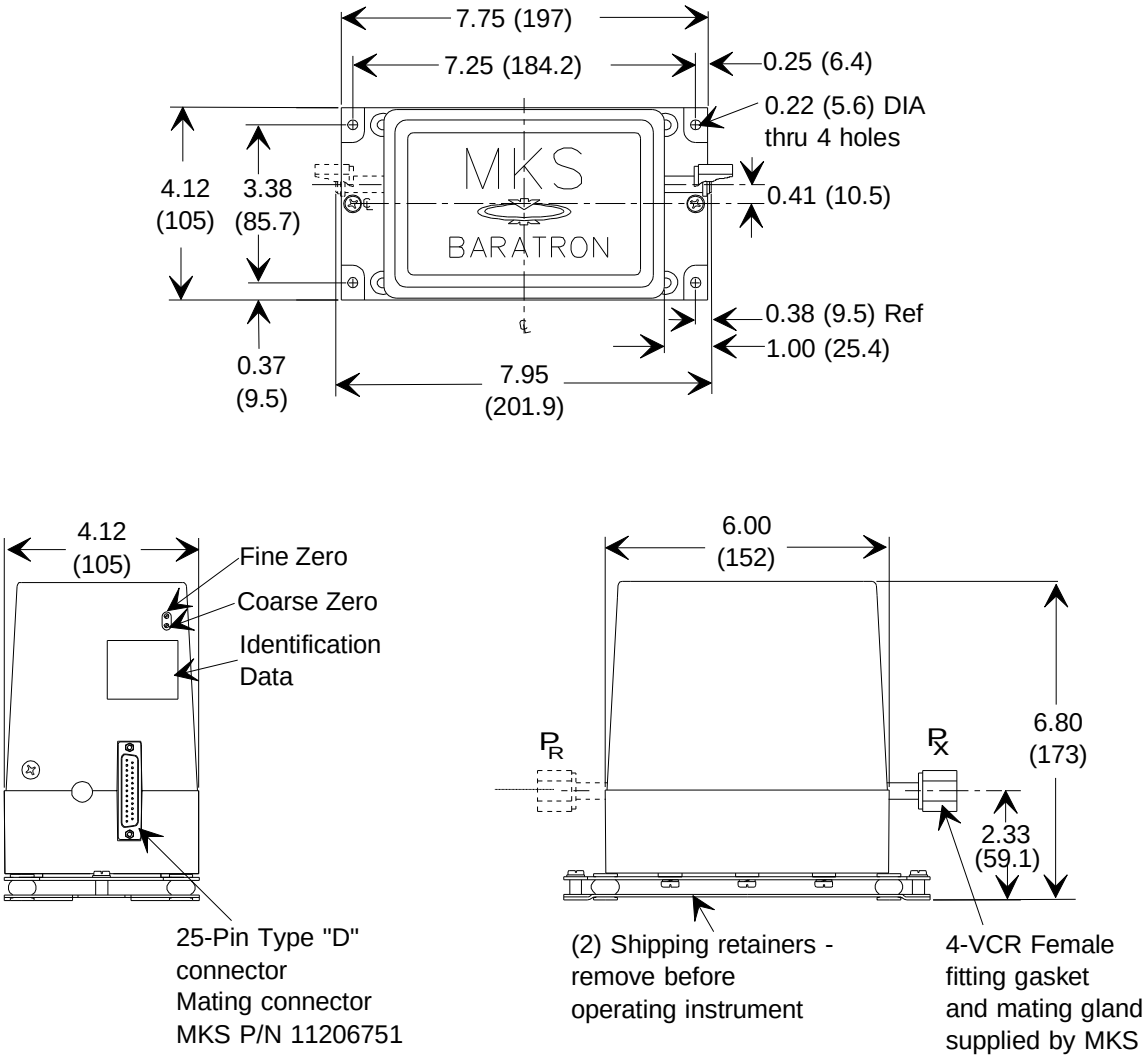


Figure 1: Dimensions of a 120A Transducer

Setup

Mounting Instructions

The 120A transducer should be mounted horizontally upon its vibration isolation base with the following points noted:

Warning

The unit *must* be mounted horizontally.

Do *not* mount the Type 120A pressure transducer vertically or upside down. The vibration mount assembly is not designed to support the weight of the unit in either position.

A. All units are supplied with vibration isolators which should be used for maximum stability. A flexible bellows connection is suggested to minimize vibration. It is recommended that the sensor be mounted such that the diaphragm plane is perpendicular to the major axis of vibration (diaphragm plane is perpendicular to the port axis).

B. Access should be provided to the two zero pots and cable connector mounted on one end of the transducer.

C. Ambient temperature around the 120A unit must not rise above 40° C as this will cause the 45° to 47° C control temperature to go out of regulation, thus reducing the system temperature stability.

D. Mount the transducer as far away from RFI and EMI sources as practical. Field experience has shown that care in positioning the transducer initially will prevent future difficulties. The transducer is internally protected against RFI and EMI. However, in systems where several ground potentials are possible, a noisy environment may cause the output to be unstable. When this happens, the only solution is an examination and correction of the source of RFI/EMI. Never run the 120A cable in the same wiring bundle as RF or SCR signals.

E. The vibration mount assembly is shipped from MKS with two shipping screws in place. For isolation mounting, these screws must be removed. However, when this transducer is subsequently reshipped on a piece of equipment, these screws ***must be reinstalled*** as the rubber feet will withstand no more than 3 g's force.

F. When installing a 120A differential transducer, allow for a cross-porting manifold; that is, connecting the two ports together. In order to properly set the zero on any differential sensor, there must be equal pressures on both sides of the sensor.

Vacuum Connections

To maximize the life and zero repeatability of the sensor, in most process applications an isolation valve is suggested. Set its closing point at or slightly above the sensors full scale range. An isolation valve protects the sensor from overpressure, which is common in processing systems that incorporate pressure purging cycles in excess of sensor specifications, as well as protecting the sensor from process chemistry/moisture contamination, which is present when a process system is vented to atmosphere. Moisture can often combine with residue on the sensor surfaces, and form acids such as HCl when chlorine or fluorine based processes are used.

The sensor inlet should be connected to the isolation valve with the appropriate length of stainless steel bellows tubing with welded VCR® fittings. The use of flexible bellows completes vibration isolation of the sensor, allowing it to function independently of significant system vibration or stress that could be induced during operation.

For Type 120A differential sensors, the measurement port (P_X) must be connected to the high side of any system whose differential pressure is to be measured. The reference port (P_R) will then be connected to the low pressure side. If connections are reversed, the instrument will output a negative signal whose accuracy is not specified. A Type 120A differential sensor may be used to make an absolute measurement by continually pumping the P_R port to a pressure below that of the resolution of the sensor.

For your convenience, MKS makes available several lengths of these bellows assemblies, including the mating VCR fittings welded to the bellows tubing.

Caution

1. **Hard coupling of the sensor inlet tube so that the transducer is suspended by this tube is not recommended as the weight of the entire assembly will cause stress on the sensor.**
2. **Do not attempt to change the inlet tube fitting by cutting or welding. If a different fitting is desired, make up an adapter, or consult MKS for a quotation on a special-version sensor.**

Cabling and Interconnections

Refer to Figure 1, page 26, for the location of the connector on the 120A transducer housing. Table 5, page 30, shows the transducer cable pinout. Certain interface cables can be supplied by MKS, or the user may choose to make up their own provided the appropriate specifications contained herein are maintained.

For convenience, when a user purchases a complete measurement system with all MKS components, MKS can supply the appropriate shielded cable with connector(s), in standard nominal lengths. Refer to Figure 2, page 31, for the cable numbers used with various readout/controller systems. Cable pricing may be obtained from a local salesperson or MKS order entry group. Shielded cable assemblies in a nominal 10' (3m) length, with one end terminated in “flying leads" (pigtail) fashion are available at nominal cost. The electrical connections are shown in Figure 3, page 32. Shielded cable assemblies are recommended, especially if the transducers environment contains high EMI/RFI noise.

Note

1. Metal, braided, shielded cables are required to meet CE Mark certification.
2. To order metal, braided, shielded cables, add an “S” after the cable type designation. For example to order a standard cable to connect the 120A transducer to a 652 controller, use part number CB120A-6; for a metal, braided, shielded cable, use part number CB120AS-6.

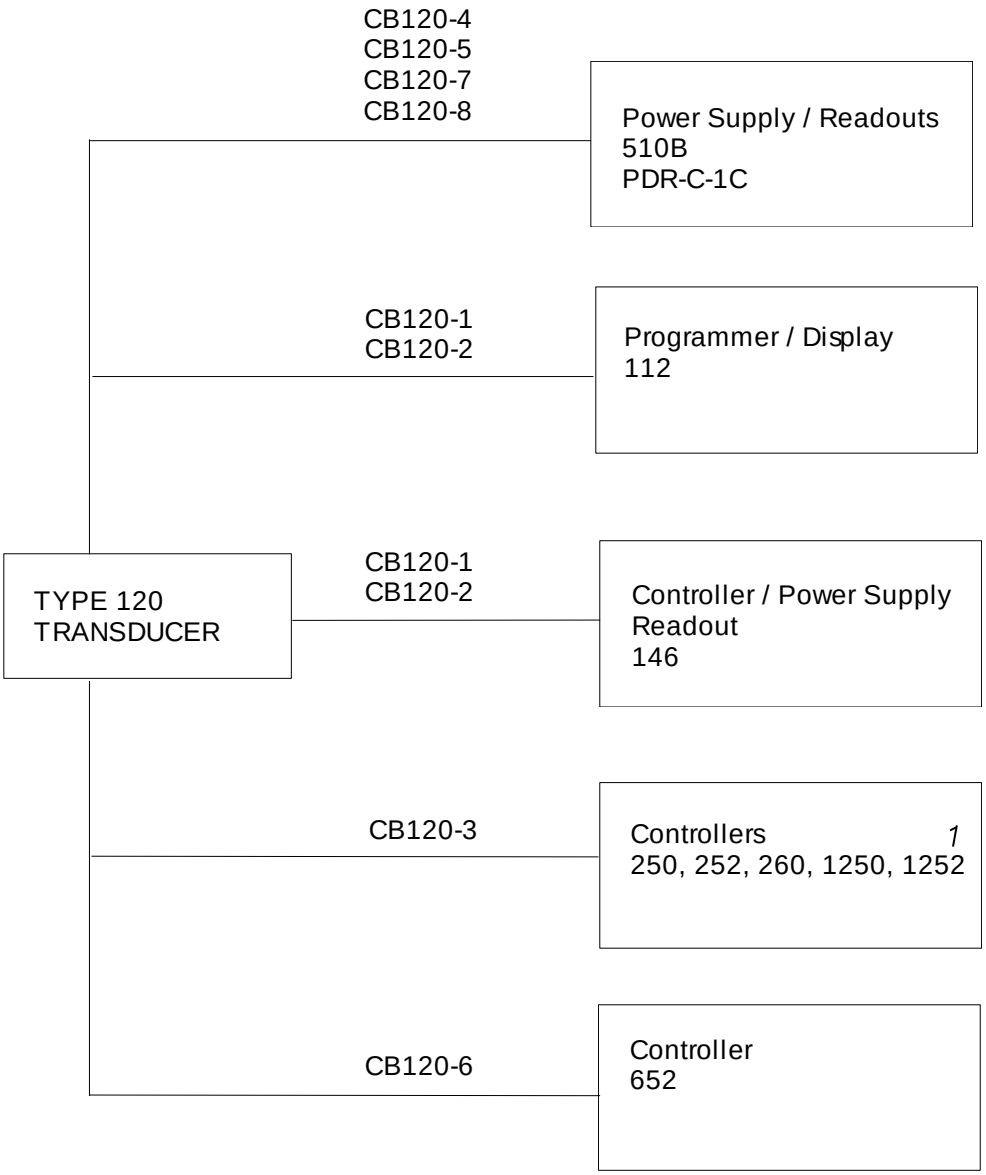
Figure 4, page 32; Figures 5 and 6, page 33; and Figure 7, page 34; show the connections of cables used to interface the 120A transducer to various MKS controllers and power supply readout devices along with the part numbers of the connectors. All cables are shielded and provide full access to the 120A transducer features. Refer to *Chapter Four: Operation*, beginning on page 37, for wiring information to utilize the 120A transducer remote zero and downranging features.

120A Transducer Pinout	
Pin Number	**Assignment**
1, 25	Chassis Common
7	Digital Common
9	Pressure Output +
10	Pressure Output Common
11	Supply Input -
12	Supply Input +
15	Remote Zero Input
16	x 0.1 Range Input
17	Remote Zero Overange Output
18	Range Identification Output
19	Remote Zero Bypass Input
2-6, 8	Reserve
13, 14, 20-24	No Connection

Table 5: 120A Transducer Pinout

Note

1. The "Reserve" pin assignment refers to a pin with an internal connection which is ready for use.
2. The "No Connection" pin assignment refers to a pin with no internal connection.



1. An additiona power supply is requred when using 250,252,260,1250 and 1252 Controllers

Figure 2: Cables for the 120A Transducer

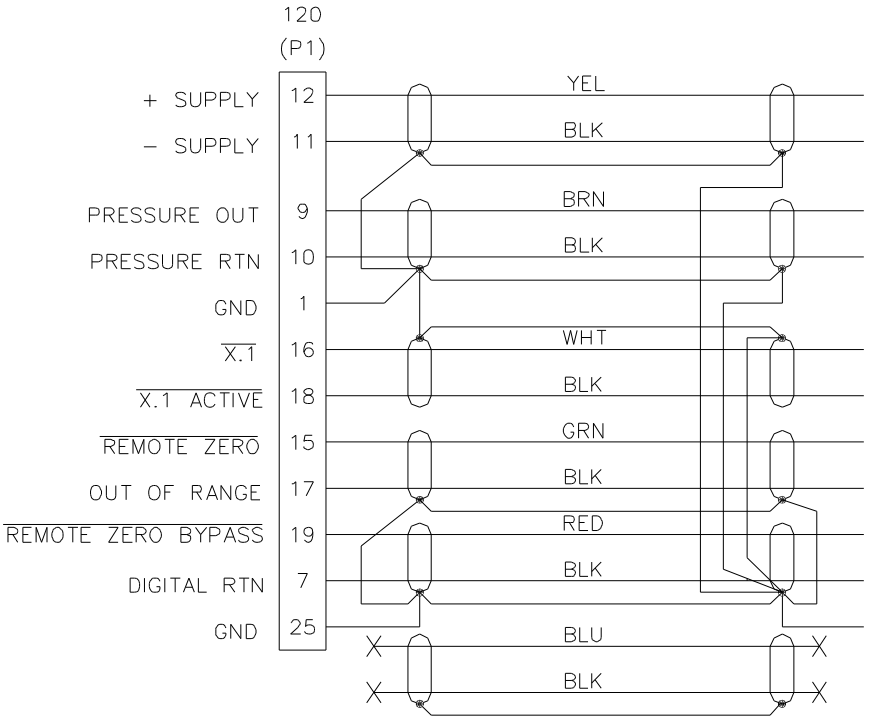


Figure 3: 120A Transducer to Type PDR-C-2C Power Supply/Readout ("Flying Leads")
(Cable Part Numbers CB120A-4, CB120A-5)

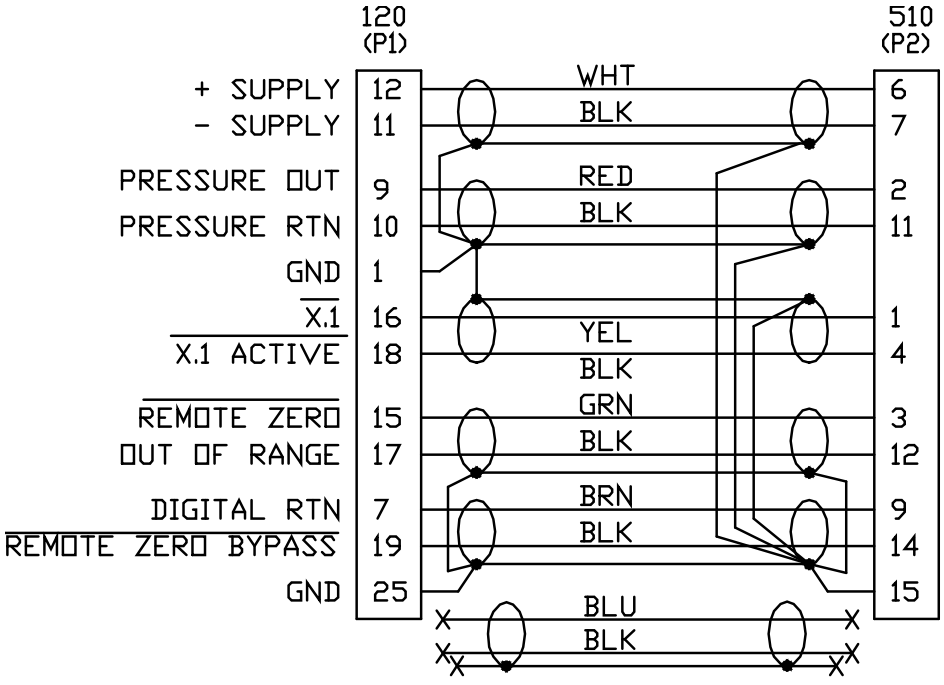


Figure 4: 120A Transducer to Type 510B Power Supply/Readout
(Cable Part Numbers CB120A-7, CB120A-8)

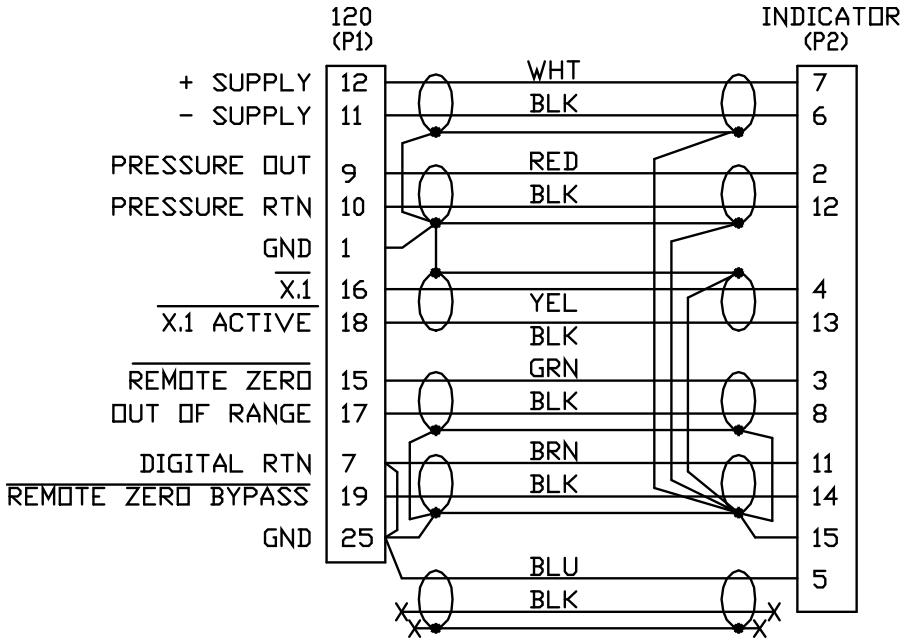


Figure 5: 120A Transducer to Type 112, 146 Units
(Cable Part Numbers CB120A-1, CB120A-2)

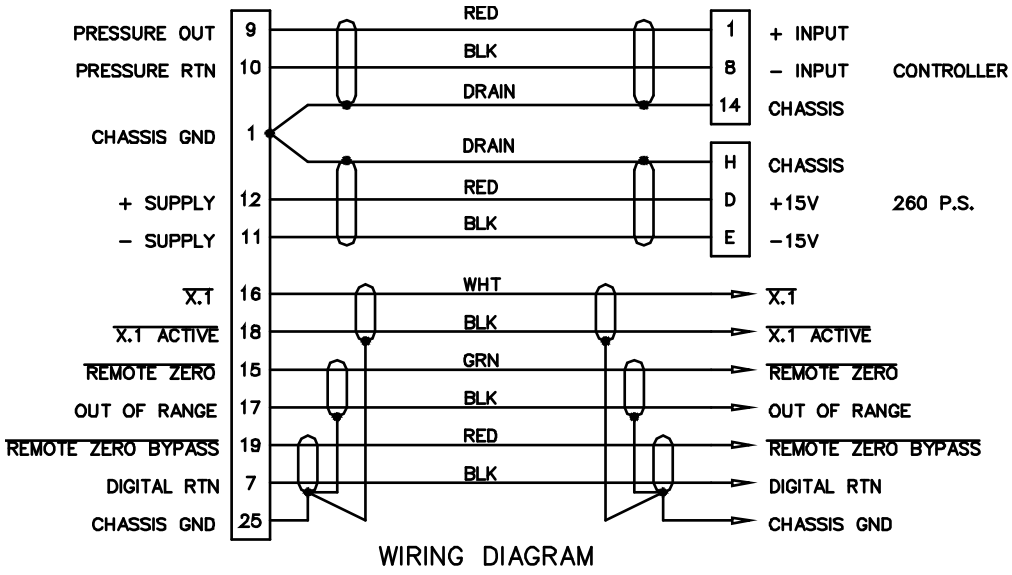


Figure 6: 120A Transducer to Type 250, 252, 260, 1250, 1252 Controllers
(Cable Part Number CB120A-3)

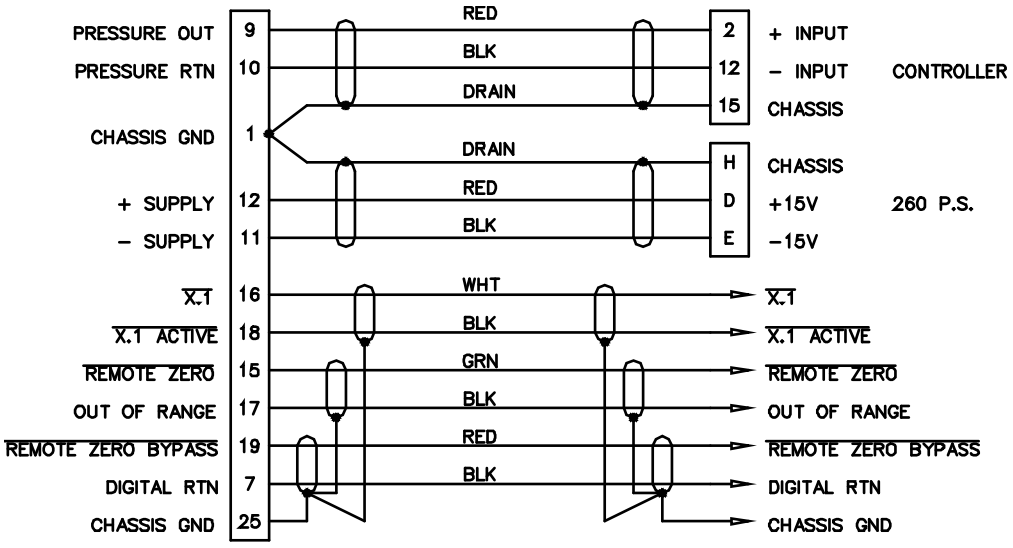


Figure 7: 120A Transducer to Type 652 Controller
(Cable Part Number CB120A-6)

Chapter Three: Overview

General Information

The 120A transducer is composed of seven subsections assembled within a single chemically inert, injection molded, high impact enclosure. These sections are: 1) an Inconel variable capacitance diaphragm sensor; 2) an electronic preamplifier and bridge circuit; 3) an inner temperature controlled housing; power, and signal conditioning printed circuit boards. The Inconel sensor, together with its high impedance bridge circuit and preamplifier, is mounted within a thick walled, temperature controlled aluminum housing. This miniature "environmental chamber" reduces the ambient temperature effects upon the sensor and bridge circuit by more than a factor of 50 to 1.

The 120A absolute pressure sensor is able to make a reliable absolute pressure measurement by virtue of its own built-in "zero" pressure reference cavity. During production, the low pressure side of the sensor is pumped to less than $1x10^{-7}$ mmHg, outgassed thoroughly, chemically gettered, and permanently sealed. The extremely low gas loads and active gettering material in the reference cavity assure the user of many years of useful service.

The 120A differential sensor is unique in that the entire sensor is surrounded by an Inconel guard volume case. Ambient line pressure appears between the sensor and this case, thus eliminating sensitivity changes due to line pressure induced stress variations within the sensor structure. Careful deadweight testing has shown a variation of less than 0.003% of reading as line pressure varies from 1 to 15 psia.

The variable capacitance sensor consists of rigidly attached capacitive electrodes located on the back or reference side of a metal diaphragm. When pressure is applied to the diaphragm, its deflection produces a change in the distance between the electrodes and the diaphragm and a resultant capacitance change. The center electrode increases its capacitance at a greater rate than the outer concentric electrode. This imbalance in capacitance caused by pressure is converted into an AC voltage by the high impedance bridge circuit and preamplifier which is excited by a precision constant frequency oscillator. This AC signal is then amplified, and synchronously demodulated, resulting in a very stable 0 to 10 VDC output, directly proportional to pressure. Refer to Figure 8, page 36, for a block diagram of the transducer and electronics.

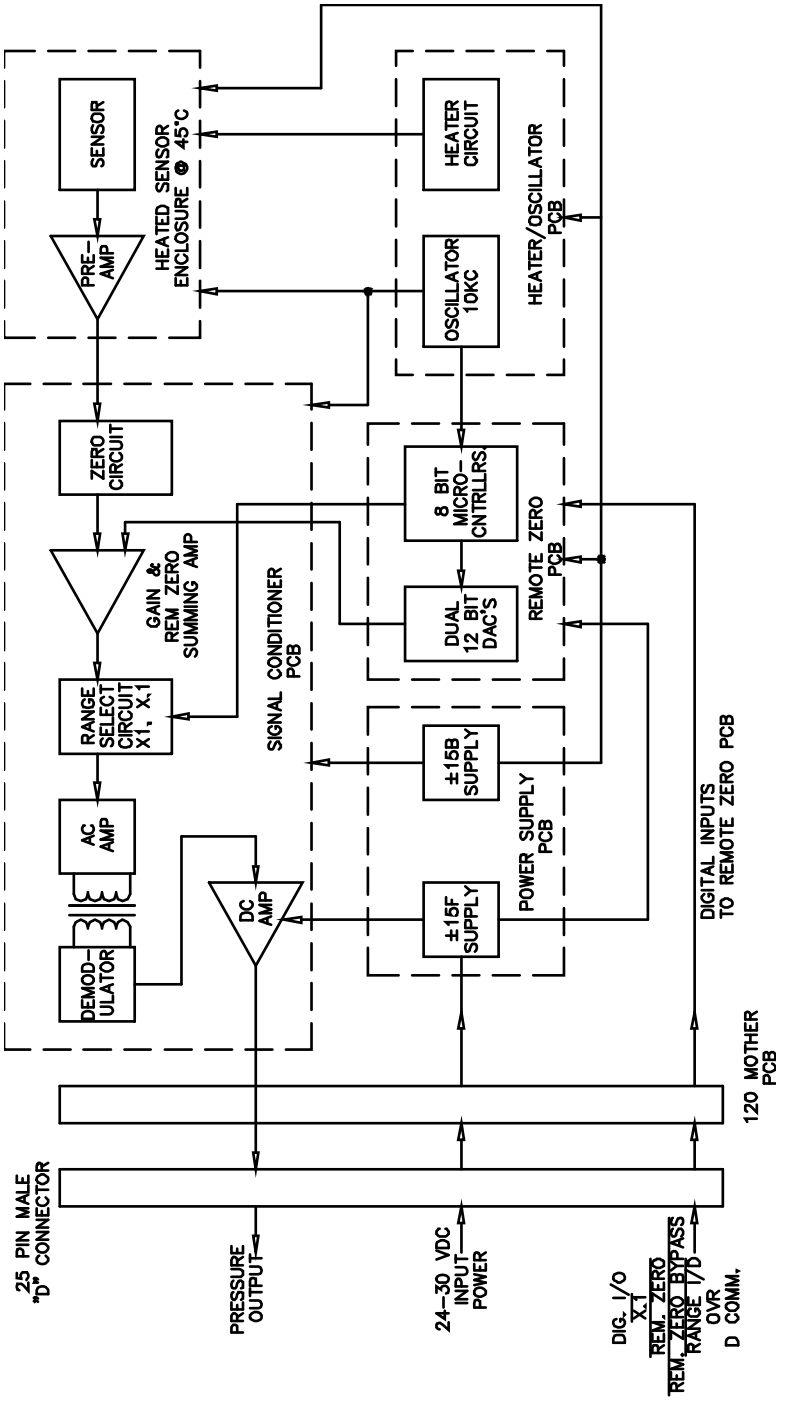


Figure 8: 120A Transducer Block Diagram

Chapter Four: Operation

General Information

The 120A transducer should first be inspected and installed as outlined in the installation section of this manual. The transducer will operate with a single 24 to 30 VDC supply or a dual ±15 VDC supply with the supply common not connected. This power supply must be capable of providing 700 mA of current maximum for a cold transducer. Only TTL compatible inputs and outputs should be connected to the 120A transducer digital inputs and outputs. The 120A transducer pressure output voltage signal is isolated from chassis ground. It is recommended that this isolation be maintained, in order to prevent any offsets in the DC output that may result due to system ground loops.

It is important to remember that all temperature controlled, diaphragm-variable capacitance pressure transducers require the user to zero the device after suitable warm-up and pumping have been accomplished. Zeroing should only be attempted after the sensor has been installed and supplied with power for a minimum of four (4) hours. This permits the transducer to stabilize thermally at the correct control temperature. While waiting for the sensor to reach stable thermal equilibrium, the appropriate vacuum pumps in the processing system should be engaged, so as to pump down the sensor below its useable resolution. In differential units, the processing system should be engaged, in such a manner to provide equal pressure on both sides of the sensor. This can also be accomplished by cross-porting, that is, connecting the two ports together.

How To Adjust the Manual Zero

This section deals with the manual adjustment pot only. If the remote (digital) zero correction feature is used, *How To Adjust the Remote (Digital) Zero*, page 39, is applicable as well.

After the warm-up time and pumping requirements have been met, the zero can be properly set. Before attempting to set zero it is important to establish a pressure at the transducer which is below its resolution. Each full scale range has different base pressure criteria. Table 6 summarizes the basic pressures needed prior to setting the "zero."

Maximum Pressures For Proper Zero Setting		
Range Full Scale (Torr)	**Highest Pressure for Zero Adjust (Torr)**	**Warm-Up Time Before Zero Adjust**
1	$<1 \times 10^{-6}$	4 Hours Minimum*
10	$<1 \times 10^{-5}$	"
100	$<1 \times 10^{-4}$	"
1000	$<1 \times 10^{-3}$	"
10000	$<1 \times 10^{-2}$	"
* *All temperature controlled transducers should be powered continuously.*		

Table 6: Maximum Pressures For Proper Zero Setting

To zero a differential transducer it is necessary to cross-port the two pressure ports (P_x and P_R) to equalize the pressure on each side of the diaphragm.

For initial operation, and periodically as required, the transducer zero can be set by adjusting the coarse and fine zero potentiometer, shown in Figure 1, page 26.

Note The zero adjustment procedure should be performed only after the unit is fully stabilized.

Zero the indicated output using the coarse and fine zero potentiometers. For increased stability, these are precision wirewound potentiometers which actually act as a 100 step switch, not a potentiometer. The stability of the setting is extremely good if the pot is adjusted to center the wiper on one wire.

To correctly set the potentiometer take the following steps. This procedure is followed first for the coarse adjustment and then with the fine adjustment as required.

1. Verify that there are 4 distinct steps in the DC output per revolution.
2. Zero the transducer then turn the shaft an extra ½ turn in the same direction.
3. Come back slowly until the desired zero is obtained.
4. Turn the shaft an additional 1/8 turn in this same direction.

   This will center the pot in the middle of a step, for maximum stability.

For reference, the frequency of setting zero will depend on use, variations in ambient temperature, and application. For extremely critical measurements of very low pressures, checking the zero more often will ensure the most accurate measurements attainable with this transducer. Total rangeability of the zero potentiometer range from approximately ±2% of range for higher pressure ranges to ±5% for 1 Torr full scale transducers.

How To Adjust the Remote (Digital) Zero

The Remote Zero feature is available on all 120A transducers. This feature allows the user to cancel out any zero offset up to ±2% of full scale (in addition to manual zero potentiometer) by either shorting pin 15 to pin 7 on the 120A connector or inputting a TTL low signal on pin 15. In order to do this refer to *Cabling and Interconnections,* beginning on page 29, showing for the pinout for the 120A transducer and associated color code of the wire for the particular cable being used.

It is important to note that during the time that the instrument is in an active remote zero cycle the analog pressure output signal is invalid. For the remote zero function to work properly, the vacuum system to which the transducer is attached must be pumped down to a pressure below the minimum resolution of the sensor used, or in the case of the differential transducers, the sensor should be cross-ported to equalize the pressure on both sides of the diaphragm. It is also important that the sensor temperature has stabilized. Refer to *How To Adjust the Manual Zero*, page 38, for details. If power to the 120A unit is interrupted for any reason the remote zero correction information is saved in EEPROM. Once power is returned, this information is re-established as zero correction in the circuitry.

The remote zero feature offers a rangeability of ±2% of full scale, resolution of ±1 ppm, and repeatability of ±5 ppm (all on the X1 sensor range). The correction cycle time is typically less than 3.5 seconds (during which time the analog pressure output signal is invalid) to achieve maximum resolution. To initiate a remote zero, pin 15 must be pulled to a TTL low for a minimum of 10 milliseconds to properly trigger the conversion cycle.

Overrange

If the signal to be corrected exceeds ±2% of full scale, an overrange condition exists. In such a case the remote zero circuitry will sense the polarity of the offset and correct as much as possible and set the overrange output signal to a TTL high level.

This signal is pin 17 on the 120A connector and can drive one TTL load. If this zero reading is not sufficient the user has the ability to then re-set the manual zero potentiometer to achieve the required zero reading.

Bypass

You can manually re-set the zero reading while disabling or "bypassing" the remote zero feature. This is done by pulling pin 19, which is the Remote Zero Bypass pin, on the 120A transducer to a TTL low. This effectively removes any correction signal that the remote zero feature injects into the circuitry. The remote zero function will be bypassed as long as pin 19 is held low. The advantage of this is that the user can manually set the zero using the zero potentiometer so that the full range of the remote zero function can be utilized once again.

After the unit is zeroed manually the Remote Zero Bypass can be removed. The output reading will then show the amount of correction which was added prior to bypassing and manual zeroing and this signal can be eliminated merely by initiating another remote zero cycle.

It is also important to note that the remote zero function only corrects for zero offset of the 120A transducer output reading. The readout instrument, such as a DVM (digital voltmeter), may have an internal offset. The 120A transducer remote zero cannot correct for this reading.

How To Use the Remote Range Turndown

A standard feature of the 120A transducer is a remotely activated range turndown capability to provide full scale output of 0 to 10 VDC for 100% or 10% of sensor range (X1 or X.1 of full scale). To set the transducer for a full scale output of 10 VDC for 10% of sensor range, short pin 16 (X.1 pin) to pin 7 (digital common) or input a TTL low on pin 16. Once again refer to *Cabling and Interconnections,* beginning on page 29, to determine the color code of these wires for the particular cable being used. The transducer will be in the downranged mode until the TTL low input is removed.

As a range identification output from the 120A transducer, pin 18 will have a TTL low output when in the downranged mode (X.1 range) and will output a TTL high when in the X1 range (10 VDC output for 100% of sensor range). This output can drive one TTL load and can be monitored to indicate the range of the sensor. Note that whenever the range is changed you must wait 250 milliseconds minimum before reading the analog pressure output signal to allow it to stabilize.

Digital Interfacing Considerations

In order to utilize the 120A transducer remote zero and range functions, you can either momentarily connect the appropriate input to digital common or inject the correct TTL logic level as discussed in previous sections. The digital outputs can be monitored by LEDs or computer as long as interfacing concerns have been met. Figures 9 and 10, page 42, and Figure 11, page 43, are timing diagrams to facilitate handshaking when the digital interfacing is handled by a computer.

The power-up sequence of the 120A transducer is shown in Figure 9, page 42. In the diagram, it takes approximately 200 milliseconds for the power to be within the operating range for instrument. After power is within tolerance, the reset signal is kept in the active state for a maximum of 1 second to allow the power supply and processor to stabilize. When the reset goes to the inactive state, the EEPROM is read and the circuitry is loaded with the remote zero value which was saved when power went down. Once this function is completed, the initialization cycle is complete and all digital functions are operational. The last timing trace in the diagram shows the total initialize time. This is measured by monitoring the Range Identification output. The X0.1 line was purposely tied to digital common on power-up and the Range Identification. output line monitored for a TTL low. It took a maximum of 1.3 seconds on power-up for the transducer to initialize and range change.

A typical timing sequence for a remote zero function is shown in Figure 10, page 42. In this sequence the Remote Zero input is used together with the X0.1 input and the Range Identification output to initiate a remote zero cycle and monitor the status of a remote zero function. To initiate a remote zero the transducer is first placed in the X1 range. When this is done the Range Identification output can be used as a remote zero status indicator since a remote zero is done in the X0.1 range. Once in the X1 range it takes 250 milliseconds for the analog output to stabilize. If the transducer is already in the X1 range these steps are not required. After the output is stabilized a remote zero is initiated by a TTL low for 10 milliseconds minimum. The transducer is then internally set to the X0.1 range (to zero on the most sensitive range) and reset to the X1 range when the remote zero cycle is complete.

The EEPROM is then updated with the new remote zero data and the Range Identification line goes high (X1 range) to indicate the cycle is complete. The cycle time is 3.5 seconds maximum. The remote zero overange line is low to indicate that the zero offset was within the correction range of the transducer. Note that during the remote zero cycle the analog pressure output signal is invalid and also that whenever the transducer is switched between the X1 and X0.1 ranges, you must wait 250 milliseconds minimum before reading the analog pressure output signal to allow the output to stabilize.

The remote zero cycle and timing is shown again in Figure 11, page 43. In this case the zero offset is greater than the remote zero correction range of the transducer. This condition is detected within 2 seconds and the overange line is a TTL high to indicate an overange condition.

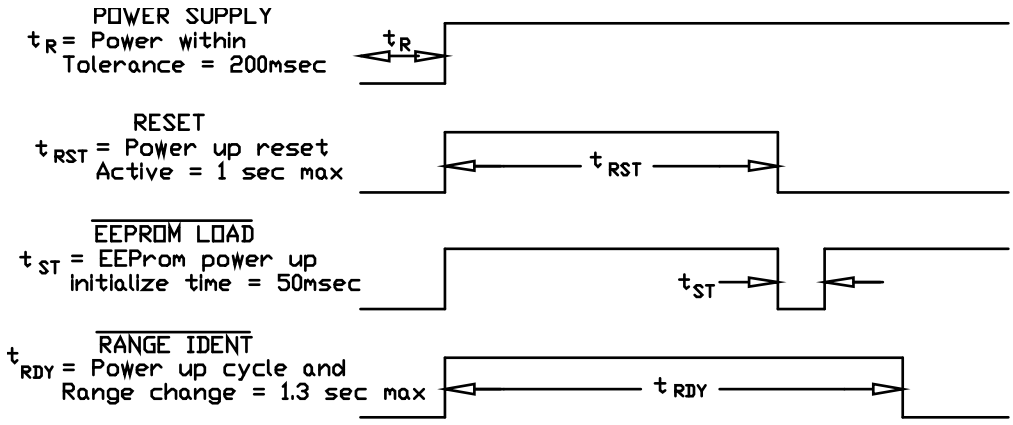


Figure 9: 120A Transducer Power-Up Timing

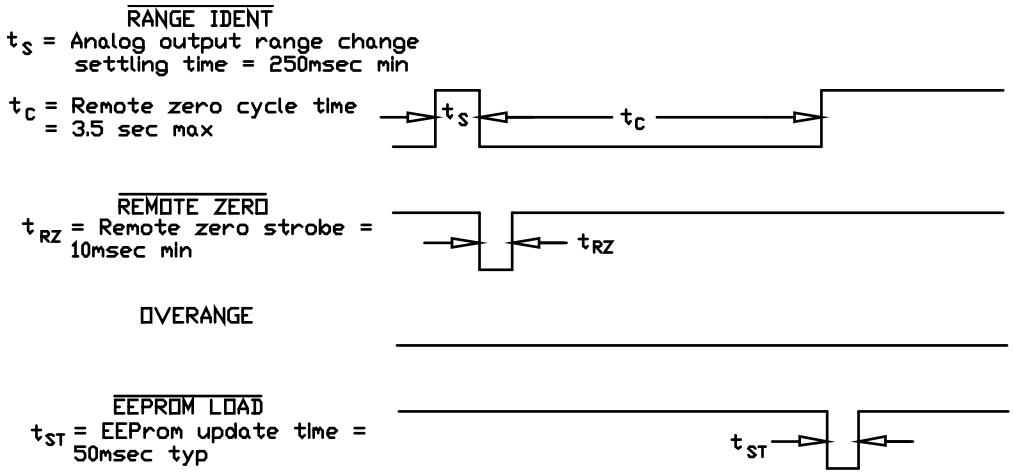


Figure 10: 120A Transducer Remote Zero Timing

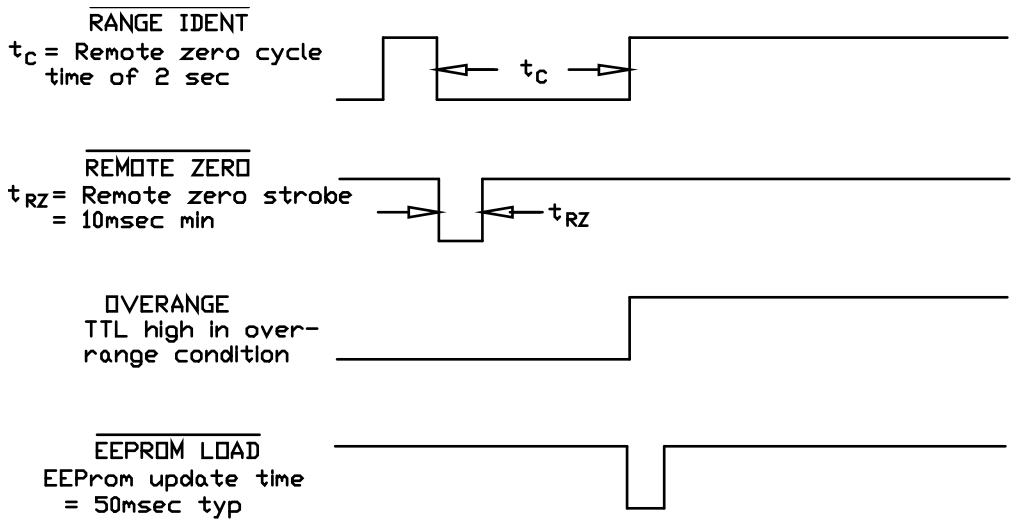


Figure 11: 120A Transducer Overange Timing

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Chapter Five: Maintenance and Troubleshooting

General Information

If the 120A transducer fails to operate properly upon receipt, check for shipping damage, and check the cables for proper continuity. Any damage should be reported to the carrier and MKS Instruments immediately. If it is necessary to return the unit to MKS, obtain an ERA number (Equipment Return Authorization Number) from a MKS Service Center before shipping. Please refer to the inside back cover of this manual for a list of MKS Calibration and Service Centers.

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

Maintenance

Generally, nothing needs to be done to maintain the transducer other than its proper installation and operation.

Troubleshooting

Troubleshooting Chart		
Problem	**Symptom**	**Possible Solution**
Cannot Zero	Pressure not below the reading resolution.	Pump down measurement side (Px) to less than 1 X 10^{-6} of full scale. For differential transducers, equalize the pressure on both sides of the diaphragm by cross-porting.
	Cannot zero when power first applied. Sensor not at operating temperature.	Allow time to stabilize (at least four (4) hours).
	Cannot zero on most sensitive range due to amplifier overload or system noise.	Go to less sensitive range and try again or improve vibration isolation.
Zero Shift	Zero shift after applying power.	Allow four (4) hour minimum stabilization time.
	Zero shift after changing from atmospheric to vacuum operation.	Allow time for outgassing completion.
	Zero shift caused by a leak in the vacuum system.	Check pressure connections at head and other fittings.
	Zero shift upon turn on of RF power in systems such as sputtering systems due to interference pickup.	Replace interface cable with shielded version or relocate sensor on system or improve grounding.
Measurement Drift	Measurement goes slowly negative with time and runs out of zero adjustment.	Possible reference leak. Replace the sensor.
	Measurement goes slowly positive with time and runs out of zero adjustment.	Possible build up of contamination in the measurement cavity or an overpressure condition. Replace the sensor.
	Signal output is overange positive or negative.	Sensor may be shorted or the interface cable may be damaged.

Table 7: Troubleshooting Chart

Appendix A: Product Specifications

Performance

Accuracy	± 0.12% of Reading Standard (consult factory for optional accuracy data)
CE Mark Compliance[1]	EMC Directive 2004/108/EC
Full Scale Ranges	1, 10, 100, 1000, 5000, 10000, 15000, 20000, 25000 mmHg
Line Pressure Effects on Span (Differential)	< 0.003% of Reading/15 psi
Maximum Line Pressure (Differential)	150 psig
Maximum Overpressure	125% of F.S. or 20 psia, whichever is greater
Media Compatibility	Any gas compatible with Inconel and Type 316 stainless steel
Resolution	1 x 10^{-6} of Full Scale
Temperature Coefficient Zero Span	 ± 0.0015 % of F.S./° C max. (15 ppm/° C) ± 0.01% of Rdg./° C max. (100 ppm/° C)
Time Response	< 40 msec.
Type of Measurement	Absolute or Differential
Usable Measurement Range	F.S. to 1 x 10^{-5} (5 Decades)
Volume Absolute Differential	 1 to 1000 mmHg F.S.: 2.2 cc. 5000 to 25000 mmHg F.S.: 14.0 cc. 1 to 1000 mmHg F.S.: 8.0 cc. Pr Port 1.9 cc. Px Port 5K to 25K mmHg F.S.: 8.0 cc. Pr Port 14.0 cc. Px Port

[1] Requires metal, braided, shielded cables.

Environmental

Humidity	0 to 95% non-condensing
Operating Temperature Range	15° to 40° C (59° to 104° F) Temperature controlled at 45° C (113° F)

Electrical

Connector	25-pin, Type “D” male
Output	0 to 10 VDC into >10K OHM load
Power Required	±15 VDC (with supply common not connected) or 24 to 30 VDC @700 mA maximum on turn on, (450 mA typical after 4 hour warm-up)
Range Identification (output)	Range I/D (pin 18) TTL high on X1 range TTL low on X0.1 range
Remote Range Turndown	X1 and X0.1 of range, initiated by TTL logic low or shorting (pin 16) to digital ground
Remote Zero	Correction Range: ±2% of Full Scale Resolution: ±1 ppm of Full Scale Repeatability: ±5 ppm of Full Scale Correction Time: < 3.5 Seconds Cycle initiated by TTL logic low or shorting (pin 15) to digital ground.
Remote Zero Bypass (input)	This function removes the "remote zero" correction. It can be used to reset the manual zero correction. Remote zero bypass initiated by TTL logic low or shorting pin 19 to digital ground.
Remote Zero Overange (output)	Overange goes to TTL logic high upon zero greater than ±2% of full scale

Mechanical

Fittings	Swagelok® 4-VCR®
Mechanical Outline	Refer to Figure 1, page 26.

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

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