121740-P1
Rev A, 5/98
Instruction Manual

MKS Type 243A
Controller and Readout

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WARRANTY

Type 243A Equipment

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

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

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

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

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

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

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MKS Type 243A
Controller and Readout

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Symbols Used in This Instruction Manual

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

Warning 

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

Caution 

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

Note 

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

Symbols Found on the Unit

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

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

Table 1: Definition of Symbols Found on the Unit

Safety Procedures and Precautions

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

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT

Do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to an MKS Calibration and Service Center for service and repair to ensure that all safety features are maintained.

SERVICE BY QUALIFIED PERSONNEL ONLY

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

GROUNDING THE PRODUCT

This product is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting it to the product input or output terminals. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

DANGER ARISING FROM LOSS OF GROUND

Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulating) can render an electrical shock.

GROUND AND USE PROPER ELECTRICAL FITTINGS

Dangerous voltages are contained within this instrument. All electrical fittings and cables must be of the type specified, and in good condition. All electrical fittings must be properly connected and grounded.

USE THE PROPER POWER CORD

Use only a power cord that is in good condition and which meets the input power requirements specified in the manual.

Use only a detachable cord set with conductors that have a cross-sectional area equal to or greater than 0.75 mm^2. The power cable should be approved by a qualified agency such as VDE, Semko, or SEV.

USE THE PROPER POWER SOURCE

This product is intended to operate from a power source that does not apply more voltage between the supply conductors, or between either of the supply conductors and ground, than that specified in the manual.

USE THE PROPER FUSE

Use only a fuse of the correct type, voltage rating, and current rating, as specified for your product.

DO NOT OPERATE IN EXPLOSIVE ATMOSPHERES

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

HIGH VOLTAGE DANGER

High voltage is present in the cable, and in the sensor when the controller is turned on.

Sicherheitshinweise

In dieser Betriebsanleitung vorkommende Symbole

Definition der mit WARNUNG!, VORSICHT! und HINWEIS überschriebenen Abschnitte in dieser Betriebsanleitung.

Warnung!

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

Vorsicht!

Das Symbol VORSICHT! weist auf eine Gefahrenquelle 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 Produkts oder von Teilen des Produkts führen kann.

Hinweis

Das Symbol HINWEIS weist auf eine wichtige Mitteilung hin, die auf einen Arbeitsablauf, eine Arbeitsweise, einen Zustand oder eine sonstige Gegebenheit von besonderer Wichtigkeit aufmerksam macht.

Am Gerät angebrachte Symbole

Der untenstehenden Tabelle sind die Bedeutungen der Symbole zu entnehmen, die an dem Gerät angebracht sind.

Definitionen der am Gerät angebrachten Symbole			
Ein (Netz) IEC 417, Nr. 5007	 Aus (Netz) IEC 417, Nr. 5008	 Erde IEC 417, Nr. 5017	 Schutzleiter IEC 417, Nr. 5019
 Rahmen oder Chassis IEC 417, Nr. 5020	 Äquipotentialanschluß IEC 417, Nr. 5021	 Gleichstrom IEC 417, Nr. 5031	 Wechselstrom IEC 417, Nr. 5032
 Wechselstrom und Gleichstrom IEC 417, Nr. 5033-a	 Geräteklasse II IEC 417, Nr. 5172-a	 Drehstrom IEC 617-2 Nr. 020206	
 Vorsicht! Bitte Begleitdokumente lesen! ISO 3864, Nr. B.3.1	 Vorsicht! Stromschlaggefahr! ISO 3864, Nr. B.3.6	 Vorsicht! Heiße Fläche! IEC 417, Nr. 5041	

Tabelle 2: Definitionen der am Gerät angebrachten Symbole

Sicherheitsvorschriften und Vorsichtsmaßnahmen

Die untenstehenden allgemeinen Sicherheitsvorschriften sind bei allen Betriebs-phasen dieses Instruments zu befolgen. Jede Mißachtung dieser Sicherheits-vorschriften oder sonstiger spezifischer Warnhinweise in dieser Betriebsanleitung stellt eine Zuwiderhandlung der für dieses Instrument geltenden Sicherheits-standards dar und kann die an diesem Instrument vorgesehenen Schutzvor-richtungen unwirksam machen. MKS Instruments, Inc. haftet nicht für eine Mißachtung dieser Sicherheitsvorschriften seitens des Kunden.

Keine Teile austauschen und keine Veränderungen vornehmen!

Bauen Sie in das Instrument keine Ersatzteile ein, und nehmen Sie keine eigenmächtigen Änderungen am Gerät vor! Schicken Sie das Instrument zu Wartungs- und Reparatur-zwecken an einen MKS-Kalibrierungs- und -Kundendienst ein! Dadurch wird sicher-gestellt, daß alle Sicherheitseinrichtungen voll funktionsfähig bleiben.

Wartung nur durch qualifizierte Fachleute!

Das Gehäuse des Instruments darf vom Bedienpersonal nicht geöffnet werden. Das Auswechseln von Bauteilen und das Vornehmen von internen Einstellungen ist nur von qualifizierten Fachleuten durchzuführen.

Produkt erden!

Dieses Produkt ist mit einer Erdleitung und einem Schutzkontakt am Netzstecker versehen. Um der Gefahr eines elektrischen Schlages vorzubeugen, ist das Netzkabel an einer vorschriftsmäßig geerdeten Schutzkontaktsteckdose anzuschließen, bevor es an den Eingangs- bzw. Ausgangsklemmen des Produkts angeschlossen wird. Das Instrument kann nur sicher betrieben werden, wenn es über den Erdleiter des Netzkabels und einen Schutzkontakt geerdet wird.

Gefährdung durch Verlust der Schutzerdung!

Geht die Verbindung zum Schutzleiter verloren, besteht an sämtlichen zugänglichen Teilen aus stromleitendem Material die Gefahr eines elektrischen Schlages. Dies gilt auch für Knöpfe und andere Bedienelemente, die dem Anschein nach isoliert sind.

Erdung und Verwendung geeigneter elektrischer Armaturen!

In diesem Instrument liegen gefährliche Spannungen an. Alle verwendeten elektrischen Armaturen und Kabel müssen dem angegebenen Typ entsprechen und sich in einwand-freiem Zustand befinden. Alle elektrischen Armaturen sind vorschriftsmäßig anzubringen und zu erden.

Richtiges Netzkabel verwenden!

Das verwendete Netzkabel muß sich in einwandfreiem Zustand befinden und den in der Betriebsanleitung enthaltenen Anschlußwerten entsprechen.

Das Netzkabel muß abnehmbar sein. Der Querschnitt der einzelnen Leiter darf nicht weniger als 0,75 mm^2 betragen. Das Netzkabel sollte einen Prüfvermerk einer zuständigen Prüfstelle tragen, z.B. VDE, Semko oder SEV.

Richtige Stromquelle verwenden!

Dieses Produkt ist für eine Stromquelle vorgesehen, bei der die zwischen den Leitern bzw. zwischen jedem der Leiter und dem Masseleiter anliegende Spannung den in dieser Betriebsanleitung angegebenen Wert nicht überschreitet.

Richtige Sicherung benutzen!

Es ist eine Sicherung zu verwenden, deren Typ, Nennspannung und Nennstromstärke den Angaben für dieses Produkt entsprechen.

Gerät nicht in explosiver Atmosphäre benutzen!

Um der Gefahr einer Explosion vorzubeugen, darf dieses Gerät nicht in der Nähe explosiver Stoffe eingesetzt werden, sofern es nicht ausdrücklich für diesen Zweck zertifiziert worden ist.

Hochspannungsgefahr!

Bei eingeschaltetem Steuerteil liegt im Kabel und im Sensor Hochspannung an.

Informations relatives à la sécurité

Symboles utilisés dans ce manuel d'utilisation

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

Avertissement

L'indication AVERTISSEMENT signale un danger potentiel. Elle est destinée à attirer l'attention sur une procédure, une utilisation, une situation ou toute autre chose présentant un risque de blessure en cas d'exécution incorrecte ou de non-respect des consignes.

Attention

L'indication ATTENTION signale un danger potentiel. Elle est destinée à attirer l'attention sur une procédure, une utilisation, une situation ou toute autre chose présentant un risque d'endommagement ou de dégât 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 des informations importantes. Elle est destinée à attirer l'attention sur une procédure, une utilisation, une situation ou toute autre chose présentant un intérêt particulier.

Symboles apparaissant sur l'appareil

Le tableau suivant décrit les symboles apparaissant sur l'appareil.

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

Tableau 3 : Définition des symboles apparaissant sur l'appareil

Mesures de sécurité et mises en garde

Prendre toutes les précautions générales suivantes pendant toutes les phases d'utilisation de cet appareil. Le non-respect de ces précautions ou des avertissements contenus dans ce manuel entraîne une violation des normes de sécurité relatives à l'utilisation de l'appareil et le risque de réduire le niveau de protection fourni par l'appareil. MKS Instruments, Inc. ne prend aucune responsabilité pour les conséquences de tout non-respect des consignes de la part de ses clients.

NE PAS SUBSTITUER DES PIÈCES OU MODIFIER L'APPAREIL

Ne pas utiliser de pièces détachées autres que celles vendues par MKS Instruments, Inc. ou modifier l'appareil sans l'autorisation préalable de MKS Instruments, Inc. Renvoyer l'appareil à un centre d'étalonnage et de dépannage MKS pour tout dépannage ou réparation afin de s'assurer que tous les dispositifs de sécurité sont maintenus.

DÉPANNAGE EFFECTUÉ UNIQUEMENT PAR UN PERSONNEL QUALIFIÉ

L'opérateur de l'appareil ne doit pas enlever le capot de l'appareil. Le remplacement des composants et les réglages internes doivent être effectués uniquement par un personnel d'entretien qualifié.

MISE À LA TERRE DE L'APPAREIL

Cet appareil est mis à la terre à l'aide du fil de terre du cordon d'alimentation. Pour éviter tout risque de secousse électrique, brancher le cordon d'alimentation sur une prise de courant correctement câblée avant de le brancher sur les bornes d'entrée ou de sortie de l'appareil. Une mise à la terre de protection à l'aide du fil de terre du cordon d'alimentation est indispensable pour une utilisation sans danger de l'appareil.

DANGER LIÉ À UN DÉFAUT DE TERRE

En cas de défaut de terre, toutes les pièces conductrices accessibles (y compris les boutons de commande ou de réglage qui semblent être isolés) peuvent être source d'une secousse électrique.

MISE À LA TERRE ET UTILISATION CORRECTE D'ACCESSOIRES ÉLECTRIQUES

Des tensions dangereuses existent à l'intérieur de l'appareil. Tous les accessoires et les câbles électriques doivent être conformes au type spécifié et être en bon état. Tous les accessoires électriques doivent être correctement connectés et mis à la terre.

UTILISATION D'UN CORDON D'ALIMENTATION APPROPRIÉ

Utiliser uniquement un cordon d'alimentation en bon état et conforme aux exigences de puissance d'entrée spécifiées dans le manuel.

Utiliser uniquement un cordon d'alimentation amovible avec des conducteurs dont la section est égale ou supérieure à 0,75 mm^2. Le cordon d'alimentation doit être approuvé par un organisme compétent tel que VDE, Semko ou SEV.

UTILISATION D'UNE ALIMENTATION APPROPRIÉE

Cet appareil est conçu pour fonctionner en s'alimentant sur une source de courant électrique n'appliquant pas une tension entre les conducteurs d'alimentation, ou entre les conducteurs d'alimentation et le conducteur de terre, supérieure à celle spécifiée dans le manuel.

UTILISATION D'UN FUSIBLE APPROPRIÉ

Utiliser uniquement un fusible conforme au type, à la tension nominale et au courant nominal spécifiés pour l'appareil.

NE PAS UTILISER DANS UNE ATMOSPHÈRE EXPLOSIVE

Pour éviter tout risque d'explosion, ne pas utiliser l'appareil dans une atmosphère explosive à moins qu'il n'ait été approuvé pour une telle utilisation.

DANGER DE HAUTE TENSION

Une haute tension est présente dans le câble et dans le capteur lorsque le contrôleur est sous tension.

Información sobre seguridad

Símbolos usados en el manual de instrucciones

Definiciones de los mensajes de ADVERTENCIA, PRECAUCIÓN Y OBSERVACIÓN usados en el manual.

Advertencia

El símbolo de ADVERTENCIA indica un riesgo. Pone de relieve un procedimiento, práctica, condición, etc., que, de no realizarse u observarse correctamente, podría causar lesiones a los empleados.

Precaución

El símbolo de PRECAUCIÓN indica un riesgo. Pone de relieve un procedimiento, práctica, etc., de tipo operativo que, de no realizarse u observarse correctamente, podría causar desperfectos al instrumento, o llegar incluso a causar su destrucción total o parcial.

Observación

El símbolo de OBSERVACIÓN indica información de importancia. Pone de relieve un procedimiento, práctica, condición, etc., cuyo conocimiento resulta esencial.

Símbolos que aparecen en la unidad

En la tabla que figura a continuación se indican los símbolos que aparecen en la unidad.

Definición de los símbolos que aparecen 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. Consultar 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 que aparecen en la unidad

Procedimientos y precauciones de seguridad

Las precauciones generales de seguridad que figuran a continuación deben observarse durante todas las fases de funcionamiento del presente instrumento. La no observancia de dichas precauciones, o de las advertencias específicas a las que se hace referencia en el manual, contraviene las normas de seguridad referentes al uso previsto del instrumento y podría impedir la protección que proporciona el instrumento. MKS Instruments, Inc., no asume responsabilidad alguna en caso de que el cliente haga caso omiso de estos requerimientos.

NO UTILIZAR PIEZAS NO ORIGINALES NI MODIFICAR EL INSTRUMENTO

No se debe instalar piezas que no sean originales ni modificar el instrumento sin autorización. Para garantizar que las prestaciones de seguridad se observen en todo momento, enviar el instrumento al Centro de servicio y calibración de MKS cuando sea necesaria su reparación y servicio de mantenimiento.

REPARACIONES EFECTUADAS ÚNICAMENTE POR TÉCNICOS ESPECIALIZADOS

Los operarios no deben retirar las cubiertas del instrumento. El cambio de piezas y los reajustes internos deben efectuarlos únicamente técnicos especializados.

PUESTA A TIERRA DEL INSTRUMENTO

Este instrumento está puesto a tierra por medio del conductor de tierra del cable eléctrico. Para evitar descargas eléctricas, enchufar el cable eléctrico en una toma debidamente instalada, antes de conectarlo a las terminales de entrada o salida del instrumento. Para garantizar el uso sin riesgos del instrumento resulta esencial que se encuentre puesto a tierra por medio del conductor de tierra del cable eléctrico.

PELIGRO POR PÉRDIDA DE LA PUESTA A TIERRA

Si se pierde la conexión protectora de puesta a tierra, todas las piezas conductoras a las que se tiene acceso (incluidos los botones y mandos que pudieran parecer estar aislados) podrían producir descargar eléctricas.

PUESTA A TIERRA Y USO DE ACCESORIOS ELÉCTRICOS ADECUADOS

Este instrumento funciona con voltajes peligrosos. Todos los accesorios y cables eléctricos deben ser del tipo especificado y mantenerse en buenas condiciones. Todos los accesorios eléctricos deben estar conectados y puestos a tierra del modo adecuado.

USAR EL CABLE ELÉCTRICO ADECUADO

Usar únicamente un cable eléctrico que se encuentre en buenas condiciones y que cumpla los requisitos de alimentación de entrada indicados en el manual.

Usar únicamente un cable desmontable instalado con conductores que tengan un área de sección transversal equivalente o superior a 0,75mm². El cable eléctrico debe estar aprobado por una entidad autorizada como, por ejemplo, VDE, Semko o SEV.

USAR LA FUENTE DE ALIMENTACIÓN ELÉCTRICA ADECUADA

Este instrumento debe funcionar a partir de una fuente de alimentación eléctrica que no aplique más voltaje entre los conductores de suministro, o entre uno de los conductores de suministro y la puesta a tierra, que el que se especifica en el manual.

USAR EL FUSIBLE ADECUADO

Usar únicamente un fusible del tipo, clase de voltaje y de corriente adecuados, según lo que se especifica para el instrumento.

EVITAR SU USO EN ENTORNOS EXPLOSIVOS

Para evitar el riesgo de explosión, no usar este instrumento o en un entorno explosivo, a no ser que haya sido certificado para tal uso.

PELIGRO POR ALTO VOLTAJE

Cuando el controlador está encendido, se registra alto voltaje en el cable y en el sensor.

Chapter One: General Information

Introduction

The MKS Type 243A Controller and Readout is designed to provide analog control and readout capability for the MKS Type 1153 Mass Flow Controller. Use the 243 controller to provide a 0 to 5 VDC signal and analog control of the 1153 unit, as an alternate to using the 1153 unit's on-board RS-232 interface.

The 243 unit provides analog control and readout of the following features:

- Flow Set Point
- Temperature Set Point
- Flow Readout
- Temperature Readout
- Set Point/Valve Control
- Valve Open/Close

The controller is housed in a half-rack chassis. All controls are accessed from the front panel. The rear panel contains a 9-pin Type "D" connector for power and a 15-pin Type "D" connector to interface with the 1153 unit. The 243 controller requires a power supply of ±15 VDC.

How This Manual is Organized

This manual is designed to provide instructions on how to set up, install, and operate a Type 243 unit.

Before installing your Type 243 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 information for reference should the instrument malfunction.

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

Appendix B, *Model Code Explanation,* describes the model code 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 243 instrument, or to obtain information about companion products MKS offers, contact any authorized MKS Calibration and Service Center. If it is necessary to return the instrument to MKS, please obtain an ERA Number (Equipment Return Authorization Number) from the MKS Calibration and Service Center before shipping. The ERA Number expedites handling and ensures proper servicing of your instrument.

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

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

Chapter Two: Installation

How To Unpack the Type 243 Unit

MKS has carefully packed the Type 243 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.

Caution 

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

Unpacking Checklist

Standard Equipment:

- Type 243 Unit
- Type 243 Instruction Manual (this book)

Optional Equipment:

- Interface Cables (refer to Table 5, page 20)
- RM-6 Rack Mount Kit

Interface Cables

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

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

Note 

An overall metal braided, shielded cable, properly grounded at both ends, is required during use to meet CE specifications.

Interface Cables	
To Connect the 243 Unit To...	**Use the MKS Shielded Cable...**
Type 1153 Mass Flow Controller Analog I/O Connector	CB1153S-3-xx
Type 260 PS-7 Power Supply	CB1153S-1-xx
xx = length in feet	

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. Refer to Figures 1 and 2, page 22. (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.

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

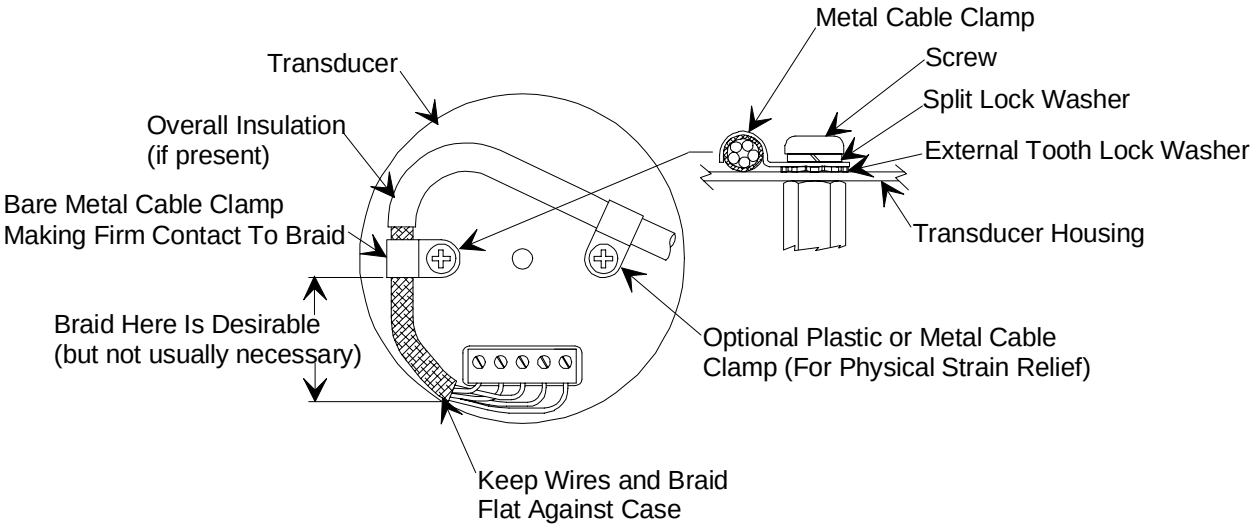

Figure 1: Preferred Method To Connect an Overall Metal Braided Shielded Cable

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

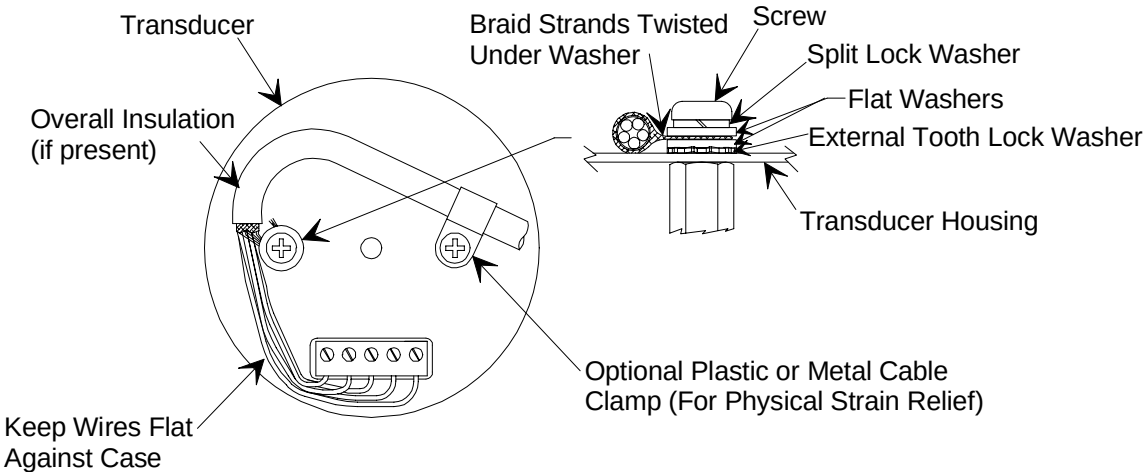

Figure 2: Alternate Method To Connect an Overall Metal Braided Shielded Cable
Use this method when cable clamp is not available

Product Location and Requirements

Power Requirements

The 243 controller requires a power supply of ±15 VDC.

Operating Temperature

The acceptable operating temperature range for the 243 unit is 15° to 45° C (59° to 113° F).

Setup

Dimensions

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

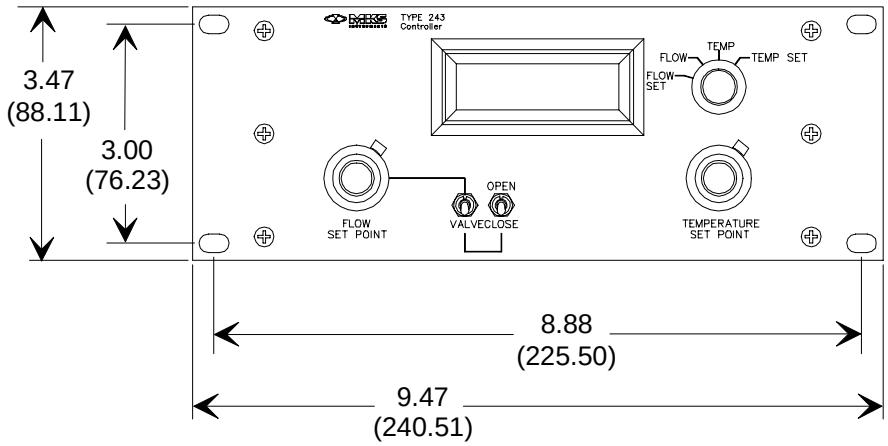

Figure 3: Front Panel Dimensions

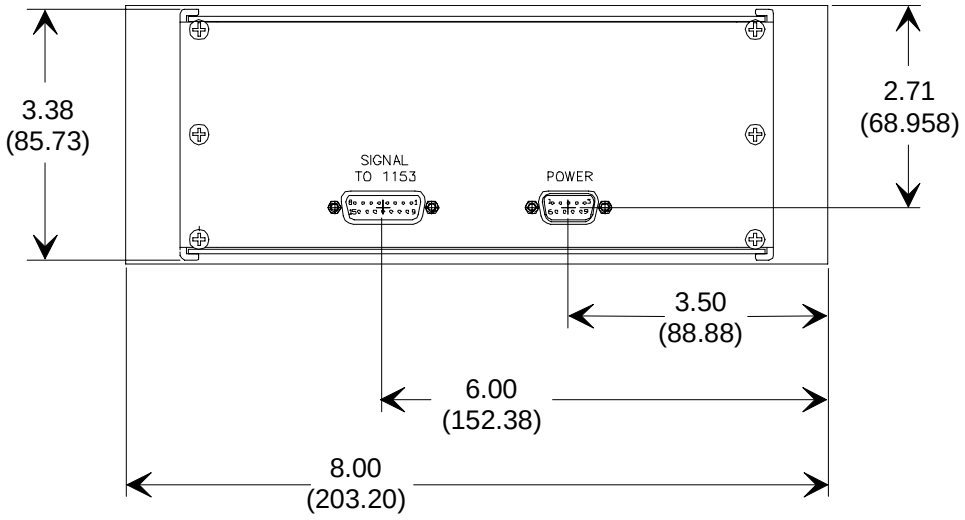

Figure 4: Rear Panel Dimensions

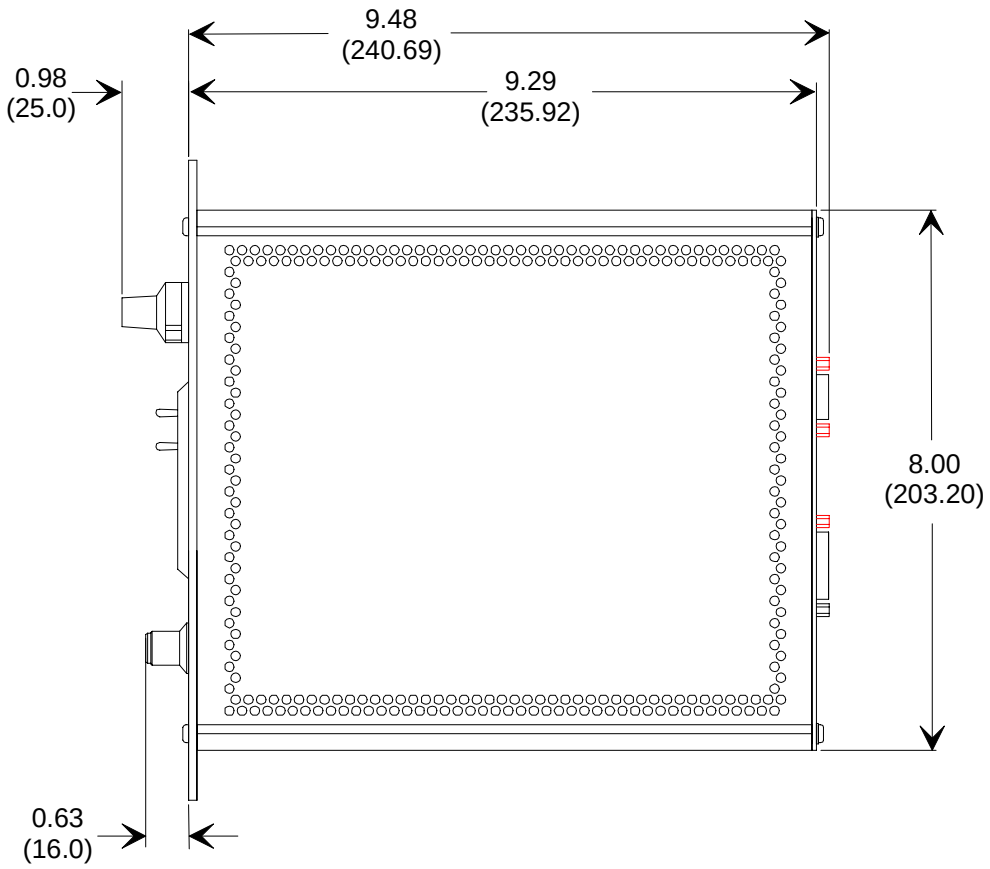

Figure 5: Top Panel Dimensions

Mounting Instructions

The 243 unit can be used as a bench top instrument, or can be mounted in a panel cutout or in a half-rack. A rack mounting kit (RM-6) is available from MKS for single or dual unit rack mounting. The mounting position is not critical as the unit will operate properly in any position.

However the unit is mounted, leave adequate space around it for proper ventilation. Refer to *Dimensions*, page 24, for dimensional drawings of the 243 unit. No special precautions are needed to protect the unit from ordinary mechanical shock and vibration.

Note Refer to the appropriate instruction manual for complete installation instructions for the 1153 MFC (p/n 119536-P1) and the 260 PS-7 power supply (p/n 121739-P1).

Connectors

The 243 unit's two connectors are located on the rear panel of the unit (refer to Figure 4, page 24). The interface cables are listed in Table 5.

Signal Interface Connector

The 15-pin male Type "D" Signal Interface connector provides the communications link between the 243 controller and the 1153 MFC. Specifically, it provides the flow and temperature input signals, and the set point and valve control for the 1153 MFC.

Signal Interface Connector Pinout		
Pin Number	**Assignment**	**Function**
1	Controller Sensing Pin	Identifies that the analog controller is being used (when the analog cable is attached to the unit).
2	Flow Input	0 to 5 V based on the % of flow (0 to 100%)
3	Valve Open/Close	Digital control signal: 0 = Closed; 1 = Open
4	Set Point/Valve Control NOTE: Pins 3 & 4 work in conjunction with each other.	Digital control signal: 0 = Valve Control; 1 = Set Point Control When Pin 4 is set for Set Point Control, the flow is controlled by the front panel Flow Set Point pot. When Pin 4 set for Valve Control, the valve operation is controlled by the front panel Valve Open/Close switch.
5	Digital Signal Common	Digital ground of the control system.
6	Reserved	None
7	Reserved	None
8	Flow Set Point Output	Analog 0 to 5 V controlled by front panel Flow Set Point pot; units are 0 to 100% FS
9	Temperature Input	Analog 0 to 5 V
10	Temperature Set Point Output	Analog 0 to 5 V controlled by the front panel Temperature Set Point pot.
11	Analog Common	Analog ground of the control system.
12	Analog Common	Analog ground of the control system.

Table 6: Signal Interface Connector Pinout

(Continued on next page)

Signal Interface Connector Pinout *(Continued)*		
Pin Number	**Assignment**	**Function**
13	Reserved	None
14	Reserved	None
15	Chassis Ground	Chassis ground of the control system.

Table 6: Signal Interface Connector Pinout

Note The "Reserved" pin assignment refers to a pin with an internal connection which may be assigned a function in the future.

Power Connector

The 9-pin male Type "D" connector provides ±15 VDC power to the controller.

Power Connector Pinout	
Pin Number	**Assignment**
1	+15 VDC
2	Power Common
3	-15 VDC
4	No Connection
5	No Connection
6	No Connection
7	No Connection
8	No Connection
9	Chassis Ground

Table 7: Power Connector Pinout

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

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Chapter Three: Overview

Front Panel Controls

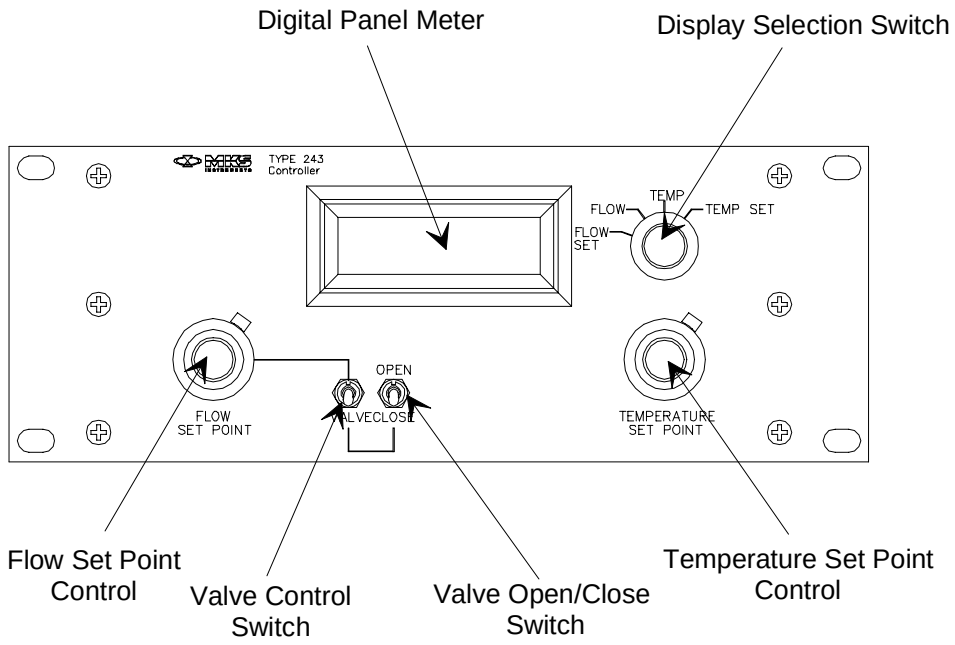

Figure 6: Front Panel Controls

Display

This 3½ digit device displays one of four input and output signals from the 1153 MFC as selected by the DISPLAY SELECTION SWITCH.

Display Selection Switch

This 4-position switch selects which input or output from the 1153 MFC is shown on the display. The four choices are FLOW SET POINT output, FLOW input, TEMPERATURE SET POINT output, and TEMPERATURE input.

Temperature Set Point Control

The 10-turn potentiometer adjusts an analog output signal which is used to set the temperature of the 1153 MFC. This is a 0 to 5 V signal representing a temperature range of 0° to 500° C (1 V / 100° C).

This output is shown on the display when the DISPLAY SELECTION SWITCH is set to TEMP SET.

Caution  **The 1153 MFC has a maximum operating temperature of 200° C. Consult the MKS Applications Department for applications requiring higher temperatures.**

Valve Open/Close Switch

This toggle switch manually selects the OPEN or CLOSE valve position when the VALVE CONTROL SWITCH is in the DOWN position.

Valve Control Switch

This toggle switch selects the method of valve control, either SET POINT CONTROL or manual VALVE OPEN/CLOSE.

When the toggle switch is in the UP position, the 243 controller supplies the digital control signal for SET POINT CONTROL to the 1153 MFC which enables the 1153 MFC to use the selected FLOW SET POINT.

When the toggle switch is in the DOWN position, the 243 controller supplies the digital control signal for VALVE CONTROL to the 1153 MFC. This enables the VALVE OPEN/CLOSE SWITCH allowing manual selection of OPEN or CLOSE.

Flow Set Point Control

The 10-turn potentiometer adjusts an analog output signal which is used to set the flow rate of the 1153 MFC. This is a 0 to 5 V signal representing 0.00 to 100.0% of the 1153 unit's Full Scale flow rate.

This output is shown on the display when the DISPLAY SELECTION SWITCH is set to FLOW SET.

Rear Panel Controls

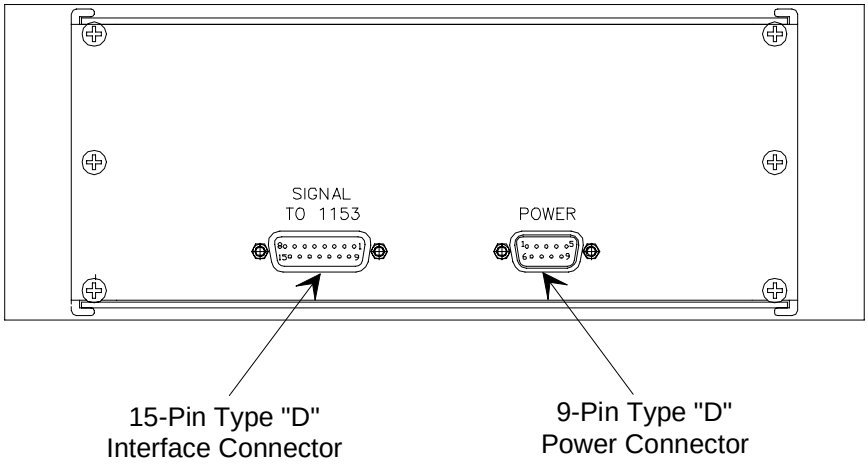

Figure 7: Rear Panel Controls

Signal Interface Connector

The 15-pin male Type “D” connector provides the communications link between the 243 controller and the 1153 MFC. Specifically, it provides the flow and temperature input signals, and the set point and valve control for the 1153 MFC. Refer to Table 6, page 26, for the Signal Interface connector pinout.

Power Connector

The 9-pin male Type “D” connector provides ±15 VDC power to the 243 unit. For protective earthing, plug the power cord into a properly grounded outlet. Refer to Table 7, page 27, for the Power connector pinout.

Labels

Serial Number Label

The serial number label, located on the side of the instrument, lists the serial number and the product model number of the unit, and displays the CE mark signifying compliance with the European CE regulations.

Figure 8: Serial Number Label

Chapter Four: Operation

General Information

1. Ensure that the 243 unit is properly installed.

   Refer to *Mounting Instructions*, page 25, for more information.

2. Ensure that the external power supply is OFF.

Caution 

The 243 controller uses the connection to the power supply as its power switch, that is, the unit is *always* on when connected to a line source.

Plugging the cables in with the external power supply ON can damage the 243 unit or can cause the unit to malfunction.

3. Connect the 1153 MFC and the Type 260 PS-7 power supply to the connectors on the rear panel of the 243 unit (refer to Figure 7, page 31) using the proper interface cables.

   The interface cables are listed in Table 5, page 20.

Caution 

Ensure that the cables are plugged STRAIGHT into the Type "D" connectors on the 243 unit. Plugging the cables in improperly (such as on an angle) can damage the 243 unit or can cause the unit to malfunction.

4. Set the flow and temperature set points using the potentiometers on the front panel (refer to Figure 6, page 29).

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Chapter Five: Maintenance and Troubleshooting

General Information

If the 243 controller 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.

Maintenance

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

How To Clean the Unit

Periodically wipe down the unit with a damp cloth.

Troubleshooting

If the controller is not operating properly, check for obvious problems such as whether the cable connections are loose or there is input power failure. If, after checking these items the unit still does not function properly, contact MKS for assistance.

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Appendix A: Product Specifications

Accuracy	
Flow and Temperature Set Point	±0.1% of FS
Flow and Temperature Readout	±1 count on readout; 1° C for temperature, 0.1% for flow
CE Compliance	
Electromagnetic Compatibility[1]	EMC Directive 89/336/EEC
Product Safety Requirements	Product Safety Directive 92/59/EEC
Display	3½ digits
Input Impedances	> 10 K ohm
Input Power Requirements	
Voltage	±15 VDC (regulated)
Current	+15 VDC @ 0.75 A -15 VDC @ 0.1 A
Long Term Drift	0.2% of FS
Operating Temperature Range	0° to 50° C (32° to 122° F)
Output Noise Bandwidth	1 pA/Sqrt (Hz)
Range	0° to 500° C temperature; 0 to 100% flow
Resolution	1° C temperature; 0.1% FS flow
Settling Time	0.5 seconds
Signal Inputs	0 to 5 VDC
Signal Outputs	0 to 5 VDC into > 10 K ohm load
Storage Humidity Range	0 to 95% RH (non-condensing)
Storage Temperature Range	-20° to 80° C (-4° to 176° F)
Warm Up Time	1 minute

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

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

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Appendix B: Model Code Explanation

Model Code

The type number designates the model number of the instrument. The controller is identified as the Type 243A.

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