



Series 245 Quick Start Guide for Granville-Phillips® Series 245 Pressure/Flow Control Valve.

Quick Start Guide p/n 245002-Rev. B

NOTICE

More detailed instructions regarding installation, operation, and service of the Series 245 Pressure/Flow Control Valve are provided in the Instruction Manual, p/n 245001 which can be downloaded from the MKS website. Go to: www.mksinst.com and search for 245001.

This Quick Start Guide is for the following Series 245 Pressure/Flow Control Valves:

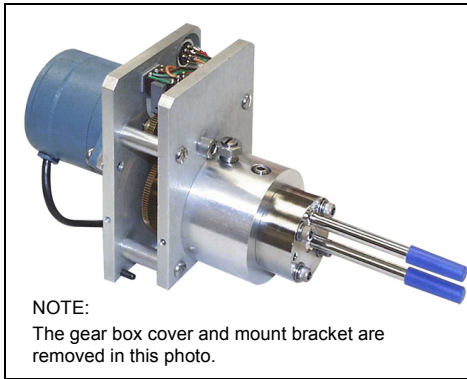


Figure 1: Series 245 Flow Control Valve

Catalog Numbers for Flow Control Valves covered in this Quick Start Guide and Instruction Manual 245001

Catalog #	Description
Complete Assemblies	
245-11179	VALVE,MOTOR/DRIVE,VCR FLG,BEND 02
245-11450	VALVE,MOTOR/DRIVE,NW16CF BOTH PORTS,BEND 02
245-11885	VALVE,MOTOR/DRIVE,NW35CF B PORT ONLY,BEND 02
245-11929	VALVE,MOTOR/DRIVE,VCR,BEND 02
245-12013	VALVE,MOTOR/DRIVE,VCR BOTH PORTS,BEND 04
245-12688	VALVE,MOTOR/DRIVE,NW35CF BOTH PORTS,BEND 02
245-13135	VALVE,MOTOR/DRIVE,NW16CF PORT B ONLY,BEND 02
245-13893	VALVE,MOTOR/DRIVE,VCR BOTH PORTS,BEND 04
245-21509	VALVE,MOTOR/DRIVE, NW16CF BOTH PORTS, BEND 04
245-21578	VALVE,MOTOR/DRIVE,NW16CF B PORT ONLY,BEND 04
245-21591	VALVE,MOTOR/DRIVE,NW16CF,BEND 05,316SST PORT
245-23479	VALVE,MOTOR/DRIVE,NW35CF BOTH PORTS,BEND 03
245-24958	VALVE,MOTOR/DRIVE,VCR BOTH PORTS,BEND 04
245-25266	VALVE,MOTOR/DRIVE,VCR BOTH PORTS,BEND 02
245-27104	VALVE,MOTOR/DRIVE,VCR,BEND 02
245-28153	VALVE,MOTOR/DRIVE,316&PT,BEND 02
Replacement motor/gear drive assembly only (valve not included)	
245-216035	MOTOR/GEAR DRIVE ASSY
Replacement valve assembly only (motor/gear drive not included)	
245-15121	VALVE BODY,316SST&PLAT,VCR,SHORT PORT B, BEND 02
245-216036	VALVE BODY, w/SS TUBES
245-216037	VALVE BODY W/CUSEAL FLGS
245-216038	VALVE BODY W/CAJON VCR
245-216039	VALVE BODY W/CAJON VCO
245-216049	VALVE BODY W/MINICUS FLGS
Complete Assemblies with 8-inch extension between the motor and valve	
245-13277**	VALVE,MOTOR/DRIVE,NW16CF,BEND 02, with 8-INCH EXTENSION/
245-13278**	VALVE, MOTOR/DRIVE,NW16CF,BEND 02, with 8-INCH EXTENSION, ROTATED 180

**NOTE: See Appendix A of the Instruction Manual 245001 for information specific to units with the 8-inch extension between the motor driver and the flow control valve.

General Description

The Series 245 Pressure/Flow Control Valve provides wide-range, precision control pressure from ultra-high vacuum to 25 psig, and flow up to 2500 Torr liter/sec (400 scfh). The valve assembly is constructed entirely of low-vapor metals. There are no organic materials exposed to the gas flow.

The valve controls gases with temperatures ranging from 0 °C to 50 °C, and can be baked in the open position up to 450 °C.

Intended Use

The Series 245 Pressure/Flow Control Valve is used for pressure/flow control in a dynamic process by regulating the gas flow to compensate for gases being removed at constant or varying rates.

Improper Use

- Removal of any factory installed components.
- Modifying any factory installed components.
- Removal of any labeling or warranty seals.
- Operation of this device in any condensing vapor or liquid, or explosive environment.

Storage

Store the valve assembly indoors between 0 °C to +70 °C (32°F to 158 °F).

Bag the assembly in a sealed or shrink wrapped bag with desiccant.

All of the components should be bagged and boxed together along with the instructions for future reference.

High Pressure Operation

If a pressurized gas source will be connected to the valve, the vacuum system must be protected against exploding from the buildup of a positive pressure which may be the result of a failure in the transducer or valve assembly. A suitable pressure relief valve or burst disc must be installed if the vacuum system cannot withstand the pressure from the gas source. Do not exceed maximum allowable inlet pressures specified in the specifications table.

Chemicals

Use of certain corrosive gases can cause the valve to fail. These gases could then either leak through the sealed valve, or leak out into the atmosphere, thereby causing a health or safety hazard. Before a gas is to be used with the valve, it should be checked for compatibility with the following materials found within the valve body: fine silver and type 304 Stainless steel, or platinum and type 316 Stainless steel.

Safety Notices

These safety precautions must be observed during all phases of installation, operation, and service of this product. Failure to comply with these precautions or with specific warnings elsewhere in this instruction guide violates safety standards of design, manufacture, and intended use of the instrument. MKS Instruments, Inc./Granville-Phillips disclaims all liability for the customer's failure to comply with these requirements.

These instructions do not and cannot provide for every contingency that may arise in connection with the installation, operation, or maintenance of this product. If you require further assistance, please contact MKS, Granville-Phillips Division at the address given on this instruction guide.

Safety Symbols

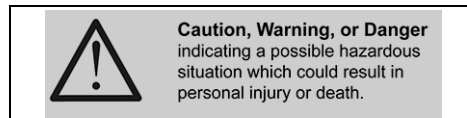


Figure 2: Safety Symbol on the Micro-Ion Module

CAUTION

General Safety Notices

This document is not a substitute for complete safety and installation guidance. See the Instruction Manual (245001) for safety notices and information regarding installation and use of this product.

Improper grounding could cause product failure or personal injury. Follow ground network requirements for the facility. Maintain all exposed conductors at Earth ground. Make sure the vacuum port to which the product is mounted is properly grounded.

Exposing the product to moisture can cause fire or electrical shock resulting in severe property damage or personal injury. To avoid exposing the product to moisture, install it in an indoor environment. Do not install the product in any outdoor environment.

To avoid measurement error or product failure due to over pressurization, install pressure relief valves or rupture disks in the system if pressure exceeds 1000 Torr (1333 mbar, 133 kPa).

Do not substitute parts or modify the instrument. Return the product to a service facility designated by Granville-Phillips for service and repair to ensure that safety features are maintained. Do not use this product if it has unauthorized modifications.

High Voltage

WARNING

Electrical Shock or Personal Injury

The service and repair information in this instruction guide is for the use of Qualified Service Personnel. To avoid possible electrical shock or personal injury, do not perform any procedures in this manual or perform any servicing on this product unless you are qualified to do so.

Grounding Requirements

WARNING

High Voltage and Proper Grounding

All components of a vacuum system used with this or any similar high voltage product must be maintained at Earth ground for safe operation.

Be aware that grounding this product does not guarantee that other components of the vacuum system are maintained at Earth ground.

Verify that the vacuum port to which the valve assembly is mounted is electrically grounded. It is essential for personnel safety as well as proper operation that the envelope of the gauge be connected to a facility ground.

Connect power cords only to properly grounded outlets or sources.

Over-pressure Conditions

WARNING

Failure to install appropriate pressure relief devices for high-pressure applications can cause product damage or personal injury.

Install appropriate pressure relief devices for automatic backfilling or other applications in which malfunction or normal process conditions can cause high pressures to occur.

Suppliers of pressure relief valves or disks can be located via an online search and are listed on Thomas.net under "Relief Valves" and "Rupture Disks". **Confirm that these safety devices are properly installed before installing and operating the product.**

Location of the Pressure/Flow Control Valve Assembly on the Vacuum Chamber

Use the following the guidelines to determine the best location for the valve assembly on your vacuum system.

Mounting Location and Orientation

The following statements should be considered when deciding where to mount the motor driven valve assembly on your system.

The dynamic response of the system will depend upon the placement of the pressure transducer with respect to the valve assembly. Gas beamed directly at the pressure transducer may cause it to sense an erroneous pressure, especially at low pressures. For best dynamic response, locate the transducer near the valve assembly, but not directly in the inlet gas stream.

The delay in system response when long, small bore tubing is used between the valve and the chamber can cause control problems. If the assembly is to be mounted more than a few inches from the chamber, the diameter of the connecting tubing should be increased so the lag in system pressure response does not cause undue control problems.

The 245 valve assembly is shipped from the factory with the mounting plate attached. It may be mounted to operate in any position, but horizontal mounting is recommended. If it is necessary to remove the mounting plate from the valve assembly so it can be mounted to a rigid support, follow the instructions below:

Remove the two Allen head screws that attach the mounting bracket to the valve body.

Carefully slide the mounting bracket off the guide pins on the motor mounting plate.

After the mounting bracket is attached to a rigid support, reverse the steps above to mount the valve assembly back onto the mounting bracket.

Dimensions

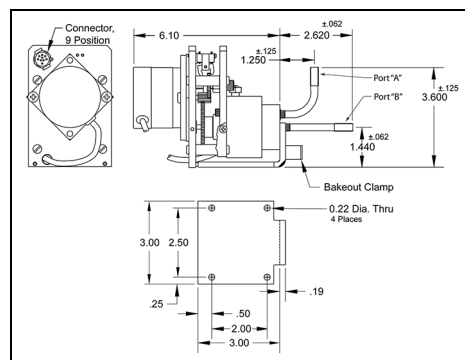


Figure 3: Dimensions of the 245 Valve Assembly

Assemblies with an 8-inch extension between the motor driver and the flow control valve

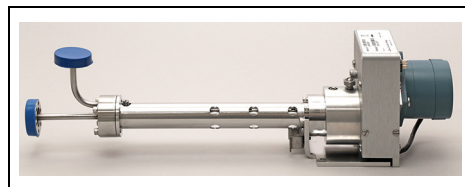


Figure 4: Feedback Control System Diagram

The 8-inch valve extender allows the valve body to be operated at elevated temperatures (up to 75 °C) without exceeding the 50 °C rating of the motor.

NOTICE

Do not install the motor and valve assembly in an enclosure of any type. Doing so prevents the motor from cooling and generates temperatures higher than the components of the motor and valve are able to withstand.

The valve can be enclosed on the system, but the motor must be at ambient temperature or cooled to maintain the operating temperature at 50 °C or less.

Vacuum Connections

Three types of connections are available for the valve body.

Flange Connections

This procedure is applicable to the 2-3/4 in. o.d. CuSeal flange and the 1-5/16 in. o.d. Mini-CuSeal flange. Between each pair of mating flanges, insert a new, clean OFHC copper gasket, using care not to mar or scratch the gasket surfaces. Insert and gradually and uniformly tighten the flange bolts until the mating surfaces are in contact. It is important that the mating surfaces be in intimate contact for good mechanical strength.

Welding Connections

The welding connections are 1/4 in. o.d. x .035 in. wall Type 304 Stainless Steel which welds readily to any other 300 series Stainless Steel except the free machining grades. An inert atmosphere inside the tubulation must be used in all welding operations to prevent the formation of an oxide scale which might enter the valve and cause a malfunction. Gas Tungsten Arc Welding (GTAW or TIG) using an argon atmosphere inside the tubulation works well.

VCR Connections

Remove the plastic or metal bead protector cap from the fitting. If a gasket is used, place the gasket into the female nut. Assemble the components and tighten them to finger-tight. While holding a back-up wrench stationary, tighten the female nut 1/8 turn past finger-tight on stainless steel or nickel gaskets, or 1/4 turn past finger-tight on copper or aluminum gaskets.

Gas Source

In some cases where control is to be extended below 10⁻⁸ Torr, the inlet pressure will need to be reduced to below one atmosphere for optimum results.

For gas inlet pressures below one atmosphere, either valve port may be connected to the system and the other port to the gas source. To obtain the minimum volume and surface area in the system, connect the center port, port B, to the system. The maximum pressures to which each port may be subjected to is 200 psig applied at port B or 25 psig applied at port A.

When operating from a pressurized gas source, a suitable burst disc should be installed in the vacuum system to prevent system explosion should system pressure rise.

Moist gases such as undried air or gases containing oil or other contaminants are difficult to control at low flow rates. Liquid films form quickly on the sealing surface, producing a liquid seal which has only on or off properties and may result in pressure oscillations.

When moist gases are being controlled, a possible solution to the problem is to place a gas drying unit in the line between the gas source and the valve. An oil trap placed between the gas source and the valve will aid in keeping oil out of the valve when controlling gases containing oil.

It is recommended that a shut-off valve be installed between the gas source and the valve. This allows the gas source to be isolated from the system when performing bakeout.

Motor Interconnect Cable

Connect the motor interconnect cable between the controller and the 245 valve assembly. Carefully match up the pins to prevent damaging the connector.

Operating Principles

The Series 245 Pressure/Flow Control Valve assembly is an electro-mechanical instrument designed to automatically regulate any parameter related to the introduction of gas pressure or flow of gas in a system. When combined with a suitable pressure or flow sensor and a vacuum pump, the 245 Valve assembly will accurately maintain any desired pressure or partial pressure in a system from 1300 Torr to less than 10⁻¹¹ Torr.

Pressure control is accomplished by automatically and continuously admitting the correct gas flow to a dynamic system to compensate for gas being removed at constant or varying rates by pumps, adsorption or other means. The 245 pressure/flow control valve assembly may be controlled to permit continuously varying pressure conditions, can be used for backfilling, and can also be used as a flow controller when combined with a suitable pressure or flow sensor.

The Series 245 assembly consists of the driver and the pressure/flow control valve. The driver has a stepper motor, a precision screw and a hydraulic driver. The motor drives the screw through a gear train. A portion of the screw is the small piston in the hydraulic cylinder. The large piston in the cylinder is connected to the nosepiece of the flow control valve by the wedge screw. The ratio of the size of the small piston to that of the large piston causes the force to be multiplied by 9. The compensating screw on the hydraulic driver is used to set the position of the large piston so the valve is just closed (leak not greater than 10⁻¹⁰ cc per second).

The seal-off screw in the compensating screw seals the hydraulic fluid chamber. The movement of the large piston opens and closes the valve. A closed limit switch and an open limit switch are located in the gear train. When the valve is either full open or full closed, the corresponding limit switch will be activated. A signal from the activated limit switch stops the stepper motor.

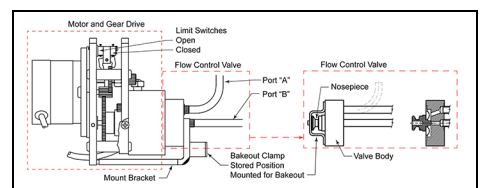


Figure 5: 245 Pressure/Flow Control Valve Assembly

A sensor senses the pressure in the vacuum chamber and sends a corresponding voltage to the input circuitry of the controlling electronics which conditions the input voltage and compares it with the reference voltage. The difference of the two voltages is the error signal. The error signal is used to control the stepper motor drive circuitry. The polarity of the error signal is used to open or close the valve to reduce the error signal to near zero.

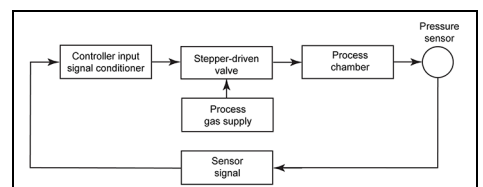


Figure 6: Feedback Control System Diagram

Temperature

The 245 valve is designed to be operated at ambient temperatures not exceeding 50 °C. It is not necessary to control the temperature of this unit during automatic operation as any change of leak rate due to temperature changes will automatically be compensated.

When the valve assembly is to be sealed during long periods, it may be desirable to control the ambient temperature of the valve. If the automatic control has been turned off, a drop of more than 10 °C may cause the valve to open slightly, permitting gas to leak into the system. If the valve has opened slightly due to an extreme decrease in temperature, it may be closed manually by turning the compensating screw clockwise 1/10 turn at a time.

Maximum Throughput

Maximum throughput is greater than 50 Torr liters/sec with atmospheric pressure on the inlet. Note that exhaust is to atmosphere.

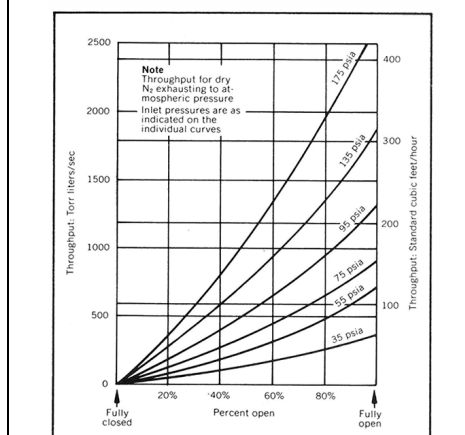
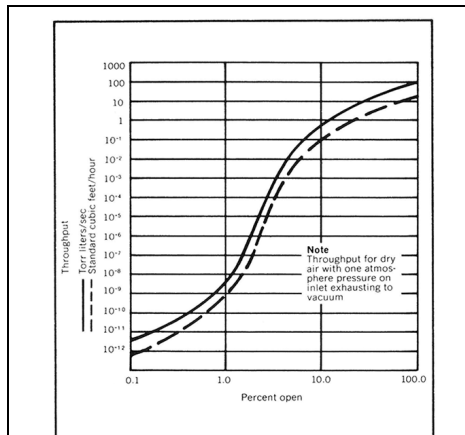


Figure 7: Control Panel on Micro-Ion Gauge Module with Analog Output

Troubleshooting

General Symptoms, Possible Causes and Corrections

Symptom	Cause/Correction
The motor does not operate properly in either automatic or manual mode.	<ol style="list-style-type: none"> The motor-to-controller cable is not connected. Connect the cable to the motor and controller. The motor-to-controller interconnect cable is defective. Repair or replace the cable. The motor is bound or defective. Contact Granville-Phillips Customer Support for factory repair.
The system fails to stabilize at the set pressure.	<ol style="list-style-type: none"> No source-gas pressure. Turn ON the source gas and set it to the proper pressure. The controller is not properly set up. Reset the controller according to the instructions provided with the controller. The base pressure of the system may be above the set reference pressure. Reduce the base pressure. Extraneous noise and distortion greater than 10% of the sensor signal output. Filter the output of the sensor signal.
The valve does not close tightly.	<ol style="list-style-type: none"> The valve mounting screws are not properly tightened. Tighten the screws as required. The compensating screw is backed out. Turn the compensating screw clockwise 1/10 turn and observe a decrease in the pressure of the vacuum system. If no change is observed, check the hydraulic fluid level. Insufficient hydraulic fluid in the valve. Use the manual switch on the controller to open the valve. Remove the compensating screw and fill hole to bottom of the threads with hydraulic oil. The fluid must have a minimum viscosity of 150 SSU at 100 °F. (Three oils that have the property mentioned above are Oil Dyne, Inc. #0-D15, Mobil #DTE 24 and Texaco #RANDO HDA). Be sure all the bubbles are dissipated. Remove the seal-off screw from the compensating screw. Replace the seal-off screw without the seal-off screw and engage the threads six full revolutions. Fill the center recess in the compensating screw to bring the oil level to the top of the screw hole. Install the seal-off screw and O-ring tight enough to seal the hydraulic chamber. Hold the hex head compensating screw with a wrench while tightening the seal-off screw. Use the manual switch on the controller to close the valve. Turn the compensating screw clockwise 1/10 turn at a time and observe a decrease in pressure of the vacuum system. The set screw on the drive gear is loose. Contact Granville-Phillips Customer Support. Sealing surfaces are contaminated. Replace the valve. Cleaning is usually not effective.
The valve does not open fully.	<ol style="list-style-type: none"> The compensating screw is screwed in too far. If the valve is operated at too high an ambient temperature the hydraulic fluid expands and the valve cannot be fully opened. Back out the compensating screw 1/10 turn at a time to relieve the condition. Hydraulic fluid has trapped air bubbles. Replenish the hydraulic fluid supply. See "Insufficient hydraulic fluid in the valve", above.
The valve envelope leaks.	Contact Granville-Phillips Customer Support for factory repair.
Hydraulic fluid is leaking around the drive screw.	The O-ring is damaged or compressed. Contact Granville-Phillips Customer Support for factory repair.

Product Specifications

Parameter	Specification
Pressure control range	10 ⁻¹¹ Torr (2 x 10 ⁻¹³ psia) to 1300 Torr (25 psig)
Maximum throughput	2500 Torr liters/sec. (400 scfh) with 175 psia on inlet, exhausting to 760 Torr (14.7 psia). Greater than 50 Torr liters/sec. (17 scfh) with one atmosphere (14.7 psia) pressure on inlet, exhausting to vacuum.
Leakage conductance	To vacuum: 10 ⁻¹² liters/sec. (1.3 x 10 ⁻¹⁰ cfh) maximum when free of dirt, dust, chips, or other contamination and when the seal region has not been deformed by misuse.
Valve inlet maximum pressures	Port A = 25 psig; Port B = 200 psig
Valve operating temperatures	0 °C Min to +50 °C Max (32 °F to 122 °F) NOTE: See Appendix A of the Instruction Manual 245001 when the valve is mounted on the 8-inch extender.
Motor operating temperatures	Typically ~50 °C (122 °F)
Operation humidity	0 to 90% (accuracy may be affected below 1x10 ⁻⁹ Torr)
Non-operating temperatures	0 °C to +70 °C (32 °F to 158 °F)
Valve bakeout maximum temperature	Up to 450 °C with the servo motor removed and the bakeout clamp installed. The pressure inside the valve during bakeout should be less than 10 ⁻⁴ Torr (2x10 ⁻⁶ psia) so oxidation is kept to a minimum. See the bakeout procedure in the instruction manual.
Valve body materials	Type 304 Stainless steel and fine silver or Type 316 Stainless steel and Platinum
Valve weight	6 lb (2.7 kg)

Specifications and dimensions are subject to change without notice.

Service / Maintenance

If the product requires service, contact the MKS, Granville-Phillips Technical Support Department at 1-303-652-4400 for troubleshooting help.

If the product must be returned to the factory for service, request a Return Material Authorization (RMA) from Granville-Phillips. Do not return products without first obtaining an RMA. In some cases a hazardous materials document may be required. The MKS/Granville-Phillips Customer Service Representative will advise you if the hazardous materials document is required.

When returning a product to Granville-Phillips, be sure to package the product to prevent shipping damage. Circuit boards and modules separated from the gauge assembly must be handled using proper anti-static protection methods and must be packaged in anti-static packaging. Shipping damage on returned products as a result of inadequate packaging is the Buyer's responsibility.

Service / Maintenance Procedures

Bakeout and maintenance instructions are given in the Instruction Manual, p/n 245001, which can be downloaded at: www.mksinst.com.

Customer Service / Technical Support

MKS Pressure and Vacuum Measurement Solutions
MKS Instruments, Inc., Granville-Phillips® Division
6450 Dry Creek Parkway
Longmont, Colorado 80503 USA
Tel: 303-652-4400
Fax: 303-652-2844
Email: mks@mksinst.com

MKS Corporate Headquarters
MKS Instruments, Inc.
2 Tech Drive, Suite 201
Andover, MA 01810 USA
Tel: 978-645-5500
Fax: 978-557-5100
Email: mks@mksinst.com

Chinese Hazardous Substances Concentration Table

Document #
145746
Revision A

有毒有害物质或元素名称及含量标识格式 (Chinese Hazardous Substances Table)

部件名称 (Part Name)	有毒有害物质或元素 (Hazardous Substances)					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
印刷电路板组件 (Printed Circuit Board Assembly)	X	O	O	O	O	O
电子器件外壳 (Electronics Enclosure)	O	O	O	O	O	O
真空传感器 (Vacuum Sensor)	O	O	O	O	O	O
电缆 (Cable Assembly)	X	O	O	O	O	O

O: 表示该有毒有害物质在该部件所有均匀材料中的含量均在GB/T 26572规定的限量要求以下
(Indicates that said hazardous substances contained in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572.)

X: 表示该有毒有害物质至少在该部件的某一均匀材料中的含量超出GB/T 26572规定的限量要求。
(Indicates that said hazardous substances contained in at least one of the homogeneous materials used for the part is above the limit requirement of GB/T 26572.)

MKS Instruments, Inc.
Granville-Phillips Div.
6450 Dry Creek Parkway
Longmont, CO. 80503-9501 USA



Notice

More detailed instructions regarding installation, operation, and service of the Series 245 Pressure/Flow Control Valve Assembly are provided in the Instruction Manual, p/n 245001, available online at www.mksinst.com/Granville-Phillips.

© 2016 MKS Instruments, Inc. All rights reserved. Granville-Phillips® is a registered trademark, and mksinst™ is a trademark of MKS Instruments, Inc. All other trademarks and registered trademarks are the properties of their respective owners.

Quick Start Guide p/n 245002-Rev. B
October 2016