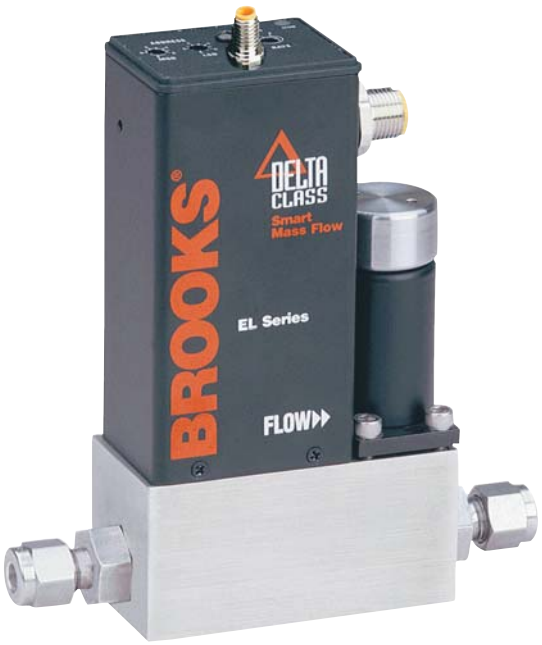
Installation and Operation Manual
X-PR-SLA5800-RT-eng
Part Number: 541B120AAG
August, 2009

Delta Class Remote Transducer Pressure Controller/Flowmeter

Model SLA5840A
Analog I/O



Model SLA5840D
Digital I/O DeviceNet

BROOKS® INSTRUMENT

Essential Instructions

Read this page before proceeding!

Brooks Instrument designs, manufactures and tests its products to meet many national and international standards. Because these instruments are sophisticated technical products, you must properly install, use and maintain them to ensure they continue to operate within their normal specifications. The following instructions must be adhered to and integrated into your safety program when installing, using and maintaining Brooks Products.

- Read all instructions prior to installing, operating and servicing the product. If this instruction manual is not the correct manual, please see back cover for local sales office contact information. Save this instruction manual for future reference.
- If you do not understand any of the instructions, contact your Brooks Instrument representative for clarification.
- Follow all warnings, cautions and instructions marked on and supplied with the product.
- Inform and educate your personnel in the proper installation, operation and maintenance of the product.
- Install your equipment as specified in the installation instructions of the appropriate instruction manual and per applicable local and national codes. Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, use qualified personnel to install, operate, update, program and maintain the product.
- When replacement parts are required, ensure that qualified people use replacement parts specified by Brooks Instrument. Unauthorized parts and procedures can affect the product's performance and place the safe operation of your process at risk. Look-alike substitutions may result in fire, electrical hazards or improper operation.
- Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent electrical shock and personal injury.

Pressure Equipment Directive (PED)

All pressure equipment with an internal pressure greater than 0.5 bar (g) and a size larger than 25mm or 1" (inch) falls under the Pressure Equipment Directive (PED). The Directive is applicable within the European Economic Area (EU plus Norway, Iceland and Liechtenstein). Pressure equipment can be traded freely within this area once the PED has been complied with.

- Section 1 of this manual contains important safety and operating instructions related to the PED directive.
- Meters described in this manual are in compliance with EN directive 97/23/EC module H *Conformity Assessment.*
- All Brooks Instrument Flowmeters fall under fluid group 1.
- Meters larger than 25mm or 1" (inch) are in compliance with category I, II, III of PED.
- Meters of 25mm or 1" (inch) or smaller are Sound Engineering Practice (SEP).

ESD (Electrostatic Discharge)

⚠ CAUTION

This instrument contains electronic components that are susceptible to damage by static electricity. Proper handling procedures must be observed during the removal, installation or other handling of circuit boards or devices.

Handling Procedure:

1. Power to unit must be removed.
2. Personnel must be grounded, via a wrist strap or other safe, suitable means before any printed circuit card or other internal device is installed, removed or adjusted.
3. Printed circuit cards must be transported in a conductive container. Boards must not be removed from protective enclosure until immediately before installation. Removed boards must immediately be placed in protective container for transport, storage or return to factory.

Comments

This instrument is not unique in its content of ESD (electrostatic discharge) sensitive components. Most modern electronic designs contain components that utilize metal oxide technology (NMOS, SMOS, etc.). Experience has proven that even small amounts of static electricity can damage or destroy these devices. Damaged components, even though they appear to function properly, exhibit early failure.

Dear Customer,

We appreciate this opportunity to service your flow measurement and control requirements with a Brooks Instrument device. Every day, flow customers all over the world turn to Brooks Instrument for solutions to their gas and liquid low-flow applications. Brooks provides an array of flow measurement and control products for various industries from biopharmaceuticals, oil and gas, fuel cell research and chemicals, to medical devices, analytical instrumentation, semiconductor manufacturing, and more.

The Brooks product you have just received is of the highest quality available, offering superior performance, reliability and value to the user. It is designed with the ever changing process conditions, accuracy requirements and hostile process environments in mind to provide you with a lifetime of dependable service.

We recommend that you read this manual in its entirety. Should you require any additional information concerning Brooks products and services, please contact your local Brooks Sales and Service Office listed on the back cover of this manual or visit www.BrooksInstrument.com

Yours sincerely,

Brooks Instrument

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Figures

Tables

1-1 Scope

Thank you for purchasing a Brooks Instrument Remote Transducer Pressure Controller/Flowmeter Product. This manual, X-PR-SLA5800-RT-eng is an installation and operation manual for your instrument.

If you have purchased a Brooks® Digital Mass Flow Product with DeviceNet Communications, a separate DeviceNet Instruction Manual shall also be provided as part of the operating documentation.

1-2 Purpose

The Brooks Digital Products are mass flow measurement devices designed for accurately measuring and controlling both pressure and the flows of gases. This instruction manual is intended to provide the user with all the information necessary to install, operate and maintain the Brooks® RT. This manual is organized into the following sections.

Section 1	Introduction
Section 2	Installation
Section 3	Operation
Section 4	Maintenance & Troubleshooting
Section A	CE Certification
Back Cover	Warranty, Local Sales/Service Contact Information

It is recommended that this manual be read in its entirety before attempting to operate or repair these Brooks Digital products.

1-3 Description

The Brooks® Model SLA5840 Pressure Controller/Flowmeter controls pressure while also measuring flow rate. The Model SLA5840 receives a remote pressure transducer signal, and using adjustable integral PID control electronics and control valve, will maintain a desired set pressure. In addition to the pressure control function, the Model SLA5840 provides a 0-5 V signal which is linear with mass flow rate. The Model SLA5840 can also be configured as a mass flow controller for calibration or test purposes.

Brooks now offers control interface with DeviceNet™, a high-speed (up to 500k baud) digital communication network adopted by the Semiconductor industry. Brooks' communications capabilities and device-profile have been certified by the ODVA™ (Open DeviceNet Vendors' Association). Other network protocols are in development. Talk to your Brooks representative about your specific needs.

The MFC's microprocessor uses a multi-point calibration curve, to deal with residual sensor non-linearity, yielding a highly accurate process signal. The microprocessor then executes Brooks' proprietary Adaptive Valve

Control algorithm to rapidly adjust the valve actuation to match setpoint. Process data and commands may be wired using either traditional 5 volt analog connections or digital communications networks, the measurement and control performance is the same!

The SLA5800 family of products takes advantage of modular design in both mechanical and electrical construction. This modularity allows for simplified customer ordering and factory configuration, enabling Brooks to more easily meet the ever changing needs of our global customers. Brooks' production flexibility translates into reduced lead times for our customers. This flexibility allows products using both traditional analog connections or leading edge network communications protocols.

The SLA5800 series of controllers can directly replace existing analog products bringing with them greatly improved accuracy. Analog and digital applications will see settling time improvements with an insensitivity to varying process conditions, due to Brooks' proprietary Adaptive Valve Control algorithm.

1-4 Specifications

⚠ WARNING

Do not operate this instrument in excess of the specifications listed below. Failure to heed this warning can result in serious personal injury and/or damage to the equipment.

Performance Characteristics:

Flow Ranges**

Model SLA5840

Any range from 0-3 sccm to 0-30,000 sccm N_2 eq.

****Standard: 0° and 101kPa (760 Torr). Per SEMI Guideline E12-96.**

Flow Control Range

(50:1) - elastomeric valve seat

Flow Accuracy

±1.0% of rate, including linearity (20% to 100% F.S.), ±0.2% of F.S. (below 20% full scale)

Flow Repeatability

±0.20% of rate

Flow Temperature Sensitivity

Zero: Less than 0.05% F.S. per °C

Span: Less than 0.1% of rate per°C

Flow Settling Time

Actual flow:

Less than 800 ms to within ±2% full scale of final value for a 0-100% step.

Constant step response of less than 800 ms for all other transient steps.

Performance Characteristics: Pressure

Pressure Ranges

Dependent upon remote sensor transducer, maximum 1500 psig.

External Sensor Input

Suitable for pressure sensors with maximum 0-10 Vdc output signals.

Pressure Control Range

100:1 for elastomer valve seat

Pressure Settling Time

Less than 1 second typical for a 20-100% setpoint step with maximum 2% overshoot. Actual pressure response highly dependent on system design.

RATINGS:

Operating Pressure

1500 psig maximum

(PED) Pressure Equipment Directive 97/23/EC:

Equipment falls under Sound Engineering Practice (SEP)

Leak Integrity

Inboard to Outboard: $1x10^{-9}$ atm scc/sec Helium max.

Ambient Temperature Limits

Operating: 0°C to 60°C (32°F to 140°F)
Non-Operating: -25°C to 100°C (-13°F to 212°F)

Fluid Temperature Limits

0°C to 65°C (32°F to 149°F)

Physical Characteristics:

⚠ CAUTION

It is the user's responsibility to select and approve all materials of construction. Careful attention to metallurgy, engineered materials and elastomeric materials is critical to safe operation.

Materials of Construction

316L Vacuum Arc Remelt (VAR), 316L, and high-alloy ferritic stainless steel.
Valve Seat: fluoroelastomers,Buna-N, Kalrez®
External/internal seals: Viton® fluoroelastomers, Buna-N or Kalrez®
Internal Wetted Surface Finish: 32 Ra

Outline Dimensions

Refer to Figures 1-1 & 1-2.

Process Connections

Refer to Figures 1-1 & 1-2.

Electrical Characteristics:

Electrical Connections

Analog I/O option: 15-pin, male
Digital I/O DeviceNet option: 5-pin Micro-Connector male.

Power Supply Voltage

Analog I/O option: +15 Vdc, ±5%
(traditional -15 Vdc pin is ignored)
Digital I/O DeviceNet option: 11 - 25Vdc

Power Requirements	Watts, typ.	Watts, max.
Analog I/O option, with valve:	2.6	4.0
Digital I/O DeviceNet option, with valve:	4.9	7.6

Analog I/O Pin Connections:

Signal:	15-pin D-conn
Setpoint/Command Common	1
Flow/Signal Out	2
+15v dc power	5
Setpoint/Command In	8
Power Supply Common	9
Output Signal Common	10
+5V reference	11
Valve Override	12
Mode Select Pin	13
External Sensor	15
no-connections	3, 4, 6, 7, 14

Setpoint Input (Analog I/O option only)
0-5 Vdc: Input will accept signals to 5.5 Vdc (110% F.S.).
Input resistance: 360K ohm min.

Flow Output (Analog I/O option only)
0-5 Vdc into 2K ohm minimum load.
Output will indicate process variable up to 6 Vdc (120% F.S.).

Valve Override Signal (Analog I/O option only)
Left floating/unconnected – instrument controls valve to command setpoint
Connected to signal at or above 5.0 Volts
– valve is forced open
Connected to signal at or below 0.0 Volts
– valve is forced closed

5 Volt Reference Signal (Analog I/O option & 15 PIN only)
5.0 Vdc + 0.2% output available for potentiometer
command setpoint input (1K ohm minimum load).

Mode Select Signal (15 Pin Only)
Select whether to control in external sensor (pressure) mode or flow mode.

EMC Directive (89/336/EEC) per 61326.

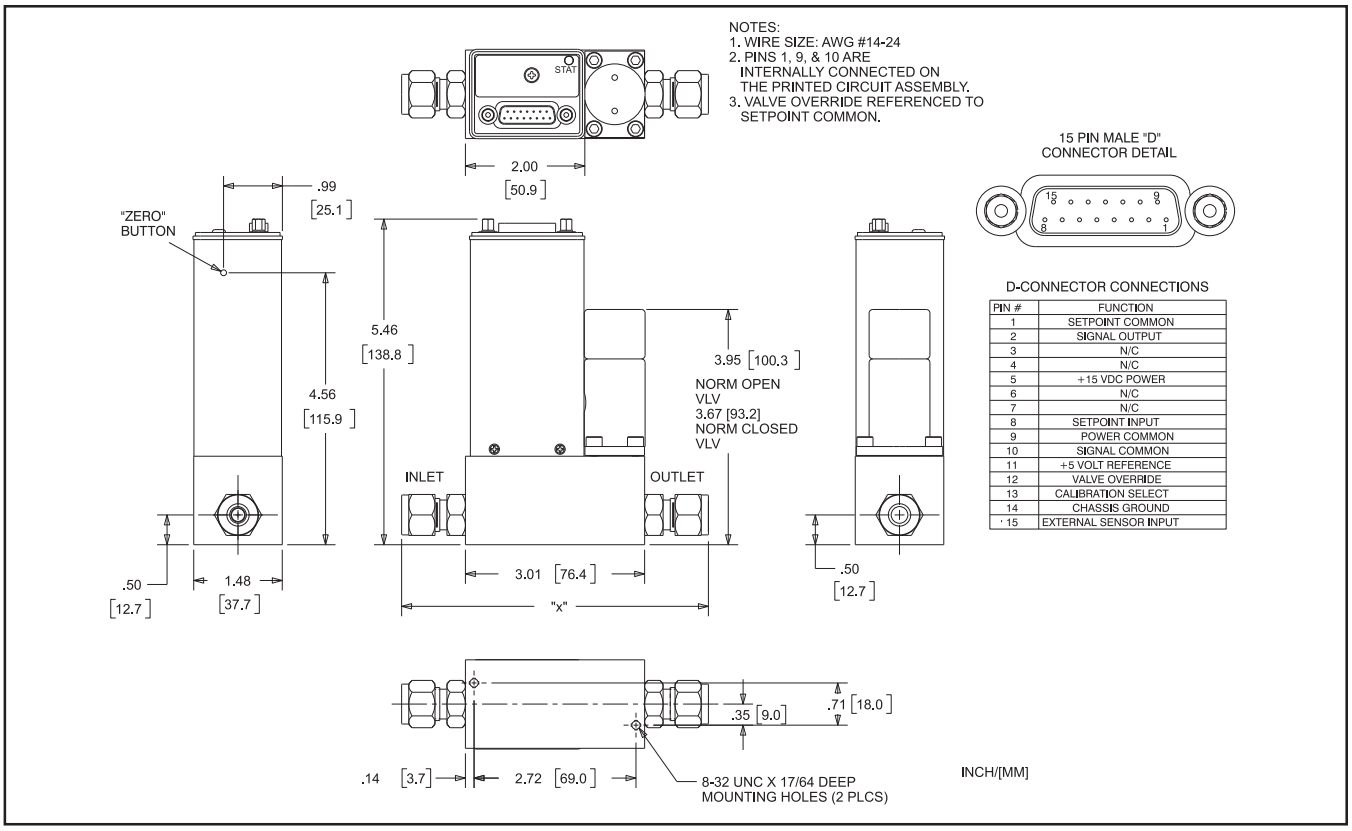

Figure 1-1 Model SLA5840 Analog I/O Controller with 1/4" Tube Connections

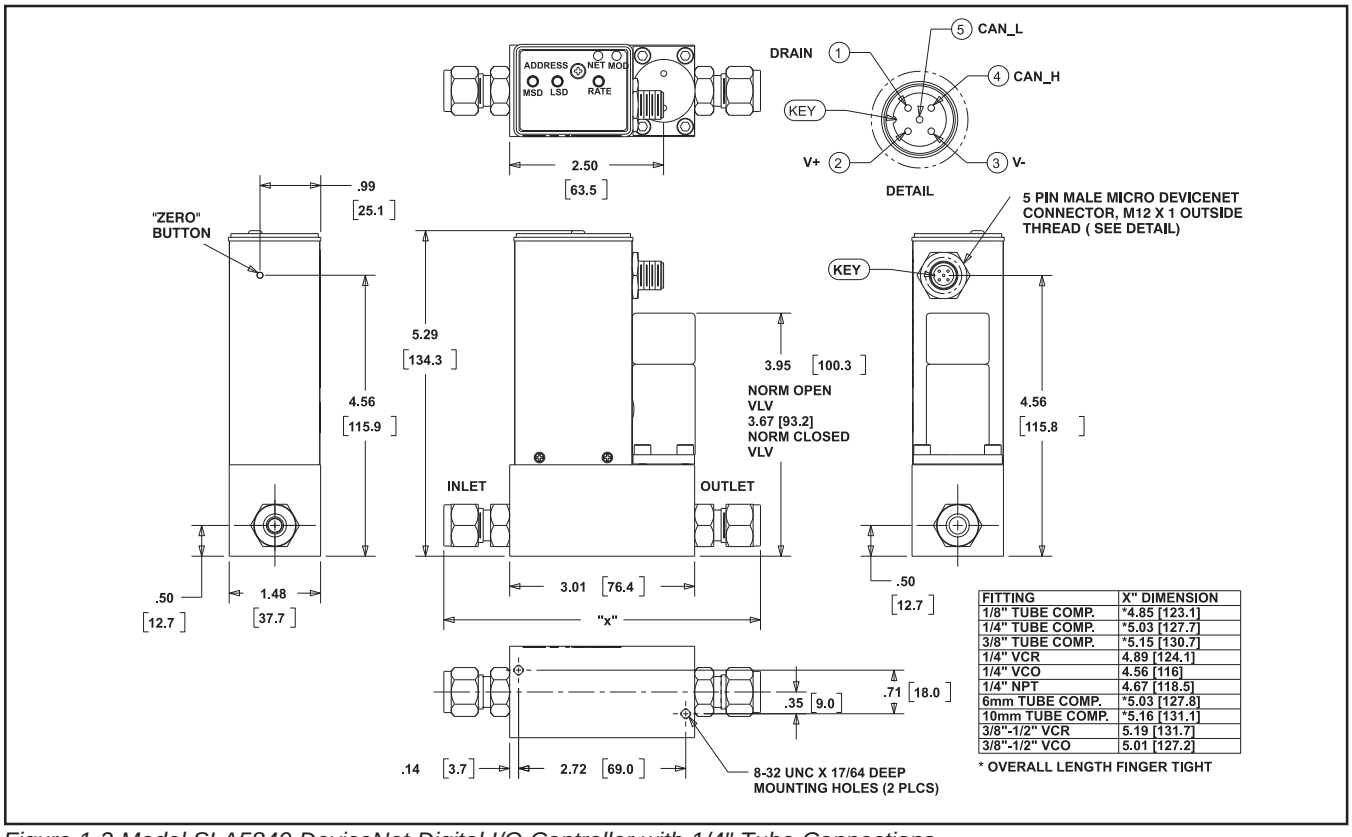

Figure 1-2 Model SLA5840 DeviceNet Digital I/O Controller with 1/4" Tube Connections

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2-1 General

This section provides installation instructions for the Brooks® Delta Class EL Series. Section 1, Figures 1-1 and 1-2 show the dimensions and electrical connections.

2-2 Receipt of Equipment

When the instrument is received, the outside packing case should be checked for damage incurred during shipment. If the packing case is damaged, the local carrier should be notified at once regarding his liability. A report should be submitted to your nearest Product Service Department.

Brooks Instrument
407 W. Vine Street
P.O. Box 903
Hatfield, PA 19440 USA
Toll Free (888) 554 FLOW (3569)
Tel (215) 362 3700
Fax (215) 362 3745
E-mail: BrooksAm@BrooksInstrument.com
www.BrooksInstrument.com

Brooks Instrument
Neonstraat 3
6718 WX Ede, Netherlands
P.O. Box 428
6710 BK Ede, Netherlands
Tel +31 (0) 318 549 300
Fax +31 (0) 318 549 309
E-mail: BrooksEu@BrooksInstrument.com

Brooks Instrument
1-4-4 Kitasuna Koto-Ku
Tokyo, 136-0073 Japan
Tel +81 (0) 3 5633 7100
Fax +81 (0) 3 5633 7101
Email: BrooksAs@BrooksInstrument.com

Remove the envelope containing the packing list. Carefully remove the instrument from the packing case. Make sure spare parts are not discarded with the packing materials. Inspect for damaged or missing parts.

2-3 Recommended Storage Practice

If intermediate or long-term storage of equipment is required, it is recommended that the equipment be stored in accordance with the following:

a. Within the original shipping container.
b. Stored in a sheltered area, preferably a warm, dry, heated warehouse.
c. 32°C (90°F) maximum,45°F (7°C) minimum.
d. Relative humidity 45% nominal, 60% maximum, 25% minimum. Upon removal from storage a visual inspection should be conducted to verify the condition of equipment is "as received".

2-4 Return Shipment

Prior to returning any instrument to the factory, contact your nearest Brooks location for a Return Materials Authorization Number (RMA#). This can be obtained from one of the following locations:

Brooks Instrument
407 W. Vine Street
P.O. Box 903
Hatfield, PA 19440 USA
Toll Free (888) 554 FLOW (3569)
Tel (215) 362 3700
Fax (215) 362 3745
E-mail: BrooksAm@BrooksInstrument.com
www.BrooksInstrument.com

Brooks Instrument
Neonstraat 3
6718 WX Ede, Netherlands
P.O. Box 428
6710 BK Ede, Netherlands
Tel +31 (0) 318 549 300
Fax +31 (0) 318 549 309
E-mail: BrooksEu@BrooksInstrument.com

Brooks Instrument
1-4-4 Kitasuna Koto-Ku
Tokyo, 136-0073 Japan
Tel +81 (0) 3 5633 7100
Fax +81 (0) 3 5633 7101
Email: BrooksAs@BrooksInstrument.com

Any instrument returned to Brooks requires completion of Form RPR003-1, Brooks Instrument Decontamination Statement, as well as, a Material Safety Data Sheet (MSDS) for the fluid(s) used in the instrument. This is required before any Brooks Personnel can begin processing. Copies of the form can be obtained from any Brooks Instrument location listed above.

2-5 Removal from Storage

Upon removal from storage, a visual inspection should be conducted to verify the condition of the equipment is “as received.” If the equipment has been in storage in conditions in excess of those recommended (See Section 2-3), the device should be subjected to a pneumatic pressure test in accordance with applicable vessel codes.

2-6 Gas Connections

Prior to installation ensure all piping is clean and free from obstructions. Install piping in such a manner that permits easy access to the instrument if removal becomes necessary.

2-7 Installation

⚠ CAUTION

When installing the Mass Flow Controller or Meter, care should be taken that no foreign materials enter the inlet or outlet of the instrument. Do not remove the protective end caps until time of installation.

⚠ CAUTION

Any sudden change in system pressure may cause mechanical damage to elastomer materials. Damage can occur when there is a rapid expansion of fluid that has permeated elastomer materials. The user must take the necessary precautions to avoid such conditions.

Recommended installation procedures:

a. The Delta Class EL Series RT should be located in a clean, dry atmosphere relatively free from shock and vibration.
b. Leave sufficient room for access to Self-zero function push-button.
c. Install in such a manner that permits easy removal if the instrument requires servicing.

⚠ CAUTION

When used with a reactive (sometimes toxic) gas, contamination or corrosion may occur as a result of plumbing leaks or improper purging. Plumbing should be checked carefully for leaks and the instrument purged with clean, dry N_2 before use.

d. The Delta Class EL Series RT can be installed in any position. However, mounting in orientations other than the original factory calibration (see calibration data sheet supplied with the instrument) can result in a <±0.5% maximum full scale shift after re-zeroing.
e. When installing a mass flow controller or meter with full scale flow rates of 10 slpm or greater, be aware that sharp, abrupt angles in the system piping directly upstream of the controller may cause a small shift in accuracy. If possible, have at least ten pipe diameters of straight tubing upstream of the mass flow controller or meter. This is not required for meters with an integrated filter.

⚠ CAUTION

Since the Model SLA5800 control valve may not provide positive shut-off, a separate shut-off valve may be installed downstream for that purpose. It should be noted that a small amount of gas may be trapped between the downstream side of the mass flow controller and the shut-off valve which will result in a surge upon accuation of the shut-off valve. This surge can be reduced in magnitude either by locating the controller and the shut-off valve close together or by moving the shut-off valve upstream of the controller.

2-8 In-Line Filter

It is recommended that an in-line filter be installed upstream from the mass flow controller or meter to prevent the possibility of any foreign material entering the flow sensor or control valve. The filtering element should be replaced periodically or ultrasonically cleaned.

Table 2-1 Recommended Filter Size

Models	Maximum Flow Rate	Recommended Filter
SLA5840	100 ccm	2 micron
SLA5840	500 ccm	2 micron
SLA5840	1 to 5 lpm	10 micron
SLA5840	10 to 100 lpm	40 micron

2-9 Electrical Interface

The Delta Class EL Series RT's are controlled using analog 0-5 Vdc signals. For an analog unit the minimum set of connections which must be made to the RT include +15 Vdc, supply common, and a setpoint signal. The setpoint signal is supplied as a 0 to 5 Vdc analog signal. All signals are supplied via the 15-pin 'D' connector.

The Delta Class EL Series electrical interface is designed to facilitate low-loss, quiet signal connections. Separate returns (commons) are supplied for the analog setpoint, analog flow signal, and the power supply. These commons are electrically connected together on the PC board.

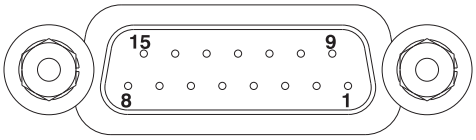
Voltage I/O Version

- Chassis Ground
- Signal Common
- Signal Output
- +15 Vdc Supply
- Setpoint Input
- Setpoint Common
- Supply Common

For a DeviceNet unit, 11-25 Vdc power and communication I/O are supplied via the standard 5-PIN Circular Micro-Connector.

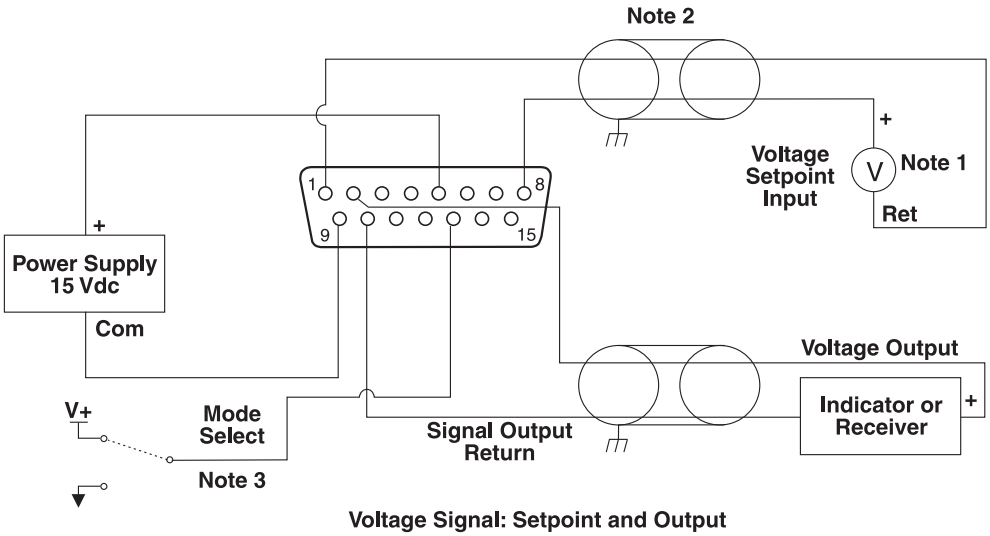
2-10 Operation Check Procedure

a. Mount the RT in its final orientation.
b. Apply power to the RT and allow approximately 45 minutes for the instrument to completely warm up and stabilize its temperature.
c. Make sure the RT is set for flow mode.
d. Do NOT supply gas to the RT. Ensure that the differential pressure across the RT is zero.
e. Check the RT zero.
f. The analog output signal should be 0.000 Vdc ± 0.2%. If the zero exceeds one of these limits, follow the re-zeroing procedure in Section 3-4.
g. Turn on the gas supply. A positive flow signal may be present due to slight valve leak-thru (RT only).
h. Supply a setpoint signal between 1 and 5 Vdc.
i. Check the analog output signal. The output signal should match the setpoint voltage (± 10mV) within 10 seconds after the setpoint is changed.



Analog I/O Pin Connections:	
Signal:	**15-pin D-conn**
Setpoint/Command Common	**1**
Flow/Signal Out	**2**
15Vdc Power Supply	**5**
Setpoint/Command Input	**8**
Power Supply Common	**9**
Output Signal Common	**10**
+5V reference	**11**
Valve Override	**12**
Mode Select Pin	**13**
Not Used (Do Not Connect)	**3,4,6,7,14,15**

Figure 2-1 D-Connector Shielded Cable Hookup Diagram - Voltage I/O Options



Notes:
1. The returns for the command input and current output are not isolated from power supply common.
2. Tie cable shields to ground at one end only. (MFC only)
3. Setting Mode Select Pin 13 high (V+) puts RT in. Pin 13 low (DC common) puts RT in.

Figure 2-2 Common Electrical Hookups Voltage I/O Version

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3-1 Overview

This section contains the following information:

- Theory of Operation
- Features

3-2 Theory of Operation for RT

A user supplied pressure sensor, with a full scale pressure as low as 10 mTorr or as high as several hundred psi and a full scale output signal of 5 or 10 Vdc, monitors the pressure in a vessel or a feed or exhaust line from the vessel. The control electronics in the Model 5866RT compare the pressure signal to a setpoint and act to regulate the flow through the integral solenoid control valve to stabilize the pressure at the setpoint. An integral mass flow sensor identical in design to the Brooks Model 5860E provides a 5 Vdc full scale signal proportional to the flow through the control valve. A system block diagram is shown in Figure 1-1.

The integration of mass flow sensor, control electronics and control valve into one unit results in a compact size. The mounting dimensions are comparable to a mass flow controller. Refer to Figure 1-2.

In the upstream pressure regulation mode shown in Figure 1-3, the pressure controller is placed at the outlet of the pressure vessel. The pressure in the process upstream of the controller will be constant independent of downstream variation. Pressure control takes place at the outlet side of the pressure vessel.

3-3 Features

Note: All Brooks Digital Series mass flow meters are configured at the factory according to customer order and do not require adjustment. Not all features are available on all instruments.

The Brooks Digital is a full-featured digital MFC. The Brooks Digital performs much like a traditional analog MFC, but with improved accuracy, step response and valve control. The analog interface matches that of Brooks' popular analog MFCs so it can be retrofitted into tools using analog MFCs. Other versions of the Delta Class can provide a variety of digital protocols, for example DeviceNet and RS-485.

The Brooks Digital equipment is capable of storing up to 10 different sets of gas calibration data. Each set includes a calibration curve, PID controller settings, valve performance data, and information about the calibration conditions. The Brooks Digital equipment can contain calibrations for different gases or for the same gas at multiple conditions (pressures, full-scale flow rates). Section 3-4 Analog I/O Mode of Operation describes more information about the data contained in the calibration table and how to access the data.

The DeviceNet Instruction Manual describes further details on specific communication features.

Calibrations will appear in the calibration table in the same order as they appeared on the customer order, unless otherwise specified. The first listed gas will appear as calibration #1 the second as calibration #2 and so on. Note that unless specified otherwise on the customer order any unit containing a single calibration will have that calibration stored in calibration position 1.

3-4 Analog I/O Mode of Operation

The following paragraphs describe the basic features of the Brooks Digital Series RT's. NOTE: Read Section 3-3, Features, before reading this section. See DeviceNet Supplemental Instruction Manual for specific details on communication features.

A. Functional Description

The analog interface is consistent with other Brooks analog RT. This includes a 0-5 volt setpoint input, 0-5 volt flow signal output, Valve Override input, and Mode Select input pin. All analog signals available are on the 15 pin D-connector. (See Fig. 2-1 for connections). Note that one formerly unused connector pin, pin 13, now allows selection of up to ten separate calibrations. The contents of the ten calibrations are determined from the customer order. Only those calibrations ordered will be available in the instrument. Unless otherwise specified, a Delta Class RT ordered with only one calibration will have that calibration stored in calibration #1. Before operating the RT, apply power and warm-up the instrument for approximately 45 minutes. After warm-up, apply gas pressure then proceed by following the instructions in the following sections.

B. Analog I/O Setpoint

This input allows the user to establish the RT setpoint. The usable range of this input is from 0 to 5.5 Vdc which corresponds to 0 to 110% of the RT full scale flow rate. Setpoints below 45 mV will be treated as 0 volt setpoints. For setpoints below 0 Vdc the RT behaves as if a 0 Vdc setpoint is present. Setpoints above 5.5 Vdc will cause a setpoint of at least 110% FS.

C. Analog I/O Flow Signal

This output is used to indicate the flow signal. The range of this signal is from -0.6 to 6.0 Vdc, with the range of 0 to 6.0 Vdc corresponding to a calibrated flow signal of 1 to 120% of the full scale flow rate. A negative flow signal indicates reverse flow through the device, but is NOT calibrated.

D. Valve Override

This input allows the valve to be forced to its most closed state or its most open state, regardless of the setpoint. If this input is not electrically connected the RT will operate according to the current values of the other RT inputs. If this input is held at 0 Vdc or -15Vdc the valve will be forced to its most closed state. If this input is head at +5 Vdc or greater (max. =24 Vdc).

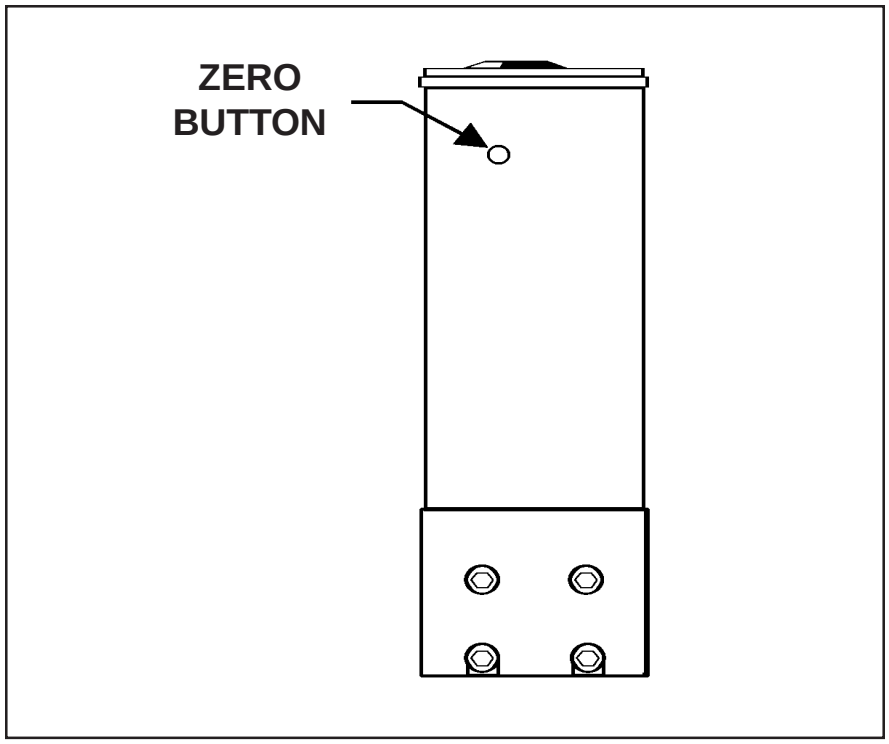


Figure 3-1 Externally Accessible Adjustment for all Meters/Controllers.

E. Mode Select Pin

Connector Pin 13, on the15 pin D-Connector allows selection of one of ten calibrations stored in the device. This pin is designed to accept pull-down resistors referenced to signal common (Pin 10).

Table 3-1 shows typical resistor values required for selecting calibrations 1 through 10. Note, these resistor values should be within ± 1% tolerance. The default condition is with no resistor connected which activates Calibration #1.

When the calibration select pin changes state, the device performs any required processing to change the calibration, then returns to normal operation. If the device determines that the selected calibration is not valid, (where applicable) the valve is driven to the closed state and the flow signal is set to zero. Typical time required to change calibrations is approximately 1.0 second.

NOTE: It is recommended to change calibration curve selection during no-flow conditions.

F. Zeroing the MFC (Self-zero)

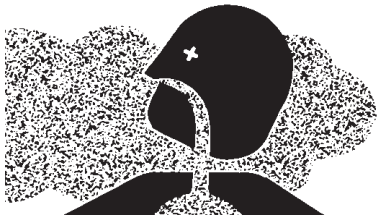
It may be desirable to re-zero the flow sensor if it is operated at its temperature extremes or if it is positioned in an attitude other than that specified on the customer order.

Note: Before zeroing the instrument, zero pressure differential MUST be established across the device. If there is pressure across the instrument during the zero process, any detected flow through the sensor will be misinterpreted as the zero flow reading. This will result in calibration inaccuracy during normal operation.
Once zero differential pressure is established and verified, press the recessed, momentary push-button (self-zero button) located on the side of the device (See Figure 3-1) to start the self-zero function. The zeroing process requires approximately 10 mseconds.

Once zero differential pressure is established and verified, press the recessed, momentary push-button (Self-zero button) located on the side of the device (See Fig. 3-1) to start the Self-zero function.

The zero process requires approximately 200 msec. During this time, the device will set its output signal to 0.0 Vdc.

4-1 Overview



⚠ WARNING

METER/CONTROLLER SEAL COMPATIBILITY

Products in this manual may contain metal or elastomeric seals, gaskets, O-rings or valve seats. It is the "user's" responsibility to select materials that are compatible with their process and process conditions. Using materials that are not compatible with the process or process conditions could result in the Meter or Controller leaking process fluid outside the pressure boundary of the device, resulting in personnel injury or death.

It is recommended that the user check the Meter or Controller on a regular schedule to ensure that it is leak free as both metal and elastomeric seals, gaskets, O-rings and valve seats may change with age, exposure to process fluid, temperature, and /or pressure.

⚠ WARNING

If it becomes necessary to remove the instrument from the system, power to the device must be disconnected.

No routine maintenance is required on the Brooks Digital RT's. If an in-line filter is used, the filtering elements should be periodically replaced. This section provides the following information:

- Troubleshooting
- Gas Conversion Facors
- Orifice Sizing*
- Restrictor Sizing

* indicates MFC only

4-2 Troubleshooting

⚠ WARNING

If it becomes necessary to remove the RT from the system after exposure to toxic, pyrophoric, flammable or corrosive gas, purge the RT thoroughly with a dry inert gas such as Nitrogen before disconnecting the gas connections. Failure to correctly purge the RT could result in fire, explosion or death. Corrosion or contamination of the RT upon exposure to air, may also occur.

⚠ CAUTION

It is important that this RT only be serviced by properly trained and qualified personnel.

This section contains suggestions to help diagnose simple RT related problems in the gas distribution system and answers commonly asked questions.

Brooks part #S273Z668AAA can be used as an accuracy for diagnosing electrical problems.

a. Problem: No response to input commands/No output status signal.

1. The unit may not be receiving power. Check that module status LED is green.
2. Connections may not be secure. Check all cable connections.

b. Problem: Flow/flow signal doesn't reach setpoint. (MFC Only)

Failure of the flow rate or flow signal to achieve setpoint could be caused by a number of factors:

1. Insufficient pressure drop across the MFC (low or no pressure). If there is not enough pressure differential across the MFC, it is impossible for the MFC's valve orifice to pass the full scale flow rate. To check for this condition, compare the actual inlet/outlet pressure drop as read from pressure gauges with that specified on the order (shown in Figure 4-1). Increase the pressure if necessary.

2. Clogged sensor tube. If the MFC sensor tube is clogged, the flow signal will be very low or zero while the actual flow will be at the valve's maximum rate.

3. Clogged restrictor. If the MFC restrictor becomes clogged, a much larger portion of the flow stream will pass through the sensor rather than going straight through the restrictor. The symptom of this condition is a substantially reduced actual flow with a flow signal that matches the setpoint.

4. Valve Override pin is active. If the valve override pin is active, the valve will be forced open or closed. Set this pin to its normal level before setting a setpoint.

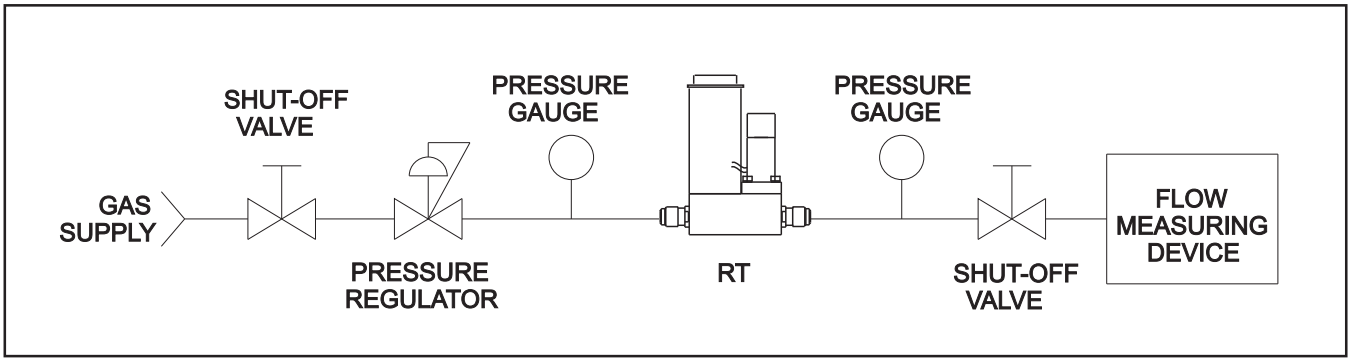


Figure 4-1 Bench Troubleshooting Circuit

4-3 Gas Conversion Factors

If an RT is operated in flow control mode on a gas other than the gas it was calibrated with, a scale shift will occur in the relation between the output signal and the mass flow rate. This is due to the difference in heat capacities between the two gases. This scale shift can be approximated by using the ratio of the molar specific heat of the two gases or by sensor conversion factor. A list of sensor conversion factors is given in Table 4-1. To change to a new gas, multiply the output reading by the ratio of the sensor factor for the desired gas to the sensor factor for the calibration gas used.

$$\text{Actual Gas Flow Rate} = \text{Output Reading} \times \frac{\text{Sensor Factor of the New Gas}}{\text{Sensor Factor of the Calibration Gas}}$$

Example:

The RT is calibrated for Nitrogen. (Sensor factor - 1.000)
The desired gas is Carbon Dioxide (CO_2) (Sensor factor = 0.740)
The output reading is 75 sccm when Carbon Dioxide is flow
Then 75 x 0.740 = 55.5 sccm of CO_2

1.000

In order to calculate the sensor conversion factor for a gas mixture, the following forumula should be used:

$$\text{Sensor Conversion Factor}_{\text{Mixture}} = \frac{100}{\frac{P_1}{\text{Sensor Conversion Factor}_1} + \frac{P_2}{\text{Sensor Conversion Factor}_2} + \frac{P_3}{\text{Sensor Conversion Factor}_3}}$$

Where,

P_1 = percentage (%) of gas 1 (by volume)
P_2 = percentage (%) of gas 2 (by volume)
P_3 = percentage (%) of gas n (by volume)

Example: The desired gas is 20% Helium (He) (Sensor Factor = 1.386) and 80% Chlorine (Cl_2) (Sensor factor = 0.876) by volume. The desired full scale flow rate of the mixture is 20 slpm. Sensor conversion factor for the mixture is:

$$\text{Mixture Factor} = \frac{100}{\frac{20}{1.386} + \frac{80}{0.876}} = 0.945$$

To calculate the sensor Nitrogen equivalent flow of the gas sensor mixture, use the actual gas flow rate calculation above.

Nitrogen equivalent flow - 20 x 1.000 - 21.16 slpm Nitrogen

It is generally accepted that the mass flow rate derived from this equation is only accurate to ±5%. The sensor conversion factors given in Table 4-1 are calculated based on a gas temperature of 80° C and a pressure of one atmosphere. The specific heat of most gases is not strongly pressure, and/or temperature, dependent. However, gas conditions that vary widely from these reference conditions may cause an additional error due to the change in specific heat caused by pressure and/or temperature.

4-4 Orifice Sizing

The Orifice Sizing Nomograph, Figure 4-2, is used to calculate the control valve's orifice size when changing any or all of the following factors from the original factory calibration:

gas
operating pressure (inlet and outlet)
flow range

The flow controller's orifice is factory-sized to a preselected gas, operating pressure and flow range. Note that the orifice is marked with its size in thousandths of an inch corresponding with Table 4-2 showing the orifice capacities for each standard size. When changing the aforementioned factors, calculate the new orifice size by following the procedure and example outlined in the following paragraphs.

Example: Determine the orifice size for the following conditions:

Gas:	Hydrogen
Flow Rate:	2,000 sccm
Outlet Pressure:	30 psig
Inlet Pressure:	50 psig

1. Determine the orifice Nitrogen equivalent flow rate (refer to Table 4-1).

$$Q_{NITROGEN} = Q_{GAS} \times \sqrt{\frac{P_{GAS}}{P_{NITROGEN}}}$$

OR

$$Q_{NITROGEN} = Q_{GAS} \times \sqrt{\frac{SG_{GAS}}{SG_{NITROGEN}}}$$

Where:

$Q_{NITROGEN}$	=	Orifice Nitrogen equivalent flow rate (sccm)
Q_{GAS}	=	Orifice Desired flow rate of the gas (sccm)
$P_{NITROGEN}$	=	Density of Nitrogen at 0°C
P_{GAS}	=	Density of the gas (taken at customer temperature)
SG_{GAS}	=	Specific gravity of the gas (taken at customer temperature)
$SG_{NITROGEN}$	=	Specific gravity of the Nitrogen at 0°C

Refer to Table 4-1 for densities.

Example:

Q_{GAS} = 2,000 sccm

$\sqrt{\frac{P_{GAS}}{P_{NITROGEN}}}$ = .269

$Q_{NITROGEN} = Q_{GAS} \times \sqrt{\frac{P_{GAS}}{P_{NITROGEN}}}$

= 2,000 x .269
= 538 sccm Nitrogen

In order to calculate the orifice conversion factor when using a gas mixture, the following formula must be used:

$$\text{Orifice Conversion Factor Mixture} = \sqrt{\frac{P_1\left(\text{Orifice Conversion Factor 1}\right) + P_2\left(\text{Orifice Conversion Factor 2}\right) + P_n\left(\text{Orifice Conversion Factor n}\right)}{100}}$$

Where P_1 = percentage of volume of gas 1
P_2 = percentage of volume of gas 2
P_3 = percentage of volume of gas n

Example: Find the Orifice Nitrogen equivalent of 20 slpm of a 20% Helium (He) (orifice factor = 0.378) and 80% Chlorine (Cl_2) (Orifice factor = 1.598) gas mixture.

$$\text{Orifice Conversion Factor Mixture} = \frac{20\ (.378) + 80\ (1.598)}{100}$$

$Q_{NITROGEN}$ = Q_{GAS} x Orifice Conversion factor
= 20 x 1.439
= 28.78 slpm Nitrogen

2. If inlet and outlet pressure are given in gauge pressure (psig) add 14.7 to convert to absolute pressure (psia).
Outlet Pressure — 30 psig + 14.7 = 44.7 psia
Inlet Pressure — 50 psig + 14.7 = 64.7 psia

3. Determine Critical Pressure Drop
Critical pressure drop occurs when the outlet pressure (psia) is less than half the inlet pressure (psia) or

$$P_{outlet} < \frac{P_{inlet}}{2}$$

If these conditions exist, the pressure drop (Dp) should be calculated as follows:

$$Dp = \frac{P_{in}}{2}$$

Dp = Pressure drop (psi)
P_{in} = Inlet pressure (psia)

If these conditions do not exist, pressure drop equals the inlet pressure minus the outlet pressure.

$$\text{Is } 44.7 \text{ psia} < \frac{64.7 \text{ psia}}{2} \text{ ?} \quad — \quad \text{No.}$$

Then Dp = 64.7 - 44.7 = 20 psi

4. Using the nomograph, locate the pressure drop (psi) on the vertical line marked "Dp" (Point A).

5. Locate the Nitrogen equivalent flow rate (sccm Nitrogen) on the vertical marked "$Q_{NITROGEN}$" (Point B).

6. Draw a line connecting Dp and $Q_{NITROGEN}$ and extend it to the baseline. Mark this point (Point C).

7. Locate inlet pressure (psia) on the vertical line marked "P_{in}" (Point D).

8. Draw a line connecting P_{in} (Point D) and baseline (Point C) and then extend this line to the vertical line marked D_o (orifice diameter, inches) (Point E).

9. This point on the line is the minimum orifice size for the given conditions. If this point is between two orifice sizes, select the next largest size orifice to ensure adequate flow. If the orifice selected falls below .0013, choose .0013 size orifice.

For the example in Figure 4-3, the .007 size orifice would be selected.4-5 Restrictor Sizing

4-5 Restrictor Sizing

The restrictor assembly is a ranging device for the sensor portion of the controller. It creates a pressure drop which is linear with flow rate. This diverts a sample quantity of the process gas flow through the sensor. Each restrictor maintains a ratio of sensor flow to restrictor flow, however, the total flow through each restrictor is different. Different restrictors (active area) have different pressure drops and produce controllers with different full scale flow rates. For a discussion of the interaction of the various parts of the controller, you are urged to review Section 3-2, Theory of Operation.

If the restrictor assembly has been contaminated with foreign matter, the pressure drop versus flow characteristics will be altered and it must be cleaned or replaced. It may also be necessary to replace the restrictor assembly when the mass flow controller is to be calibrated to a new flow rate. Restrictor assembly replacement should be performed only by trained personnel. Consult factory/Service Center.

Restrictors

The mass flow controller/meter uses different types of restrictor assemblies depending on full scale flowrate and expected service conditions.

For Models SLA5840 RT

1. Wire mesh for Nitrogen equivalent flow rates above 3.4 slpm. These restrictor assemblies are made from a cylinder of wire mesh and are easily cleaned if they become contaminated in service.
2. Anti-Clog Laminar Flow Element (ACLFE) or Sintered Metal Restrictor Assemblies are used for Nitrogen equivalent flow rates less than 3.4 slpm.

Table 4-1Conversion Factors (Nitrogen Base).

GAS NAME	FORMULA	SENSOR FACTOR	ORIFICE FACTOR	DENSITY (KG/m³) @0°C, 1 atm
Acetylene	C_2H_2	0.615	0.970	1.173
Air	Mixture	0.998	1.018	1.293
Allene	C_3H_4	0.478	1.199	1.787
Ammonia	NH_3	0.786	0.781	0.771
Argon	Ar	1.395	1.195	1.784
Arsine	AsH_3	0.754	1.661	3.478
Boron Trichloride	BCL_3	0.443	2.044	5.227
Boron Trifluoride	BF_3	0.579	1.569	3.025
Bromine Pentafluoride	BrF_5	0.287	2.502	7.806
Bromine Trifluoride	BrF_3	0.439	2.214	6.108
Bromotrifluoroethylene	C_2BrF_3	0.326	2.397	7.165
Bromotrifluoromethane f-13B1	$CBrF_3$	0.412	2.303	6.615
1,3-Butadiene	C_4H_6	0.354	1.413	2.491
Butane	C_4H_{10}	0.257	1.467	2.593
1-Butene	C_4H_8	0.294	1.435	2.503
CIS-2-Butene	C_4H_8	0.320	1.435	2.503
Trans-2-Butene	C_4H_8	0.291	1.435	2.503
Carbon Dioxide	CO_2	0.740	1.255	1.977
Carbon Disulfide	CS_2	0.638	1.650	3.393
Carbon Monoxide	CO	0.995	1.000	1.250
Carbon Tetrachloride	CCL_4	0.344	2.345	6.860
Carbon Tetrafluoride f-14	CF_4	0.440	1.770	3.926
Carbonyl Fluoride	COF_2	0.567	1.555	2.045
Carbonyl Sulfide	COS	0.680	1.463	2.180
Chlorine	CL_2	0.876	1.598	3.214
Chlorine Dioxide	CLO_2	0.693	1.554	3.011
Chlorine Trifluoride	CLF_3	0.433	1.812	4.125
2-Chlorobutane	C_4H_9Cl	0.234	1.818	4.134
Chlorodifluoromethane f-22	$CHCLF_2$	0.505	1.770	3.906
Chloroform (Trichloromethane)	$CHCL_3$	0.442	2.066	5.340
Chloropentafluoroethane f-115	C_2CLF_5	0.243	2.397	7.165
Chlorotrifluoroethylene	C_2CLF_3	0.337	2.044	5.208
Chlorotrifluoromethane f-13	$CCLF_3$	0.430	1.985	4.912
Cyanogen	$(CN)_2$	0.498	1.366	2.322
Cyanogen Chloride	CLCN	0.618	1.480	2.730
Cyclobutane	C_4H_8	0.387	1.413	2.491
Cyclopropane	C_3H_6	0.505	1.224	1.877
Deuterium	D_2	0.995	0.379	0.177
Diborane	B_2H_6	0.448	1.000	1.235
Diboromodifluoromethane f-12B2	CBr_2F_2	0.363	2.652	8.768
1,2-Dibromotetrafluoroethane f-114B2	$C_2Br_2F_4$	0.215	2.905	10.53
Dichlorodifluoromethane f-12	CCL_2F_2	0.390	2.099	5.492
Dichlorofluoromethane f-21	$CHCL_2F$	0.456	1.985	4.912
Dichlorosilane	SiH_2CL_2	0.442	1.897	4.506
1,2-Dichloroethane	$C_2H_4Cl_2$	0.382	1.879	4.419
1,2-Dichlorotetrafluoroethane f-114	$C_2CL_2F_4$	0.231	2.449	7.479
2,2 Dichloro	$C_2HC_{12}F_3$	0.259	2.336	6.829
1,1-Difluoro-1-Chloroethane	$C_2H_3CLF_2$	0.341	1.957	4.776
1,1-Difluoroethane	CH_3CHF_2	0.415	1.536	2.940
1,1-Difluoroethylene	$CH_2:CF_2$	0.458	1.512	2.860
Diethylsilane	$C_4H_{12}Si$	0.183	1.775	3.940
Difluoromethane f-32	CF_2H_2	0.627	1.360	2.411
Dimethylamine	$(CH_3)_2NH$	0.370	1.269	2.013
Dimethylether	$(CH_3)_2O$	0.392	1.281	2.055
2,2-Dimethylpropane	$C(CH_3)_4$	0.247	1.613	3.244
Disilane	Si_2H_6	0.332	1.493	2.779
Ethane	C_2H_6	0.490	1.038	1.357
Ethanol	C_2H_6O	0.394	1.282	2.057
Ethylacetylene	C_4H_6	0.365	1.384	2.388
Ethyl Chloride	C_2H_5CL	0.408	1.516	2.879

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Table 4-1 Conversion Factors (Nitrogen Base) Continued.

GAS NAME	FORMULA	SENSOR FACTOR	ORIFICE FACTOR	DENSITY (KG/m³) @0°C, 1 atm
Ethylene	C_2H_4	0.619	1.000	1.261
Ethylene Oxide	C_2H_4O	0.589	1.254	1.965
Fluorine	F_2	0.924	1.163	1.695
Fluoroform f-23	CHF_3	0.529	1.584	3.127
Germane	GeH_4	0.649	1.653	3.418
Germanium Tetrachloride	$GeCl_4$	0.268	2.766	9.574
Halothane (R-123B1)	$C_2HBrClF_3$	0.257	2.654	8.814
Helium	He	1.386	0.378	0.178
Hexafluoroacetone	F_3CCOCF_3	0.219	2.434	7.414
Hexaflorobenzine	C_6F_6	0.632	2.577	8.309
Hexafluoroethane f-116	C_2F_6	0.255	2.219	6.139
Hexafuoropropylene (HFP)	C_3F_6	0.249	2.312	6.663
Hexamethyldisilane (HMDS)	$(CH_2)_6Si_2$	0.139	2.404	7.208
Hexane	C_6H_{14}	0.204	1.757	3.847
Hydrogen	H_2	1.008	0.269	0.090
Hydrogen Bromide	HBr	0.987	1.695	3.645
Hydrogen Chloride	HCL	0.983	1.141	1.639
Hydrogen Cyanide	HCN	0.744	0.973	1.179
Hydrogen Fluoride	HF	0.998	0.845	0.893
Hydrogen Iodide	HI	0.953	2.144	5.789
Hydrogen Selenide	H_2Se	0.837	1.695	3.613
Hydrogen Sulfide	H_2S	0.850	1.108	1.539
Iodine Pentafluoride	IF_5	0.283	2.819	9.907
Isobutane	C_4H_{10}	0.260	1.440	2.593
Isobutene	C_4H_8	0.289	1.435	2.503
Isopentane	C_5H_{12}	0.211	1.605	3.222
Krypton	Kr	1.382	1.729	3.708
Methane	CH_4	0.763	0.763	0.717
Methylacetylene	C_3H_4	0.473	1.196	1.782
Methyl Bromide	CH_3Br	0.646	1.834	4.236
3-Methyl-1-butene	C_5H_{10}	0.252	1.584	3.127
Methyl Chloride	CH_3CL	0.687	1.347	2.308
Methyl Fluoride	CH_3F	0.761	1.102	1.518
Methyl Mercaptan	CH_4S	0.588	1.313	2.146
Methyl Silane	CH_6Si	0.393	1.283	2.061
Methyl Trichlorosilane (MTS)	CH_3Cl_3Si	0.267	2.310	6.675
Methyl Vinyl Ether	C_3H_6O	0.377	1.435	2.567
Monoethanolamine	C_2H_7NO	0.305	1.477	2.728
Monoethylamine	$C_2HH_5NH_2$	0.359	1.269	2.013
Monomethylamine	CH_3NH_2	0.565	1.067	1.420
Neon	Ne	1.398	0.847	0.902
Nickel Carbonyl	$Ni(CO)_4$	0.212	2.371	7.008
Nitric Oxide	NO	0.995	1.030	1.339
Nitrogen	N_2	1.000	1.000	1.251
Nitrogen Dioxide	NO_2	0.758	1.713	2.052
Nitrogen Trifluoride	NF_3	0.501	1.598	3.168
Nitrogen Trioxide	N_2O_3	0.443	1.649	3.389
Nitrosyl Chloride	NOCL	0.644	1.529	2.913
Nitrous Oxide	N_2O	0.752	1.259	1.964
Octofluorocyclobutane	C_4F_8	0.169	2.672	8.933
Oxygen	O_2	0.988	1.067	1.429
Oxygen Difluoride	OF_2	0.672	1.388	2.402
Ozone	O_3	0.738	1.310	2.138
Pentafluorethane f-125	C_2HF_5	0.287	2.070	5.360
Pentane (n-Pentane)	C_5H_{12}	0.212	1.605	3.222
Perchloryl Fluoride	CLO_3F	0.448	1.905	4.571
Perfluorobutane	C_4F_{10}	0.738	2.918	10.61
Perfluoro-2-Butene	C_4F_8	0.268	2.672	8.933
Perfluoromethyl-vinylether	PMVE	0.296	2.029	5.131

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Table 4-1 Conversion Factors (Nitrogen Base) Continued.

GAS NAME	FORMULA	SENSOR FACTOR	ORIFICE FACTOR	DENSITY (KG/m³) @0°C, 1 atm
Perfluoropropane	C_3F_8	0.179	2.591	8.396
Pentane (n-Pentane)	C_5H_{12}	0.212	1.605	3.222
Phosgene	$COCL_2$	0.504	1.881	4.418
Phosphine	PH_3	0.783	1.100	1.517
Phosphorous Pentafluoride	PF_5	0.346	2.109	5.620
Phosphorous Trifluoride	PF_3	0.495	1.770	3.906
Propane (same as $CH_3CH_2CH_3$)	C_3H_8	0.343	1.274	2.008
Propylene (Propene)	C_3H_6	0.401	1.234	1.875
Rhenium Hexafluoride	ReF_6	0.230	3.279	13.41
Silane	SiH_4	0.625	1.070	1.440
Silicon Tetrachloride	$SiCL_4$	0.310	2.465	7.579
Silicon Tetrafluoride	SiF_4	0.395	1.931	4.648
Sulfur Dioxide	SO_2	0.728	1.529	2.858
Sulfur Hexafluoride	SF_6	0.270	2.348	6.516
Sulfur Tetrafluoride	SF_4	0.353	1.957	4.776
Sulfur Trioxide	SO_3	0.535	1.691	3.575
Sulfuryl Fluoride	SO_2F_2	0.423	1.931	4.648
Tetrachloromethane	CCL_4	0.344	2.345	6.858
Tetrafluoroethylene (TFE)	C_2F_4	0.361	1.905	4.526
Tetrafluorohydrazine	N_2F_4	0.367	1.926	4.624
Trichlorofluoromethane f-11	CCL_3F	0.374	2.244	6.281
Trichlorosilane	$SiHCL_3$	0.329	2.201	6.038
Trimethyloxyborane (TMB)	$B(OCH_3)_3$	0.300	1.929	4.638
1,1,2-Trichloro-1,1,2-Triflouroet f-113	$C_2CL_3F_3$	0.231	2.520	7.920
Trimethylamine	$(CH_3)_3N$	0.316	1.467	2.639
Tungsten Hexafluoride	WF_6	0.227	3.264	13.28
Uranimum Hexafluoride	UF_6	0.220	3.548	15.70
Vinyl Bromide	C_2H_3Br	0.524	1.985	4.772
Vinyl Chloride	C_2H_3CL	0.542	1.492	2.788
Vinyl Fluoride	C_2H_3F	0.576	1.281	2.046
Water Vapor	H_2O	0.861	0.802	0.804
Xenon	Xe	1.383	2.180	5.851

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Sizing

All Delta Class EL Series Restrictor Assemblies are factory adjusted to provide a specific pressure drop for each flow rate. This corresponds to the desired full scale flow rate. A list of restrictor assemblies used in the Delta Class EL Series mass flow controllers/meters are shown in Tables 4-3, 4-4 and 4-5.

Example:

Select a resistor for a Delta Class EL Series SL5850
The desired gas is Silane (SiH4).
The desired full scale flow rate is 200 sccm.
Sensor conversion factor is 0.625 from Table 4-1.

$$\text{Sensor Nitrogen equivalent flow} = 200 \times \frac{1.000}{0.625} = 320 \text{ sccm Nitrogen}$$

In the example above a Size P restrictor would be selected from Table 4-3.

Note: If the calculated flow rate is such that two different size restrictors could be used, always select the larger size.

If a mixture of two or more gases is being used, the restrictor selection must be based on a Nitrogen equivalent flow rate of the mixture.

Example:

Select a resistor for a Delta Class EL Series SL5850

The desired gas is 20% Helium (He) (Sensor factor = 1.386 and 80% Chlorine (Cl_2) (Sensor factor = 0.876) by volume. The desired full scale flow rate of the mixture is 20 slpm. Sensor conversion factor for the mixture is:

$$\text{Mixture Factor} = \frac{100}{\frac{20}{1.386} + \frac{80}{.876}} = .945$$

$$\text{Sensor Nitrogen equivalent flow} = 20 \times \frac{1.000}{0.945} = 21.16 \text{ slpm Nitrogen.}$$

In this example a Size 4 Wire Mesh Assembly would be selected.

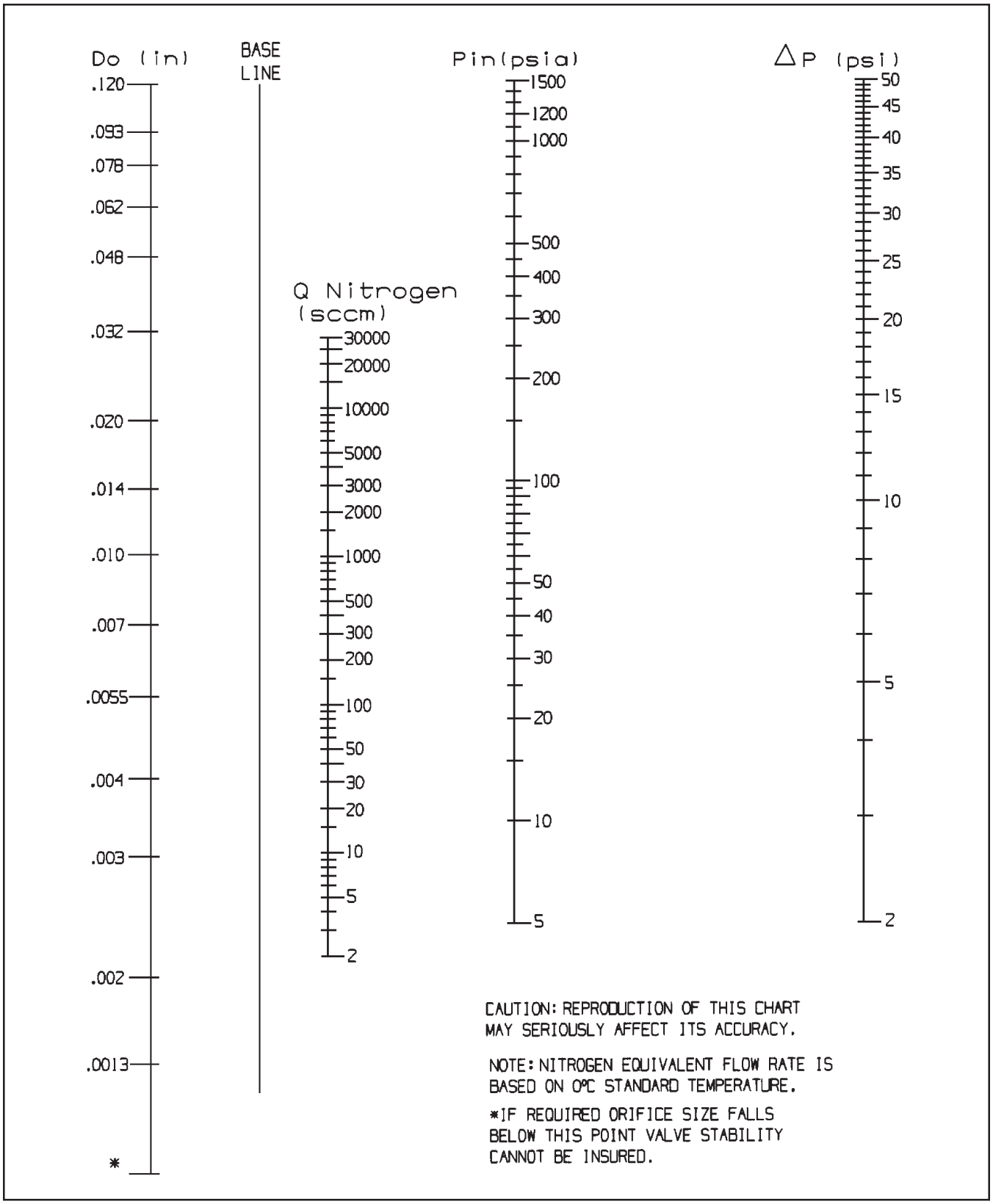

Figure 4-2 Model SLA5840 Series Orifice Sizing Nomograph.

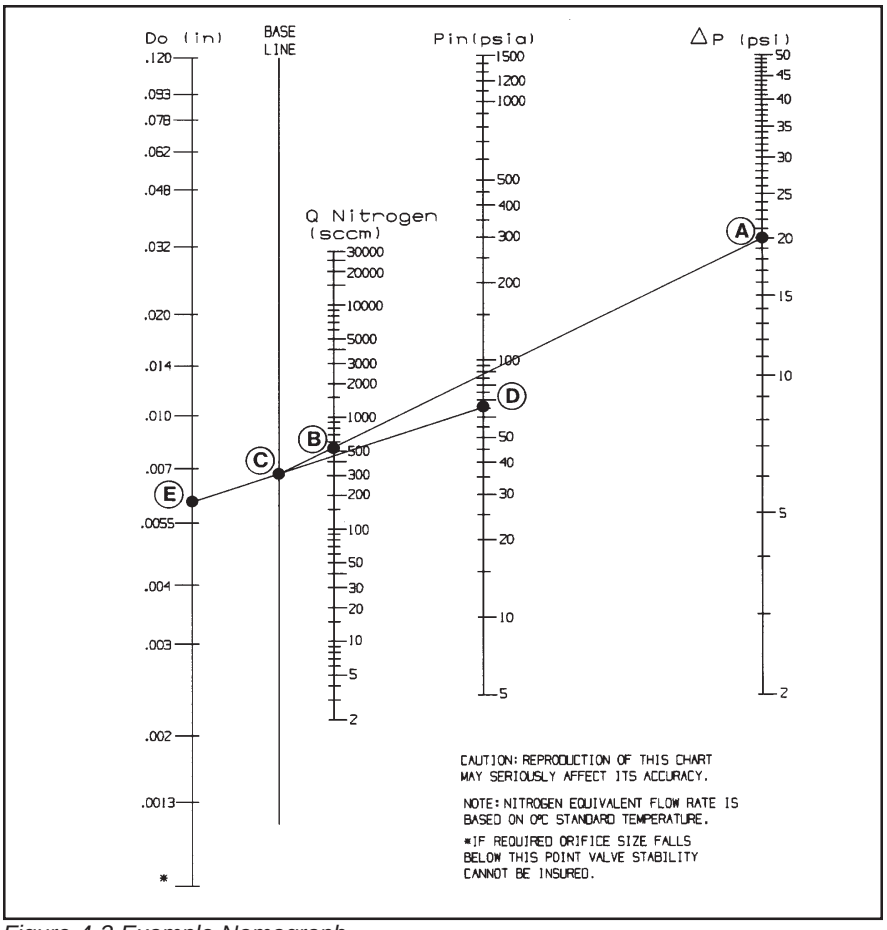

Figure 4-3 Example Nomograph.

Table 4-2 Orifice Capacities

Orifice Size (inches)	*Minimum Flow Rate (sccm)*	
	(0°C)	*(21.1°C)*
0.0013	*5.3*	*(5.7)*
0.002	*12.5*	*(13.5)*
0.003	*39.2*	*(42.2)*
0.004	*82.5*	*(88.9)*
0.0055	*190*	*(205)*
0.007	*374*	*(403)*
0.010	*748*	*(806)*
0.014	*1364*	*(1469)*
0.020	*2673*	*(2879)*
0.032	*6490*	*(6991)*
0.048	*12980*	*(13980)*
0.062	*22000*	*(2879)*
0.078	*31900*	*(34400)*
0.093	*42500*	*(45800)*
0.120	*69300*	*(74700)*

Inlet Pressure = 10 psig
Outlet Pressure = 10 inches of water (0.4 psig) or less
Note: Flow Rate based on Nitrogen

Table 4-3 Delta Class EL Series Models SLA5850 & SLA5860 Standard Restrictors.

Size	No Restrictor (ALL BODY SIZES)				
A	Restrictor size selected from the table below is based on sensor Nitrogen equivalent flow				
	Plug (Nitrogen equivalent flows of 8.022 SCCM or less)		Part Number	Part Number	Part Number
	Models SLA5850 / SLA5860				
	Min. Flow	Max. Flow	Sintered	ACLFE	Wire Mesh
	(SCCM Nitrogen equivalent flow at 0° C)				
B	-----				
C	Plug (Nitrogen flows <= 8.022 SCCM)		618K019BMT		
D	8.022	11.36	S110Z296BMA	S110Z275BMT	
E	11.23	15.90	S110Z297BMA	S110Z276BMT	
F	15.72	22.26	S110Z298BMA	S110Z277BMT	
G	22.01	31.17	S110Z299BMA	S110Z278BMT	
H	30.82	43.64	S110Z300BMA	S110Z279BMT	
J	43.14	61.09	S110Z301BMA	S110Z280BMT	
K	60.40	85.53	S110Z302BMA	S110Z281BMT	
L	84.56	119.7	S110Z303BMA	S110Z282BMT	
M	118.4	167.6	S110Z304BMA	S110Z283BMT	
N	165.7	234.7	S110Z305BMA	S110Z284BMT	
P	232.0	328.6	S110Z306BMA	S110Z285BMT	
Q	324.8	460.0	S110Z307BMA	S110Z286BMT	
R	454.8	644.0	S110Z308BMA	S110Z287BMT	
S	636.7	901.6	S110Z309BMA	S110Z288BMT	
T	891.4	1262	S110Z310BMA	S110Z289BMT	
U	1248	1767	S110Z311BMA	S110Z290BMT	
V	1747	2474	S110Z312BMA	S110Z291BMT	
W	2446	3464	S110Z313BMA	S110Z292BMT	
X	3424	4849			S110Z319BMA
Y	4794	6789			S110Z321BMA
1	6711	9504			S110Z317BMA
2	9369	13310			S110Z228BMA
3	13150	18630			S110Z226BMA
4	18420	30000			S110Z224BMA

NOTES: 1) If two sizes are allowed because of overlap, select the larger size.
2) If customer has requested a calibration based on a 21.1'C (70'F) reference temperature, divide the air equivalent flow rate by 1.077 before using the sizing table.

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Dansk

Brooks Instrument
407 West Vine St.
Hatfield, PA 19440
U.S.A.

Emne : Tillæg til instruktions manual.

Reference : CE mærkning af Masse Flow udstyr

Dato : Januar-1996.

Brooks Instrument har gennemført CE mærkning af elektronisk udstyr med succes, i henhold til regulativet om elektrisk støj (EMC direktivet 89/336/EEC).

Der skal dog gøres opmærksom på benyttelsen af signalkabler i forbindelse med CE mærkede udstyr.

Kvaliteten af signal kabler og stik:

Brooks lever kabler af høj kvalitet, der imødekommer specifikationerne til CE mærkning.

Hvis der anvendes andre kabel typer skal der benyttes et skærmet kabel med hel skærm med 100% dækning.

Forbindelses stikket type “D” eller “cirkulære”, skal være skærmet med metalhus og eventuelle PG-forskruninger skal enten være af metal eller metal skærmet.

Skærmen skal forbindes, i begge ender, til stikkets metalhus eller PG-forskruningen og have forbindelse over 360 grader.

Skærmen bør være forbundet til jord.

“Card Edge” stik er standard ikke af metal, der skal derfor ligeledes benyttes et skærmet kabel med hel skærm med 100% dækning.

Skærmen bør være forbundet til jord.

Forbindelse af stikket; venligst referer til vedlagte instruktions manual.

Med venlig hilsen,

Deutsch

Brooks Instrument
407 West Vine St.
Hatfield, PA 19440
U.S.A.

Subject : Nachtrag zur Bedienungsanleitung.

Referenz : CE Zertifizierung für Massedurchflußgeräte

Datum : Januar-1996.

Nach erfolgreichen Tests enstprechend den Vorschiften der Elektromagnetischen Verträglichkeit (EMC Richtlinie 89/336/EEC) erhalten die Brooks-Geräte (elektrische/elektronische Komponenten) das CE-Zeichen.

Bei der Auswahl der Verbindungskabel für CE-zertifizierte Geräte sind spezielle Anforderungen zu beachten.

Qualität der Verbindungskabel, Anschlußstecker und der Kabeldurchführungen

Die hochwertigen Qualitätskabel von Brooks entsprechen der Spezifikation der CE-Zertifizierung.

Bei Verwendung eigener Verbindungskabel sollten Sie darauf achten, daß eine

100 %igenSchirmababdeckung des Kabels gewährleistet ist.

“D” oder “Rund” -Verbindungsstecker sollten eine Abschirmung aus Metall besitzen.

Wenn möglich, sollten Kabeldurchführungen mit Anschlußmöglichkeiten für die Kabelabschrimung verwendet werden.

Die Abschirmung des Kabels ist auf beiden Seiten des Steckers oder der Kabeldurchführungen über den vollen Umfang von 360 ° anzuschließen.

Die Abschirmung ist mit dem Erdpotential zu verbinden.

Platinen-Steckverbindunger sind standardmäßige keine metallgeschirmten Verbindungen. Um die Anforderungen der CE-Zertifizierung zu erfüllen, sind Kabel mit einer 100 %igen Schirmababdeckung zu verwenden.

Die Abschirmung ist mit dem Erdpotential zu verbinden.

Die Belegung der Anschlußpins können Sie dem beigelegten Bedienungshandbuch entnehmen.

English

Brooks Instrument
407 West Vine St.
Hatfield, PA 19440
U.S.A.

Subject : Addendum to the Instruction Manual.

Reference : CE certification of Mass Flow Equipment

Date : January-1996.

The Brooks (electric/electronic) equipment bearing the CE mark has been successfully tested to the regulations of the Electro Magnetic Compatibility (EMC directive 89/336/EEC).

Special attention however is required when selecting the signal cable to be used with CE marked equipment.

Quality of the signal cable, cable glands and connectors:

Brooks supplies high quality cable(s) which meets the specifications for CE certification.

If you provide your own signal cable you should use a cable which is overall completely screened with a 100% shield.

"D" or "Circular" type connectors used should be shielded with a metal shield. If applicable, metal cable glands must be used providing cable screen clamping.

The cable screen should be connected to the metal shell or gland and shielded at both ends over 360 Degrees.

The shield should be terminated to a earth ground.

Card Edge Connectors are standard non-metallic. The cables used must be screened with 100% shield to comply with CE certification.

The shield should be terminated to a earth ground.

For pin configuration : Please refer to the enclosed Instruction Manual.

Español

Brooks Instrument
407 West Vine St.
Hatfield, PA 19440
U.S.A.

Asunto : Addendum al Manual de Instrucciones.

Referencia : Certificación CE de los Equipos de Caudal Másico

Fecha : Enero-1996.

Los equipos de Brooks (eléctricos/electrónicos) en relación con la marca CE han pasado satisfactoriamente las pruebas referentes a las regulaciones de Compatibilidad Electro magnética (EMC directiva 89/336/EEC).

Sin embargo se requiere una atención especial en el momento de seleccionar el cable de señal cuando se va a utilizar un equipo con marca CE

Calidad del cable de señal, prensaestopas y conectores:

Brooks suministra cable(s) de alta calidad, que cumple las especificaciones de la certificación CE .

Si usted adquiere su propio cable de señal, debería usar un cable que esté completamente protegido en su conjunto con un apantallamiento del 100%.

Cuando utilice conectores del tipo "D" ó "Circular" deberían estar protegidos con una pantalla metálica. Cuando sea posible, se deberán utilizar prensaestopas metálicos provistos de abrazadera para la pantalla del cable.

La pantalla del cable deberá ser conectada al casquillo metálico ó prensa y protegida en ambos extremos completamente en los 360 Grados.

La pantalla deberá conectarse a tierra.

Los conectores estandar de tipo tarjeta (Card Edge) no son metálicos, los cables utilizados deberán ser protegidos con un apantallamiento del 100% para cumplir con la certificación CE.

La pantalla deberá conectarse a tierra.

Para ver la configuración de los pines: Por favor, consultar Manual de Instrucciones adjunto.

Français

Brooks Instrument
407 West Vine St.
Hatfield, PA 19440
U.S.A.

Sujet : Annexe au Manuel d'Instructions.
Référence : Certification CE des Débitmètres Massiques à Effet Thermique.
Date : Janvier 1996.

Messieurs,

Les équipements Brooks (électriques/électroniques) portant le label CE ont été testés avec succès selon les règles de la Compatibilité Electromagnétique (directive CEM 89/336/EEC).

Cependant, la plus grande attention doit être apportée en ce qui concerne la sélection du câble utilisé pour véhiculer le signal d'un appareil portant le label CE.

Qualité du câble, des presse-étoupes et des connecteurs:

Brooks fournit des câbles de haute qualité répondant aux spécifications de la certification CE.

Si vous approvisionnez vous-même ce câble, vous devez utiliser un câble blindé à 100 %.

Les connecteurs « D » ou de type « circulaire » doivent être reliés à la terre.

Si des presse-étoupes sont nécessaires, ceux ci doivent être métalliques avec mise à la terre.

Le blindage doit être raccordé aux connecteurs métalliques ou aux presse-étoupes sur le pourtour complet du câble, et à chacune de ses extrémités.

Tous les blindages doivent être reliés à la terre.

Les connecteurs de type « card edge » sont non métalliques. Les câbles utilisés doivent être blindés à 100% pour satisfaire à la réglementation CE.

Tous les blindages doivent être reliés à la terre.

Se référer au manuel d'instruction pour le raccordement des contacts.

Greek

Brooks Instrument
407 West Vine St.
Hatfield, PA 19440
U.S.A.

Θέμα :Προσθήκη στο Εγχειρίδιο Οδηγιών.
Σχετικά :Πιστοποίηση CE των Οργάνων Μέτρησης Παροχής Μάζας.
Ημερομηνία :Ιανουάριος - 1996

Κυρίες και Κύριοι,

Τα όργανα (ηλεκτρικά/ηλεκτρονικά) της Brooks τα οποία φέρουν το σήμα CE έχουν επιτυχώς ελεγχθεί σύμφωνα με τους κανονισμούς της Ηλεκτρο-Μαγνητικής Συμβατότητας (EMC ντιρεκτίβα 89/336/EEC).
Οπωσδήποτε χρειάζεται ειδική προσοχή κατά τήν επιλογή του καλωδίου μεταφοράς του σήματος το οποίο (καλώδιο) πρόκειται να χρησιμοποιηθεί με όργανα που φέρουν το σήμα CE.

Ποιότητα του καλωδίου σήματος των στυπιοθλιπτών και των συνδέσμων .

Η Brooks κατά κανόνα προμηθεύει υψηλής ποιότητας καλώδια τα οποία πληρούν τις προδιαγραφές για πιστοποίηση CE.
Εάν η επιλογή του καλωδίου σήματος γίνει από σας πρέπει να χρησιμοποιήσετε καλώδιο το οποίο να φέρει εξωτερικά πλήρες πλέγμα και να παρέχει θωράκιση 100%.

Οι σύνδεσμοι τύπου "D" ή "Κυκλικοί" των καλωδίων, πρέπει να θωρακίζονται με μεταλλική θωράκιση. Εάν είναι εφαρμόσιμο, πρέπει να χρησιμοποιούνται μεταλλικοί στυπιοθλίπτες καλωδίων που να διαθέτουν ακροδέκτη σύνδεσης του πλέγματος του καλωδίου.
Το πλέγμα του καλωδίου πρέπει να συνδέεται στο μεταλλικό περίβλημα ή στον στυπιοθλίπτη και να θωρακίζεται και στα δύο άκρα κατά 360 μοίρες.
Η θωράκιση πρέπει να καταλήγει σε κάποιο ακροδέκτη γείωσης.

Οι σύνδεσμοι καρτών είναι μη-μεταλλικοί, τα καλώδια που χρησιμοποιούνται πρέπει να φέρουν πλέγμα θωράκισης 100% για να υπακούουν στην πιστοποίηση CE.
Η θωράκιση πρέπει να καταλήγει σε κάποιο ακροδέκτη γείωσης.

Για την διάταξη των ακροδεκτών: Παρακαλούμε αναφερθείτε στο εσώκλειστο Εγχειρίδιο Οδηγιών.

Italiano

Brooks Instrument
407 West Vine St.
Hatfield, PA 19440
U.S.A.

Oggetto : Addendum al manuale di istruzioni.
Riferimento : Certificazione CE dei misuratori termici di portata in massa
Data : Gennaio 1996.

Questa strumentazione (elettrica ed elettronica) prodotta da Brooks Instrument, soggetta a marcatura CE, ha superato con successo le prove richieste dalla direttiva per la Compatibilità Elettomagnetica (Direttiva EMC 89/336/EEC).

E' richiesta comunque una speciale attenzione nella scelta dei cavi di segnale da usarsi con la strumentazione soggetta a marchio CE.

Qualità dei cavi di segnale e dei relativi connettori:

Brooks fornisce cavi di elevata qualità che soddisfano le specifiche richieste dalla certificazione CE. Se l'utente intende usare propri cavi, questi devono possedere una schermatura del 100%.

I connettori sia di tipo "D" che circolari devono possedere un guscio metallico. Se esiste un passacavo esso deve essere metallico e fornito di fissaggio per lo schermo del cavo.

Lo schermo del cavo deve essere collegato al guscio metallico in modo da schermarlo a 360° e questo vale per entrambe le estemità.

Lo schermo deve essere collegato ad un terminale di terra.

I connettori "Card Edge" sono normalmente non metallici. Il cavo impiegato deve comunque avere una schermatura del 100% per soddisfare la certificazione CE.

Lo schermo deve essere collegato ad un terminale di terra.

Per il corretto cablaggio dei terminali occorre fare riferimento agli schemi del manuale di istruzioni dello strumento.

Nederlands

Brooks Instrument
407 West Vine St.
Hatfield, PA 19440
U.S.A.

Onderwerp : Addendum voor Instructie Handboek
Referentie: CE certificering voor Mass Flow Meters & Controllers
Datum : Januari 1996

Dames en heren,

Alle CE gemarkeerde elektrische en elektronische produkten van Brooks Instrument zijn met succes getest en voldoen aan de wetgeving voor Electro Magnetische Compatibiliteit (EMC wetgeving volgens 89/336/EEC).

Speciale aandacht is echter vereist wanneer de signaalkabel gekozen wordt voor gebruik met CE gemarkeerde produkten.

Kwaliteit van de signaalkabel en kabelaansluitingen:

- Brooks levert standaard kabels met een hoge kwaliteit, welke voldoen aan de specificaties voor CE certificering.
  Indien men voorziet in een eigen signaalkabel, moet er gebruik gemaakt worden van een kabel die volledig is afgeschermd met een bedekkingsgraad van 100%.
- "D" of "ronde" kabelconnectoren moeten afgeschermd zijn met een metalen connector kap. Indien kabelwartels worden toegepast, moeten metalen kabelwartels worden gebruikt die het mogelijk maken het kabelscherm in te klemmen
  Het kabelscherm moet aan beide zijden over 360° met de metalen connectorkap, of wartel verbonden worden.
  Het scherm moet worden verbonden met aarde.
- "Card-edge" connectors zijn standaard niet-metallisch. De gebruikte kabels moeten volledig afgeschermd zijn met een bedekkingsgraad van 100% om te voldoen aan de CE certificering.
  Het scherm moet worden verbonden met aarde.

Voor pin-configuraties a.u.b. verwijzen wij naar het bijgesloten instruktie handboek.

Hoogachtend,

Norsk

Brooks Instrument
407 West Vine St.
Hatfield, PA 19440
U.S.A.

Vedrørende : Vedlegg til håndbok
Referanse : CE sertifisering av utstyr for massestrømsmåling og regulering
Dato : Januar 1996

Til den det angår

Brooks Instrument elektrisk og elektronisk utstyr påført CE-merket har gjennomgått og bestått prøver som beskrevet i EMC forskrift om elektromagnetisk immunitet, direktiv 89/336/EEC.

For å opprettholde denne klassifisering er det av stor viktighet at riktig kabel velges for tilkobling av det måletekniske utstyret.

Utførelse av signalkabel og tilhørende plugger:

- Brooks Instrument tilbyr levert med utstyret egnet kabel som møter de krav som stilles til CE-sertifisering.
- Dersom kunden selv velger kabel, må kabel med fullstendig, 100% skjerming av lederene benyttes.

"D" type og runde plugger og forbindelser må være utført med kappe i metall og kabelnipler må være utført i metall for jordet innfesting av skjermen. Skjermen i kabelen må tilknyttes metallet i pluggen eller nippelen i begge ender over 360°, tilkoblet elektrisk jord.

- Kort-kantkontakter er normalt utført i kunststoff. De tilhørende flatkabler må være utført med fullstendig, 100% skjerming som kobles til elektrisk jord på riktig pinne i pluggen, for å møte CE sertifiseringskrav.

For tilkobling av medleverte plugger, vennligst se håndboken som hører til utstyret.

Vennlig hilsen

Português

Brooks Instrument
407 West Vine St.
Hatfield, PA 19440
U.S.A.

Assunto : Adenda ao Manual de Instruções
Referência : Certificação CE do Equipamento de Fluxo de Massa
Data : Janeiro de 1996.

O equipamento (eléctrico/electrónico) Brooks com a marca CE foi testado com êxito nos termos do regulamento da Compatibilidade Electromagnética (directiva CEM 89/336/EEC).

Todavia, ao seleccionar-se o cabo de sinal a utilizar com equipamento contendo a marca CE, será necessário ter uma atenção especial.

Qualidade do cabo de sinal, buchas de cabo e conectores:

A Brooks fornece cabo(s) de qualidade superior que cumprem os requesitos da certificação CE.

Se fornecerem o vosso próprio cabo de sinal, devem utilizar um cabo que, na sua totalidade, seja isolado com uma blindagem de 100%.

Os conectores tipo "D" ou "Circulares" devem ser blindados com uma blindagem metálica. Se tal for necessário, deve utilizar-se buchas metálicas de cabo para o isolamento do aperto do cabo.

O isolamento do cabo deve ser ligado à blindagem ou bucha metálica em ambas as extremidades em 360º.

A blindagem deve terminar com a ligação à massa.

Os conectores "Card Edge" não são, em geral, metálicos e os cabos utilizados devem ter um isolamento com blindagem a 100% nos termos da Certificação CE..

A blindagem deve terminar com ligação à massa.

Relativamente à configuração da cavilha, queiram consultar o Manual de Instruções.

Suomi
Brooks Instrument
407 West Vine St.
Hatfield, PA 19440
U.S.A.

Asia : Lisäys Käyttöohjeisiin

Viite : Massamäärämittareiden CE sertifiointi

Päivämäärä : Tammikuu 1996

Brooksin CE merkillä varustetut sähköiset laitteet ovat läpäissyt EMC testit (direktiivi 89/336/EEC).

Erityistä huomiota on kuitenkin kiinnitettävä signaalikaapelin valintaan.

Signaalikaapelin, kaapelin läpiviennin ja liittimen laatu

Brooks toimittaa korkealaatuisia kaapeleita, jotka täyttävät CE sertifikaatin vaatimukset. Hankkiessaan signaalikaapelin itse, olisi hankittava 100%:sti suojattu kaapeli.

“D” tai “Circular” tyyppisen liitimen tulisi olla varustettu metallisuojalla. Mikälì mahdollista, tulisi käyttää metallisia kaapeliliittimiä kiinnitettäessä suojaa.

Kaapelin suoja tulisi olla liitetty metallisuojaan tai liittimeen molemmissa päissä 360°:n matkalta.

Suojan tulisi olla maadoitettu.

“Card Edge Connector”it ovat standarditoimituksina ei-metallisia. Kaapeleiden täytyy olla 100%: sesti suojattuja jotta ne olisivat CE sertifikaatin mukaisia.

Suoja on oltava maadoitettu.

Nastojen liittäminen; katso liitteenä oleva manuaali.

Ystävällisin terveisin,

Svensk
Brooks Instrument
407 West Vine St.
Hatfield, PA 19440
U.S.A.

Subject : Addendum to the Instruction Manual

Reference : CE certification of Mass Flow Equipment

Date : January 1996

Brooks (elektriska / elektronik) utrustning, som är CE-märkt, har testats och godkänts enligt gällande regler för elektromagnetisk kompabilitet (EMC direktiv 89/336/EEC).

Speciell hänsyn måste emellertid tas vid val av signalkabel som ska användas tillsammans med CE-märkt utrustning.

Kvalitet på signalkabel och anslutningskontakter:

Brooks levererar som standard, kablar av hög kvalitet som motsvarar de krav som ställs för CE-godkännande.

Om man använder en annan signalkabel ska kabeln i sin helhet vara skärmad till 100%.
“D” eller “runda” typer av anslutningskontakter ska vara skärmade. Kabelgenomföringar ska vara av metall alternativt med metalliserad skärmning.

Kabelns skärm ska, i bada ändar, vara ansluten till kontakternas metallkåpor eller genomföringar med 360 graders skärmning.

Skärmen ska avslutas med en jordförbindelse.

Kortkontakter är som standard ej metalliserade, kablar som används måste vara 100% skarmade för att överensstämma med CE-certifieringen.

Skärmen ska avslutas med en jordförbindelse.

För elektrisk anslutning till kontaktstiften hänvisas till medföljande instruktionsmanual.

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Brooks® Model SLA5840

LIMITED WARRANTY

Seller warrants that the Goods manufactured by Seller will be free from defects in materials or workmanship under normal use and service and that the Software will execute the programming instructions provided by Seller until the expiration of the earlier of twelve (12) months from the date of initial installation or eighteen (18) months from the date of shipment by Seller. Products purchased by Seller from a third party for resale to Buyer ("Resale Products") shall carry only the warranty extended by the original manufacturer.
All replacements or repairs necessitated by inadequate preventive maintenance, or by normal wear and usage, or by fault of Buyer, or by unsuitable power sources or by attack or deterioration under unsuitable environmental conditions, or by abuse, accident, alteration, misuse, improper installation, modification, repair, storage or handling, or any other cause not the fault of Seller are not covered by this limited warranty, and shall be at Buyer's expense.
Goods repaired and parts replaced during the warranty period shall be in warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. This limited warranty is the only warranty made by Seller and can be amended only in a writing signed by an authorized representative of Seller.

BROOKS SERVICE AND SUPPORT

Brooks is committed to assuring all of our customers receive the ideal flow solution for their application, along with outstanding service and support to back it up. We operate first class repair facilities located around the world to provide rapid response and support. Each location utilizes primary standard calibration equipment to ensure accuracy and reliability for repairs and recalibration and is certified by our local Weights and Measures Authorities and traceable to the relevant International Standards.

Visit www.BrooksInstrument.com to locate the service location nearest to you.

START-UP SERVICE AND IN-SITU CALIBRATION

Brooks Instrument can provide start-up service prior to operation when required.
For some process applications, where ISO-9001 Quality Certification is important, it is mandatory to verify and/or (re)calibrate the products periodically. In many cases this service can be provided under in-situ conditions, and the results will be traceable to the relevant international quality standards.

CUSTOMER SEMINARS AND TRAINING

Brooks Instrument can provide customer seminars and dedicated training to engineers, end users and maintenance persons.

Please contact your nearest sales representative for more details.

HELP DESK

In case you need technical assistance:

Americas	☎ 1 888 554 FLOW
Europe	☎ +31 (0) 318 549 290
Asia	☎ +81 (0) 3 5633 7100

Due to Brooks Instrument's commitment to continuous improvement of our products, all specifications are subject to change without notice.

TRADEMARKS

Brooks ..... Brooks Instrument, LLC
DeviceNet ..... Open DeviceNet Vendors Association, Inc..
Kalrez ..... DuPont Dow Elastomers
Teflon ..... E. I. DuPont deNemours & Co.
Viton ..... DuPont Performance Elastomers
VCO ..... Cajon Co.
VCR ..... Cajon Co.

CE ISO 9001 QUALITY SYSTEM

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